STUDIEREEKS

24

The 1%-target for public expenditure on R&D: International Benchmark

FLEMISH COUNCIL FOR SCIENCE AND INNOVATION

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The 1%-target for public expenditure on R&D: International Benchmark

CONTENTS

FOREWORD

On 19 January 2011 the Flemish Council for Science and Innovation (VRWI), the strategic advisory body of the Flemish government on science and innovation policy, received a request for advice from Flemish Minister for Innovation Ingrid Lieten regarding the 1% R&D target. This target refers to the share of public R&D expenditures as a percentage of GDP, where the aim is to achieve 1% at EU level by 2020.

In the request for advice several sub questions could be distinguished:

- To set out various growth scenarios to achieve this 1% target in Flanders;
- To analyse options for the legal anchoring of this growth path in Flanders;
- To provide an international benchmark and to search for best practices in other countries/regions;
- To analyse whether regulatory or legal commitments exist in other countries/regions to safeguard the budget and/or growth path for R&D, and what forms these commitments take.

Given the size and complexity of the request, the VRWI decided to split it up in several work packages. This study deals with the international benchmark, best practices and the search for regulatory commitments in other countries/regions. It was provided to Minister Lieten as Advisory Report 153bis 'International benchmark' on 30 June 2011.

The simple comparison of policy strategies, choices and resources ignores a complex reality where a crucial role is played by the existing knowledge institutions, the availability of resources and the specific context, while the institutional clas-

sification of different countries should also be taken into account. Moreover, research and innovation systems, strategies, policy visions and related objectives or growth paths that arise elsewhere, cannot simply be projected on Flanders. 'Copy-and-paste' work is both impossible and inappropriate.

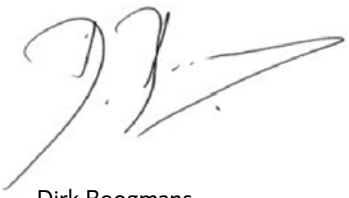
For the reasons mentioned above the VRWI has chosen to present a more descriptive advice. In part one we summarise the most striking findings and best practices from the benchmark exercise. Part two is the analytical section where the methodology and the results of this benchmark exercise are described in more detail per country/region.

The region of Flanders is unique, because - through federalisation - it acquired the competencies for the whole range of science and technology policy in 1988-1989. More than half of the R&D expenditures in Belgium, namely 79%, are executed by the regions. Flanders accounts - by far - for the largest part of the efforts, in terms of both government and private expenditures. This implies that for R&D policy, Flanders is to be compared with other countries rather than with other regions. On the other hand, Flanders lacks some important levers - an important one being fiscal competence - due to which Flanders cannot draw up a comprehensive and optimal smart policy mix.

We are aware that our benchmark exercise is not exhaustive - a detailed comparison of the entire context could not be included. Nevertheless we are convinced the study is one of a kind and contains interesting material worth sharing.

The report was drawn up by the Expert Group for Indicators and Budget (EGIB) of the VRWI. Data collection and processing was performed in close collaboration by members of the VRWI staff and the department of Economy, Science and Innovation (EWI) of the Flemish Government.

Information was obtained from OECD documents, EU documents, various presentations and policy documents of different countries/regions, etc. Information and/or data was also provided by representatives of the different countries/regions. I wish to thank all of them.



Dirk Boogmans
President

CHAPTER 1

INTRODUCTION

On 19 January 2011 the Flemish Council for Science and Innovation (VRWI) received a request for advice from the Flemish Minister for Innovation Ingrid Lieten regarding the 1%-target (Note: this refers to the share of public R&D expenditures as a percentage of GDP, where the aim is to achieve the target of 1% at EU level). In the request for advice, several subquestions can be distinguished:

- The request for various growth scenarios to achieve this 1%-target;
- The question of possible Flemish Government decree-determined paths to anchor this target;
- A benchmark and request for best practices in other countries/regions;
- Legal commitments in other countries/regions;

Given the size and complexity of the request for advice, the VRWI decided to proceed in two stages.

In its first Advisory Report 153 of 15 February 2011, the VRWI depicted several growth scenarios to achieve the 1%-target. In this Advisory Report the VRWI also announced that it would proceed with:

- A benchmark of best practices in other countries / regions to achieve this 1%-target;
- Examples of anchoring of the target in other countries/regions;
- A proposal for the implementation of this growth path and the various sub-growth paths within the Science & Innovation (S&I) budget.

Present study, handed to Minister Lieten as Advisory Report 153bis on 30 June 2011, deals with the benchmark and request for best practices and any regulatory (contract, law, decree, etc.) commitments in other countries/regions. It was prepared

by the Expert Group for Indicators and Budget (EGIB) of the VRWI. Data collection and processing was performed in close collaboration by members of the VRWI staff and the department of Economy, Science and Innovation (EWI) under the supervision and guidance of a technical working group established under the auspices of the EGIB (see Annex 2).

The allocation of the budgetary means in the growth path to the 1%-target forms the subject of a separate Advisory Report 153ter.

SOME PRELIMINARY REMARKS

In her request for advice, Minister Lieten asks that the VRWI examines international best practices aimed at attaining the 1%-target.

According to the VRWI, such a comparison with other countries and regions should be drawn up in a well-considered manner. Research and innovation systems, strategies, policy visions and related objectives or growth paths that arise elsewhere, cannot simply be projected towards Flanders. 'Copy-and-paste' work is both impossible and inappropriate.
Therefore a strategy was developed to select benchmark countries and regions as focused as possible. The philosophy behind the approach and the criteria used are described in Chapter 3 'Analysis'.

As far as the countries are concerned, it is true that in principle they have full national competence (whether or not shared with regions) to make choices for their

research and innovation strategy, policy, instruments and accompanying budget. For the regions this is almost never the case. This is why a separate section has been added: it provides some explanation on this aspect and gives a deeper insight in the division of competences in the countries to which the EU regions selected in this note belong.

The simple comparison of policy strategies, choices and resources, however, ignores a complex reality where a crucial role is played by the knowledge institutions, by specific situations and available resources, in addition to the institutional classification of different countries. Therefore STI (Science, Technology & Innovation) policy can be set according to very different methodologies. Such a detailed comparison of the entire context could not be included in this benchmark.

This is why the VRWI has chosen to present a more descriptive advice. It consists of two parts: firstly a summarising section, in which the most striking findings and best practices from the benchmarking exercise are submitted to the minister and secondly an analytical section where the methodology and the results of this benchmark exercise are described in more detail.

CHAPTER 2

SUMMARY:
KEY FINDINGS AND BEST PRACTICES FROM THE BENCHMARK EXERCISE

1. TARGET FOR R&D INTENSITY

1.1. CONTEXT

During the European summit in Barcelona in 2002 the objective was formulated whereby the European Union should spend 3% of its gross domestic product on research and development (R&D) by 2010. This took place within the framework of the Lisbon Strategy that aimed to make the European Union the most competitive knowledge economy in the world and to close the gap with its competitors, namely Japan and the U.S.A. Hereby 1/3 of R&D expenditures should be borne by government and the other 2/3 by enterprise. This Barcelona target was then adopted by most EU countries as a national target.

At the end of the Lisbon Strategy in 2010 it became clear that this 3%-target was not achieved by most EU Member States nor by the European Union as a whole - exceptions being Sweden, Finland and Denmark. And yet, even though there was (only) a slight evolution in the R&D intensity at the EU-27 level, in real terms significant progress in R&D investments has been made in all 27 EU Member States. This is because the 3%-target has been adopted as a target by most Euro-

pean countries and regions, in spite of its limitations. Limitations are that (1) the 3%-target puts more emphasis on the input in R&D rather than on its results and (2) it is widely accepted that innovation is broader than R&D.

The EU 2020 Strategy, the new long-term strategy of the European Union and the successor to the Lisbon Strategy, has renewed the 3%-target, but has extended the deadline at European level to 2020. And with an important nuance: the target now depends on the context and objectives of each Member State.

1.2. OVERVIEW OF TARGETS FOR R&D INTENSITY

As part of the new EU 2020 Strategy, the Member States have drawn up new multiannual policy choices, which were formulated in their National Reform Programmes. In these national reform programmes most EU countries set a target for R&D intensity, but this target is now clearly 'personalised' and, by analogy to the EU 2020 strategy, the deadline has been extended. The table below shows the targets of the National Reform Programmes 2011, along with their deadlines.

According to the VRWI the following considerations should be taken into account when comparing these R&D intensity targets:

1. The implicit purpose of the 3%-target is to increase net expenditures in R&D. However, this indicator is a fraction, and as such not only determined by the evolution of its numerator (expenditures), but also by its denominator (GDP). To illustrate: the relatively strong increase of the Finnish R&D intensity (up to

nearly 4%) between 2007 and 2009 is mainly due to the shrinking Finnish economy – i.e. the decrease in the Finnish GDP at that time.

2. Furthermore, the relationship between private and public R&D investments also plays a role. On the one hand there is the relationship between both. For example, in the Basque Country the government spends relatively more on R&D compared to the private sector, while the opposite holds true in Baden-Württemberg. On the other hand, the trend of each separately is also important. The effect of increased public funds can be offset by a simultaneous decrease in the private R&D expenditures. This seems to have been the case for Belgium and Flanders in the previous period. It is therefore important that both the private and public sector contribute positively towards achieving the R&D target.

3. In addition some countries or regions have already achieved the set 3%-target, making future efforts relatively limited – growth in R&D expenditures needs to keep up with the pace of economic growth. For example: Denmark has already achieved the 3%-target that the country set itself for 2020 due to significant efforts during the last years (see figure in the analysis). In 2010, the public share in R&D expenditures amounted to 1.05% of GDP.

4. Another aspect to consider when comparing R&D intensities is the ratio of internal resources versus external resources. For some countries or regions, the R&D funds originate (much) more from supranational or international institutions (e.g. EU FP RTD, Cohesion Funds, Structural Funds), thus limiting the efforts required by their own government to achieve the set R&D target.

We can get an indication of how ambitious or realistic achieving this objective is by looking at the table below. This table states the set target for R&D intensity, alongside the most recent figure for R&D intensity, and an estimation of the R&D intensity in 2020, based on annual growth during the period 2000-2009 and extrapolated to 2020 (source: Innovation Union Competitiveness Report 2011). This information is also graphically represented in the country sheets further in this document.

	Target for R&D intensity	**R&D intensity (2009)**	**Extra-polation to (2009)**
Flanders	3% by 2014 (Pact 2020, Flemish coalition agreement 2009-2014) 3% by 2020 (Flemish Reform Programme EU 2020 and Flanders in the Belgian National Reform Programme EU 2020)	2.12%	
Belgium	3% by 2020	1.96%	Unchanged
Denmark	3% by 2020	3.02%	> 3.5%
Germany	3% by 2015	2.82%	3.30%
Baden-Württemberg	No targets known	4.37% (2007)	
Bavaria	3.2% in 2013; 3.6% in 2020	2.81% (2007)	
North Rhine-Westphalia	No targets known	1.78% (2007)	
Finland	Maintain at least 4%	3.96%	> 4.5%
France	3% by 2020	2.21%	2.30%
Île-de-France	No targets known Other, related target: 5% of the total budget of the region for R&D&I	3.11% (2004)	
Nord-Pas de Calais	No targets known	0.67% (2004)	

	Target for R&D intensity	R&D intensity (2009)	Extra-polation to (2009)
Rhône-Alpes	No targets known	2.47% (2004)	
Netherlands	2.5% by 2020	1.84%	1.7%
Austria	3.76% by 2020	2.76%	4.0%
Spain	3% by 2020	1.38%	2.3%
Basque Country	3% by 2015 Total investment in innovation: 6.01% GDP Public investment: 1.70% of GDP and Business R&D investment: 1.28% of GDP	1.98% (2008)	
Catalonia	R&D intensity: 3.05% by 2017 and 3.50% by 2020 R&D&I intensity: 3.75% in 2013 and 4.5% in 2017 2/3 of expenditures by private sector and the rest is by Catalan government and other autorities	1.62% (2008)	
United Kingdom	No target in EU 2020 National Reform Programme, 2.5% by 2014 (target set in 2004)	1.87%	1.9%
Scotland	No explicit target known Recognition of EU 2020 3%-target and will report on this target in its Reform Programma	1.46% (2008)	
South-East England	No target known Other R&D target: BERD increases from 3.2% of gross added value in 2003 to 4% by 2016	2.48% (2008)	
Sweden	4% by 2020	3.62%	3.7%
Lombardy	No target known Overall target: increase the current value of 1.4%	1.20% (2007)	

Switzerland, which does not belong to the EU, and thus does not have to follow the EU 2020 Strategy, identifies itself with the R&D target. Switzerland has already reached the 3%-level and should spend 3.86% of its GDP on R&D in 2020 according to the extrapolation (with continuous efforts).

Canada compares itself mainly to other OECD countries as regards R&D intensity and its ranking therein. The Canadian federal government aims to ensure that the country remains one of the best performers with respect to public R&D expenditures. Canada has a strong knowledge base (certainly compared to ten years ago), which is supported by public investment in R&D (0.90% of the GDP in 2005).

South Korea aims to invest 5% of its GDP in R&D by 2012. Three quarters of this total must be supplied by the private sector, one quarter by the South Korean government.

1.3. SUBSIDIARY OBJECTIVES

Our analysis specifically focused on whether a target for public expenditures was set in addition to the overall 3%-target:

Finland decided to maintain R&D expenditures at least at 4% of its GDP by 2020, of which **1.2%** are **public funds**. For these government expenditures a growth path has been drawn up (see further in this document).

Austria aims to increase expenditures for R&D to 3.76% of its GDP by 2020, compared to the current 2.76%. **At least two-thirds, and preferably 70%**, should

come from the **private sector**. However, the public sector (government) has a role to play by improving the framework conditions for R&D. No explicit target for government expenditures has been set.

The **United Kingdom** does not include an explicit target for R&D intensity in its National Reform Programme, but adheres to its earlier objective (set in 2004) to arrive at an R&D intensity of 2.5% by 2014, of which **1.7% should be borne by the private sector and the remaining 0.8% by the public sector**.

Also noteworthy is the fact that the **German federal government and the Länder** (regions), in **addition to the 3%-target**, have agreed to an additional 10% target for collective expenditures on research and education in relation to the total budget.

2. GROWTH PATH /(ADDITIONAL) RESOURCES.

Some governments align their budget to achieve the target for R&D intensity (e.g. 3%-target, 1%-target); others focus predominantly on the objectives of their strategic plan (see further in this document). An explicit budgetary growth path, drawn up in terms of achieving the aforementioned targets, is quite rare. However, in many countries an increase of the R&D budget has been provided for.

Finland is the only country where we find a **genuine growth path** aligned to achieve a target for R&D intensity and more specifically regarding the **government's part** herein (i.e., attaining 1.2% in 2015). To this end the Finnish Government has devised

a growth scheme wherein the necessary increase in public R&D funds (370 million euro in total) are spread over the period 2011-2015.

Sweden has no real growth path in that sense, but for the period 2009-2012 the **funds have been significantly increased** by 5 billion Swedish Crowns (545 million euro), for which a **growth trajectory until 2012** was set out, in which the additional funds are distributed among various initiatives.

We also note that the **economic/financial** crisis has clearly had an impact: various countries have reacted in different ways.

No growth path but an additional budgetary stimulus of 35 billion euro was found for France. In 2009 it was decided to issue a large state loan under the name 'Investissement d'avenir' in order to strengthen the French innovation potential and the international appeal of the French universities so as to give the economy a strong boost. This 'grand emprunt' in fact consists of a 21.9 billion euro loan from the French banking system, supplemented with the repayment of state aid worth 13.1 billion euro which the banks received during the financial crisis.

Germany also heavily invests in R&D. Despite the crisis and the necessary budget cuts, the German coalition's agreement for the current legislature to invest **12 billion euro extra in research and education** between 2010 and 2013 has remained intact. The multiannual budget for the BMBF (Bundesministerium für Bildung und Forschung, the German Federal Ministry for Education and Research) gives an idea about the growth curve of their resources (see further in this document).

The **United Kingdom** has adopted a different approach. Despite enormous pressure on public expenditures and unlike the savings in other policy fields, resources for scientific research have been safeguarded. To this end the British government had previously introduced a **ring-fence system**, which means that funds allocated to R&D cannot decrease, cannot be used for other government purposes and are thus secure. Since 1997, the proportion of the S&I budget within this ring fence has increased from 1.3 billion pounds (1.44 billion euro) to 3.4 billion pounds (3.77 billion euro) a year. Higher education research financing has now for the first time also been included in this ring fence, due to which the safeguarded amount has increased to 4.6 billion pounds (5.10 billion euro). Since funds for other policy fields are decreasing, the share of S&I in the budget hence increases. Noteworthy is also that the United Kingdom is clearly committed to more efficient use of the resources.

The **Netherlands** is the only country where a **negative growth path** emerges. In the Dutch Total Research Financing (TOF) of April 2011 – which is somewhat similar to Flanders' 'horizontal science policy budget' (HBPWB) – a decrease in governmental R&D expenditures is projected of 350 million euro, from 5.3 billion euro in 2010 to 4.9 billion euro in 2015 due to savings agreed in the governmental agreement. The Dutch government has opted for a **shift away from specific towards generic policy** and has replaced grants for (international) entrepreneurship, innovation and spatial economy by reduced costs for companies (tax incentives).

For some regions where a target has been included in the analysis, information can be provided concerning a potential growth path. However, it should be no-

ted that often funds available to regions, to a large extent do not originate from their own budget. They have access to federal/national resources, as well as EU resources (FP for Research, Technology and Development, Structural Funds, other initiatives) as well as specific bilateral initiatives. Furthermore, in many cases the federal/national government distributes resources between the country's institutions on the basis of mutual competition.

The region itself therefore has no decisive say on the overall size and/or the increase in these resources. Moreover, the region does not always know in advance exactly which percentage of the federal/national resources will end up with the institutions in its territory. There are some exceptions to this rule, as e.g. the Basque government itself provides an average of 80% of the public effort, supplemented by 13% Spanish and 7% other (mainly EU) funds. These considerations must be kept in mind when looking at or comparing regions' growth scenarios.

3. POLICY FRAMEWORK - STRATEGIC PLAN FOR R&D&I IN COUNTRIES AND REGIONS

Most countries analysed have drawn up a strategic plan for scientific research and innovation. The overall objective is usually to strengthen the position of the country as regards scientific research and innovation, with the ultimate intention to increase competitiveness, improve economic growth, face the 'grand challenges' (e.g. energy, climate, population aging, etc.) and ensure prosperity and welfare. It is clear that all countries are convinced that science and innovation are (or can be) the driving force behind this.

Nevertheless, the strategic plans that have been examined are (very) different by nature, content, focus/purpose, timeframe and approach. Some plans are the result of a broad consultation exercise, a thorough evaluation of the S&I system and recommendations of relevant Advisory Boards. Others can be seen as a kind of policy paper. Often other plans exist besides the strategic plans mentioned here. Such plans mainly focus on one single aspect (e.g. higher education/universities). Mapping all these interactions falls outside the remit of this analysis.

While some strategic plans are very recent - sometimes prompted by the economic and financial crisis - others are less so. Their implementation has almost been completed and it is most likely that the preparation of new strategic plans has already been started. The time period in which the plans were drawn up certainly has an influence to bear on where they put their focus. Also, we do not always have a clear view on the extent to which these plans are actually implemented and what their impact is.

'Denmark 2020 knowledge-growth-prosperity-welfare' was drawn up by the **Danish** government in the spring of 2010 in response to the economic and financial crisis and has a fairly broad scope. It is a strategic plan, comparable to the Flemish ViA plan (Flanders in Action), with a horizontal approach to innovation. The **French** *'Stratégie nationale de recherche et d'innovation (SNRI)'* (2009), on the other hand, limits itself to research and development, and sets a frame of reference for this. Its aim is to strengthen the research potential in France and aims for innovation and impact on the national economy.

Most strategic plans are descriptive and only set the main principles and objectives. The actual implementation occurs by means of programmes, etc. (see e.g. Spain further in this document). An exception are South Korea's plans, which are very concrete, with tangible and quantified targets and associated budgets. Also Spain links measurement indicators to the targets set.

Characteristic for *'Der weg zum innovation leader'*, the very recent plan of the **Austrian government**, is that it is a horizontal policy plan, across boundaries of ministries and supported by the various competent ministers. The basic premise is that all stakeholders (in education, research, industry and government) are convinced that they must collaborate to achieve the objective - i.e. developing Austria into an innovation leader.

Regional R&D&I strategies employ different methodologies and function within various situations. Regions usually start from a vision and have a corresponding (thematic) strategy, but do not always develop an (integrated) R&D&I plan or strategy. They also tend to focus more on innovation than on research, although in recent years more regions have been pursuing their own (additional or reinforcing) research policy. The fact that (fundamental or strategic basic) research has received less consideration at the regional level, is to do with the fact that regions often possess fewer policy levers (and resources) for the research domain than for pursuing an innovation policy. The general objectives and emphasis of the regional (strategic) plans are generally aligned to those pursued by countries. A region's size as well as the extent to which it is active in the international knowledge area also determine its strategy and objectives. Some regions have a higher total value

of GERD compared to medium-sized EU countries or even a higher level of R&D intensity compared to traditional leaders in the EU such as Sweden and Finland. In regions an R&D&I strategy or plan can also be part of, or be aligned with, a more generic or multiannual strategy with respect to economic or educational policy.

4. FOCUS

The examined strategic plans usually contain a number of rather generic, general principles and starting points such as encouraging collaboration, but in a later stage specific objectives or actions can be linked to this. In addition, more specific and/or thematic emphases/focuses are laid, usually based on existing strengths and excellences. The aim here is to prepare for the grand societal challenges or to develop a niche position.

Where a government policy puts its focus (or where choices are made) of course reflects its views on the domains where the highest return on public investment in R&D&I can be attained and on which players are deemed best able to realise this.

Our review of the policy plans for R&D&I illustrates that the benchmark countries and regions **often emphasise the same grand themes**. For example the areas of health and climate and energy are explicitly mentioned as priorities in the plans of a.o. France, Sweden, Germany, Spain, the Netherlands, Canada, South Korea, Scotland and North Rhine-Westphalia. The choice for these areas seems logical, considering the (global) societal challenges. Also, the areas are broadly defined so as not to preclude further differentiation according to subdomains. Nevertheless,

the question arises to which extent the countries and regions concerned will actually be able to become internationally competitive in these domains at a scientific and technological level.

This is why it is interesting to note that a region such as Catalonia clearly aims for **international profiling** in its policy plan (2010-2013 PRI) *The 2010-2013 PRI will promote broad-based strategic RDI projects linked to the focus areas of the PRI in order to develop international leadership in specific niches*.

In addition to thematic focus it should also be noted that various countries and regions pay explicit attention to the **critical mass of policy initiatives**. In this way ZENIT, the Innovation and Technology Centre of North Rhine-Westphalia, sees the reduction of the number of clusters as a priority for transforming industrial policy up to 2015. Scotland has initiatives aimed at its digital and creative industries, and brings together researchers from higher education institutions and research institutions according to themes (research pooling) so as to achieve a higher critical mass. The Scottish Reform Programme EU 2020 also stresses the importance of pooling (international) resources[1]. Finland has also listed its intention to guard against a fragmentation of resources in its policy plan[2]. Catalonia expresses explicitly its readiness to cut off certain flows of money from public research institutions if a cost-benefit analysis would provide reason to do so[3].

[1] "Research pooling: developing Europe-wide research collaborations aligned to Europe's Grand Challenges".
[2] "The reallocation and pooling of resources to form more effective entities that create a critical mass and which are often based on partnerships is vital." (Research and innovation policy guidelines 2011-2015)
[3] "Secondly, the PRI focuses on organising and connecting public research agents (funded by the Government of Catalonia), to make them more efficient and better aligned with the R&D&I focus areas of the PRI. This process is based on a rigorous evaluation of excellence, strategic opportunity and viability. These criteria and mechanisms will be applied to both the creation and closure of funding structures by the Government of Catalonia".

Regarding the choice between investing in basic versus more applied research, it can be established that among the multitude of initiatives aimed at innovation and where the time horizon used is rather short, a number of countries emphasise their **commitment to fundamental research**. Thus the federal government in Germany will define 'forward-looking projects' that focus on the main challenges in a discipline and where objectives are formulated for a period of ten to fifteen years. In Sweden most of the central research funds go to universities and other higher education institutions. The support of basic research by the Swedish government has for a long time taken place through direct funding of universities (faculty funds) on the one hand and grants through research councils (council appropriations) on the other hand, where these funds are not allocated to specified domains. In Switzerland the public (confederate) investments in R&D go mainly to basic research where excellence plays an important role (source: ERI Dispatch 2008-2011). South Korea has formulated a strategy to evolve into a 'creative innovator' rather than an 'imitator', which has led the South Korean government to opt for basic research and large projects with long timeframes. A striking new initiative in this regard is the 'Adventurous Research Project' which received 4 trillion Korean Won (KRW) (2.6 million euro) in 2010. Here it concerns more challenging and spearhead projects in which creative researchers are allowed to fail; a 'positive system failure' has been integrated.

Although one can assume that excellence is an inherent criterion when a government tries to attain the greatest allocative efficiency with its - by definition scarce - means, it is worth identifying which countries and regions **put special emphasis on excellence when allocating resources for R&D&I**. A systematic pursuit of ex-

cellence implies a greater likelihood of unequal distribution of resources, which is translated into fewer initiatives, each of which has the critical mass to become one of the sustainable scientific and technological poles. Examples of policy initiatives which use (international) excellence as a criterion include the Netherlands where 1.5 billion euro of public funds is made available for a limited set of top sectors in the 'To the top'-plan. The United Kingdom announced in October 2010 it would invest more than 200 million British pounds (222 million euro) in a network of 'elite' technology and innovation centres, created and managed by the Technology Strategy Board. Canada formulated a similar strategy: *"The Government will support large-scale research and commercial centres in areas where Canadians have the potential to achieve world-class excellence."* Other countries go even further by focusing on those areas where they already possess proven international competitiveness. Accordingly the '577 initiative' in South Korea is a comprehensive R&D strategy that focuses on seven strategic technological areas in which South Korea is strong. In allocating the resources for R&D, amongst others in the KSLV-1 and -2 Programme (Korea Space Launch Vehicle), South Korea uses the principle of 'selection and concentration' in a system of internal competition. Also Sweden emphasises in its strategic plan *'A boost to research and innovation'* that the strategic areas where investments will be prioritised, have been determined partly according to whether they are fields *"in which Sweden already carries out world class research"*.

One can deduce from the different policy plans that when countries and regions use excellence as criterion in the allocation of public funds, they do this because they expect that this will lead to excellent results as regards research and innovation. In this way, Austria, for example, strives to improve its ranking on the Innova-

tion Union Scoreboard from 'innovation follower' to 'innovation leader'. Spain has set itself a set of indicators - such as private investments in R&D and the number of innovative companies – for which it wants to score above the European average.

This has implications for the R&D&I policy in Flanders: If this commitment to excellence in the benchmark countries and regions described above is effectively translated into results, this means that a region such as Flanders has to keep ahead. Given that Flanders has set itself the objective to become one of the leading innovative regions, we should not presume that other countries and regions will rest on their laurels and simply maintain their current level of effort.

In most cases regions rather focus on bottom-up policy based on their own context and/or strengths and their policy is complementary to and thus aligns with the overall policy of the country. The policies tend to be the consequence of or to be attuned to their specific situation (e.g. local industrial fabric, degree of specialisation in research and technology) and the players present in their territory (both regional as well as federal/national knowledge actors, large (international) companies in certain sectors). Only a few regions attain a scale that is sufficiently large - expressed in absolute terms or in relative terms within their own country - such that they can perform a more-or-less comprehensive policy in many different domains. Compared to countries, regions seem to pursue a more concrete thematic focus, more closely linked to developments and networks close to market or the economic exploitation of relevant research. In addition, the priorities and reach of successive plans may evolve or contain more specific objectives. The same type

of support measure may exist in different regions and may or may not be part of an encompassing regional plan, such as innovation vouchers in Bavaria, Baden-Württemberg, North Rhine-Westphalia or Scotland. Due to the above reasons, the emphasis or focus made by a region is often a combination of certain domains and themes that are deeply embedded, linked to the associated playors or types of excellence.

5. INTERNATIONALISATION

The examined policy documents show that internationalisation becomes increasingly important. In the context of growing globalisation, the great global challenges, etc., internationalisation is seen as both an important opportunity and a great challenge.

By internationalisation we mean first and foremost the **mobility** (incoming and outgoing) of students/researchers, **but also participating in European/international programmes, working with foreign partners**, **representing the own interests and exerting influence on agenda-setting and decisions by European/international forums**. Finally 'science sharing' is sometimes included as well: the use of knowledge in aid of developing countries and the collaboration with these.

Two of the countries examined, namely Finland and Germany, worked out **a separate strategy for internationalisation**. This does not mean that other countries are unaware of the importance of international cooperation and the influence and attraction of Europe. Internationalisation is mostly included as a component in the strategic policy documents.

The objectives often remain very general and possible actions not very concrete. However, regions/countries are convinced that focusing **on one's own strengths (smart specialisation) and focused, efficient deployment of (more) resources for internationalisation is becoming a must.**

In almost all regions internationalisation belongs to the policy pursued or the comprehensive strategy for R&D&I, albeit in different degrees (e.g., providing active support, creating favourable framework conditions, establishing bilateral cooperation, etc). Sometimes this is implicitly the case because the institutions and companies in the region play an important economic and/or scientific role in their country, implying they will arrange many international agreements or collaborations. Of course, the competences and resources at the disposal of a regional government also determine the extent to which it is possible to pursue a policy that is specifically focused on internationalisation.

All regions represented in this note want to strengthen the competitiveness of companies in their territory by increasing their innovative potential. Not only large national and international companies, but also SMEs are often explicitly part of the target group. On the other hand, they also want to create a favourable environment to (further) attract foreign companies, e.g. by providing support to all kinds of networks which advise companies on technological matters and offer solutions (competence centres, clusters, innovation networks), or by promoting the transfer of knowledge from various organisations and knowledge institutes. Obviously this varies depending on the region - and also within a region depending on the economic sector - on the technological profile or on the research topic. In (one

or more of) the aforementioned specialisation fields the respective regions often aim for a leading position within their country or even internationally, whether or not shared with other regions from the same country or other countries. Also building networks with other regions around themes or sectors is sometimes an explicit strategy. One example is the biotechnology cluster of Rhône-Alpes with Piedmont (Italy) and Switzerland.

The focus on internationalisation comes partly from the fact that all regions in this note belong to one of the five major EU economies, implying that local interactions between research themes and economic strengths are often mirrored in international ambitions in the field of research (e.g., higher participation in themes from the EU FP for Research, Development and Technology, ESFRI projects, Joint Technology initiatives, etc.) and in economic fields. Of course, the 'Four Motors for Europe', namely Baden-Württemberg, Catalonia, Lombardy and Rhône-Alpes, also work closely together on specific research topics.

6. LEGAL ANCHORING

The analysis of the examined countries and regions, all of which are among the best performers in the R&D&I-field, shows that:

1. Legal anchoring of the growth paths or the extra funds is very rare;
2. There is no uniformity in the method used;
3. Due to insufficient insight in the legislative and legal framework abroad, it is not easy to compare the established practices to those prevalent in Belgium/Flanders (and the ability to apply them here);

4. The effect on additional financial resources can vary strongly from case to case, even with legal anchoring.

Here, we can deduce that no matter how the Flemish Government chooses to anchor a growth path or additional resources for R&D(&I) (e.g. governmental decree, long-term budget, pact, decision, memorandum of understanding (gentlemen's agreement), parliamentary resolution, etc), it is crucial that such an agreement is executed very carefully.

Here are some examples of various types of engagements.

The legal framework for the Investissements d'avenir in **France** consists of the Loi de Finance rectificative of 9 March 2010. Through means of a decision, the Commissariat Général à l'Investissement is assigned a monitoring task. The Investissements d'avenir are part of a series of measures and adjustments contained in the Loi de Finance rectificative. We see some resemblance with the programme laws and decrees in Belgium, respectively Flanders. Furthermore, this law seems to be voted following a budgetary control/adaptation.

The significant increase in resources for research and education (12 billion euro in 2010-2013) in **Germany** was part of the coalition agreement between CDU, CSU and FDP at the start of the legislature at the end of 2009. Based on this aspect in the coalition agreement the Ministry of Finance provides an annual increase in the R&D budget of all ministries involved. This is the case until 2013 (see the agreement to reach the extra 6 billion euro for R&D and the extra 6 billion euro

for education by the end of this legislature, i.e. 2013). Apart from this multiannual budget, in which the growth path is set out, there is no legal framework for anchoring the resources. Nevertheless, a serious political problem would arise if this agreement were not fulfilled, due to which it may be deemed to be a quasi-statutory anchoring. On the other hand this coalition agreement only covers the current legislature.

In **Austria** there is an ongoing discussion about possible ways to determine a growth path for R&D and legally anchor it. In the federal government's strategy '*Der Weg zum innovation leader*' the idea was put forward to use a Federal Law on Research funding as a key instrument. This new legislation would:

1. determine the principles and objectives of national science and innovation policy;
2. define results-oriented objectives;
3. permit long-term planning;
4. provide a Code of Conduct.

The law is also meant to be valid for a longer term. However, no concrete information is available at the moment of drawing up this document.

In **Spain**, in 2005 the first steps were taken towards a general legislative framework for R&D. Following the national reform programme a series of concrete actions were outlined to reach the 3%-target under the name *'Ingenio 2010'*. Also the *'State Strategy for Sustainable Economy'* was accepted in 2009 as one of the most important elements on the way to economic growth and sustainable development. This includes the development of a strategy for innovation and a (new)

legislative framework for science, technology and innovation. The Innovation Strategy was approved in July 2010. The legislative proposal on science, technology and innovation is approved by parliament. From the information we could access about this law, it is not clear whether the resources for R&D are included. This law focuses on three major challenges: a stable and attractive research career, the need for an efficient and effective R&D system and the development of a genuine knowledge society through a (more) sustainable economy.

The *'Basic Law for Science and Technology'* is the basic law on R&D in **South Korea** containing all basic rules and regulations. It states that every five years a strategy for R&D should be developed in which medium- and long-term targets objectives are set. The *'Framework Act on Science and Technology'* entered into force on 6 September 2008. It contains all the intentions and objectives. And while no numbers for R&D resources are included, increasing the R&D budget is always mentioned as an objective.

7. THE POSITIONING OF FLANDERS

In this international benchmark Flanders occupies a somewhat exceptional position.

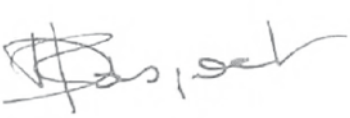
Through federalisation, in 1988-1989 Flanders acquired the competencies for the whole range of science and technology policy. Research conducted at universities became a Community competence. Industrial and technological research and innovation became a Regional competence. In Flanders these Regional and Community competences were bundled. To this day the federal level continues to manage

some residual competences, such as space research, the Interuniversity Attraction Poles programme, thematic research programmes in support of federal policies (including social cohesion, sustainable development, information society etc.), international cooperation and coordination, etc.

According to the OECD study mentioned later, Belgium is the only country where more than half of the R&D expenditures, namely 79%, are executed by the states (regions and communities). Within Belgium, Flanders accounts - by far - for the largest part of the efforts, in terms of both government and private expenditures. In this way it is good for almost half of all government funds for R&D (the federal government accounts for approximately one quarter of all Belgian public efforts), and Flanders accounts for nearly 2/3 of the country's total R&D expenditure (public and private spending combined).

This implies that for R&D policy, Flanders is to be compared with other countries rather than with other regions.

On the other hand, Flanders lacks some important levers - an important one being fiscal competence - due to which Flanders cannot draw up a comprehensive and optimal smart policy mix.



Danielle Raspoet
Secretary

Dirk Boogmans
Chairman

CHAPTER 3

ANALYSIS

1. PHILOSOPHY AND APPROACH

Minister Lieten commissions the VRWI in her request for advice to examine relevant international best practices to attain the 1% target for R&D.

Such a comparison with other countries and regions should be drawn up in a well-considered manner. Research and innovation systems, strategies, policy visions and related objectives or growth paths that arise elsewhere, cannot simply be projected towards Flanders. 'Copy-and-paste' work is both impossible and inappropriate. Accordingly, a strategy was developed to select benchmark countries and regions as focused as possible. The philosophy behind the approach and the criteria applied are listed below.

1.1. SELECTION CRITERIA

It speaks for itself that Flanders should compare itself with the leading countries/regions or the entities where a sufficiently 'broad and deep' research and innovation landscape exists. Furthermore, it is recommended to only benchmark with countries and regions where the governments pursue a clear vision, strategy, objective or growth path. Moreover, the VRWI limits this excercise to those countries and regions that are somewhat comparable to Flanders (regarding the composition of the economic landscape, order of magnitude of GDP, population, innovation profile, policy choices, etc). Benchmarking with countries or regions with too different a profile, active in a completely different context, or without explicit strategy may provide insufficient or incorrect information or insights.

In order to interpret the data correctly, it is important to have an insight into the division of competences between the federal level and the regions within the different countries. As far as the countries are concerned, it is true that in principle they have full competence at the national level (whether or not shared with the regions) to make choices for their research and innovation strategy, policies, instruments and related budget. For the regions this is almost never the case. Therefore, a separate section has been included which provides some explanation on this aspect and gives insight in the division of competences in the countries to which the selected EU regions in this note belong (see below).

A third condition is that there is sufficient standardised information available for most of the aspects and sub-questions considered in this note. This is usually the case for the countries belonging to the EU or the OECD and having a similar standard of living as Flanders.

1.2. KEY QUESTIONS

To answer the Minister's question on best practices as well as possible, it was divided in several sub-questions that look at different aspects of the S&I policy and possible strategies and visions.

For the following questions an answer was sought:

1. Which target for R&D intensity has been pursued?
    a. What is the planned timetable?

b. Is there also a target for government spending (1%)?

2. Resources
   a. Budgets/growth path?
   b. Is there a clear earmarking (implicit or explicit) of the (additional) funds?
   c. Is there a change in financial instruments? E.g. tax versus non-tax incentives?

3. Has the growth path/additional funds been legally anchored? If so, how?

4. Policy framework
   a. Is there a plan/framework for scientific research and innovation?
   b. Where are the accents put? Focus on themes/areas, excellence and/or players? Strengthening of the existing and/or establishing new (types of) institutions/instruments/programmes?
   c. To what extent is there alignement with international themes? Has active participation in international programmes or cooperation been sought?

1.3. COLLECTED DATA

To be able to benchmark Flanders with relatively similar governments (in the EU), a number of OECD countries and some regions of the EU have been selected in the summary of strategies, growth paths, objectives and priorities. These countries and regions must meet one or more of the following criteria:

- Be very R&D intensive;
- Develop an active policy strategy (or have a number of important policy objectives either horizontally or thematically);
- Set policy priorities;
- Achieve a minimum scale;
- A ratio of public to private R&D expenditures that does not differ significantly from what is usually the case with the EU-15 countries.

Therefore a 'passport' has been drawn up for all countries/regions with key data, ranging from general information such as GDP and level of education to the traditional innovation indicators.

Regions – just like countries - have diverging profiles and can be divided into various categories. While EU countries are usually classified according to R&D intensity and are subdivided into the four innovation categories of the Innovation Union Scoreboard (called European Innovation Scoreboard until 2010), more types of divisions exist for regions. Appendix 1 contains a summary of some divisions that the OECD and European institutions (Commission, Committee of the Regions) use to make a distinction in the (knowledge or technological) profile.

The strategic plans and associated budgets and growth paths were then mapped for these countries and regions, based on the four key questions from section 1.2. For each country a sheet was compiled based on these questions.

Information was obtained from OECD documents, EU documents (mainly from the European Commission), various presentations and policy documents of different countries/regions, etc. In 2010 the ten-year cycle of the Lisbon Strategy for growth and jobs came to an end and the Member States had to begin with the establishment of new multiannual policy choices, this time in the context of the new EU 2020 Strategy. This is why after 2009 no records at EU level of the ERAWATCH (DG Research and Innovation), the Trend Chart on Innovation (DG Enterprise and Industry) or the monitoring of the Lisbon Strategy (General Secretariat of the Commission) have been prepared. Early 2011 a meeting took place in this context within ERAC (the committee of delegates from EU Member States to advise the Commission on its research policy), where a number of participants presented recent policy/budget measures in their country. This was a very valuable input to our survey. We therefore wish to thank explicitly the representatives of the EU countries who sent us this (additional) information. In the summer of 2010 a survey was prepared in the competent OECD committee of recent important measures that were implemented or are planned. This aided in completing our overview.

A list of the sources is added to the analysis as Annex 3.

1.4. SELECTED COUNTRIES AND REGIONS

Only countries that meet the criteria outlined above were included in the analysis. Within the EU, only countries belonging to the EU-15 are considered, as the newly acceded EU countries function within a different policy and budgetary context. The selected regions share additional features. They all come from the five eco-

nomically most important EU member states (Germany, France, United Kingdom, Italy, Spain), and within their countries, these regions play an active role in research, innovation or represent a substantial part in the field of research and innovation. The selection thus includes the members of the so-called 'Four Motors for Europe' (i.e. Baden-Württemberg (DE), Catalonia (ES), Lombardy (IT), Rhône-Alpes (FR)). This also explains why for example Lombardy has been considered but not Italy itself.

This list, therefore, includes our neighbouring countries and major trading partners, the leading Scandinavian countries (Sweden, Finland, Denmark), as well as other high-performing countries in Europe (Austria, Switzerland) and on a global scale (South Korea, Taiwan and Canada) and further contains the most prominent regions within the EU.

Following entities have been retained as a benchmark (*):

a. EU countries:
    - The leading countries for R&D intensity (> 3%): **Finland (FI), Sweden (SV) and Denmark (DK)**;
    - The three largest EU countries and important trading partners: **Germany (DE), France (FR), United Kingdom (UK)**;
    - Medium-sized (comparable) countries with recent policy plans: **the Netherlands (NL), Austria (AT)**;
    - Countries with a high relative increase in R&D intensity: **Spain (ES)**.
b. Countries outside the EU:
    - The following OECD countries: **Switzerland (CH), Canada (CA), South Korea (ZK), Taiwan (TW).**

c. Regions (within the EU only):
    - In **DE: Baden-Württemberg (BW), North Rhine-Westphalia (NW), Bavaria (BY)**;
    - In **FR: Ile-de-France (IdF), Rhône-Alpes (RA), Nord-Pas de Calais (N-PC)**;
    - In **UK: South-East England (SEE), Scotland (SCT)**;
    - In **ES: Catalonia (CT), Basque Country (PV)**;
    - In **IT: Lombardy (LOM)**.

(*) Also the French neighbouring region of Nord-Pas-de-Calais has been included in the Survey.

1.5. REGIONAL COMPARISON

The competences of a region can vary strongly between countries and even within a country. This is primarily due to the different institutional context in which they operate. Regions therefore do not always avail of the same/equivalent policy instruments and resources to perform research and/or innovation policy. Other factors that contribute to mutual differences include:

- The available infrastructure and the technological specialisation that is different in the region (knowledge institutions, universities, researchers, research-intensive companies,...);
- Knowledge institutions in the region, whether or not forming part of the important research infrastructure with the corresponding institutions of the country itself (e.g. the Fraunhofer or the Max Planck institutions in Germany);

- The presence of important private players in the research and innovation area, particularly (knowledge intensive) large companies and the degree of internationalisation and competition in which they function;
- Cultural aspects: the historical context, the proximity of (neighbouring) countries with or without common languages;
- The relative importance of a region within its own country and its differing contribution to the efforts and results in the research and innovation field (e.g., comparisons (within Spain) Catalonia with Extremadura, or (within Germany) Bavaria with Mecklenburg-Vorpommern).

All these characteristics also determine the possibilities in designing their own policy with accompanying instruments and resources, play a crucial role in prioritizing research and innovation policy and have an impact on the relationship between the region and the country of which it forms a part. The region itself can also choose to prioritise research and/or innovation policy. Moreover, within the same country, the regions may possess different degrees of STI (Science, Technology and Innovation) competences. Within the United Kingdom Scotland has more autonomy compared to the other British regions. The same applies to Spain, where in 2009 the Spanish government handed over R&D competences and resources to the Basque Country, which are now applied in consultation with the central government.

As an illustration there is an overview below from the recent OECD study 'Regions and Innovation Policy' (4 May 2011) with the degree in which STI competences and resources are decentralised in the different countries (or split, as is the case in Belgium).

Degree of devolution in STI policy competences and resources		Federal countries	Countries with elected regional authorities	Countries with non-elected regional level/descentralised state agencies
Significiant control of STI powers and/or resources by regions		Austria, Belgium, Germany, Australia, Canada, Switzerland, United States, Brazil	Italy, Spain, United Kingdom (Scotland, Wales, Northern Ireland)	
Some decentralisation of STI powers and/or resources to regions		Mexico	France, Netherlands, Poland, Sweden (pilot regions), Norway, Denmark (autonomous regions)	United Kingdom (English regions), Korea, Sweden (except pilot regions)
No descentralisation of STI powers	Regional innovation strategies		Denmark, Slovak Republic, Turkey, Czech Republic, Portugal (autonomous regions)	Hungary, Ireland, Portugal (mainland)
	Innovation projects only		Chile, Japan	Greece, Finland, Luxembourg, Iceland, New Zealand, Slovenia

As mentioned before, the regions selected for this exercise belong to the economically most important EU countries. The division of competences for research and innovation between the national and the regional level in these countries is explained below:

a. Germany

The German regions (16 Länder) are equally responsible for a number of different aspects of policy; each region has its own budgets and tax revenues. Some policy

tasks concerning science, technology and innovation are fulfilled by the federal government, some are a regional competence and others are tackled jointly (*Gemeinschaftsaufgaben*, legally different but similar in effect: *Rahmenvereinbarungen*). To a certain extent each German region takes its own policy measures with regard to R&D. The Länder (regions) are responsible for financing research and education at regional universities - each *Bundesland* determines its own regulatory framework autonomously. The regions also contribute to the financing of non-university research institutions and have a wide competence regarding STI, which leads to a range of regional research programmes and interventions. For higher education policy the responsibility lies almost exclusively at regional level (each region autonomously determines its own regulatory framework). Moreover, the regions contribute to the financing of R&D institutions, which are funded jointly with the federal government. In some cases, the contribution of regions may amount to 50%, but it is generally lower (*Rahmenvereinbarung Forschungsförderung*). Although the regions have some autonomous competences for public R&D, the guidelines for this area are usually developed in cooperation with the federal government and with the relevant regional players. In this way, in many areas the regional governments play a lobbying role and they try, for example, to attract these public R&D institutions through means of advantageous ways of support (e.g. the institutions of the *Fraunhofer Gesellschaft* (FhG), for which 90% of the current expenditures is covered by the federal government).

Important differences exist among German regions as regards the characteristics of their research infrastructure and the regional R&D intensity. More specifically, the regions that are able to supplement their regional budget with ERDF-funds,

usually issue a larger package of measures than the regions that mainly rely on their own tax revenues. Many German regions spend a significant budget to support R&D activities (not least because of the significant support for research and innovation from the European Structural Funds). As a result, many regions can offer large regional support programs. In most cases, these programmes are not (or only to a limited extent) coordinated with federal policy measures. On the other hand, some regional programmes are - more or less explicitly - linked to and supported by national programs, such as the federal initiative 'BioRegio', which was followed by supporting actions designed and financed by the regions. Since German Länder have important competences, in particular regarding the financing of public universities (they finance the bulk of the expenditures of public universities), they generally have a major impact on higher education. Moreover, they significantly contribute to the financing of the non-university public research organisations and the institutes located in the particular region. The share of institutional funding that they have to contribute to the financing of public research activities depends on the type of organisation and the status of the institutes.

The regional support programmes for R&D in the business sector are correctly considered to be at least as essential as the regional contributions for public R&D in higher education in attaining the 3% target.

Finally, the three German regions included in this note have a different degree of integration of STI policy and belong to the following categories regarding the R&D intensity:

- Business-centred innovation system (BERD/GERD> 70%): Bavaria (R&D intensity of almost 3%) and Baden-Württemberg (high intensity with > 4%);
- Business-oriented innovation system (BERD/GERD> 50%): North Rhine-Westphalia (intensity between 2 and 3%).

b. France

France has 26 regions and research is spread throughout the country; yet almost half of all national expenditures for R&D is concentrated in the region Ile-de-France (included in this note). Almost all headquarters of public research institutions and large companies participating in R&D are located in this region. Furthermore, research activity in France is highly concentrated in a few regions. The metropolitan region, Ile-de-France, in first position has no direct competitors: in 2006, with 15.5 billion euro, the region accounted for 42.2% of the national GERD and 43.3% of the national BERD.

One of the main objectives of national research policy is to increase the attractiveness of the regions. Most national instruments of research policy are established on a territorial basis, e.g. 'Pôles de Compétitivité'. The main challenge is to maintain coherence between the research policy of the national government and that of the regional governments. As regards policy actions, the regions are responsible for higher education, vocational training, etc. The regions can identify and develop regional technology poles, prepare multiannual programmes for regional matters and be closely involved in 'the design and execution of national research policy'.

Some regions have set up a regional research programme or a regional programme for research and higher education. (The first region to do this was Rhône-Alpes in 2005).

In practice, the relationship between regional government and central government has been organised through the signing of a seven-year agreement between the state and the regions (*Contrat de Plan Etat/Région or CPER*). This agreement has established which financial assistance is provided by the central government, in accordance with the regional objectives. In these agreements, a separate chapter is devoted to research. The current agreements (2007-2013) are drawn up in coordination with the European Structural Fund Programmes.

At regional level, the research policy is designed and planned mainly within the regional councils, the intention being to develop the region economically (to increase the attractiveness and competitiveness of the region). All regional and local governments have their own budgets and decide autonomously on the amount they spend to support R&D. They can finance public and private research on a project basis, through PhD, equipment, individual fellowships, etc.

National research programmes with a regional focus are often heavily financed and supported by local authorities and especially by the regional councils. Recent initiatives are:

- competitive clusters, which aim to strengthen the relations between the public and private research and innovation players; the reasoning of this is to create regional 'poles of excellence' which are focussed on regional strengths and have international visibility. Most of these are inter-regional.

- centres for research and higher education (PRES, Pôles the Recherche et d'Enseignement Supérieur) and thematic research networks (RTRA, Réseaux Thématiques de Recherches Avancées), which aim to bring research and higher education players together.

The regional research programmes benefit from structural funds. In the 1990s, most regions began to set their own research priorities. The resulting 'research programmes' could then be financed in partnership with PROs, with the central government, with delegations from national agencies in the region, etc. In practice, the regional councils fulfil the role of assistant to the research institutions. They invite the research actors to undertake activities in thematic areas they consider a priority.

c. United Kingdom

In the United Kingdom, 'research policy' or 'science policy' is an integral part of innovation policy. Consequently, any distinction between these two policy areas is misleading: regional research policies are largely synonymous with regional innovation policy. The policy of the country is characterised by a mix of centralised and decentralised agreements. For example: all universities and those who conduct research in the devolved administrations may request financing by a Research Council. The United Kingdom is divided into nine English regions (among others South-East England (SEE) included in this note) and three devolved administrations (among others Scotland included in this note). The latter authorities have more autonomy than the English regions, which are not directly responsible for

R&D policy (the exclusive responsibility of the central government). That is the reason why Scotland has more impact on R&D activities than South-East England. However, all English regions have their own regional innovation policy. Within this policy the financing of R&D and the levels of public and private R&D that takes place in the region are considered, but these are by no means dominant considerations. Nevertheless, the English regions are involved in coordinating activities with national policymakers and with agencies responsible for designing R&D policies as well as the broader innovation policy. This is because of the regions' interest in science and R&D as factors with an influence on innovation in the regional economy. Some national financing is currently managed at regional level to ensure that business support for innovation and access to relevant expertise is tailored to the individual needs of local, innovative companies. Similarly to the United Kingdom's policy considerations, a close link also exists in Scotland between science policy and the agenda for innovation policy. A key element on the Scottish agenda for innovation policy is an active participation by and consensus among all important regional stakeholders and partners. The aim is to offer a framework to evolve to an innovation-driven regional economy. As on the national level, the research policy at regional level contains many issues around innovation policy. It is not standard practice for regional authorities to become involved in local aspects of research. Scotland has similar provisions but has more autonomy for policy as well as a number of separate funding arrangements (such as separate 'Funding Councils' for higher education or their equivalent). In Scotland science and research are parallel competences. The Scottish Funding Council (SFC) manages institutional financing for higher education and quality elements (through the Research Excellence Grant, Horizon Grants and the General Fund). All universities as well as anyone

eligible performing research may request financing by the UK Research Council. Scotland has its own science and innovation policy to ensure cooperation between public and private sectors and important stakeholders. The Scottish ministers are responsible for the policy of the Scottish Funding Council, for competences related to knowledge transfer from higher and post-school education to business and society. Given the location of the most important research universities in the United Kingdom, the principle of research funding based on excellence (regardless of location) leads to geographical inequalities in research funding. At first glance, for example, the research budget of the 'Department for Business, Innovation and Skills' (formerly DTI and DUIS) has been largely diverted to London, South East and East of England. However, when one corrects for the number of institutions for higher education (HEIs) in each region eligible to request funding from the Research Council, the situation appears more balanced across the country.

d. Spain

Spain is composed of seventeen regions and has a quasi-federal, decentralised system, which is also reflected in its R&D and innovation policy. In recent decades there has been a political struggle between the regional authorities and the national government to determine which official authorities belong to which level, due to the ambiguous definitions of R&D in the various laws/constitution. Today, that debate has died down and even though not all regions officially have the same competences, most regions have developed similar R&D programmes and now a large number of instruments, programmes and agencies coexist at both government levels (the overall and regional), which often overlap each

other. This unclear division of competences leads to double efforts and complementary instruments.

All local authorities have currently developed regional policy measures, although the focus and scope of these are very different. This means that the present structure of Spanish R&D&I policy is confusing, and that the coordination between overall and regional policy remains a complex and difficult issue. The regions have different ambitions and policy measures regarding R&D&I, a certain degree of official structure such as their own science laws, priority setting, use of priorities in the regional plans, collaboration with other Spanish regions, coordination with national and European policy measures or with the policy measures of other regions. Nevertheless, the new programmes related to the Cohesion Funds (2007-2013) have been developed in a coordinated manner by the regional and central government together. Today there is a tendency to try to integrate all policy measures regarding technology and science into a single so-called R&D&I Plan (similar to the Spanish National Plan), although the 'I' often refers to cooperation between the private and public sector. Many regions have developed regional innovation or technology plans - sometimes as part of their overall regional plan - and European support programmes finance several of these. The two Spanish regions included in this note, the Basque Country and Catalonia, have already implemented such integration.

It is difficult to calculate accurately - or even approximate - the amount Spanish regional governments spend on their innovation policy because of a lack of transparency in the regional budgets. Most regional plans are co-financed by national and European funds, but often they do not give a precise division of the sources.

The annual report of the national R&D&I plan contains information on regional policy measures, but these data are not complete for all regions and there is no standardisation of these concepts, which affects the reliability and comparability of the data. As regards the structures for managing, supporting and implementation of regional policy measures, most regions originally developed a structure similar to that of the central government (such as subsidies for R&D projects in companies, universities and cooperation projects, fellowships for PhD students, mobility programmes for students and teachers, encouragement of partnerships and companies based on new technologies, etc.). Although the regional R&D plans differ to some extent, the overall trends go in the same direction. These plans and structures evolved differently between the regions, where many changes are made on a political basis. This has led to a very diverse system that is difficult to bring under one umbrella. In the early 1990's, almost all regions started to develop infrastructures for industrial research linked to the relevant regional sectors, infrastructures as technology centres or technology parks. In most cases, agencies for economic development were established to initiate these activities. In some cases, these are very important, but in other cases they are superficial political initiatives, especially in the case of technology parks.

The increases in regional R&D budgets are partly a result of the general decentralisation of policy competences, such as the transfer of agricultural, health and university research. In the case of the universities the regional government pays the staff salaries, which are considered part of the overall expenditures on R&D. Project financing comes mostly from national funds and from European and regional programmes. Moreover, the decentralisation of the hospitals has resulted

in greater financial contribution in the research of medicine and healthcare by the regions. As in most countries, R&D activities are highly concentrated: in 2008, 58% of GERD and 65% of the BERD was concentrated in three Spanish regions.

e. Italy

Regions have acquired more responsibility through a change in the Italian Republic's Basic Law (L. 3/2003), which enables them, along with the state, to adopt autonomous Science, Technology and Innovation (STI) policies. The research activities in Italy are mainly concentrated in two regions: Lombardy and Piedmont (particularly company R&D), and also in Latium (mainly public research). In general, R&D is less widespread in the southern regions than in the rest of the country; this does not hold true for public research and R&D in some areas.

As to the division of competences between the state and its 20 regions, the national research programme 2004-2006 determines that the regional legislative authorities are 'cooperative' as far as STI policy is concerned. This means that the regional governments can regulate aspects of the STI policy that are not regulated by the state; that all regions are allowed to have a local regulation and will develop a specific regional STI policy. The interventions that are reserved to the state are mainly located in the area of R&D and public research institutions, e.g. supporting academic research and public research institutions, specific R&D programmes, establishing public-private laboratories, supporting research infrastructure. Regions can adopt policies that are determined and implemented in competition with the policies of the central state. Among other things, this means each region

has its own research policy and innovation policy that runs concurrently with that of the state. In most Italian regions the establishment of administrative structures for research policy is still in its infancy (for example there are no regional research councils yet). Some regions have a policy based on a variety of instruments for competitive funding, such as tendering for private and public affairs. Sometimes this policy is cast in a detailed three-year plan. So far, the regional approach to STI policy is based on the 'technological district' concept. A task is assigned to the district; this task involves socio-economic development and creation of research networks.

A variety of approaches and situations arise in the area of regional R&D&I strategies. Regions usually have a vision and a corresponding (thematic) strategy, but not always an (integrated) R&D&I plan or strategy. They also tend to focus more on innovation than on research; although in recent years more regions also conduct own (additional or reinforcing) research policy. The fact that fundamental or strategic (basic) research was/is relatively less high on the agenda, is linked to the fact that regions often have fewer levers (and resources) available for this than for conducting innovation policy. Indeed, the bulk of the financing of higher education institutions or other (specialised) knowledge actors, often originates from resources that fall under the competence of the federal or national government.

Regions strive for a more integrated policy and attempt to evolve from mere support for innovation to more research-oriented support, and within aim, they focus more on excellent research (also in alignment with their technological specialisati-

on). Sometimes the central government exerts its competences in a region in close collaboration with the regional government and the institutions of that particular region. Moreover, central governments increasingly make their own resources available to regions (either block-funding or support based on competition), due to which the regional autonomy to set R&D strategies increases. The general aims and foci of the regional (strategic) plans run parallel to those of the countries. In addition, a region's scale and the extent to which it is active in the international knowledge domain, help determine its strategy and objectives. Some regions indeed have a higher total GERD value compared to medium-sized EU member states or even a higher R&D intensity compared to traditional leaders in the EU such as Sweden and Finland.

The relationship between public and private funding also plays a role. In some cases the BERD share in GERD is very high. According to the 2007 Regional Innovation Scoreboard (RIS) there were eight regions where this ratio was more than 2/3. This is the case with some of the regions included in this note, in case Bavaria and Baden-Württemberg (each about 80%), Lombardy, Ile-de-France, and Rhône-Alpes. Indeed, Ile-de-France for instance is the region where, apart from many of the national public research institutions, the most important French and international companies active in France have their headquarters and execute their R&D. The support instruments and associated budgets as set out in a policy plan and strategy will consequently most likely have a different focus compared to the cases where the government share (= funds from various governments: regional + federal/national + EU FP for Research, Technology and Development + EU structural funds) is bigger.

It is also important to note that certain regions have a high degree of autonomy and extensive policy instruments, but not necessarily always an accompanying (recent) comprehensive strategy that frames everything within a specific plan. Within a country this may also vary among regions. A strategy or plan for R&D&I may in regions also be part of - or be connected to - a more comprehensive or long-term strategy on an economic or educational level. Examples include the regional development plan, regional plan for the future (e.g. up to 2020), or the regional reform programme for the EU 2020 Strategy. This is the case in South-East England (SEE) and in Lombardy. In South-East England a 'Corporate Plan 2008-2011' exists, focused on innovation, prepared by the 'South-East England Development Agency' and part of the Regional Economic Strategy 2006-2016 (Regional Economic Strategy (RES)). In Lombardy, innovation is important within a number of policy measures, including the CSF for 2002-06, the regional development plan of 2007, as well as in regional framework agreements between partners (Lombard Region - Italian Ministry of Education, LOM Region, Unioncamere Frame). In France, the state has concluded economic and innovative multiannual plans with the regions, which in turn in some cases also develop their own plan focused on higher education, R&D and innovation in their territory. In 2005 Rhône-Alpes was the first region to do so. It can also be the case that separate thematic strategies are interrelated. Scotland, a region in the United Kingdom with a relatively comprehensive set of instruments, has launched initiatives aimed at digital and creative industries, and brings researchers from its higher education and knowledge institutions together on a thematic basis (research pooling), in order to obtain higher critical mass. The R&D&I strategy can also be shaped by a set of laws, regulations, rules, agreements ('pact', coalition agreement) or funding

instruments (e.g. in certain German regions); these may be subject to change depending on the existing coalition.

In this comparison Flanders occupies a somewhat exceptional position. Through federalisation in 1988-1989 Flanders has become responsible for the whole range of the science and technology policy. University-conducted research became a Community competence (Gemeenschapsbevoegdheid). Industrial and technological research and innovation became a Regional competence (Gewestbevoegdheid). In Flanders, these Regional and Community competences were combined. To this day the federal level continues to manage a number of residual competences, such as space research, the Interuniversity Attraction Poles programme (IUAP), thematic research programmes in support of the federal policies (including social cohesion, sustainable development, information society, etc.); international cooperation and coordination; etc.

According to the above-mentioned OECD study, Belgium is the only country where more than half of the R&D expenditures, namely 79%, is executed by the regions - communities. Within Belgium, Flanders accounts - by far - for the largest part of the efforts, in terms of both public and private expenditures. In this way it respresents almost half of all public funds for R&D (the federal government accounts for approximately one quarter of all Belgian public efforts), and Flanders accounts for nearly 2/3 of the country's total R&D expenditure (public and private spending combined).

This implies that for R&D and its related policy, Flanders is to be compared with other countries rather than with other regions.

On the other hand, Flanders lacks some important levers - an important one being fiscal competence - due to which Flanders cannot draw up a comprehensive and optimal smart policy mix.

These considerations are important for accurately appraising the regional information on research and innovation. Since most regions do not have overriding authority over R&D&I, let alone represent such a large share of the R&D expenditures within their country, their policies and budgetary objectives or growth paths cannot easily be compared with those in Flanders. Namely, in practically all cases the region and country follow a joint or coordinated policy approach, and make similar budgetary efforts. For Belgium this is clearly not the case at all.

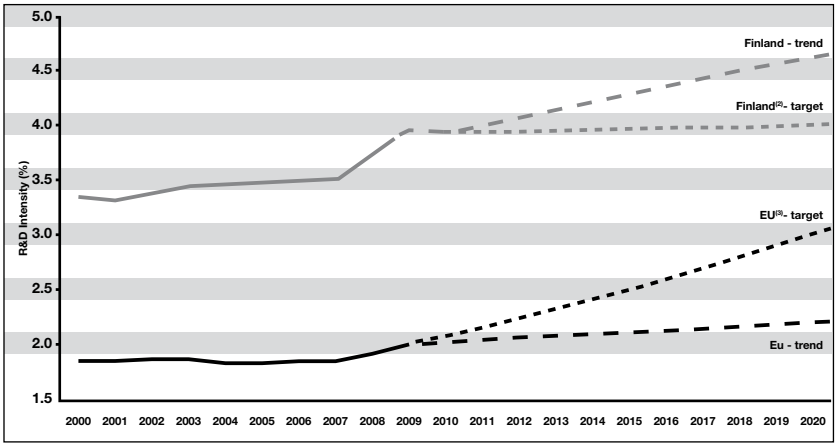
In benchmarking exercises and comparative analysis, the major question always addresses the adequacy of the comparison. The cases could be similar in size, structure and dynamics whereby possible differences in the instruments' on a similar hierarchical level can be identified. On the other hand, they could be different, in which case other approaches which seem appropriate to test and adjust, may be identified or they could cover both aspects, in which case it concerns horizontal and vertical benchmarking.

2. COUNTRY INFO SHEETS

FINLAND

R&D target

FINLAND: R&D Intensity projections, 2000-2020[1]



Source: DG Research and Innovation – Innovation Union Competitiveness Report 2011

In its National Reform Programme Finland postulates to maintain the already attained 4% R&D intensity. Besides this 'general' target Finland also sets a target for government expenditures. It has been decided to maintain R&D expenditures in the years '10 at least at 4% of GDP, of which by 2015 1.2 % will consist of government resources.

Growth path / additional resources

For the growth of R&D government expenditures to 1.2 % of GDP by 2015 Finland has drawn up a growth path. In the Finnish 'Research and Innovation Policy Guidelines 2011-2015' a schedule has been set. The necessary increase in public R&D funds in the period 2011-2015 amounts to a total of 370 million euro. The R&D resources are therefore increased annually with a minimum of 4% in real terms, as suggested in the table below.

	2009	2010	2011	2012	2013	2014	2015
Government R&D funding (mio euro)	1 900	2 055	~2 080	2 175	2 260	2 360	2 450
% GDP	1.11	1.16	1.11	1.13	1.15	1.18	1.20
R&D expenditure, total (mio euro)	6 787	~6 930	>7 290	7 580	7 750	7 900	8 130
% GDP	3.96	~3.90	~3.90	~3.95	~3.95	>3.95	4.00

Earmarking (additional) resources

Where these additional resources will be allocated and where the emphasis is put, becomes evident from the table below, where distribution by institution and the usage is explained.

The funding is first of all intended for research infrastructure, for basic research and the development of tenure tracks for researchers, for education, for research and innovation activities at the highest international level and for other selected areas, SHOKs and internationalisation.

By organisation	M€	Area of use
Tekes	70	Corporate R&D 45, SHOK 20, others 5
Academy of Finland	40	Basic research 30, SHOK 10
Universities	25	Basic research
Polythechnics	20	R&D
Public research institutes	35	R&D; VTT 15
Ministries	135	R&I infrastructures 120
Others[1]	45	EVO funding 15, health and welfare R&D 10, internationalisation
Total	**370**	

[1]: In order to strengthen clinical research, government subsidy for scientific health research in university hospitals (EVO) will be increased by EUR 15 million. Strengthening R&I in the health and welfare sector requires the targeted strengthening of resources of many different actors. Funding that promotes internationalisation cannot be allocated in its entirety in advance to actors. These types of costs include attracting foreign researchers and experts to Finland and an increase in operating expenditure due to increased international cooperation in R&I.

The following table shows the total public funds for R&D (GBAORD: Government budget appropriations or outlays for R&D), their distribution across the various ministries and the increase compared to 2010.

	R&D funding (mio euro)	Share of R&D funding, %	Nominal change from 2010, %	Real change from 2010, %
R&D funding total	2 065.0	100.00	3.8	2.1
Main administrative branches (ministries)				
Ministry of Education and Culture	945.6	45.8	9.1	7.3
Ministry of Employment and the Economy	746.2	36.1	-2.2	-3.9
Ministry of Social Affairs and Health	142.9	6.9	9.3	7.5
Ministry of Agriculture and Forestry	95.1	4.6	-2.6	-4.2
Funding organisations				
TEKES	590.3	28.6	-3.4	-5.0
Universities	555.7	26.9	9.8	7.9
Academy of Finland	349.9	16.9	9.8	8.0
Government research institutes	301.9	14.6	2.1	0.4
Other R&D funding	227.2	11.0	4.2	2.5
University central hospitals	40.0	1.9	0.0	-1.7

The administrative sector of the Ministry of Education and Culture receives 46% of the Government R&D funding and that of Employment and the Economy 36%. R&D funding by the Ministry of Education and Culture increases by 79 million euro to nearly 950 million euro. In contrast, funding awarded by the Ministry of Employment and the Economy goes down by 17 million euro, being just under 750 million euro. Nearly two thirds of the increase in funding by the Ministry of Education and Culture comes from growing research funding for universities. R&D funding by the Ministry of Social Affairs and Health grows by 12 million euro as well.

R&D funding by Tekes (the Finnish Funding Agency for Technology and Innovation), the largest funding organisation, falls in 2011 by, 20 million euro, more than the whole administrative sector it represents. The appropriations and outlays of Tekes total 590 million euro and their share of public research funding is just under 29%. The share of the Academy of Finland, which is the other organisation awarding funding on a competitive basis, is 17% and its total funding amounts to 350 million euro. Funding by the Academy of Finland grows by 30 million euro. A total of 556 million euro, or 50 million euro more than in the previous year, is recorded in statistics for universities in 2011.
In total, 105 million euro of the R&D funding, paid from different items in the State budget are allocated to international operators. Of this, 80 million euro are awarded to European research organisations and programmes.

Policy Framework

Strategic plan

The Finnish *'Research and Innovation Policy guidelines 2011-2015'* is a report drawn up by the Research and Innovation Council chaired by the Minister responsible for Education, Research and Innovation (ERI). It plans measures to improve the quality and efficiency of the Finnish ERI and provides guidelines for national measures and financing that will be needed in the next legislature (2011-2015). The programme aims to accelerate the reform of the research and innovation system, which has been commenced under the current government. It also contains topics with a timetable up until 2020.

Internationalisation

The low level of internationalisation is seen as a weakness in Finnish S&I policy. To remedy this, the Finnish Research and Innovation Council accepted a strategic document on 1 December 2009 regarding its *"promoting the internationalisation of Finnish education, research and innovation in 2010-2015."*

From this policy document we take the following:
"With a view to more effective cooperation, Finland must prioritise the research areas and geographical regions which have the greatest relevance to us and in which our country has world-class expertise and potential for development. Closer interaction, especially with leading global partners, entails that we have world-class expertise of our own. In international collaboration we must be able to exert more influence regarding both the content and targets of cooperation.

One special challenge for Finland is to further enhance our solid knowledge base, maintain internationally competitive clusters of top quality and strong relevance and to set up selected, high-standard innovation environments in the regions. This requires close interaction among the central administrative sectors and large urban areas (incl. municipalities, regional development companies, technology centres and science parks), the pooling of resources and joint development action. A stronger systemic approach is needed in policy action relating to internationalisation and involving several responsible authorities.

Success in international cooperation and competition calls for both specialisation and reallocation of resources and actions. The choices must fall on areas

already prioritised. These are the fields of the strategic centres of excellence, the bio and nano fields to the extent Finnish knowledge is of world-class standard, and software expertise. Secondly, Finland must concentrate on fields in which Finnish research exceeds the critical mass and is internationally known. Thirdly, it is necessary to focus on new openings, such as sustainable, energy conserving and environmentally friendly solutions and clean technologies. Similarly the need for knowledge, new procedures and innovations in the health and well-being sector is growing at a rapid pace, which calls for significant intensification of international collaboration in this sector.

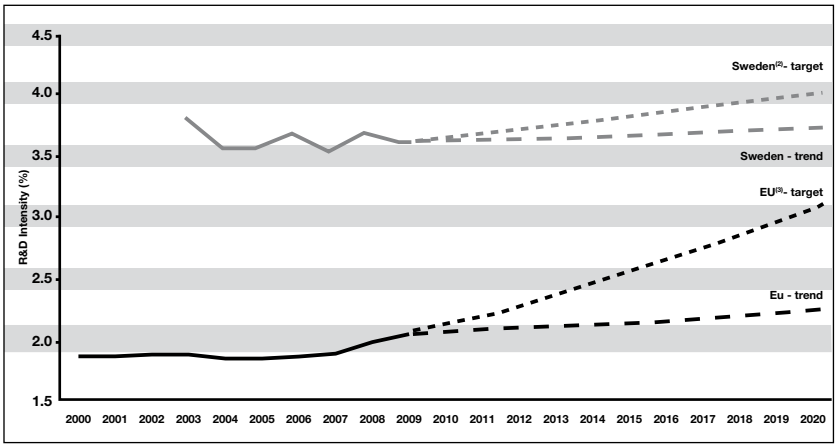
With a view to enhancing human capital and responding to educational needs, Finland must enlarge the recruitment base and activities, internationalise education and training and enhance the quality of education. In development, attention needs to be focused on improving the attractiveness of the researcher career and increasing mobility. Better quantification and (re)direction of education and knowledge are of the essence. Similarly, more vigorous efforts must be made to promote the integration of migrants and the utilisation of their knowledge in society. Finland must adopt a proactive employment- and competence-based immigration policy and legislation in support of it.

Large-scale internationalisation requires further resources; both public and private investments need to be increased. New joint financing measures and resources involving several partners are highly needed. Through consolidation, development must aim at ensuring sufficient human resources of the highest quality, creating and maintaining infrastructures and speeding up the internationalisation of (growth) enterprises. Improving competitiveness and capacity for cooperation entails incentives and steering that efficiently promote networking and risk-taking on the part of the operators in Finland and internationally."

SWEDEN

R&D target

SWEDEN: R&D Intensity projections, 2000-2020[1]



Source: DG Research and Innovation – Innovation Union Competitiveness Report 2011

In its National Reform Programme Sweden aims to attain R&D expenditures of 4% of GDP by 2020. Sweden is already one of the leaders as regards R&D intensity: 3.62% in 2009. There is no target for government expenditures.

Growth path/additional resources

The country does not propose a growth path to reach this 4% target.

Sweden is one of the countries where government invests most in research and development in relation to population size. Public funds to R&D in the central government budget are estimated to amount to SEK 25.6 billion (2.8 billion euro) in 2008. Central government funds to R&D combined with R&D funds from municipalities, county councils and research foundations are estimated to amount to some 0.94 per cent of GDP in 2008.

In Sweden public support for R&D remained constant for a long time, but resources dedicated to R&D increased in the period 2009-2012 with an additional 5 billion SEK (545 million euro). Note that this growth is not included in the forecast (see figure). With this investment of 5 billion SEK (545 million euro), the government estimates that public sector R&D support will amount to 1% of GDP.

Of the Swedish government's direct R&D investment, 56% goes to curiosity-driven research and 42% to mission-oriented R&D (20% to defence-related research and 22% to non-defence-related research). The clear majority of the investment in curiosity-driven research (SEK 11.0 billion or 1.2 billion euro) is transferred directly to the universities and the university colleges and the remainder is funnelled through three research councils (respectively the Swedish Research Council, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS) and the Swedish Council for Working Life and Social Research (FAS)). A range of sector agencies manages the investment that is not directly defence-related.

Earmarking (additional) resources

Although no growth path has been drawn up, it has been stipulated how the extra 5 billion SEK (545 million euro) will be distributed. This is shown in the table below (figures in million SEK).

	2009	2010	2011	2012
Appropriations for universities and higher education institutions	700	1000	1200	1500
Strategic areas – medicine, technology and climate	500	1000	1300	1800
Research Councils	200	300	300	500
Infrastructure – biobanks, registers, etc.	100	100	100	100
Industrial research institutes	100	200	200	200
Innovation package	100	100	100	150
Abolition of higher education VAT	300	300	300	300
Previously announced*	400	400	400	400
Total	**2400**	**3400**	**3900**	**5000**

**To be divided in accordance with the 2007 Budget Bill*

Most of these central government funds go to universities and other higher education institutions. The appropriations will increase by SEK 1.5 billion (163.5 million euro) over the period 2009–2012. Apart from this increase, the major portion of the strategic investments will also benefit universities and other higher education institutions. This will be distributed in accordance with a new system in which quality will determine how much each university or higher education institution will receive. Quality will be measured by means of two criteria - publications/ references to publications and external research funds.

SEK 1.8 billion (196 million euro) of the SEK 5 billion is allocated to what is planned to be a permanent, annual increase in appropriations to research in a number of strategically important areas (medicine, technology and climate, see below). The investments are built up gradually: SEK 500 billion (54.5 billion euro) has been allocated for 2009, and additional funds are provided in 2010 and 2011 to reach an annual level of SEK 1.8 billion in 2012.

In terms of actual amounts, the largest increases will benefit research into medicine, technology and the climate. The largest increase in resources will take the form of direct appropriations to universities and higher education institutions, but the Swedish Research Councils and the Swedish Agency for Innovation Systems will also benefit from significant increases in appropriations.

MEDICINE

Molecular bioscience	SEK 190 million
Stem cells and regenerative medicine	SEK 65 million
Diabetes	SEK 70 million
Neuroscience	SEK 70 million
Epidemiology	SEK 25 million
Cancer	SEK 70 million
Psychiatry	SEK 25 million
Health care research	SEK 70 million

TECHNOLOGY

Nanoscience and nanotechnology	SEK 80 million
e-Science	SEK 70 million
Materials science	SEK 65 million
Production science	SEK 70 million
IT and mobile communications	SEK 125 million
Transport research	SEK 160 million
Aviation	SEK 20 million
Space research	SEK 20 million

CLIMATE

Energy	SEK 310 million
Sustainable use of natural resources	SEK 70 million
Impact on natural resources	SEK 75 million
Climate models	SEK 40 million
Marine environment research	SEK 40 million

OTHER

Security and emergency preparedness	SEK 40 million
Conditions for economic growth	SEK 10 million
Politically important geographical regions	SEK 20 million

The increase will partly be an outcome of the abolition of the Research VAT (8%) on external funding, which corresponds to SEK 300 million (or 32.7 million euro) yearly.

In the new research bill, the Government also presents an 'innovation package' to increase the commercialisation of research results. Innovation offices will be set up at a seven universities, supporting commercialisation, patenting and licensing, etc. A total of SEK 150 million per year (16.4 million euro) has been allocated for this purpose. Almost half of these funds will be allocated in 2009.

Policy Framework

Strategic Plan

The Swedish Strategic Plan for R&D *'A boost to research and innovation'* can be considered as the policy framework, which was presented by the new government when it took office in 2008 and which has defined both the framework for and the distribution of means of research supported by the Swedish government for the period 2009-2012.

Focus

Sweden has since long adopted a model where public funds for research are mainly linked to universities. The majority of the central research funding goes to universities and other higher education institutions. The support of 'basic' research by the central Swedish government has for a long time been performed in two ways: on the one hand there are the direct credits to universities (first flow of funds: operating funds) and on the other hand there are the credits distributed through the research councils (second flow of funds). This occurs without putting any particular focus.

'*A boost to research and innovation*' not only announces the largest ever increase as regards financial resources for S&I (20% increase over four years), but also carries out the most important reform in 60 years, by breaking with the above-mentioned dual system and by introducing a third important type of public funding: 'Strategic Investments'. These strategic investments aim to build new world-class research environments in research areas specifically selected for their strategic importance to society. To this end the strategic plan advances three broad areas, to which more resources have been allocated: medicine, technology and climate. Three criteria were used to determine these strategic areas:

- The research should contribute to finding solutions to important worldwide issues and themes;
- It must take place in areas where Sweden is already performing world-class research;
- It must concern research areas where Swedish companies carry out their own research and development, and where public investments strengthen the development and competitiveness of the corporate sector in Sweden.

Internationalisation

From the Swedish policy document it can be seen that Sweden is also convinced that *"International cooperation is necessary to carry out high quality research, as well as recruiting students, doctoral candidates and researchers from other countries. As a result of the European framework programmes, cooperation with European researchers has increased, and is now at a level with the cooperation that*

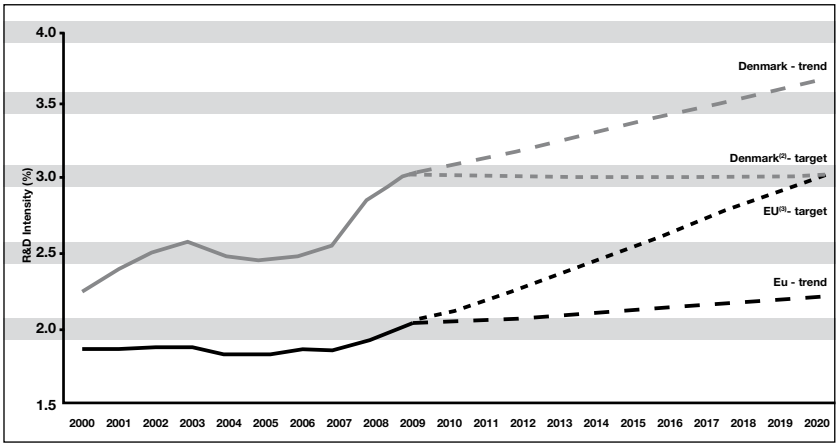
exists with researchers in the USA. This is a development that should be supported. Swedish institutions of higher education should play a leading role in international cooperation by actively cooperating with researchers from other countries and by increased student and teacher exchange.

The EU's decision to invest in the European Institute of Innovation and Technology (EIT) will lead to the creation of networks between European universities in different areas of technology. This proposal fits in well with the Swedish research landscape with its high levels of competence in information and communications technologies, and environmental and energy technologies. Sweden's strategic investments can facilitate the participation of higher education institutions in playing a leading role in some of these EU initiatives. Within the framework of fund appropriations, funding should be provided for international research cooperation also with countries outside the EU."

DENMARK

R&D target

DENMARK: R&D Intensity projections, 2000-2020[1]



Source: DG Research and Innovation – Innovation Union Competitiveness Report 2011

In its National Reform Programme, Denmark postulates attaining the 3% by 2020. The country has actually already achieved this target, due to considerable efforts during the past years. The expenditures of the public sector amounted to 0.99% of GDP in 2009. There is no real target for this.

Growth path/additional resources

No information was found about a possible growth path and further increase of public funding for R&D. In terms of net expenditures the budget of the Ministry of Science, Technology and Innovation shows a considerable increase from 2007-2008 (10%) after a rather stable development since 2003.

Earmarking (additional) resources

The distribution of the net expenditures of the ministry shows that funding to Danish universities constitute by far the largest budget post included in the Ministry's budget. The level of appropriations to research and university education has remained fairly stable around 1.340 to 1.475 billion euro in the period 2003-2006, but amounted to 1.924 billion euro in 2010. Funding to research councils and research education increased from around 134 million euro in 2003 to 333.4 million euro in 2008. In 2010, it reached its highest level with 362.9 million euro. Funding to research institutions increased during the period 2003-2005 from 44 million euro to 64 million euro, but fell sharply to 23.1 million euro in 2008 as a result of the amalgamation of most of the research institutions with universities. In 2010, the net expenditures amounted to 18.9 million euro.

Administrative expenditures almost doubled from 2003 to 2005 (from 73 million euro to 141 million euro) but have been reduced to 70.1 million euro in 2008. We mention this budget post because, in addition to the management of the Ministry, it also includes international research collaboration and new research programmes.

Policy Framework

Strategic Plan

The strategic plan *'Denmark 2020 knowledge-growth-prosperity-welfare'* that the Danish government has drawn up in spring 2010 in response to the economic and financial crisis is fairly broad. It is a strategic plan that is rather comparable to the Flemish ViA plan.

Focus

As in Sweden, the Danish S&I policy focuses mainly on the universities. Again a large part of R&D funding is directly allocated to the universities or through the 'Council for Independent Research', the 'Danish National Research Foundation' and the 'Danish National Advanced Technology Foundation'. This implies that the overall policy documents usually do not give a clear indication of those areas on which Denmark should focus.

However, this has changed somewhat with the report 'Forsk2015', published by the Ministry of Science, Technology and Innovation in May 2008. This report is a catalogue over 21 strategic research priorities and is the result of a broad process involving universities, research councils, public research organisations, national authorities and non-governmental organisations. The catalogue shall be used for guiding strategic research priorities.

In any case, every year a part of the public resources is devoted to strategic research in those areas that could drive increases in prosperity or help solve important social difficulties. In 2009 a total of 383 million DKK (51.3 million euro) was allocated to strategic research; and the amount for 2010 totalled 624 million DKK (83.7 million euro). The following themes were designated as priorities:

- Energy, climate and environment
- Production and technology
- Health and prevention
- Innovation and competitiveness
- Knowledge and education
- People and social design

As mentioned previously, the Danish strategic plan is very general but ambitious. The objectives are focused on long-term challenges that Denmark has to face:

1. Denmark should belong to the richest countries in the world.
2. Danish manpower supply must belong to the world's top ten.
3. Danish school children must be among to the smartest in the world.
4. At least one Danish university must belong to the top 10 in Europe.
5. Denmark must be one of the ten countries in the world where people live the longest.
6. Denmark must be a green, sustainable society and belong to the three most energy-efficient countries in the world.
7. Denmark should be at the top in creating equal opportunities.

8. Denmark must belong to the freest countries and be among the best in Europe for successful integration.
9. The Danes must belong to the people with the most confidence and the greatest sense of security in the world.
10. The public sector must be one of the most efficient and less bureaucratic in the world.

One of the objectives states that Denmark should have at least one university in Europe's top-10, while all Danish universities should at least maintain their current international ranking (or even improve it) by 2020. Also, the high international level that some Danish research and education institutions have reached should be maintained.

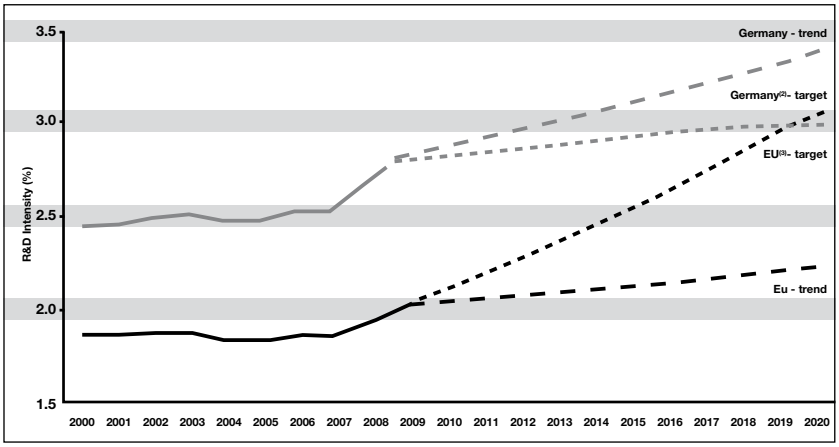
Internationalisation

Denmark is working on the internationalisation of its universities. *"The Government will continue the work towards internationalising Danish research activities and international cooperation between universities. In the ongoing allocation of the globalisation funds, the Government will endeavour to prioritise funds for Danish universities' participation in international university partnerships and networks. We will give priority to the networks and partnerships where Danish universities gain access to cooperation with foreign universities that are among the world's leading universities."*

GERMANY

R&D target

GERMANY: R&D Intensity projections, 2000-2020[1]



Source: DG Research and Innovation – Innovation Union Competitiveness Report 2011

In its National Reform Programme Germany has included its aim to attain 3% R&D intensity by 2015.

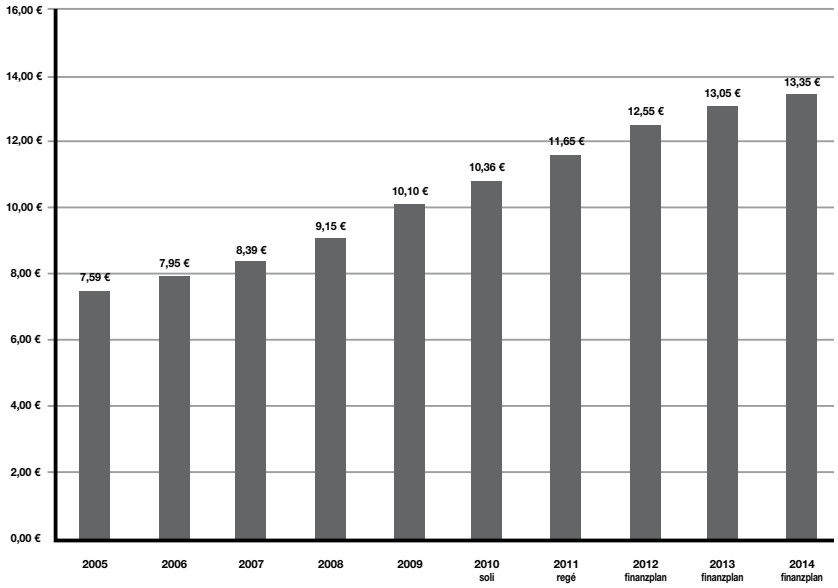
Also noteworthy is the fact that - apart from the 3% target - the German federal government and the Länder (regions) have agreed on a further joint 10% target for research and education.

Growth path/additional resources

A real growth path towards these targets could not be found. In the German 'coalition agreement' for the current legislature, the government partners did agree to invest an extra 12 billion euro in the key fields of education and research between 2010 and 2013 - 6 billion euro in each of the two areas. Despite the subsequent necessary savings, this agreement has remained intact: the extra 12 billion euro has been included in the budget of the federal ministries and the financial planning of the federal government.

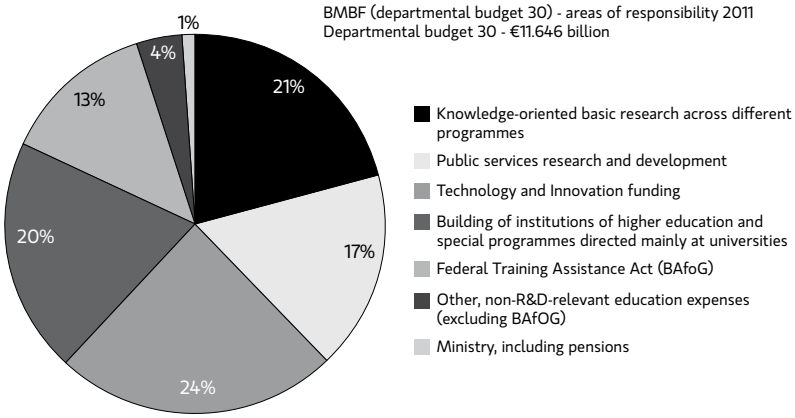
The BMBF (*Bundesministerium für Bildung und Forschung*, the German Federal Ministry for Education and Research) plays a central role in these activities and is to receive more than half of the funding for education (59%) and about two thirds of the funding for research (66%). The remainder will be made available to other Ministries that have responsibilities in the areas of education and research in addition to their core fields of work.

With a total volume of 1.6 billion euro, the BMBF's budget for 2011 has increased by about 789 million euro - or more than 7,2% - compared with 2010. The 2010 budget in turn alo increased with 750 million euro or 6.5% compared to 2009. The further steps would look as follows:



Earmarking (additional) resources

A rough distribution of the resources for BMBF for 2011 is shown below:



A more detailed overview and a further subdivision of the additional resources cannot be found. It should also be noted that 'education' here is understood in its broadest sense. Special priorities include early childhood education, promoting young skilled staff, and higher education.

For example, the BMBF is providing an additional 160 million euro to increase training assistance under the BAföG (*Bundesausbildungsförderungsgesetz* or law for student financing). The existing pillars of the Hochschulpakt (a joint programme of the federal states and the Federal Government, which aims at creating additional student places at universities and improving university research) are constantly

reinforced. To this end a total of 910 million euro has been dedicated in 2011. In addition, the Federal Government and the federal states have created a third pillar for the *Hochschulpakt* - the pillar of quality education. In 2011 the federal government will set aside 140 million euro for this pillar.

The BMBF will make almost 327 million euro available for the continuation of the successful Initiative for Excellence (*Exzellenzinitiative*). It supports cutting-edge research at universities, undertaken in cooperation with research organizations and the private sector. This is strengthening research at universities and making it more visible. The first round already generated a wave of innovation at German universities, triggered structural changes, and significantly increased the attractiveness of German universities for researchers and students from Germany and abroad. The competition 'Advancement through Education: Open Universities' is being launched in order to strengthen lifelong learning. 250 million euro are to be provided for this by 2018.

The Federal Government is also increasing funding for large research organizations. It will continue the successful Joint Initiative Research and Innovation, which guarantees German research organizations an annual increase of 5% from 2010 to 2015. Basic funding for institutions will increase by approximately 228 million euro compared with 2010. The Joint Initiative for Research and Innovation is designed to give financial planning security to institutions that are jointly funded by the Federal Government and the Länder (Fraunhofer Society, Helmholtz Association, Max Planck Society and Leibniz Association) as well as the Deutsche Forschungsgemeinschaft. In addition, they can receive additional funds if they

establish new organizations or change their form of funding. This will give them room for manoeuvre and enable them to trigger dynamic developments despite the rising costs.

The establishment of German centres for health research is a core element of this coalition's research policy agenda.

Project funding in the life sciences will continue at a high level, with approximately half a billion euro. The same applies to new technologies (709 million euro), with a special focus on electromobility research and on the area of climate, energy and environment (368 million euro). This means that the electromobility and battery research initiatives and the photovoltaics innovation alliance can be realized according to plan. A total of 131 million euro will be available in 2011 for new funding instruments in connection with the High-Tech Strategy, particularly the Leading-Edge Cluster Competition, the validation of research results, and the industry-research campus.

Legal anchoring growth path/(additional) resources

The significant increase in resources for research and education (12 billion euro in 2010-2013) was part of the 'coalition agreement' between CDU, CSU and FDP at the start of the legislature at the end of 2009. Based on this aspect in the coalition agreement the Ministry of Finance provides an annual increase in the R&D budget of all ministries involved. This is the case until 2013 (see the agreement) to reach the extra 6 billion euro for R&D and the extra 6 billion euro for education by

the end of this legislature, i.e. 2013. Apart from this multiannual budget, in which the growth path is set out, there is no legal framework for anchoring the resources. Nevertheless, a serious political problem would arise if this agreement were not fulfilled, due to which it may be deemed to be a quasi-statutory anchoring. On the other hand this coalition agreement only covers the current legislature.

Policy Framework

Strategic Plan

The German '*High-Tech Strategy*' is the central instrument for the strategic coordination of the national innovation policy. In the *'High-Tech Strategy'* objectives have been formulated around a wide range of different areas of innovation, priorities have been set, new instruments introduced, etc. The objective is to create leading markets and establish leading suppliers, to ensure greater cooperation between knowledge institutions and industry and to further improve the general conditions for innovation. The *'High-Tech Strategy'* is a comprehensive R&D plan at government level where various players such as ministries and programmes (both existing and newly developed) are involved in a common strategy, although the budget is still based on annual budget cycles.

Focus

With this 'High-Tech Strategy' Germany aims at being among the world leaders in tackling global challenges such as:

- climate / energy;
- health / nutrition;
- mobility;
- security;
- communications

and offer convincing answers to the pressing issues of the 21st century. With this, they not only intend to improve prosperity and welfare, it also offers new potential for value creation in the private sector, creation of high-level employment and making better use of talent.

One of the most important aims of the new *'High-tech strategy'* is to gear research and innovation policy towards a number of central objectives. To this end, the federal government will define 'forward-looking projects', which will study the main challenges in the above-mentioned fields of action. These projects seek to achieve specific objectives for scientific and technological development over a period of ten to fifteen years. Innovation strategies will be formulated and, in concrete cases, steps for their realisation are planned. The selected 'forward-looking projects' are e.g. 'to living an independent life well into old age' and 'CO2-neutral, energy efficient and climate-adapted cities'.

Key technologies (information and communication technologies, optical technologies, production technologies, materials technologies, biotechnologies, nanotechnologies, microsystems technologies and innovative services) are recognised as driving forces for innovation. Therefore the financing of these key technologies is geared towards solving specific problems in the selected action fields.

Also, measures to improve the general conditions for innovation will be financed to encourage new developments in these five action areas. It concerns e.g. the conditions for starting up a business, innovation finance / venture capital, skilled manpower, etc.

Internationalisation

In February 2008 the German federal government approved the '*Strategy for the Internationalisation of science, research and development*' with which Germany's position in the knowledge society should be strengthened. This strategy has four main objectives:

1. Strenghten cooperation in the field of research with the worldwide leaders:
   In the future the German researchers must work even more closely with the most innovative researchers and internationally leading research groups. At the same time, Germany has to become first choice for the best researchers and students from all around the world.

2. International exploitation of the innovation potentials:
   German companies have to acquire a good place in the leading and newly emerging high-tech world markets and as a partner convince the world's most creative R&D centres. In doing so, the attractiveness of Germany should increase as an environment for innovation, particularly for R&D-intensive companies.

3. Intensify cooperation with developing countries in education, research and development on a long-term basis:
   In the future scientific and technological cooperation and development cooperation will be better coordinated so that modern higher education, research and innovation systems can be established or expanded in Africa, Latin American and Asian developing countries and the conditions for closer scientific cooperation can be improved with the newly established scientific and economic centres. This also signifies an important contribution to the economic, social and cultural development of these countries and is part of the international efforts to reduce poverty and to tackle other global challenges.

4. Assuming international responsibility and tackle global challenges:
   Germany will use its research and innovation potential to contribute towards solving the worldwide challenges regarding climate, resources, health, security and migration. In this way, Germany will not only be able to make concrete its objectives in science policy but also its objectives regarding foreign policy and development.

To realise these objectives, the emphasis must be on internationally oriented research policy measures:

The training of young researchers must increasingly have an international profile to improve the international and particularly the European mobility of the German researchers. International research projects and excellent, internationally available German research infrastructure should help provide German researchers access to research infrastructure, the large facilities and collaboration in other countries as well.

Funding programmes with a national, regional or international focus should be better coordinated and strategically aligned in those cases where they can be complementary. The general conditions for international R&D investments in Germany and the knowledge transfer between public research institutions, higher education institutions and companies should be optimised. German investments abroad should produce the greatest possible benefit for Germany.

The instruments for development cooperation and those for scientific and technological cooperation will be strategically aligned and where possible supplemented in accordance with the priorities agreed with the partner countries. Strengthening higher education and research structures contributes to the development of local solutions to worldwide problems, avoids migration of the elite from the developing countries, helps the developing countries to catch up with the worldwide knowledge society and facilitates co-operation with the German researchers based on partnership, in the interest of both parties.

The federal government uses its influence in the international bodies to develop and execute an international research agenda that tackles worldwide challenges, including climate change, resolving the shortage of resources, dealing with threats to security and combating infectious diseases worldwide. In addition, international cooperation in human and social sciences will be intensified to support the globalisation process in a constructive manner and to control its impact on society.

GERMAN REGIONS

R&D target – growth path – resources

Bavaria has only general objectives, but no concrete plan for a budget increase for R&D in the future. Germany has foreseen a growth path of 5% annually for the (federally financed) research organisations, through its package of additional R&D support worth 12 billion euro, This concerns in particular the Fraunhofer Society, Helmholtz Association, Max Planck Society, Leibniz Association and the German Research Association. For the institutions concerned that are located in Bavaria, the regional government will also foresee an increase of the budget of 5% annually. This increase means about 8 million euro per year for the budget of the Bavarian minister for science and research. Fraunhofer Gesellschaft, however, falls under the responsibility of the Bavarian Ministry of Economic Affairs (no exact data are known). Noteworthy is that all these institutions are financed jointly by the Bündesstaat (German federation) and the Länder (regions), but the support ratio varies depending on the case. It is a fifty-fifty ratio for the Max-Planck Society,

while for the Helmholtz Association 90% of support is federal and 10% regional. The criteria for how the share of each region is determined follow different rules for each research institution. For these reasons it is not obvious to know the exact (regional) government efforts. These must also be placed in the overall context: 80% of more than 12 billion euro GERD spent annually in Bavaria is financed by the private sector. For North Rhine-Westphalia and Baden-Württemberg no information is available.

Legal anchoring growth path/ (additional) resources

In Bavaria specific budget increases are discussed during the budget negotiations for the respective two years budgets and ultimately by the Bavarian state parliament (the 'Bayerischer Landtag') that has the constitutional right to decide about the budget. The coalition agreement sets the increase of the R&D share of Bavaria in GDP at 3.2% in 2013 and 3.6% in 2020.

Policy Framework

Strategic Plan

The government of North Rhine-Westphalia set in 2006 an 'Overarching Innovation Strategy', in one single document. The region now focuses mainly on human potential.

Baden-Württemberg has no explicit overarching strategy at the moment, but will prepare this after the regional (state) elections that took place recently. Nonethe-

less, North Rhine-Westphalia and Baden-Württemberg possess of extensive policy instruments and associated budgets to support research and innovation with the present knowledge institutions.

Bavaria coordinates its Innovation Strategy, which is set out in several related policy documents. It has a relatively comprehensive policy of general and specific (thematic) policy intentions and initiatives, for both innovation and research. An integrated strategy for R&D is being drawn up at this moment between the relevant ministries (BY State Ministry for Science, Research and the Arts and the BY State Ministry for Economic Affairs, Infrastructure, Transport and Technology). In the coalition agreement of 2008 the ruling parties declared that they will maintain and strengthen Bavaria's leading position in research, technology and innovation: *"Research, innovation and new opportunities through ethically justified technological progress are fundamental requirements for good jobs today and tomorrow"*. The plan from 2007 *'Zukunft Bayern 2020 - Nachhaltige Politik für Kinder, Bildung und Arbeit - Megatrends und ihre bessere Nutzung durch Wirtschaft und Wissenschaft'* has put priority objectives for 2020. The 'High-Tech-Offensive Bayern' shapes the overall STI framework. There is also the *'Allianz Bayern Innovativ'* from 2008, which should encourage cross-sector regional networks and focus on 19 technology areas.

Focus

The German regions included in this note have a relatively comprehensive strategy (systemic, thematic, instrumental), although not always defined under this heading.

For example, in Bavaria, the expansion of the research landscape and the (further) commitment to excellence is a top priority for the government. Both traditional and new policy instruments support the technological landscape. Their traditional instruments include:

- The funding and upgrading of basic research activities at universities and Max-Planck institutes;
- The funding and upgrading of applied research activities, primarily at the universities of applied sciences and institutes of Fraunhofer-Gesellschaft;
- A firm level, non-technology-specific R&D support programme (BayTP or Bayerisches Technologieförderungs-Programm);
- A technology-specific R&D support programme, e.g. in microelectronics, microsystems technologies, new materials;
- The support of start-up and entrepreneurial activities within the context of high-risk technological and economic development projects (BayTOU – Bayerisches Programm zur Förderung technologieorientierter Unternehmungsgründungen).

The Bavarian State Government has set up and funds three major technology transfer organisations. The guidelines of the objectives of its research strategy are:

a. Strategic:
    - Creating conditions as optimal as possible for research and science;
    - Reinforcing the competitiveness of the research institutions;
    - Promoting interdisciplinary research and networking;
    - Ensuring the practicability of research results.

The *'Cluster Campaign'* was set up to promote Bavaria's role as a top destination for companies and researchers. It is flanked by a second pillar in the form of the *'Allianz Bayern Innovative'* from 2008, which should encourage cross-sector regional networks and focus on nineteen technology areas.

b. Instruments: the R&D instruments contain different approaches that interact with each other, in particular:
   - legal framework, inter alia in tax law for businesses and in industrial and collective bargaining law for scientists;
   - competitive pay and attractive research and working conditions for scientists at universities and research institutions;
   - modern infrastructure of research institutions;
   - budget increases;
   - international networking of Bavarian universities and research institutions.

c. Thematic: The Bavarian state universities cover a broad thematic range of scientific disciplines. Further increasing the acknowledged excellence of research and strengthening it with the view to international competition is an important goal of the Bavarian research policy. The Bavarian research and technology policy has set targeted priorities on specific key technologies for the long time period. The key technologies are:
   - Air and space technology;
   - Information and communication technology;
   - Life sciences;
   - Medical technology;

- Materials research;
- Environmental technology;
- Mechatronics;
- Nanotechnology.

Bavaria is the only German region with a regional strategic concept ('Elite Network of Bavaria') that includes, among other things, the following: elite graduate programmes, international doctoral programmes and a support programme for excellent students.

Baden-Württemberg has a very strong research infrastructure and within the public research sector a large number of research institutions active in basic and application-oriented research. It is one of the most research-intensive regions in Europe, according to all types of indicators: share of labour force in high-tech manufacturing, patent intensity, R&D-intensity (4.4% in 2007). In absolute terms the GERD exceeds that of countries such as Finland and Sweden

Within the regional (state) government, research policy initiatives and projects are co-ordinated with technology policy measures for innovation support, as well as education and further training. The regional (state) government funds research in universities and non-university research institutions in a wide range of fields, with a focus on both breadth and depth. Important principles and priorities of research and technology policy in Baden-Württemberg include:

- priority for scientific excellence;
- development of PPP and co-operation;

- strengthening openness to innovation in companies;
- securing human resources for research and innovation.

Initiatives include for example:

- Safeguarding scientific excellence at the universities;
- Promotion of research and teaching for university colleges (= universities of applied sciences);
- Development of Research Infrastructure via the Promotion of centres for applied research at universities of applied sciences (*Fachhochschulen*);
- Support of regional applied oriented research institutes (*Innovation alliance Baden-Württemberg)*.

Also the development of strategic research fields (e.g. life sciences, new materials, nano and microsystems technologies, optical technologies) is promoted.

For more than 10 years, an important instrument of research funding is the priority programme of the Ministry of Science, Research and Arts, through which the allocation of funds to universities is organised in the form of a competition (and with the use of leverage effects), the 'Forschungsschwerpunktprogramm', in order to stimulate the universities look for other national or international funding sources. It is one of the first ministries in a federal state to do this. Particular to Baden-Württemberg is the 'Landesstiftung Baden-Württemberg', a non-profit foundation with capital of 2.4 billion euro raised by privatisation which supports pre-competitive research activities by projects in the fields of education, science and research. Due to legal constraints, however, it is not able to support applied,

market-oriented research. The necessary complement is thus partially provided by the nationally active Steinbeis-Foundation, an institution dedicated to providing innovation related consulting and to enabling technology transfer to enterprises, which was set up and is still headquartered and very active in Baden-Württemberg.

Unlike in many other regions, the role of the regional government is not so much directed towards direct public intervention (i.e. technology promotion), but rather towards the development of the research system and the design of favourable framework conditions in the field of institutional funding, transfer and innovation consulting, cluster and network building. This is due to the fact that in Baden-Württemberg more than 80% of the gross expenditures for R&D originate from industry. There is, therefore, no plan in Baden-Württemberg to increase public spending in this field. The R&D profile is strongly influenced by enterprises in the vehicle and mechanical engineering and electrical engineering sectors (over 80% of the R&D capacity in the companies is concentrated on these three branches of industry. Some 45% of all people employed in R&D enterprises work in vehicle engineering research establishments). The region has a long tradition in this kind of innovation policy, which is favoured by an economic set-up in which many large companies act as important innovation and networking engines. The research and technology policy hence focuses on fostering close co-operation between the science, business and policy-making sectors. For example, a recent activity deals with the further development of technology clusters, not through a big programme, but complementing already existing networks between firms and research institutes. These take place in various fields: automotive development, production technology, renewable energies, medical technologies, microsystems, information

technologies and media, life sciences, fuel cells, crystalline silicon solar technologies, aerospace technologies, intra logistics, digital production, photonics, material sciences, and technical textiles. The philosophy in Baden-Württemberg was and still is to create a dense network of organisations which support research and innovation activities in SMEs and by this qualify them as an interesting partner and supplier for the large firms in the automobile, mechanical engineering and electronic sectors which are a special feature of the regional economy.

Based on the afore mentioned strengths and starting point a more comprehensive approach was proposed in 2008 with a new framework for innovation and technology policy. The major objective of this strategy is to secure and further develop the leading position of Baden-Württemberg within Germany, but also to improve its position as innovation engine and as an attractive investment location on the global scale. Three major fields of activity are important in this respect:

- strengthening world-class research;
- further development of technology clusters;
- promote technology and innovation consulting.

While Baden-Württemberg is one of the innovation engines of Europe (and has a similar structure to Bavaria), North Rhine-Westphalia is an old industrial region which faced severe structural problems from the 1970s onwards, but which now is well on the way to recovery. North Rhine-Westphalia reformulated its innovation strategy in August 2006. In North Rhine-Westphalia, at least in the past 20 years, innovation and technology policy was directed towards too many activities

so that budget constraints mostly lead to the effect that after some years of funding no sustainable structures could be established. Policy was mainly oriented towards short-term success and did not succeed in really establishing competitive technological and scientific potentials. The Innovation Strategy in 2006 of North Rhine-Westphalia includes a number of policy lines aimed at different players and activities:

- '*Hochschulfreiheitsgesetz*' (Law pertaining to universtity colleges of North Rhine-Westphalia);
- Pact for Research and Innovation/initiatives regarding the Excellence Program;
- Pact for Applied Research (applied research at university colleges);
- Knowledge and Technology Transfer from university colleges;
- Patent Strategy *'Innovations-Allianz'* (alliance of innovation) of the university colleges of North Rhine-Westphalia);
- Programmes aimed at stimulating innovation (Innovation Fund);
- Establishment of the ERDF Target objective 2 Programme for North Rhine-Westphalia for the period 2007 to 2013;
- Cluster policy in North Rhine-Westphalia (16 areas and technology branches).

In 2007 North Rhine-Westphalia adopted its regional cluster policy as a component both of innovation strategy as well as its marketing and economic development strategy. The key objective is to establish and nurture targeted and selected regional networks throughout the entire region (state) and to accompany a process of sector-related and technology-based bundling. Thereby 16 areas have been prioritised for 3 years.

The present region (state) government of North Rhine-Westphalia focuses primarily on human resources. It presents itself as a region of talent 'Land der Talente Nordrhein-Westfalen'. This includes the following components: "*Chancen schaffen, Innovationen erweitern, Spitzenforschung ausbauen, Hochschulen unterstützen, Wissen weitergeben, Innovationspreis.*"

The policy mix in North Rhine-Westphalia is designed to react to economic conditions which are not as positive and well developed as in Baden-Württemberg. New research plans and innovation strategies have been formulated and are now in their first phase of implementation. It tries to improve the conditions for research and innovation and formulated strategic goals which should express this realignment in research and innovation policy. The major objective of North Rhine-Westphalia is a fairly ambitious one: to become Germany's number one innovative region. Essential policy elements like the development of the research infrastructure, the strengthening of innovation in SMEs and knowledge and technology transfer activities are addressed. The regional specialisation in technology is only slightly pronounced. North Rhine-Westphalia tries to focus its research and innovation policies towards a closer range of activities. The Ministry of Innovation focuses on four sectors which represent the way forward:
The Ministry of Innovation focuses especially on four sectors that represent the way forward:

- Biotechnology;
- Energy and environment-related research (North Rhine-Westphalia is Europe's leading energy region);

- Medical research/medical engineering;
- Nanotechnology, microtechnology and innovative materials.

ZENIT, the Innovation and Technology Centre in North Rhine-Westphalia, mentions the following priorities for transforming industrial policy in North Rhine-Westphalia during the coming years (until 2015):

- Focus on SMEs (new Qualification & Innovation Programme to reduce qualification gap in SMEs, bridge the gap between SMEs, crafts and research, improve Technology Transfer through Patent Scouts, Patent Expolitation Fund);
- Structural Policy (Reduce numbers of clusters → concentration on lead markets, Branch specific measures: focus on Material & Ecological Sciences, Energy, Green Technologies, Production Technologies, Logistics, Creativity Economy, Bio- and Medical Technologies).

Internationalisation

Baden-Württemberg is very active internationally in the field of research, in various countries throughout the world. For example, it has agreements or long-term cooperations in East and South-East Asian countries (Japan, Israel, Singapore, South Korea, China, Malaysia, Indonesia, Thailand, Vietnam), South American countries (Chile and Brazil), Central and East European countries and the U.S. (Massachusetts, Connecticut, North Carolina, Arizona, California, Oregon) and Canada (Ontario), Africa (Egypt, Namibia, Tunisia, South Africa, Burkina Faso) and Australia.

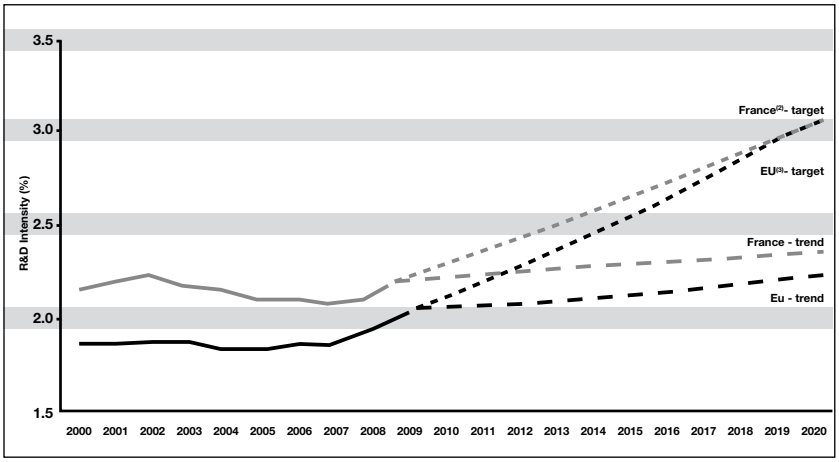
A wide range of international companies or indigenous companies that are internationally active, are located in the regions included in this note, e.g. the German regions, Ile-de-France, Catalonia or South-East England. Part of the STI focus has therefore been on the themes with which these companies have presented themselves, e.g. in Germany this is energy in North Rhine-Westphalia, automotive technology in Baden-Württemberg and medical innovation and technology in Bavaria.

Some of the regions are already at top international level. An example is the case of Bavaria and Baden-Wurttemberg, which have not only demonstrated their strengths through positive participation in EU programmes, but also by participating in the German government's initiative for excellence. In both regions there are thus a number of (university) institutions that can be called excellent and therefore receive significant additional federal financing. Due to this they can further strengthen their position as a leader in international research and education.

FRANCE

R&D target

FRANCE: R&D Intensity projections, 2000-2020(1)



Source: DG Research and Innovation – Innovation Union Competitiveness Report 2011

France sets itself the target to attain 3% R&D intensity by 2020. There is no explicit target for public expenditures.

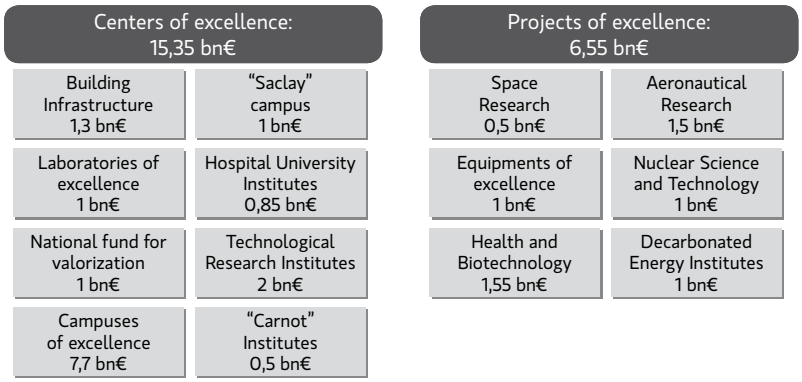
Growth path/additional resources

No growth path, but an additional budgetary stimulus of 35 billion euro can be found for France. In order to shape to the French SNRI (*Stratégie nationale de*

recherche et d'innovation), a special investment plan has been set up: in 2009 it was decided to issue a large state loan of 35 billion euro to strengthen the French innovation potential and the international appeal of the French universities with the purpose of giving a big boost to the economy under the name '*Investissement d'avenir*'. This 'grand emprunt' consists, in fact, of a loan of 21.9 billion euro from the French banking system, plus the repayment of state support worth 13.1 billion euro that the banks received during the financial crisis.

Earmarking (additional) resources

The 21.9 billion euro are managed by the Ministry of Higher Education and Research. 11.9 billion euro go to research and development and are intended both for the development of laboratories and high-level research institutions (*Laboratoires d'excellence, équipements d'excellence, Instituts de recherche et de technologies*) as well as for investment in strategic areas as biotechnology, aerospace and nuclear energy of tomorrow. The resources for higher education (10 billion euro) within the framework of the *'Investissements d'avenir'* are used to promote quality education pools (initiatives d'excellence) and to encourage the establishment of high-level teaching and research pools (Opération Campus, Plateau de Saclay). How this is further thematically and structurally divided, is set out in the figure below.



The remaining 13.1 billion euro goes to support for new information and communication technologies, industry and SMEs. Thanks to the *'Investissements d'avenir'* in the area of digital technology (4.5 billion euro) and in the industry and SMEs (6.5 billion euro), companies can alleviate their costs in the coming years, finance their growth and become more competitive. These investments also finance a programme of sustainable development (1.1 billion euro) and a programme regarding training and equity of chances (1 billion euro). Other benefits may be expected from these investments in the future: for example, synergy can arise around industry areas, campuses, research centres or institutions. In addition, universities or certain sectors of activity can acquire access to more human and financial resources by improving quality and increasing their reputation.

Legal anchoring growth path/ (additional) resources

The legal framework for the *'Investissements d'avenir'* in France is formed by the 'Loi de Finance rectificative' of 9 March 2010. The *'Commissariat General à l'Investissement'* is given the task by decree to monitor the coherence of the state's investment policy.

Looking at the *'Loi de Finance rectificative'*, we notice that the *'Investissements d'avenir'* are part of a series of measures and adjustments in this law. We see in this some resemblance to the programme laws and decrees in Belgium, respectively Flanders. Furthermore, this law seems to have been passed following a budgetary control/adaptation.

Policy Framework

Strategic Plan

The French *'Stratégie nationale de recherche et d'innovation (SNRI)'* (2009) focuses on research and development and determines a reference framework for these. Its purpose is to strengthen the research potential in France and it is committed to go for innovation and impact on the national economy. The plan is also a guideline for steering the research agenda and the S&I budget in the period 2009-2012. It is the result of a widespread consultation with public and private research institutions, parliamentarians and representatives of each of the ministries involved.

Focus

The plan defines five principles and three priority research areas. The five principles are:

- Fundamental research is essential for any knowledge-based society. It should be supported in all its dimensions, particularly with regard to large research infrastructures;
- A research strategy open to society and the economy will improve growth and employment. To develop its competitiveness, France must revitalise the relationship between public research institutions and enterprise, through greater trust and more cooperation and based on specific objectives for the medium and long term. This general view implies aiming for a creative society, where innovation is not only accepted by citizens but also brought about and carried by them;
- Better risk management and more security are particularly important in our society; this should be duly taken into account with social, cultural and technological innovations;
- The human and social sciences must play a bigger role in all priority areas, by contributing to the development of interdisciplinary interfaces in all key domains;
- Multidisciplinarity is extremely important for paving the way for the most innovative approaches and for tackling the challenges of our society.

The three priority research areas are in line with the socio-economic needs and with the scientific disciplines in which France has built up a leading position. They

also respond to social challenges, correspond to new economic opportunities with strong innovation potential and require interdisciplinary research for which France can mobilise top researchers.

- Health, care, nutrition and biotechnology;
- Environmental urgency and eco-technology;
- Information, communication and nanotechnology.

For both the five principles and the three priority research areas, the note gives input/ideas for the further development (common key ideas) and sets priorities/objectives. Thus they wish e.g. to make research careers more attractive (more motivating), to create a more attractive innovation climate, etc. However, no concrete actions have yet been associated with these underlying ideas. The *'Investissemtents d'avenir'* do correspond to these issues (see above).

FRENCH REGIONS

R&D target - growth path - resources

Rhône-Alpes and Nord-Pas de Calais have no target or growth path for R&D intensity. The additional resources that the French government approved in 2010 for the institutions in France, will probably partly end up in Rhône-Alpes, given that some 'pôles de compétitivité' perform strongly in this region and enjoy international recognition. This will positively influence the total R&D expenditures in the region.

The same applies for Ile-de-France. It has a 5% target for R&D&I expenditures as % of total regional expenditures. For the 2007-2013 economy-innovation plan that Ile-de-France is executing jointly with France, the data are as follows:

The total budget of the *'contrat de projets Etat-Région 2007-2013 (CPER)'*, signed on 23 March 2007, amounts to 5.466 billion euro (not including the Plan Seine), with a contribution of 3.425 billion euro (62.7%) for the region and 2.041 billion euro (37.3%) for the French state. Within the framework of the new contract, the French state and the region will jointly commit 1.42 billion euro for higher education and research, of which 725.4 million euro will come from the French state and 689.4 million euro from Ile-de-France. Compared to the CPER 2000-2006, these resources have increased by over 22% for the state and by more than 75% for the region. The region thus allocates a relatively higher proportion from its own resources. In the agreement between both parties, the following division is stated under Grand Projet 4 (figures in million euro):

	Eng. total Etat/Région	**Eng. Fin. de l'Etat**	**Eng. Fin. de la Région**
GRAND PROJET 4: Enseignement supérieur	1.214.000	625.000	589.000
GRAND PROJET 4: Recherche	200.800	10.000	28.000
GRAND PROJET 4: Pôles de compétitivité	38.000	10.000	28.000

Legal anchoring growth path/(additional) resources

For Ile-de-France the commitments of the budgetary increase are agreed in the 2007-2013 agreement between the region and the French state. The recent 2011-2016 plan for higher education and research in the region was endorsed by the regional government through a convention of 7 April 2011. The 2011-2014 *(SRDEI - Stratégie Régionale de Développement Economique et d'Innovation)* plan will be put to the vote in June by the Ile-de-France government. The objective to spend 5% of the regional budget on R&D&I comes from the Conseil régional.

Also in Nord-Pas de Calais and Rhône-Alpes the regional authorities approve their own plans, and there is an agreement with the French state for 2007-2013 to commit budgetary resources.

Policy Framework

Strategic Plan

In its *'Strategy Régionale de Développement Economique et d'Innovation'* for 2011-2015 Rhône-Alpes takes a series of measures for its further socio-economic development under the motto *'Entreprendre, soutenir, innover'*. With its Stratégie régionale, the region also approved a plan for *'Enseignement supérieur, recherche & innovation'*, aimed at supporting the transformation to a knowledge society in February 2011. In 2005 it was the first French region to establish such a plan for

higher education, also due to the fact that Rhône-Alpes belongs to the EU regions with the highest R&D intensity and a large research presence (e.g. 28.000 permanent researchers). Rhône-Alpes wishes to strengthen its reputation as a key region for innovation.

Nord-Pas de Calais is focusing its efforts particularly on innovation rather than on R&D. Since 2010 it has a '*Stratégie Régionale de l'Innovation*' focused on three thematic priorities and a number of transversal objectives. The economic players proclaimed 2008 as an innovative year and drew up a *'plan innovation valorisation de la recherche'* with a communication campaign for the brand *'J'innove'*, which is still ongoing and mainly business-oriented.

Also in Ile-de-France a policy is being pursued that promotes innovation in particular, given the many large companies on its territory. But the region is also making big(ger) efforts for research resources focused on the institutions in its territory. As a region making by far the largest R&D effort in France, in late 2010 it approved the *'Politique regionale en faveur de l'enseignement superieur et de la recherche'* for the period 2011-2016. Ile-de-France is working on a new economic development and innovation strategy for 2011-2014 (*SRDEI - Stratégie Régionale de Développement Economique et d'Innovation*). This should be approved in June 2011 and contain more concrete data. Like the other French regions, it has an agreement with the state for the period 2007-2013 which also includes research and innovation and in which the region makes its own extra efforts.

Focus

Rhône-Alpes lists a comprehensive set of measures for its further socio-economic development in its *'Stratégie Régionale de Développement Economique et d'Innovation 2011-2015'*, including strengthening the role of SMEs in the *'pôles de compétitivité'* and *'clusters'*, in addition to assisting companies to perform innovation. According to its *Stratégie pour l'enseignement supérieur*, *recherche d'innovation*, Rhône-Alpes seeks a combination of the different forms of innovation, both technological, organisational and social ... The objectives of the innovation part of the plan are:

- To seek multidisciplinary synergies between the economic world and the research networks;
- To facilitate incubation, transfer and valorisation;
- To respond to the grand challenges for society and environment (Pôle Ecotech, INES, etc.);
- To accelerate the dissemination of innovation in micro, small and medium-sized companies.

The plan for *'Enseignement supérieur, recherche & innovation'* focuses on three large themes and a number of cross-cutting priorities:

- Higher education: students are at the centre of the regional priorities
  Improve the conditions for students: continue the effort for the internationalisation of curricula, support the academisation of health education and social education;

- Research:
  Supporting sustainable economic development, health and social development and give the region Rhône-Alpes international fame: stimulate interdisciplinary collaboration in research; encourage a research model that is innovative in form and objectives; support young researchers and promote scientific employment; emphasise research skills of the higher education institutions in the debate on science and society.

- Innovation:
  To develop a real innovation culture and ensure an effective link between the economic and social world and scientific and technological skills: to offer micro and medium enterprises greater access to innovation; to support synergy between actors in research and economic players of the region; to ensure a better match between supply and demand for innovation and knowledge; to encourage ambitious initiatives which bring a new economic dynamism; to support incentive and incubation structures.

- Cross-cutting priorities:
  A balanced regional development based on the potential of every individual; an international strategy for the benefit of the knowledge triangle; to contribute to a new relationship between science and society by integrating the dimension 'science in society'.

Moreover, the Rhône-Alpes region is acquiring research infrastructures, through the State-Region project agreement, that will increase the region's scientific po-

tential and will help internationalise its research centres and higher education institutions. These infrastructures are essential to transform Rhône-Alpes into an attractive destination for students and researchers and to make the partnerships between public and private research more efficient.

Rhône-Alpes aims to enhance its reputation as an important innovation region by engaging in multiannual cooperation projects between the region, higher education institutions and research institutions; by providing higher education and research the opportunity to contribute to the development of Rhône-Alpes (sustainable economy, health and social development); and by making higher education more accessible. Public research organisations in France are also developing research programmes with a regional focus. A French report dating from 2005 put the emphasis on the increasing development of regional strategies by public research organisations, such as the CNRS (*Centre National de la Recherche Scientifique*), the INSERM (*Institut national de la santé et de la récherche médicale)* or the CEA (*Commissariat à l'énergie atomique)*. More specifically, the report indicated that the cluster of micro- and nanotechnologies in Rhône-Alpes came into existence due to the fact that CEA-Leti, located in Grenoble, was prepared to launch a project not only based on its own skills but also on local scientific and industrial skills and that could compete on an international level. Rhône-Alpes is the home base of technologic platforms and important large-scale projects in areas of activity within the scientific priorities of Rhône-Alpes. An example of such a big large project is NanoBio, an innovation cluster for micro- and nano-technologies applied to biology and health care.

A substantial part of the activities is performed by public research institutes belonging to the French state (and associated R&D&I priorities), which also explains the strength and focus of the region. Through this longstanding influx of national R&D resources, the region has not only attained a high R&D intensity, but Rhône-Alpes is also favoured through important economic spillover effects. For example, the 'GenoPole Lyon-Grenoble' is a strong player in the national French biotechnology plan which forms a trans-alpine biocluster across the borders.

Rhône-Alpes is strong in various research fields and its regional strategy revolves around five areas of excellence:

- Micro- and nanotechnologies;
- Life sciences and biotechnology;
- Green chemistry and the environment;
- Engineering and renewable energy;
- Human and social sciences.

Since 2004 a total of fourteen research clusters have been set up around projects started by universities, university colleges and laboratories in the region. These projects carry out research in specific areas: digital technology, nanotechnology and materials; management - organisation - production, chemistry - energy – transport; biotechnology - health, lifestyle - culture, science - society. The research clusters are connected to fifteen *'pôles de compétitivité'* (of the more than 70 throughout France) and with twelve 'Rhône-Alpes clusters' (e.g. *Aérospace, Eco-energies, Automotive, I-Care* [medical technologies]). Three of the competitiveness clusters are of world-class level. They were set up to take advantage of the dynamics of

existing research clusters or other regional sector policies. Their goal is to organise the regional supply and make the companies present on any market (e.g. aeronautics, renewable energy, organic products, etc.) more competitive by using various levers such as technological innovation, internationalisation, commercial development, human resource management and industrial productivity.

Among the sectors represented in Rhône-Alpes, there are six with significant research potential, different strengths, a remarkable economic tissue and a good deal of growth opportunities:

- environmental technology;
- life sciences;
- sports and mountain industry;
- digital entertainment and cultural image industry;
- industrial subcontracting;
- micro- and nanotechnology.

Above players (clusters and competence poles) contribute to the development of these sectors.

Rhône-Alpes actively promotes the transfer of scientific knowledge from research institutions to companies, and in 2008 founded the '*Agence Régionale du Développement et de l'Innovation (ARDI)*'. The region reinforces the dynamics of the network by offering instruments which make it possible to carry out joint research and development projects. These instruments are a.o. the technological platforms of Rhône-Alpes, the technological resource centres, consortia between research institutions and companies and a technological innovation component for each cluster in Rhône-Alpes.

In Ile-de-France the emphasis lies particularly on greater coherence between education and research, apart from an increase in (regional) resources. As far as the main thematic priorities for R&D&I in Ile-de-France are concerned, there are eight 'pôles de compétitivité' with sectors of excellence (they all receive regional grants except 'Cosmetic Valley'): *Advancity* (construction, infrastructure, urban development and engineering), *ASTech Paris Region* (aeroplane engines, satellite launch systems and business aviation), *Cap Digital* (information and communication technologies and digital content technologies), *Cosmetic Valley* (perfumes and cosmetics), *Finance Innovation* (industrial and research projects with clear added value for financial expertise), *Medicen Paris Region* (advanced healthcare and pharmaceutical technology, drug research and development of new gene, molecular and cellular therapies), *Mov'eo* (automotives, public transport, aviation and road safety), *Systematic Paris Region* (optics, electronics and software technologies, and the design and management of complex systems intended for four applications markets: telecommunications, automotive and transport, security and defence, system design and development instruments and open-source software).

Important themes that are more research-oriented correspond to the fourteen themes supported through the *'Domaines d'intérêt major'* (DIM - areas of great importance) for which Ile-de-France provides a multiannual subsidy to help the important regional research organisations to establish and implement joint research programmes. A project lead coordinates an action programme for five years, including operating costs (grants for doctoral and postdoctoral research, organizing a symposium, etc.) and investments (buildings, laboratories, equipment, …). To reflect the evolution of the research landscape in Ile-de-France better, sixteen new

DIMs will be defined for the period 2012-2015 after a selection and labelling process in collaboration with a new regional scientific council. The current fourteen DIMs include a.o. *'Cancéropôle'* (cancer research), *'Nerf'* (neuroscience and neurodegenerative diseases) and *'STEM-pôle'* (cellular medicine and stem cells). The 'Genopôle' project is a special case. This is the first French bio park dedicated to research on genomics, genetics and biotechnologies, to which Ile-de-France also gives financial support.

In the context of cooperation between the region and France 2007-2013, both parties decided to focus on:

- Developing the attractiveness and international reputation of the universities and research centres in Ile-de-France;
- Promoting a successful democratisation of higher education;
- Making Ile-de-France more accessible by continuing the organisation and design of university sites;
- Encouraging synergy and groupings, particularly in the field of research;
- Improving students' living conditions and the reception of students and foreign students;
- Making higher education and research an instrument of regional spatial planning and for reducing territorial inequalities.

This should help to respond to new scientific challenges, to address international competition and to adapt the higher-education system to society's expectations. The region has also agreed to a framework convention for a partnership between

Ile-de-France and eight *'Pôles de recherche et d'enseignement supérieur (PRES)'*, where the role of the poles for research and higher education will be strengthened to leading nine priority sites. Through the convention, the *PRES* (groupings of universities, university colleges and research institutions) become privileged interlocutors in the organisation of regional policy on higher education and research, and therefore bilateral agreements for co-financing of these projects have been concluded. These nine objectives are:

- improvement of students' living and studying conditions;
- real estate policy (in particular libraries, housing for researchers, housing for students);
- democratisation of higher education;
- involvement in the professional life of students and young researchers;
- valorisation of research and innovation activities;
- development of the dialogue between science and society and dissemination of scientific culture;
- international openness: a policy of cooperation and international promotion of research and training activities (including the international mobility of students, doctoral students and researchers);
- implementation of shared equipment, in particular in the field of digital technology;
- finally lifelong learning and training courses.

In general, the existing policy measures in the region of Ile de France are focused mainly on: R&D cooperation projects (pôles de compétitivité, PRES, sectors of great importance, etc.) directly supporting R&D by companies through grants or

loans (OECD schemes, regional support for R&D and innovation projects, etc.) and indirect support organised at a national level (tax credit for research, young innovative companies), encouraging technology transfer (through regional centres for innovation and technology transfer - CRITT, technology platforms, etc.), encouraging technology transfer among companies (Centres for scientific and technological expertise, regional centres for innovation and technology transfer).

The intentions of the Stratégie Régionale Innovation of Nord-Pas de Calais of end 2009 are:

- thematic strategic orientations:
  - o to be at the top at European level in a limited number of innovative sectors, chosen for their scientific excellence and industrial clout;
  - o to support rapidly changing industries through innovation;
  - o to deploy innovation so that new industries can emerge.

For the first orientation three strategic areas of activity are selected: rail transport (including the aspects intermodality, logistics and intelligent transportation systems), trade of the future (including the logistical and technological issues), health-nutrition (including aquaculture products, food security and safety).
For the second orientation, four strategic areas of activity are selected: automotive; advanced materials (biologically- based products, textiles, composite materials), buildings and ecological construction; mechanics.
For the third orientation, four strategic areas of activity are selected: energy and power electronics; waste disposal, sediments, polluted sites and soils; digital images and creation; e-health.

Hinged on the following axes for cross-cutting effort:

- Supporting the establishment of innovative companies and continuing to sensibilise them to entrepreneurship, by valorising the potential of higher education and coordinating the support structures;
- Changing drastically the practice of regional SMEs by focusing on strategic analysis and human capital;
- Attracting investments with high technological intensity, changing the image of the region;
- Innovation by and for services;
- Better financing of innovation: encouraging company directors to adopt a capital-intensive strategy and use our financial instruments as elements of attraction;
- The research potential and the practice of valorisation.

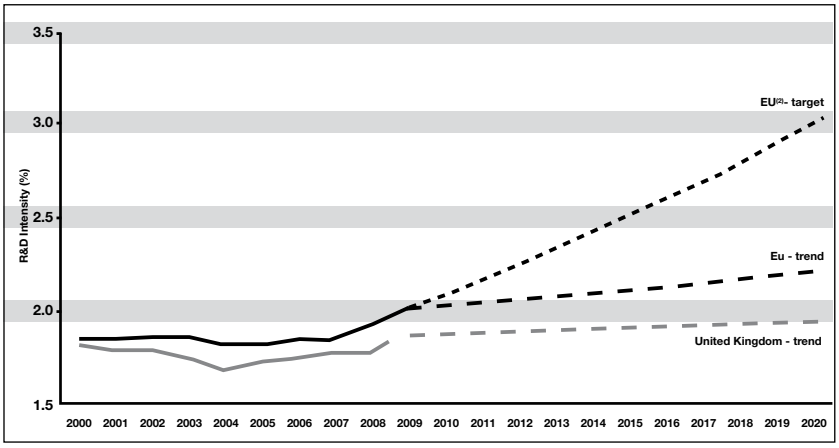
Internationalisation

Rhône-Alpes makes exceptional efforts to internationalise the students, and in some areas works closely together with neighbouring countries (e.g. in biotechnology with partners from Piedmont and Switzerland). Some of the *'pôles de compétitivité'* in its territory enjoy international fame.

UNITED KINGDOM

R&D target

UNITED KINGDOM: R&D Intensity projections, 2000-2020[1]



Source: DG Research and Innovation – Innovation Union Competitiveness Report 2011

The United Kingdom does not have a target for R&D expenditures (by 2020 or earlier) in its National Reform Programme, but is sticking to its earlier target (from 2004) (see below) to reach an R&D intensity of 2.5% by 2014, of which the private sector should have to account for 1.7% and the public sector 0.8% of GDP. To achieve this 2.5% target by 2014, an annual growth of 5.75% is required between 2004 and 2014 according the 2004 SIIF (see below).

Growth path/additional resources

Despite the enormous pressure on public spending, the support for scientific and research programmes was protected In the United Kingdom. To secure resources for R&D, the British government introduced a *ring-fence* system, which means that these resources cannot decrease, cannot be raided for other government needs and therefore they are secured. Because the resources for other policy areas do decrease, the share of S&I in the budget increases. Since 1997 the protected 'Science Budget' has increased from 1.3 billion pounds (1.44 billion euro) to 3.4 billion pounds (3.77 billion euro) a year. And now, for the first time, the allowance for research in higher education in England is included in this ring-fence. Maintaining the ring-fence around science and research programme funding, and including within it block grant funding for research in England, is clear evidence of the Government's commitment to science and research. On the other hand, the overall resource budget for Higher Education, excluding research funding, has been reduced from 7.1 billion pounds (7.87 billion euro) to 4.2 billion pounds (4.65 billion euro), a 40% or 2.9 billion pounds (3.21 billion euro) reduction by 2014-15.

From the *'Science and innovation investment framework'* of December 2010 and the *'Annual innovation report 2010'* we note that:

- 4.6 billion pounds (5.1 billion euro) a year is ring-fenced for science and research;
- The British government is also clearly committed to efficient use of the resources. By 2014-2015, cost savings of 324 million pounds (359 million euro) will be realised. These resources will be reinvested in science and research within the ring fence;

- Besides the 4.6 billion pounds (5.1 billion euro) a year for scientific and research programmes, over the four years of the SR10 (*Spending Review 2010* - the British Government's savings plan) 1.9 billion pounds (2.1 billion euro) in capital resources has been allocated to science and research. (see table below)

	2011/12	**2012/13**	**2013/14**	**2014/15**	**Total over the spending period**
Research Councils	2,596,196	2,573,678	2,586,641	2,599,812	10,356,327
HEFCE	1,662,112	1,699,578	1,685,689	1,686,321	6,733,700
National Academies	87,465	86,547	86,547	86,547	347,106
UK Space Agency	205,637	191,963	192,864	179,221	769,685
Capital	514,000	449,000	416,000	517,000	1,896,000

In addition to supporting R&D, government in the UK also plays a role in supporting and underpinning innovation, through a range of organisations often referred to as the innovation infrastructure or ecosystem. This infrastructure includes direct support to business, intellectual property protection, measurement, standards, accreditation and design. The Technology Strategy Board has been established as the prime channel through which the Government incentivises business-led technology innovation. It is a business focused organization with a leadership role to stimulate and accelerate technology development and innovation in the areas which offer the greatest potential for boosting UK growth and productivity.

The Technology Strategy Board is creating a network of world-leading technology and innovation centres to transform the UK's capability for innovation in specific

technology areas and help drive future economic growth, 'The Technology and Innovation Centres'. This 200 million pounds (221.6 million euro) programme was announced in October 2010. In January 2011 the Technology Strategy Board published a prospectus to begin the process of establishing these world-leading centres.

Policy Framework

Strategic Plan

In the United Kingdom the *'Science and Innovation Investment Framework'* (SIIF, 2004) exists for the period 2004-14 next to the *'UK Innovation Nation White Paper'* (INWP, 2008).

The rationale for the Government's investment in the research base was set out in 2004 in the ten year Science and Innovation Investment Framework.

The main objectives of SIIF are:

- Retain and build world-class centres of excellence;
- Improve the responsiveness of publicly funded research;
- Increase business investment in R&D to 1.7% by 2014 (ambition set in 2004);
- Strengthen supplies of scientists, engineers and technologists;
- Ensure sustainable and financially robust universities and public laboratories;
- Boost public confidence in and awareness of scientific research.

The INWP particularly wants :

- Promote innovation in business and make the public sector and public services more innovative;
- Strengthen use of procurement and regulation.

REGIONS IN THE UNITED KINGDOM

R&D target - growth path - resources

Through its research pooling and increased focus on excellence Scotland has managed to increase the participation in the EU FP for RTD (an objective since several years), to obtain more international co-citations and to attract researchers (back) from the U.S., Canada or Australia to its (virtually) merged institutions.

GERD in Scotland increased between 1999 and 2009 from 1 billion pounds (1.11 billion euro) to more than 1.9 billion pounds (2.1 billion euro); an increase of R&D intensity from 1.32% to 1.67%. In this total, the GoVERD remained relatively stable and the HERD mainly increased (source: National Statistics publication for Scotland, 30.03.2011). Since the region has no explicit target for R&D intensity (yet the 3%-target of the EU 2020 is recognised), there is no specific growth path. There are objectives for research and innovation within the 'National Outcome' which are part of the policy monitoring plan 'Scotland performs' and supported and monitored with indicators, but without any specific budgetary commitments.

In South-East England the objectives are mainly innovation-oriented. The revision of its 'Corporate Plan 2008-2011' that the South-East England Development Agency carried through in June 2009 (due to the crisis), besides innovation, also mentioned the objective for the R&D indicator: to increase R&D expenditure in South-East England to 4% of GDP by 2016. In addition, the 2008-2011 plan and the 2006-2016 plan include other objectives such as the increase in the number of companies that have indicated to have R&D ties with universities; an increase from 3.3 billion pounds (3.7 billion euro) to 3.6 billion pounds (3.95 billion euro), approximately 250 million pounds (277 million euro) per year from the BERD; an increase in the percentage of the total South-East business turnover attributable to new products (from 12% in 2004 to 20% by 2016), an increase of the percentage attributable to significantly improved products (from 18% in 2004 to 25% by 2016). To realise these objectives, the resources provided in the Corporate Plan 2008-2011 in the 'Global Competitiveness' part (in 1000 pounds) are as follows:

SEED PROGRAMMES	2008/09	2009/10	2010/11	2008-11
Global Markets	4,455	4,350	4,350	13,155
Research and Development	15,985	15,160	15,970	47,115
Innovation and Creativity	16,485	16,330	17,710	50,525
ICT/Broadband	775	480	210	1,465
Total	**37,700**	**36,320**	**38,240**	**112,260**

Given the fact that in South-East England, for example, Oxford University is a high-performing institution, this region will score relatively well in assigning (competitively distributed) resources by the United Kingdom. The additional resources that the British government grants in the United Kingdom from 2011 and subsequent

years, to found between six to eight new excellence centres in several spearhead domains, will probably be partly assigned to initiatives and institutions situated and active in South-East England. This will also positively influence expenditures.

Policy Framework

Strategic Plan en Focus

Within the United Kingdom the three autonomous regions - Scotland, Wales and Northern Ireland - have more autonomy than the various regions within England, with implications for policy and resources.

Thanks to this, Scotland, for example, can finance its own institutions for higher education and it has a relatively higher level of support for programmes and instruments compared to an English region such as South-East England. The Scottish innovation policy mix is both nearly complete and refined and is comparable to the innovation policy mix of most (smaller) European countries. Four large types of policy objectives can be identified, each supported by a number of measures:

- To strengthen the scientific base and human capital for science and technology: financing and settlements aimed at improving scientific awareness and scientific careers, such as the Scottish Science Centres, STEM.
- To increase the R&D intensity of companies and their innovation activities.
- To commercialise research and encourage the creation and growth of new companies based on technology.

- To ensure greater interrelationships within the innovation system and more knowledge transfer from the research base.

Besides these measures, which are financed and carried out by the Scottish institutions, a number of measures which can be applied throughout the whole United Kingdom provide an additional support: in particular the R&D tax credit , the Technology Strategy Board and the financing that Scottish higher education institutions can acquire from research councils active throughout the United Kingdom.

The innovation policy context is given in the Scottish Reform Programme for EU 2020. The most important policy lines are:

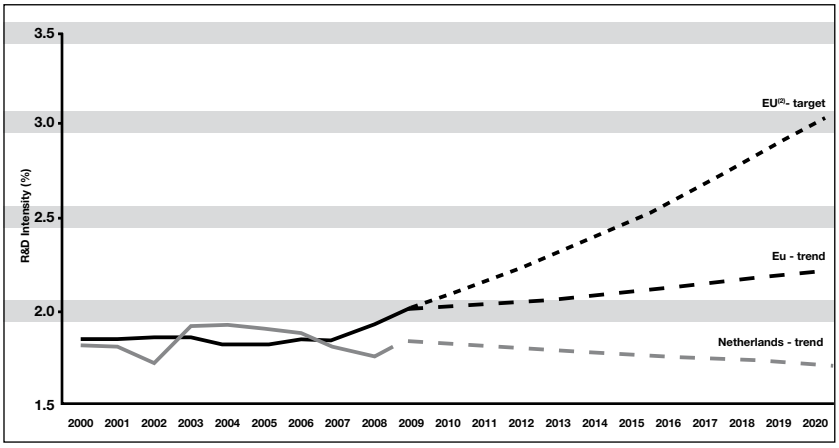
- the importance of innovation (create a dynamic infrastructure for research and innovation);
- research base (the most important strengths of the research in Scotland are closely related to the European priorities; Scottish institutions are world leaders in health, biological and clinical sciences, information technology and low carbon technologies);
- research pooling (development of collaboration between researchers across Europe, following the great challenges for Europe);
- interface and innovation vouchers;
- low carbon economy;
- digital strategy.

South-East England focuses more on business-oriented research and innovation, to which it has aligned its policy mix. Moreover, the policy strategy for research 2008-2011 in South-East England is also part of the regional multiannual economic development plan 2006-2016. For example, the South-East England Development Agency supports the Innovation Advisory Service (IAS), which offers different types of advice to companies, including a team of advisers on innovation, with a consortium led by Oxford Innovation. The portfolio 'Global Competitiveness' covers three themes, on the one hand R&D (with four priority activities: *Innovation Action Plan*, *Innovation Collaborations, Science and Innovation campuses; Environmental Technologies Global Strategy*) and on the other hand *Innovation & Creativity* (with three priority activities: *Innovation Teams, Manufacturing Advisory Service, Finance for Innovation*).

THE NETHERLANDS

R&D target

NETHERLANDS: R&D Intensity projections, 2000-2020(1)



Source: DG Research and Innovation – Innovation Union Competitiveness Report 2011

The Netherlands is the only country which has revised its target for R&D expenditures downwards: the Netherlands has now put forward 2.5% by 2020 in its National Reform Programme. There is no explicit target for public resources.

Growth path/additional resources

The Dutch TOF (total research financing - somewhat similar to the Flemish 'horizontal science policy budget') survey from April 2011 - for the period 2009-2015

estimates that Dutch government expenditures on R&D between 2010 and 2015 (respectively 5.333 and 4.943 billion euro) will decrease with 350 million euro due to the cuts made in accordance with the government agreement.

The most important saving is in the Department of Economic Affairs that, from 2015 onwards, will have to work with half of the resources compared to 2010 (332.5 million euro compared to 702 million euro). The figures for 2011 are taken from the draft budget; the ones for the future from the multiannual forecasts. Note that these figures are not final yet!

There is a - substantial - decrease in the thematic innovation subsidies. Of the existing subsidies in the field of (international) entrepreneurship, innovation and environmental economy 500 million euro are converted into lowering costs for businesses. In part this occurs by reducing the corporation tax and in part by expanding the 'Wet Bevordering Speur- en Ontwikkelingswerk' (Improvement Research and Development Law), a deduction for wages for research and development. Thus the Dutch government chooses for a shift from specific to generic policy.

Policy Framework

Strategic Plan

'To the Top' from the Netherlands is an example of a strategic plan that focuses solely on innovation, and this particularly economic - business-oriented. It sets the contours for the new industrial policy. For nine top sectors a coherent policy

agenda has been developed across the full spectrum of government policy; from foreign policy to education policy, from regulatory burden to research policy and from development cooperation to infrastructure and ICT.

Focus and Earmarking

The nine top sectors are:

- Agro-food (agro-food sector: various (vegetable and animal) food chains, Food Valley);
- Horticulture and basic materials (breeding, vegetables, fruit and trees, flowers and bulbs, Greenports);
- High-tech materials and systems (high tech materials and systems, Brainport, nano technology Automotive, Aircraft, Agro, safety, steel);
- Energy (sustainability in energy management, international energy market (gas hub) and Energy Valley);
- Logistics (international supply chains, coordinating role at nodes, service logistics, innovation aviation, freight transport by water, main ports of Rotterdam and Schiphol and hinterland connections);
- Creative industries (architecture, fashion, gaming, industrial design, media);
- Life sciences (vaccines, diagnostics, pharmaceuticals, biomedical materials, preventive techniques and resources serving public and animal health and Bio Science Park Leiden, Health Valley);
- Chemicals (petrochemicals, basic chemicals and fine chemicals, Maintenance Valley);
- Water (water and delta technology, maritime construction, water as resource, water purification).

The public budget has provided approximately 1.5 billion euro for the nine top sectors. For the policy and for the top sectors below presented the resources will be made available from the departmental budgets. This includes programme resources which have already been partly invested for the coming years or have already been assigned. The timing and phasing of available resources is examined further.

	Resources available, in million euro (2015)
Knowledge, innovation and finance[1]	
1. NWO / KNAW share top sectors[2]	350
2. Applied research (TNO, GTI's, DLO)	250
3. Improve innovation power top sectors	50
4. Profiling knowledge structure[3]	50
5. Innovation Funds	75
6. Fiscal support top sectors[4]	50
TOTAL	825
Sector contributions departments	
7. VWS: Life sciences care	50
8. EL&I: Energy innovation	100
9. EL&I: Food and Horticulture	50
10. I&M: Logistics	25
11. I&M: Water	25
12: Defence: High tech and water	20
TOTAL	270
International	
13. International business and development cooperation (Buza)[5]	300
14. International business (EL&I)	10
TOTAL	310
European contribution of knowledge and innovation	
15. Framework Programme Europe[6]	50
TOTAL	1455

	Resources available, in million euro (2015)
Other contributions	
16. Co-financing business	Pm
17. Regions	Pm
TOTAL	1455 + pm

1) Within these resources, the matching funds for European programmes will also have to be found.
2) This includes research funds that are deployed by NWO/KNAW on the basis of scientific quality and impact - based on the still to be set knowledge agendas and the commitment of enterprise.
3) This includes upgrading the ICT research infrastructure.
4) It is being examined how the reduction in burden – as agreed by government - can be realised such that a substantial part of this is allocated to the top sectors, preferably through existing instruments such as WBSO and Innovation box. The specific design will also depend on the outcome of the evaluation of WBSO. In the table above 50 million euro have been considered.
5) In working out the new policy for development cooperation, collaboration with enterprise increases, in particular regarding the priorities of water and food security, which will result in a close coordination with the top sectors Water and Agro-Food.
6) The amount is based on the average contribution from the framework programme to the top sectors in the past years.

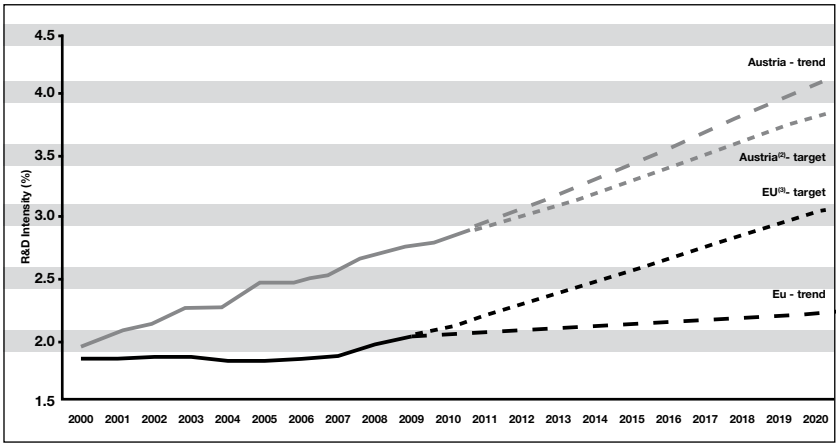
Internationalisation

A big part of the nine top sectors in the Netherlands fits well with the Flagship initiatives of the EU 2020 Strategy 'Innovation Union', 'Efficient raw materials for Europe', 'Digital Agenda for Europe' and 'An Industrial Policy in a Global Era'.

AUSTRIA

R&D target

AUSTRIA: R&D Intensity projections, 2000-2020[1]



Source: DG Research and Innovation – Innovation Union Competitiveness Report 2011

The Austrian target is to increase the research expenditures as percentage of GDP from the current 2.76% to 3.76% by 2020. At least 2/3 - and preferably 70% - should come from the private sector. The public sector (the government) should contribute by improving the framework conditions for R&D.

Interesting is also the objective of Austria to climb from *innovation follower to innovation leader*.

Legal anchoring growth path/ (additional) resources

Austria is currently looking at ways to design and anchor a legal growth path for R&D funding. In this context the federal government's strategy *'Der weg zum innovation leader'* proposes use of a Federal Law on research financing as a key instrument. According to this strategy, the new legislation should:

1. determine the principles and objectives of the national research policy;
2. define results-oriented objectives;
3. permit long-term planning;
4. provide a Code of Conduct.

The law should offer a prospect of several years and therefore provide a genuine financing procedure. At present there is no specific information or time frame for this legal project.

Policy Framework

Strategic Plan

'Der Weg zum innovation leader', in which the Austrian Government draws up the new strategy for research, technology and innovation, was published very recently (March 2011). Austria has set itself the goal to progress from the class of innovation followers to the class of innovation leaders of the EU Member States. This ambitious goal is directly related to the EU Innovation

Scoreboard of 2010, where Austria was classified under the innovation followers.

Characteristic to this plan is that it is horizontal: it cuts across ministries and is supported by the various ministers with the relevant competences. They realise that all stakeholders (in education, research, industry and policy) must work together to reach the objectives.

'Der weg zum innovation leader' builds on the successful development of the Austrian research and innovation system during the past decades, which has resulted in Austria now being on top in the group of innovation followers. New forms of short-term (due to the worldwide financial and economic crisis) and long-term challenges ('grand challenges', such as the worldwide energy scarcity and scarcity in natural resources, climate change, demographic changes) have formed the framework within which the strategy must function. Science, research and technology must bring strategies to adapt to these challenges and options for development.

Focus

'Der weg zum innovation leader' has focused on the most important challenges and opportunities to improve in the following areas:

- Human resources: improving the relationship between education and innovation systems - basic research: more state funding for basic research;

- Risk capital: because of the dominant role of banks in enterprise financing in Austria, venture and risk capital are underdeveloped;
- Competition: the conditions to encourage innovative activities can be improved upon;
- Administration: the Austrian government structures still have weak points, which hinder the development of the innovation system;
- Structural change: the government wants to promote a more dynamic, structural change, such that more attention is given to research, innovation and knowledge-intensive industries.

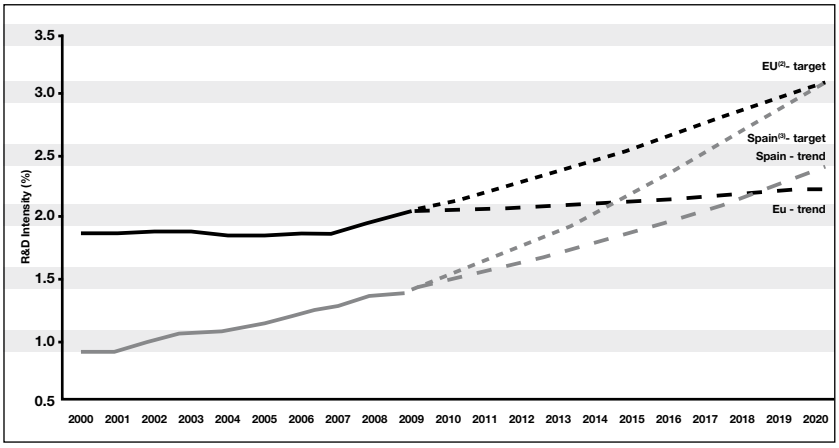
The strategy defines concrete objectives and actions in five areas related to the aforementioned major challenges:

- encourage and develop talent: sustainable reorganisation of the education system;
- create knowledge and stimulate excellence: strengthen the knowledge society base;
- use knowledge and provide added value: activate the innovation potential;
- provide governance and create frameworks: efficient organisation of political governance;
- provide encouragement and opportunities: broaden the financial base.

SPAIN

R&D target

SPAIN: R&D Intensity projections, 2000-2020(1)



Source: DG Research and Innovation – Innovation Union Competitiveness Report 2011

By 2020 Spain aims to spend 3% of GDP on R&D (see the National Reform Programme). Spain is still far from this target, but has made an enormous effort in recent years: R&D-expenditures have increased from 1.06% of GDP in 2004 to 1.38% in 2009, an increase of 30.2% (far above the European average over the same period).

Growth path/additional resources

Spanish GBAORD (Government Budget Appropriations or Outlays on R&D) has increased steadily with an average annual growth rate of 14.1% between 2004 and 2009. Public funding to research and innovation decreased slightly in the 2010 national budget, but in 2011 the country protected R&I investment as compared to the rest of the budgetary expenses.

Spain has set interim targets: in the ENCYT (see below) there are five indicators which refer to the financial sources associated with R&D&I expenditures. The targets set for each indicator are shown in the table below.

Indicators	2005	2015
1. Gross domestic expenditure on R&D (GERD) as a percentage of GDP	1.13	2.50
2. Percentage of GERD performed by Business enterprise sector	53.80	65.00
3. Percentage of GERD financed by Industry	46.30	60.00
4. Expenditure on innovation as a percentage of GDP	1.49	4.00
5. National budget for R&D&I Chapters I-VII (as % of total National budget)	0.98	2.20

The table below shows the percentage increases needed in the Public Administrations' R&D&I resources to meet the goals set for 2011 (the plan dates from 2008). Given that the end-users do not receive these resources until the following year, the resources to be decided upon for 2010 correspond to 2008 and 2009. The table shows that the 2011 goals can be met with a 16% increase in overall State Administration resources in 2008-2009 and a similar increase in Regional Governments resources for the same period.

Year	GSA	RGs	R&D/GDP	% R&D financed by industry
2008	16%	16%	1.6%	53%
2009	16%	16%	1.8%	54%
2010	16%	16%	2.0%	55%
2011	16%	16%	2.2%	55%

This budget planning is subject to compliance with the yearly caps set on nonfinancial expenditure and with budgetary stability objectives, taking into account the financial autonomy of the Regional Governments.

Legal anchoring growth path/ (additional) resources

In Spain the first steps were set in 2005 to create a general legislative framework for R&D. Following the National Reform Programme a whole range of specific actions to achieve the 3%-target was outlined under the name '*Ingenio 2010*'. In the same vein the '*State Strategy for Sustainable Economy*' was accepted in 2009 as one of the most important elements on the way to economic growth and sustainable development. This includes a.o. the development of a strategy for innovation and a (new) legislative framework for science, technology and innovation. The Innovation Strategy was approved in July 2010. The legislative proposal on science, technology and innovation is to be approved by parliament. From the information we could obtain about this law, it is not clear whether the provisions for resources for R&D have been included. This law focuses on three big challenges: a stable and attractive research career, the need for an efficient and effective R&D system and the development of a genuine knowledge society through a (more) sustainable economy.

Policy Framework

Strategic Plan

The *'National R&D&I Plan 2008-2011'* (ENCYT or *Estrategia Nacional de Ciencia y Tecnologia*) is the Spanish planning instrument for science and technology, which establishes the objectives and priorities for the research, development and innovation policy in the medium term. It determines the basic principles of all R&D activities and technological innovations until 2015 and, consequently, the activities financed under the national plan. The plan also establishes the annual increases in the state budget expenditures for research, development and innovation policy, such that most important objectives could be achieved by 2011.

The determination of priorities is based on rather abstract ideas, while the division of the subsidies - which indicates where the real priorities are - will be done in the annual work programmes of the Spanish National R&D&I plan. The plan also includes quantitative objectives aimed at a further improvement for sixteen R&D indicators. Also the few, very specific targets of the INGENIO 2010 Programme are included in the projected level for these indicators (e.g. an increase in R&D investments to 2% of GDP with private participation of 55%) – this as part of the National Reform Programme to meet the challenges of the Lisbon strategy.

The *Spanish innovation strategy (E2I)* was accepted in July 2010. The most important objective is to align all existing resources so as to stimulate innovation. The Spanish innovation strategy is based on a diagnosis of the current state of innovation in Spain and defines and quantifies objectives in the medium and long term

which should improve the innovation performance of the economy. The Spanish innovation strategy is considered to be an initiative where enterprise as well as all political, social and economic stakeholders have been involved.

Focus

The *Spanish National R&D&I* plans are/were traditionally thematically assembled; this means based on scientific-technical areas and on national programmes, most of them thematically, which shaped policy and grant programmes. To better reach the general objectives, this model has now been abandoned. The sixth plan - for the period 2008-2011 - is structured around four areas:

- Creating knowledge and skills;
- Promoting cooperation in R&D;
- Technological innovation;
- Sectoral and technological development and innovation;
- Strategic actions.

The identified strategic actions are related to horizontal sectors or technologies:

1. health;
2. biotechnology;
3. energy and climate change;
4. telecommunications and information society;
5. nanoscience and nanotechnology, new materials and new industrial processes.

For these strategic actions all instruments available in other areas will be put into action. The objective is to achieve an integrated management of the financing of each of the strategic actions. For this reason, non-oriented research has also been included linked to subsequent developments so as to close the innovation circle where possible, including its socio-economic dimension. This will lead to more cooperation and joint management and decision-making in those cases where different units are involved in the management of the same instrument (e.g. R&D projects related to health).

The *Spanish innovation strategy* (E2I) (Estrategia Estatal de Innovación) has been divided into five large axes - an 'innovation pentagram': creating a financial environment in favour of innovation, promotion of innovation through public demand, international scope, strengthening regional cooperation and human capital.

Specific targets of the innovation strategy are:

- To double the private R&D by 2015;
- To double the number of innovative companies in the period 2010-2015;
- To increase the number of employees in medium and high technology sectors by 500,000 during the period 2010-2015;
- To achieve a 10% return on European programmes;
- To achieve a significant improvement in the balance of technological products and services.

Internationalisation

The *'Spanish National Programme for the Internationalisation of R&D*', one of the programmes giving effect to the R&D&I plan, will promote the internationalisation of R&D. All initiatives and activities designed to increase the level of internationalisation, participation in international R&D activities by national stakeholders and cooperation in the field of research will be coordinated within this programme. The objective is to promote the participation of Spanish research groups internationally, particularly Spanish companies and public centres in the 7th EU Framework Programme for RTD. A series of measures will be taken to encourage the participation of companies and associations so as to increase the Spanish return, and to promote a strong presence and enterprise leadership in all regional governments in strategic R&D&I projects of great importance to international cooperation within the new ERA initiatives.

Funding (maximum four years) is designated for the establishment and/or strengthening of European project offices, training and qualification of international project managers, financing of the membership of networks and European platforms, financing of improvements in project management systems and promotion of cooperation with other national and international entities in the 7th EU Framework Programme for RTD.

SPANISH REGIONS

R&D target – growth path - resources

In Catalonia, the R&D intensity has increased in the period 1996-2008 from 0.9% to 1.61% (2/3 private sector), which in absolute terms implies a quadrupling of the expenditures by all players to 3.3 billion euro (an annual growth rate of 13%). The Pact for Research and Innovation of October 2008, signed between the government and a range of stakeholders, has set an ambitious target: to attain 3.05% R&D expenditures as percentage of GDP by 2017 and 3.5% by 2020. In 2017 - the year that the 3%-target should be reached total expenditures should amount to 11.53 billion euro (see table below), divided as follows:

- 3.55 billion euro government;
- 7.39 billion euro private expenditures and non-profit expenditures;
- 0.58 billion euro from abroad.

The part of public expenditures should come:

- 2.15 billion euro from the Catalan government;
- 1.40 billion euro from other governments and higher education.

For the R&D&I expenditures, the ratio in 2017 should be 4.5%. Below goes an overview of the evolution of the expenditures according to the proposed scenario (based on growth projections of the summer 2008).

Scenarios for R&D spending (2005-2020) - Figures in millions of current euros (except where indicated)								
	2005	2006	2007	2008	2009	2010	2011	2012
General parameters								
GDP mp	170,519	184,085	196,688	208,490	219,957	235,353	251,828	269,456
R&D/GDP (%)	1.35%	1.42%	1.54%	1.67%	1.82%	2.00%	2.15%	2.30%
Total R&D spending	2,302	2,614	3,029	3,482	4,003	4,707	5,414	6,197
Funding of R&D spending by large sectors								
Public Administration	816	948	1,124	1,320	1,551	1,863	2,114	2,376
Private enterprise and PNPIs	1,374	1,537	1,757	1,995	2,263	2,624	3,047	3,530
Abroad	112	129	148	167	189	220	253	291
Breakdown of the Public Administration sector								
Government of Catalonia	494	587	663	800	939	1,128	1,280	1,438
Other administrations and HE	322	361	461	521	612	734	834	938
	2013	2014	2015	2016	2017	2018	2019	2020
General parameters								
GDP mp	288,318	308,500	330,095	353,202	377,926	404,381	432,688	462,976
R&D/GDP (%)	2.45%	2.60%	2.75%	2.90%	3.05%	3.20%	3.35%	3.50%
Total R&D spending	7,064	8,021	9,078	10,243	11,527	12,940	14,495	16,204
Funding of R&D spending by large sectors								
Public Administration	2,640	2,903	3,151	3,373	3,552	3,640	4,057	4,511
Private enterprise and PNPIs	4,089	4,732	5,484	6,360	7,389	8,627	9,663	10,803
Abroad	335	385	443	509	585	673	774	890
Breakdown of the Public Administration sector								
Government of Catalonia	1,598	1,758	1,908	2,043	2,150	2,202	2,455	2,729
Other administrations and HE	1,042	1,146	1,243	1,330	1,402	1,438	1,603	1,782

Figures shown in *are consolidated.*

Note: The spending by "Other administrations & HE" (HE: higher education) corresponds mainly to the Spanish Government.

PNPI: Private Non-Profit Institutions.

Nothing is mentioned or known regarding the current situation and the adjusted data since the crisis. The current plan of Catalonia for research and innovation 2010-2013 provides budgetary commitments. The PRI foresees an increase in expenditures of the government of Catalonia in R&D&I in line with the expectations established by the PNRI (15-20% per year). The planned total expenditures of the PRI amount to 5.31 billion euro between 2010 and 2013. Of this amount 2.21 billion euro is equivalent to the salary list of research staff in universities and hospitals. This block of expenses will represent 41% of the total in 2013 (it was 46% in 2008 and nearly 70% in 2005). This means that the share available for active R&D&I policy will increase. As previously mentioned, 30% of public expenditures should be allocated to the seventeen areas identified as priorities.

The PRI has provided a wide range of actions and objectives meant to mobilise additional resources:

- Spanish government resources through competitive and structural funding (through investments in infrastructure, CSIC research centres and mixed investments);
- EU resources received by the government of Catalonia and to be used for PRI policy and policy promoting access of research staff to R&D&I funds from the European Union (with the objective to increase this by 5 to 10% per year in the next years);
- Private resources for R&D&I by boosting private investments e.g. through public procurement.

R&D expenditures are divided into two blocks, due to differences in programming and decision-making:

- Block 1: Increased expenditures on research personnel in health care (estimated at 4% per year) and universities (estimated at 4-6% per year), as well as the share of the investment plan for the universities set aside for research. This increases from 515 million euro in 2010 to 596 million euro in 2013 (total: 2 209 million euro);
- Block 2: Expenditures on PRI-action lines, with an average annual increase of 18%. These percentages are similar to those during the period of the last plan and are in line with the PNRI commitments. This share increases from 562 million euro in 2010 to 1 037 million euro in 2013 (total: 3 099 million euro).

Accordingly one arrives at a total of 1.077 billion euro expenditures in 2010, 1.201 billion in 2011, 1.397 billion in 2012, and finally 1.633 billion in 2013, or a total of 5.31 billion euro in the period 2010-2013. The PRI 2010-2013 is a budgetary and policy priority, as it may be considered as its financial programme. The planned PRI expenditures for the period 2010-2013 are in line with the scenario outlined in the PNRI, adapted to the evolution of GDP. This implies a serious commitment in terms of R&D&I, particularly in the context of an annual increase of 3-4% as is planned for the total budget of the government of Catalonia for the next few years.

Some areas in which specific investments are done:

- The competitive financing structure, based on excellence and aimed at the focus areas of the PRI, will gradually be increased to 100 million euro by 2013;
- The development of excellent research centres, financed through programme

contracts with objectives: 150 million euro by 2013;

- The development of scientific and technological infrastructure: a roadmap to optimally use existing infrastructure and increased financing (137 million euro, from 2010-2013, plus 6% of the infrastructure plan);
- Strategic R&D&I projects on a broad basis, linked to the focus areas of the PRI such as to develop international leadership in specific niches (65 million euro, 2011-2013).

For the Basque Country, the average annual growth in R&D expenditures of 12.85% over the last ten years was one of the highest in Europe. The STI Plan 2010 expected the Basque country and its provinces would be responsible for 80% of public resources that amounted to around 6.7 billion euro, planned over a period of five years, and that 20% would come from outside the region (13% Spain, 7% EU or other). The objective of the Basque government to spend 3% of GDP on R&D by 2015 is not (yet) supported by a specific growth path; the PNRI 2015 does aim to maintain the ratio 80% private - 20% other resources.

Legal anchoring growth path/ (additional) resources

The resources for Catalonia have been defined in its PNRI 2010-2013 which the Catalan government approved, and in agreements with Spain. The growth path up to 2020 and the targets for this decade were agreed in the Research and Innovation Pact in late 2008. However, this pact has no legal value and cannot be considered as an anchoring; moreover it has not been revised after the crisis.

The Basque Country's target of 3% R&D intensity was set in the PCTI 2015 which was recently approved by government. The other related objectives and plans have als been approved by the Basque government.

Policy Framework

Strategic Plan

In the Basque Country the PCTI 2007-2010 (Science, Technology and Innovation Plan) has been one of the main building blocks of the so called *'Basque Second Economic Transformation'*, which has sought a comprehensive approach of research and innovation policy. The recently approved new plan of 2011 (PCTI 2015) consists of five vertical and three horizontal objectives. This plan wants for STI to penetrate through all aspects of society and transform the region into an innovation model for Europe. The plan also fits into a long term strategy (Euskadi Innova Dora 2020) and integrates or connects with other plans of the region (or the Spanish state). There are also a number of other Basque plans which overlap with the area of R&D&I, including: 'Plan de Competitividad Empresarial 2010-2013,' 'Plan Universitario 2011-2014', 'Estrategia Energética Euskadi 2020', 'Plan de Innovación Pública y Administración Electrónica 2010-2013', 'Plan Euskadi en la Sociedad de la Información 2015' and 'Estrategia Investigación and Innovación social 2010'.

In Catalonia the government and a series of stakeholders have signed a National Pact for Research and Innovation in October 2008, which lists 131 objectives. The current PNRI 2010-2013 (Pacte Nacional per a la Recerca i la Innovació) plans, pro-

motes and coordinates R&D and innovation in ICT and also includes a commitment to increasing expenditures.

Focus

In Spain the Basque Country and Catalonia conduct a policy aimed at strengthening innovation in business that is moreover increasingly focused on human capital and improving the research level. The Basque Country and Catalonia are both regions trying to coordinate their innovation policy in cooperation with Spain, based on the construction of a mutual relationship: '*agreeing to work together*'. The agreements have been supplemented by more specific annual plans.

The Catalan Innovation Support Agency, ACC1Ó, and the Spanish CDTI (Centre for the Development of Industrial Technology) share common objectives for promoting innovation, spin-offs and knowledge transfer. Catalonia is the leading region in terms of CDTI funding receipt, so there are clear mutual interests in better collaboration. A 2005 convenio serves as a framework agreement to work together through a commission composed of actors on both sides to develop annual plans. The new Spanish E2I (Estrategia Estatal de Innovación) is modelled on a 'pentagram of innovation' that covers finance, markets, internationalisation, people and territorial co-operation. The contracting region commits to its own quantitative objectives for meeting the plan's 2015 targets. The goal is to therefore to intensify co-ordination actions to support research, development and innovation in areas of common interest. Similar to other contracts, there is a joint monitoring commission with representatives from both levels. The funds are in the form of a loan to be reimbursed to the central government.

The Basque Country is one of the first four regions to sign such E2I state-region contracts. The Basque STI policy has provided continued public support for networks of private technology centres. They build on older sectoral centres (e.g. industrial technologies, automation, robotics and materials). These centres are partly funded by the regional government but also provide services to firms in return for membership fees and consultancy payments. Over time, they have become more research-intensive and are competitive in attracting national and international research programme funds. The Basque Country has also identified an apparent missing link: its research base. It recently began prioritising a series of governmental actions to strengthen the regional research base and its human capital. Regional industrial production is being retooled to keep pace with changing paradigms, to take advantage of the opportunities offered by the global knowledge economy, and improve the region's standard of living. Certain assets of the Basque Country have helped to shape the search for the new frontier. Its history of manufacturing and production suggests development of research capacities and investment in the generation of new knowledge. The inward orientation of certain aspects of the regional innovation system calls for selectively improving, international collaboration and linkages for innovation, as well as investing in the training, attraction and retention of skilled workers.

A relatively comprehensive plan is the 2010-2013 PNRI of Catalonia. It is structured around five content areas and has the following priorities:

- build three transversal lines for policy actions: SMEs, the service society, internationalisation;
- deal with the weaknesses of the research and innovation system and take advantage of its strengths;

- take into account and prioritise:
  - Shaping demand (social innovation regulation, innovative public procurement);
  - Directing political action in research and innovation at challenges;
  - Starting from an entrepreneurial and innovative position.

The current PNRI has in total ten objectives:

- Excellence scientific, creative, innovative and entrepreneurial talent;
- A strong public research system, connected to value creation;
- Companies that systematically innovate and are internationalised;
- Innovative public sector;
- Involve of society and citizens in scientific and innovative progress;
- Internationalisation and knowledge and innovation communities;
- Improving the governance of the RDI system;
- Focusing RDI on challenges;
- Environments and regions with the ability to incorporate knowledge and innovation
- Mobilising more resources for RDI more efficiently

In the second objective regarding the public research system Catalonia has set priorities as regards financing and encouraging excellence and the organisation of the actors. The PNRI will boost the financing for agents of the public research system: under the new financing model, universities play a much greater role in research. Apart from this model, a competitive funding structure will be developed based on excellence and directed at the focus areas of the PRI. This funding will be progressively increased to 100 million euro by 2013. The PRI also builds

on the policy of developing research centres of excellence with the involvement of various ministries of the Government of Catalonia, funded through programme contracts by objectives (150 million euro by 2013). Taking into account two sectors of great importance to Catalonia, it aims at consolidating hospital-based research institutes and RDI in the food and agriculture cooperative system. Secondly, the PRI focuses on organising and connecting public research agents (funded by the Government of Catalonia), to make them more efficient and better aligned with the RDI focus areas of the PRI. This process is based on a rigorous evaluation of excellence, strategic opportunities and viability. These criteria and mechanisms will be applied to both the creation and closure of funding structures by the Government of Catalonia. Mechanisms and incentives will also be developed to ensure that knowledge transfer is established as a key element of the public research system. As envisaged in the PNRI, a public-private body for knowledge valorisation in Catalonia will be set up, based on the best international practices. The PRI also contains a firm commitment to developing scientific and technological infrastructures. A roadmap will be drawn up to optimise existing infrastructures and increase funding. The PRI will promote broad-based strategic RDI projects linked to the focus areas of the PRI in order to develop international leadership in specific niches.

Science, technology and the production sectors meet in each of the 17 research and innovation focus areas defined by the 2010-2013 PRI. In line with the recommendations of EU experts, the target is that 30% of total RDI spending by the Government of Catalonia will be allocated to the PRI's RDI focus areas by 2013. It concerns three types of challenges:

1. Environmental challenges:
   Mitigation and adaptation to climate change, Energy efficiency and decentralised renewable energy, Water management and planning for sustainable use, Effective flows of people and goods (sustainable mobility) and of information, Buildings, cities and regions for living and generating value;

2. Challenges for people and society:
   Quality, healthy and pleasurable food, Prevention and health care, Lifelong learning and distance learning, Artistic creations, cultural products and services of excellence that are broadly disseminated, Products and services linked to tourism, leisure and emotional consumption, Social cohesion and management of social complexity to generate opportunities, New services society with innovative consumer and business service products and e-services, Security of people, goods, information and the territory;

3. Scientific, productive and organisational challenges:
   Frontier research and sciencific research and technology of excellence, Development of materials, production systems and eco-products with innovative designs, Non-technological innovation, transformation of organisations and new working methods, Improvement of governance, socioeconomic and political mechanisms

The Research Centres of Catalonia, a network of over 30 centres, have been created to achieve the region's science goals. They were established as private entities outside of universities, albeit often associated with them, to ensure greater

accountability for results. These centres cover areas important for the region's sectors requiring science-based development (such as biotechnology) as well as the social sciences.

ACC1Ó is the Catalan agency for competitiveness that specializes in innovation, internationalization and attracting inward investment. The strategy in the Plan 2009-2013 supports different elements to bring the companies to the top of the world markets. The most important objectives for 2013 are all aimed at strengthening the competitiveness and innovative strength of companies, for example: a 20% increase in the number of innovative companies; achieve 400 multinational manufacturing companies, attract 200 high value investments in Catalonia; bring the share of technological export to 66% of the total; create 1 000 technology-based companies; triple Catalan participation in the EU seventh Framework Programme regarding the above.

In the Basque plan for research and innovation 2007-2010, the main innovation policy trends have focused on the following areas: innovation and competitiveness support, ICTs for competitiveness, R&D support, modernisation and renovation of manufacturing equipment, entrepreneurship. Similar to Catalonia, the region uses an approach aimed at diversification into new and strategic sectors and their competitive power. However, due to the smaller scale of the Basque Country, they are more focused than in Catalonia and this on the following areas: biosciences, nanosciences, alternative energy, electronics for intelligent transport. The recently approved PCTI 2015 for research and innovation has five specific objectives and three cross-cutting objectives:

- a production structure focused on enterprise sectors with high added value based on science, technology and innovation;
- competitive and innovative companies at the top of global markets;
- efficient and advanced public services thanks to the contribution of science, technology and innovation;
- a society that promotes science, technology and innovation and reflects a competitive country with regard for solidarity;
- the Basque Network for Science, Technology and Innovation, that adds value to the production system and enjoys international recognition.

The three transversal elements of the PCTI 2015 are:

- the Basque Country as advanced source of talent;
- the Basque Country as backbone;
- new financing model.

The whole is framed by a new governance structure and monitored by means of indicators.

Internationalisation

The objective of internationalisation can also be expressed more generally. Thus one of the five objectives of the PCTI 2015 of the Basque Country is to give to the Basque STI network international recognition. Coupled to this, there are some more specific objectives, e.g. to increase the innovation level of companies (Innovative effort by industrial companies equivalent to 3% of their turnover), and

to increase the number of STI-workers (5% of the working population carrying out research and 3% carrying out research within companies) and to arrive at a technology and HR stock close to the EU average.

ACC1Ó, the CT agency for competitiveness, has included following objectives in the Plan 2009-2013, to be achieved by 2013:

- increase the number of regular exporters by 20%;
- reach 400 manufacturing multinationals;
- attract 200 high-value investments in Catalonia;
- triple the Catalan participation in the EU 7FP for RTD as far as the above is concerned (innovative companies, etc.):

In the Catalonia-objectives of end 2008 that drew up a growth path for R&D expenditures up to 2020, a.o. an increase in resources from the EU FP for RTD was foreseen. The economic development agency of South-East England has set similar objectives to Catalonia, focused on the internationalisation of the existing (technology-driven) companies.

LOMBARDY (IT)

R&D target – growth – resources

Lombardy has no specific target for R&D intensity but wishes to increase the value of the indicator. A growth path has not been foreseen nor have specific resources been set aside. The Lombardy region attempts to work according to its programmes and thereby increase resources by activating synergies with other associations and institutions (e.g. chambers of commerce, ministry of education, universities and research).

Legal anchoring growth path/ (additional) resources

At Italian national level the legal basis for the growth path is the National Research Programme. At the regional Lombardy level this is the Regional Law 1/2007 'Instruments for the competitiveness of the companies and for the region of Lombardy' and the Regional Development Programme, which takes into account the objectives of this law and the mentioned National Programme.

Policy Framework

Strategic Plan

Lombardy tries to stimulate the different players of the system and bring them together: citizens, companies, research and technology transfer institutions, finan-

cial institutions and the different levels of government. The actual plan is the 'Strategic Document' which has been approved by the regional government in late 2003. At this moment a new, updated document is in preparation. Lombardy and other regional players have as common objectives:

- To increase innovation capacity in high technological industry and in traditional industry and the resultant international competitiveness of Lombardian industry with positive impact on the economy and employment;
- To increase citizens' quality of life;
- To increase scientific and technological excellence in the regional research system and the associated improvement of the higher education system;
- To increase the attractiveness of the system to talent, leading companies and capital, by positioning as a global network for knowledge production and economic development.

To ensure critical mass, concentration of resources and widening of regional investments, Lombardy promotes joint participation of various players in R&D&I policy. Additionality is promoted internally by the regional administration (under different ministries), among public entities (European Commission, national governments, the Lombardian region and local authorities) and among public and private entities. In particular, additionality between the public and private sector is the underlining as well as a relevant proof of the interest of industry for a specific action. Therefore regional interventions are focused on support of demand for innovation through co-financing which can stimulate and support the private intervention. The Strategic Document incorporates the guidelines from the national research programme.

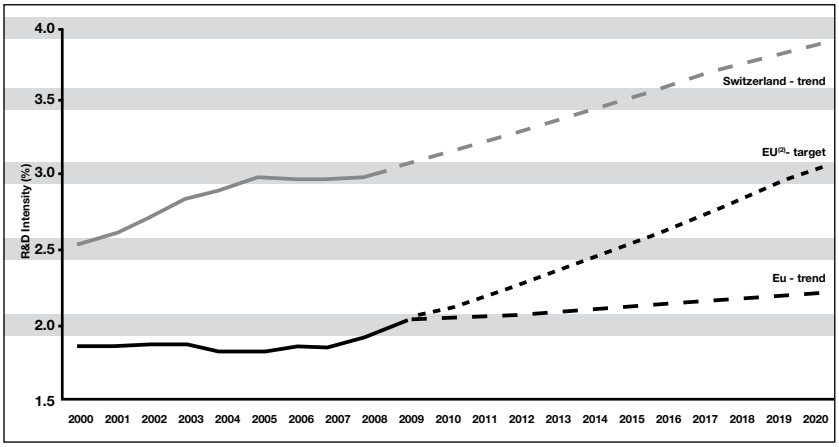
Focus

Within Italy Lombardy started relatively late with a regional research plan: only in 2007 did it accept a law to stimulate the industrial competitive potential. The region has sought synergy with IT objectives. The manufacturing industry is important and the share of private funding in total R&D support is relatively high. In 2002-2003 the MIUR (Ministero dell'Istruzione, dell'Università e della Ricerca, the Italian Ministry for Education, Universities and Research) launched an initiative regarding technological districts. The original objectives of this initiative were the creation of regional 'poles of excellence' for research and innovation, strengthening of the technology transfer and valorisation of the research results of the SMEs. Between 2003 and 2005 this mission shifted from valorisation of research results to supporting industrial innovation. Lombardy has three sectors latently active in this context: ICT, Biotechnology and New Materials. The region has not drawn up any growth path or target for R&D expenditures which makes it impossible to define and delimit clear priorities. There is consistency with the objectives of Italy; the strategy document includes guidelines from the national research programme. Furthermore Lombardy aims to directly activate programmes in synergy with other associations and institutions.

SWITZERLAND

R&D target

SWITZERLAND: R&D Intensity projections, 2000-2020(1)



Source: DG Research and Innovation – Innovation Union Competitiveness Report 2011

Switzerland, which does not belong to the EU and thus does not have to adhere to the EU 2020-strategy, does mirror itself to the target set. Switzerland has already reached the 3% and should, according to the extrapolation spend 3.86% of its GDP on R&D in 2020, with continuous efforts.

Growth path/additional resources

In Switzerland an average annual growth of the (federal) ERI (Education, Research & Innovation) budget of 6% has been foreseen since 2008. For the period 2008-2011 this represents an amount of 20 billion CHF (16.5 billion euro). This is an increase of 3.3 billion CHF (2.7 billion euro) compared to the budget of 2004-2007 (16.7 billion CHF or 13.8 billion euro).

Earmarking (additional) resources

The Swiss public (confederate) investments in R&D go largely to basic research where excellence plays an important role. In the Swiss ERI Dispatch 2008-2011 (see below) a list of priorities was established for the allocation of additional resources. This resulted in different growth rates depending on the different R&D instruments. The biggest priority was given to 'bilateral and multilateral cooperation' (14.9%), 'Lifelong learning and training' (8.7%), 'universities of applied sciences' (7.8%), 'Swiss National Science Foundation' (7.5%) and the 'Agency for the Promotion of Innovation' (7.3%). The only area with a higher growth rate is space research.

Policy Framework

Strategic Plan

In Switzerland there is a plan for the period 2008-2011, called '*ERI*' (*Education, Research & Innovation*) '*Dispatch 2008-2011*' consisting of guidelines and measu-

res for the Swiss confederal policy for education, research and innovation. This confederal policy is responsible for:

1. The Federal Technology Institute (shortly FIT);
2. Vocational Education and Training;
3. The Universities of Applied Sciences;
4. The promotion of research and innovation;
5. International cooperation.

The ERI Dispatch 2008-2011 also shows the commitment of the confederate government for those parts of the S&I system for which the cantons are primarily responsible, namely the universities and grants. Probably it is already working on a plan for the period 2012-2015.

Each of the measures proposed in the ERI Dispatch 2008-2011 can be accommodated in one of the two overarching directives:

1. Education Guideline: sustainably securing and improving quality;
2. Research and Innovation Guideline: increasing competitiveness and growth.

The research and innovation guideline includes: investing in basic scientific research, promoting knowledge transfer between universities and business, supporting promising application-oriented research and development projects, subsidies for specific measures to promote young scientists, supporting universities and research institutions in the FIT (Federal Institutes of Technology) sector, supporting lifelong learning and training and the universities of applied sciences, creating

optimal conditions for the players in the ERI system through membership in strategically important funding organisations and programmes at the international level.

Internationalisation

Bilateral and multilateral cooperation receives highest priority in allocation of additional resources in the Swiss ERI Dispatch 2008-2011. Resources are a.o. assigned to ESA (480 million CHF or 397 million euro), participation in 'EU educational, occupational training and youth programmes' (70 million CHF or 58 million euro), performing Swiss experiments in international research infrastructures such as CERN (52.6 million CHF or 43.6 million euro), bilateral worldwide scientific cooperation (43 million CHF or 35.6 million euro), COST (28 million CHF or 23.2 million euro), bilateral scientific cooperation in Europe (18.2 million CHF or 15 million euro) ...

CANADA

R&D target

Canada compares itself mainly to other OECD countries in terms of R&D intensity and respective ranking. The federal government aims to ensure that Canada remains a leader as regards public R&D efforts in comparison with the other G-7 countries. Canada has a strong knowledge base (particularly compared to ten years ago) supported by public investment (0.90% of GDP in 2005).

Earmarking (additional) resources

The Canadian plan (see below) is linked to the Budget Plan 2007. The latter invests significantly in additional resources in science and technology, for a total amount of 1.9 billion CAD (1.36 billion euro) with clear earmarking, including:

- 500 million CAD (358 million euro) over seven years for technologies for sustainable development;
- 100 million CAD (71.7 million euro) for Genome Canada.

Policy Framework

Strategic Plan

Canada does have a (federal) strategic plan, '*Mobilizing Science and Technology to Canada's Advantage 2007*'. This S&T strategy is a plan of (federal) Canadian

government with the aim to translate scientific findings and ideas into innovations that provide solutions for social problems and improve Canada's economic competitiveness.

Focus

It is a broad multiannual plan for science and technology based on three implicit beliefs:

1. Canada needs a strong commitment for science and technology of the private sector;
2. Canada must continue to strengthen its knowledge base;
3. Canada must be a magnet for talent.

Based on these beliefs the federal government will make the difference by focusing on entrepreneurship (entrepreneurial advantage), knowledge (knowledge advantage) and people (people advantage). The government actions are guided by four principles:

1. promoting excellence at world level;
2. setting priorities;
3. improving collaborations;
4. increasing the responsibility to deliver results based on public financing (~ outcome financing).

In addition to federal government the provinces also spend resources on R&D. The largest R&D investments are from Quebec, Ontario and Alberta (90% of the total provincial R&D expenditures in 2004).

Canada does not want to only go for excellence but also sets priorities: *"The private sector will identify and lead new research networks that address their priorities under the Networks of Centres of Excellence Program. In addition, the government will support large-scale research and commercialization centres in areas where Canadians have the potential to achieve world-class excellence, in partnership with other levels of government and the private sector"*. […] Canada's federal government will focus strategically on research in areas that are in the national interest from a social and economic perspective. We will focus more of our energies and resources in the areas identified below:

- Environmental sciences and technologies;
- Natural resources and energy;
- Health and related biosciences and -technologies;
- Information and communication technologies...

The federal government wants to increase the impact of its programmes for business R&D a.o. through streamlining existing R&D programmes and activities of existing federal organisations (i.e., strengthening existing instruments and players).

SOUTH KOREA

R&D target

South Korea aims to invest 5% of its GDP in R&D by 2012. Three quarters of the total must be supplied by the private sector, one quarter by the South Korean government.

Growth path/ additional resources

The objective to attain the 5%-target for R&D expenditures implies that R&D expenditures have to increase with 50% in five years (2008-2012), from approximately 10.8 trillion KRW (7 billion euro) in 2008 to 16.2 trillion KRW (10.5 billion euro) in 2012. Total expenditures for R&D in South Korea have increased with an average of around 10% per year since 2000. The share of the public sector has increased with approximately 14.9% over the last ten years.

Earmarking (additional) resources

The public investments in R&D amount to:

- 2009: 12 500 billion KRW (8.1 billion euro)
- 2010 (planned): 13 600 billion KRW (8.8 billion euro)

A large part of the 13 600 billion KRW (8.8 billion euro) will go to basic and fundamental research. A share of 31.3% has been foreseen for fundamental research

in R&D public expenditures in 2010. For basic research this is 11.4%. However, the exact definitions of basic research, fundamental research and fusion technology are not clear to us.

Expenditures for basic research will increase from 500 billion KRW (324 million euro) in 2009; about 650 KRW (421 million euro) in 2010 to 1500 KRW (972 billion euro) in 2012. More specifically, the South Korean government provides additional resources for:

- A new initiative, namely the Adventurous Research Project that receives 4 trillion KRW (2.6 million euro) in 2010. It concerns rather challenging and spearhead projects where creative researchers are allowed to fail, a 'positive failure system' has been integrated;
- In basic research an increase in green technology and growth is foreseen of 6.9 billion KRW (4.5 million euro) in 2009 to 21,8 billion KRW (17.1 million euro) in 2010;
- Investments in facilities and equipment (such as KSTAR or Korea Superconducting Tokamak Advanced Reactor).

For fundamental research in 2010:

- 139 billion KRW (90 million euro) for nanotechnology (including green nanotechnology);
- 90.3 billion KRW (58.5 million euro) for biotechnology, including new medicine and stem cell research;
- 2 billion KRW (1.3 million euro) for IT;

- 30.4 billion KRW (19.7 million euro) for infrastructure, such as the New Medicine R&D Centre and the National Biological Resource Data Centre.

For 'fusion' technology in 2010:

- Investments in fusion technologies 'high risk/high return' will increase from 55 billion KRW (35.6 million euro) in 2009 to 70 billion KRW (45.4 million euro) in 2010;
- 13 billion KRW (8.42 million euro) in 2010 for the Brain Research Centre.

Global frontier project (planned budgets in 2010)

- 10 to 30 billion KRW (6.5 to 19.4 million euro) for each selected project in the national strategic research areas, in order to give South Korea a top-four position worldwide in basic and fundamental research by 2021.

Additional 80 billion KRW (51.8 million euro) (in 2010) for technologies in the following areas: health for elderly people, daily life of the disabled people, protecting citizens from natural disasters and terrorist attacks.

Legal anchoring growth path/ (additional) resources

The *'Basic Law for Science and Technology'* is the basic law regarding R&D in South Korea which contains all basic rules and regulations and sets out that a strategy for R&D should be developed every five years, in which objectives for medium and long term should be set. A separate chapter (Chapter IV, Art. 21 to 25) within this

framework is dedicated to 'Expansion of S&T Investment and Human Resources'. This indicates a strong commitment. These five year plans have a tremendous impact on the coordination and distribution of R&D resources.

The *'Framework Act on Science and Technology'* entered into force on 6 September 2008. It contains all intentions and objectives. And although no amount for R&D resources has been included, increasing the R&D budget is mentioned every time.

Policy Framework

Strategic Plan

In South Korea three plans have recently been developed to stimulate R&D. The intention is that these plans make South Korea into an innovator. So far the country has been a good follower (emulator or imitator) of new technologies. It is considered important to change this.

The first of the three plans can be summarised with three digits, the *'577 Initiative'*. The plan runs from 2008 to 2012 and falls under the even broader 'Science and Technology Basic Plan' (2008-2012). Each number has a meaning:

- 5 - INPUT: The '5 'is a plea to increase the R&D share in the South Korean GDP from 3.23% in 2006 to 5% in 2012. (see above)
- 7 - PROCESS: The first '7' points to the seven most important technology areas as on which will be focused: (1) consumer electronics and automotive industries,

(2) 'big science' projects in aerospace, nuclear energy and military technology, (3) nanotechnology and robotics. (see below).

- 7 – PERFORMANCE/OUTPUT: The second '7' points to the objective to belong to the top-7 of the R&D world players by 2012. The calculation will be based on output indicators such as the citation index and the number of patent applications. In 2008 the country was placed twelfth. South Korea will therefore have to move up at least five places in the R&D world ranking list in four years time.

The two other long-term plans *'National Strategy and Five Year Plan for Green Growth (2009-2013)'* and *'International Science Business Belt Plan'* focus more on one single aspect, respectively green technology and the creation of a global hub for knowledge creation in which industry and knowledge institutions work closely together and in an international perspective.

Focus

These three plans of South Korea, particularly the '577', are very specific, with tangible and quantifiable objectives.

The '577-plan' is a very comprehensive package or overall strategy to develop R&D. It focuses on seven strategic technological areas where the country is very strong. In other words: South Korea will bet on a strong technological agenda. The R&D focus areas are:

- important industrial technologies (automotive, shipbuilding, ...);
- emerging industrial technologies (medicines, health and medical care);
- knowledge-based service technologies (logistics, communication, ...);
- state-controlled technology ('Big Science': nuclear, weapons, satellite);
- national interest technologies ('Risk science': food safety, infectious diseases, ...);
- technologies regarding issues of worldwide importance ('Mega Trend Science': energy, climate, etc.);
- basic technologies ('National Platform Tech': biochips, robotics, nano-materials, ...);

In addition, a strong focus will be put on seven national S&T systems which will be introduced in South Korea:

- human S&T capital at world level;
- promotion of basic and fundamental research;
- SME innovation;
- globalisation of S&T;
- regional innovation;
- S&T infrastructure;
- S&T culture.

The principles used for R&D in South Korea are 'selection and concentration', such as the KSLV-1 and -2 programme (Korea Space Launch Vehicle). In other words, there is internal competition to receive funding. The funds are distributed according to researchers' performance:

- The share of direct subsidised staff costs in public research institutions will be increased from 54.6% in 2009 to 60% in 2010;

- The 'Science and Technology Personnel Pension System' has been extended to 7,090 persons in 2010 (almost the double of 2009);
- For all institutions an open management system will be used so that they can also hire foreign people.

Another focus is the collaboration universities/knowledge institutions and industry (also a.o. to increase the employment level).

Internationalisation

In South Korea, it is the intention that the 'Sciences Business Belt' grows into an international hub. Concrete projects to promote international cooperation include the 'World Class University' (WCU) project, the 'Global Research Network' (GRN) Project and the 'Global Research Lab' (GRL) project. The first focuses on international cooperation and on inviting Nobel Prize Laureates to come give lectures in South Korea or to come for research. The second focuses on international exchange of research personnel and the third on attracting foreign research institutions. For each of these projects resources have been designated. The goal is to support ten WCU's (World Class Universities) by 2015 so that by 2015 three feature in the world top 30.

TAIWAN

Policy Framework

Strategic Plan

The NSTDP (National Science and Technology Development Plan (2009-2012)) of Taiwan has six objectives:

1. To strengthen the knowledge innovation system;
2. To create an industrial competitive advantage;
3. To improve the citzens' quality of life;
4. To promote national sustainable development;
5. To increase/encourage citizens' scientific and technological skills ;
6. To strengthen an autonomous defence technology.

This plan remains rather vague and descriptive, particularly when it comes to concrete implementation of these objectives.

The NSTDP 2009-2012 in Taiwan is based on six major sci-tech development strategies:

1. To connect the human sciences (language and culture education) with technology so as to improve quality of life;
2. To train sci-tech manpower and engage talent usefully;

3. To match the legal and regulatory system to the sci-tech sources;
4. To pursue academic excellence and increase social involvement;
5. To strengthen technological innovation and improve the industrial environment;
6. To link technological capacities so as to stimulate sustainable development.

These six global strategies are translated into 144 measures, jointly executed by 23 agencies. The agency responsible for each important measure must prepare an implementation plan and yearly present specific indicators and key points of the implementation plan. As for sci-tech development work carried out by any government agency in any area of science and technology, each agency must draw up objectives, strategies and a financing plan for the next four years and must achieve individual implementation tasks.

3. DATA COUNTRY PASSPORTS

Table 1: General Information

Country / Region	Population	GDP per capita in PPP (in euro)	Employment rate (%)	Number of highly educated (%)
France	64 350 759	25 400	64.1	41.3
Germany	82 002 356	27 400	70.9	27.7
United Kingdom	61 179 256	26 500	69.9	39.7
Spain	45 828 172	24 300	59.8	39.8
Finland	5 326 314	26 600	68.7	45.7
Sweden	9 256 347	28 000	72.2	42.0
Denmark	5 511 451	28 400	75.7	45.4
Austria	8 355 260	29 300	71.6	22.2
Belgium	10 839 905	27 400	61.6	42.9
Netherlands	16 485 787	30 800	77.0	40.2
Flanders	**6 251 983**	**27 600**	**65.8**	**43.6**
Baden-Württemberg	10 749 506	32 582 (2007)	74.4	29.8
North Rhine-Westphalia	17 933 065	28 519 (2007)	67.8	25.3
Bavaria	12 519 728	33 997 (2007)	74.6	30.7
Catalonia	7 290 292	30 300 (2008)	63.9	
Basque Country	2 136 061	34 500 (2008)	64.2	
South-East England	8 332 007	30 951 (2007)	74.3	41.7
Scotland	5 156 500	28 070 (2007)	70.9	46.8
Ile-de-France	11 729 613	42 000 (2008)	66.7	50.0
Rhône-Alpes	6 165 126	26 800 (2008)	64.8	
Nord-Pas de Calais	4 025 344	21 700 (2008)	56.3	34.5
Lombardy	9 826 141	33 500 (2008)	65.8	

General comments

- Some regions are at NUTS1 level:
  - o Flanders (B)
  - o Baden-Württemberg (D)
  - o North Rhine-Westphalia (D)
  - o Bavaria (D)
  - o South East England (UK)
  - o Scotland (UK)

- Other regions are at NUTS2 level:
  - o Catalonia (ES)
  - o Basque (ES)
  - o Ile-de-France (FR)
  - o Rhône-Alpes (FR)
  - o Nord-Pas-de-Calais (FR)
  - o Lombardy (IT)

Most data at regional level can be found at NUTS2, in some cases also at NUTS1, but usually not at both NUTS1 and 2.

Sources

Population

- reference year: 2009
- source: Eurostat

GDP per capita in PPP (purchasing power parities)

- reference year: 2009 unless otherwise stated
- source: Eurostat, Flanders: Studiedienst Vlaamse Regering

GDP per capita is expressed in PPP (purchasing power parity), which allows a more objective basis for comparison and corrects for price differences between countries. An absolute GDP is often expressed in the local currency and is a more difficult comparison base.

Employment rate %

- reference year: 2009 unless otherwise stated
- source: Eurostat, Flemish Region: Centre for WSE
- The employment rate is calculated as: the number of employed persons aged between 15 and 64 years divided by the total number of people in the same age group. The indicator is based on the EU Labour Force Survey.

Number of higher education (educational level)

- reference year: 2008 for countries and regions at NUTS1 level
- Source: Eurostat, Nord-Pas de Calais and Ile-de-France - web site Plan Wallonia

- The level of education is calculated as: the % of graduates in higher education (tertiary level) (ISCED 5-6) compared to the age group 30-34 years

Table 2: R&D&I Indicators - PART 1

Country / Region	**GERD**			**BERD**	**GBAORD**	
	a) R&D intensity: GERD as % of GDP b) GERD in million euro c) GERD per capita (PPP)			as % of GDP	d) As % of GDP e) absolute value in million PPP $	
	a)	b)	c)		d)	e)
Finland	3.96	6 786.472	951.3	2.83	1.13	2 119.163
Sweden	3.62	10 540.159	989.6	2.55	0.91	3 161.998
South-Korea	3.21					
Denmark	3.02	6 715.386	708.5	2.02	0.99	2 058.428
Germany	2.82	67 655.000	622.6	1.92	0.87	25 857.839
Austria	2.75	7 546.150	710.7	1.94	0.78	2 544.563
France	2.21	42 080.464	494.4	1.37	0.78	17 010.967
Belgium	1.96	6 652.938	504.1	1.32		2 644.468
United Kingdom	1.87	29 269.503	466.7	1.16	0.71	15 331.349
Netherlands	1.84	10 542.000	516.8	0.88	0.79	5 338.864
Spain	1.38	14 581.676	269	0.72	0.78	11 540.008
Flanders	**2.12**	**4 258**	**529.8**	**1.39**	**0.71**	**1 738.246**
Baden-Württemberg	4.37 (2007)	15 664.15 (2007)	1 215.8	3.56 (2007)		
North Rhine-Westphalia	1.78 (2007)	9 453.99 (2007)	437.1	1.12 (2007)		
Bavaria	2.81 (2007)	12 196.39 (2007)	813.7	2.21 (2007)		
Catalonia	1.62 (2008)	2 908.70 (2007)		0.93 (2008)		
Basque Country	1.98 (2008)	1 216.70 (2007)		1.52 (2007)		

Country / Region	GERD			BERD	GBAORD	
	a) R&D intensity: GERD as % of GDP b) GERD in million euro c) GERD per capita (PPP)			as % of GDP	d) As % of GDP e) absolute value in million PPP $	
	a)	b)	c)		d)	e)
South-East England	2.48 (2008)	6 471.772 (2008)	710.7	1.72 (2008)		
Scotland	1.46 (2008)	2 168.875 (2008)	373.9	0.48 (2008)		
Ile-de-France	3.11 (2004)	15 512 (2006)	1 094.8 (2004)	2.1 (2004)		
Rhône-Alpes	2.47 (2004)	4 536 (2006)				
Nord-Pas de Calais	0.67 (2004)	570.255 (2004)	121.8 (2004)	0.29 (2004)		
Lombardy	1.20 (2007)					

Sources

GERD - R&D intensity

- reference year: 2009 unless otherwise specified
- source: Eurostat

GERD – in million euro

- reference year: 2009 unless otherwise specified. At NUTS2 level there is no information available;
- source: Eurostat, Basque Country and Catalonia (2007) – website Plan Wallonia

GERD per capita (PPP constant prices 2000)

- reference year: 2009 unless otherwise specified. At NUTS2 level there is no information available;
- source: Eurostat
- GERD numbers Ile-de-France and Rhône-Alpes: Cordis, ERAWATCH profile France

BERD as % of GDP

- reference year: 2009 (countries) and for Flanders. For the regions at NUTS1 level the reference year is 2007 and 2008. At NUTS2 level there is no information available;
- source: Eurostat, Basque Country and Catalonia (2007) – website Plan Wallonia

GBAORD as % of GDP

- reference year: 2009. There is no information available for regions at NUTS1 and NUTS2 level,
- source: OECD Main Science & Technology Indicators 2010/2 and EWI department

GBAORD absolute value in million PPP $

- reference year: 2009. There is no information available for regions at NUTS1 and NUTS2 level,
- source: OECD Main Science & Technology Indicators 2010 / 2 and EWI department

Table 3: R&D&I Indicators - PART 2

	Innovation performance	% Higher education/ MST	% Employed		% Number Innovative Companies
			High Tech Services	Medium & High Tech Industries	
Finland	innovation leader	24.3	4.04	5.54	52.2
Sweden	innovation leader	13.2	4.23	4.95	53.7
Denmark	innovation leader	15.5	3.69	5.06	51.9
Germany	innovation leader	12.5	2.54	10.18	79.9
Austria	innovation follower		2.62	4.97	56.2
France	innovation follower	20.2	2.85	4.96	50.2
Belgium	innovation follower	11.6	3.29	5.23	58.1
United Kingdom	innovation follower	17.6	3.10	3.80	45.6
Netherlands	innovation follower	8.8	3.30	2.66	44.9
Spain	moderate innovator	11.6	2.99	3.71	43.5
Flanders		**14.0**	**3.23**	**6.07**	**61.6**
Baden-Württemberg			2.29	16.54	
North Rhine-Westphalia			2.46	9.24	
Bavaria			2.89	12.91	
Catalonia			2.91	6.68	
Basque Country			3.29	9.04	
South-East England			4.72	4.19	
Scotland			2.10	2.79	
Rhône-Alpes			2.52	5.84	
Nord-Pas de Calais			1.99	4.69	
Lombardy			3.00	8.97	

Sources

Innovation performance: for the countries innovation performance has been taken as specified in the Union Innovation Scoreboard 2010, for the regions, see appendix 1.

% higher education / MST

- reference year: 2008. There is no information available for the regions at NUTS1 and NUTS2 level.
- source: Eurostat and Education Department
- calculated as: the number of higher graduates in mathematics, science and technology in the age group 20 to 29 years

employment rate in high-tech services

- expressed as % of total population
- reference year: 2009
- source: Eurostat

employment rate in medium-high-tech and high-tech industry

- expressed as % of total population
- reference year: 2009
- source: Eurostat

% innovative companies

- source: CIS2009 (data 2006-2008) - Report EU + Flanders figures ECOOM. Different regions, no figures.

APPENDIX 1:
TYPOLOGY OF REGIONS

Several international institutions have each recently made a classification of categories of research and innovation profiles, in which they then accommodate regions. Below are some important typologies. They are prepared by or on behalf of the OECD, the European Commission (Directorate-General for Research and Innovation and Directorate-General for Regional Policy), and the Committee of the Regions.

1. OECD CLASSIFICATION[4]

The OECD study 'Regions and Innovation Policy' (May 2011) ranked the OECD regions into three main categories. The analysis is based on twelve regional variables for 23 OECD member countries and covers 240 regions. The sample represents 78% of the GDP of the OECD and 71% of its population. Based on regional performance, employment and indicators for technology-based innovation, eight regional groups were identified. These groups can be divided into three main categories: knowledge hubs, industrial production zones and non S&T driven regions. These three categories display a number of common characteristics in terms of their specialisation but each have their own policy challenges.

KNOWLEDGE HUBS

Knowledge-intensive city/capital districts

These densely populated metropolitan or urban districts have a high R&D intensity

[4] Source: Ajmone, G. and K. Maguire (forthcoming), Categorisation of OECD Regions Using Innovation-Related Variables, Regional Development Working Papers, OECD Publishing, Paris.

and a high number of patent applications. The high share of services in knowledge-intensive sectors benefits from the highly educated working population. Because of their small geographical size and commuting traffic, these regions on average have a high GDP per capita. They also have a relatively high unemployment rate.

Knowledge and technology hubs

These are the top regions for knowledge and technology in the OECD. They exhibit by far the highest averages for R&D and patent applications, as well as the portion of R&D performed by companies. The industry consists mainly of companies in high tech sectors. Examples: Baden-Wurttemberg, several other German regions such as Bavaria.

INDUSTRIAL PRODUCTION ZONES

Examples: Basque Country, Rhone-Alpes, Flanders, Quebec (Canada).

U.S. states with an average S & T performance

This group includes 38 states of the U.S., generally those states that are not knowledge centres. They differ from the regions in other OECD countries because of their high wealth levels, above average R&D intensity and number of patent applications. In general, industry consists largely of companies in high and medium high technology sectors and services consist of many knowledge-intensive sectors. The working population is significantly lower educated compared to other industrial production areas. These states are also less densely populated compared to other OECD regions, partly due to the larger geographical scale of U.S. states compared with regions in other countries.

Service and natural resources regions in knowledge-intensive countries

These regions are often second-rate regions in knowledge-intensive countries. Mostly they are of a smaller geographical scale and/or less densely populated, but they have a highly educated workforce. They acquire their wealth partly from the high share of employment in knowledge-intensive services or from natural resources. They have a more limited industry, in lower technology compared to other industrial production areas.

Medium manufacturing and service providers

These are industrial production regions (factories and services) and a number of metropolitan regions in countries with average income. They are not world level high-technology centres but they still have a strong medium-low and medium-high technology industrial base. They have a relatively high knowledge potential and a large part of the working population has enjoyed higher education.

Traditional manufacturing regions

These regions have the highest employment in industry, mostly in medium-low and low-technology (traditional) sectors. The bulk of R&D investments are made by companies. This group distinguishes itself by the relatively unskilled working population (the lowest share of people with higher education will be found here).

NON S&T DRIVEN REGIONS

Structural inertia or de-industrialised regions

These regions suffer from persistent underdevelopment traps and face a process of desindustrialisation or experience structural inertia. The GDP per capita is significantly lower compared to the other groups and they have the highest average unemployment rate. They score low for S&T indicators.

Intensive regions

In the southern and eastern European regions with a low population density, the emphasis mainly lies on the primary sector or on low-technology industries. On average, they score lowest on the S&T indicators (R&D, patent applications, and share of R&D by companies).

2. COMMISSION, DIRECTORATE-GENERAL FOR RESEARCH AND INNOVATION

The EU Directorate-General for Research and Innovation divides the research policy of the European regions in three types[5]:

1. Research policies developed by regions and applicable to the region

(Sometimes this regional policy can be supplemented by national or EU structural funds).

Examples:

- in Belgium: the Flemish or Walloon policy for research, development, technology and innovation, which is fully within the competence of the regions and communities.
- the French Pôles the Compétivité;
- the higher education of the German Länder (Elite Network of Bavaria, the only regional strategic concept of a German state) or the STI policy of the states (Bavarian High-Tech Offensive);
- the technological districts in Italy (particularly Lombardy);
- the Spanish regional innovation or technology plans or scientific laws (particularly in Catalonia and Madrid).

[5] Last updated 18/05/2009, source: Cordis.

2. National policies on innovation and/or R&D focused on regions

Examples:

- the French similarities between the state and region (CPER);
- the joint policy tasks regarding STI in Germany (tasks jointly tackled by the federal minister and the states);
- in the United Kingdom: the power of the DIUS for the RDA (regional development agencies) in England;

3. In some EU Member States the R&D activities are concentrated geograpically around universities/research centres or capital areas.

Examples:

- in the Czech Republic, R&D investments are concentrated in the region around Prague; in Hungary, the activities on research, technological development and innovation are concentrated mainly in the centre of the country (Budapest and the county Pest);
- concentration of R&D in the Dutch province of North-Brabant (around Philips and the University of Eindhoven).

Furthermore, the European Commission divides the most important research policies and programmes in the regions of EU Member States according to the following categories[6]:

The main distinctive categories of policy measures and programmes for research in the EU MS are the following:

- Cluster initiatives, centres or incubators (usually based on regional infrastruc-

[6] Last updated op 18/05/2009, source: Cordis.

ture): The Flemish Innovation Cooperation Networks (VIS), the French Pôles de Compétitivité, the German Silicon Saxony, the Spanish Basque Country;

- regional programmes (at regional level) as the Belgian regional programmes for research, technological development and innovation; the French PRO; the German High-Tech Offensive in Bavaria and the 'Elite Network of Bavaria' focused on higher education; all Spanish regional innovation plans or strategies (such as the PRI in Catalonia); the Scottish FEDS in the United Kingdom.
- co-financed/run programmes (at national and regional level) such as the German federal initiative 'BioRegio' or the Scottish SEERAD in the United Kingdom.
- programmes related to the EU (mostly through structural funds and the Regional Innovation Strategy), such as the Czech RIS in Southern Moravia or in Bohemia;
- thematic policy measures such as business-oriented programmes, for example the Flemish TETRA Fund and the Walloon FIRST programmes in Belgium, the German 'Bavarian Research Foundation' (BFS);
- international inter-regional and cross-border programmes such as INTERREG programmes in the United Kingdom and France;
- thematic policy measures such as linking higher education to the regional R&D system. Examples: Belgium with the Flemish support for universities; France with the PRES, RTPA or PRO; the German states that finance public universities; the Spanish regional subsidies for students.

3. COMMISSION, DIRECTORATE-GENERAL ENTERPRISES AND INDUSTRY

In April 2011, the first annual report of the 'Regional Innovation Monitor' (RIM)[7] was published on behalf of the Directorate-General Enterprise and Industry of the Commission. In this document, the EU regions have been divided in seven groups based on their different patterns of innovative performance. These are defined by focusing on the relative strengths displayed in three key determinants of regional innovation systems: innovative entrepreneurship, technological innovation and public knowledge. The main purpose of this typology is to represent the patterns of innovation performance in order to establish a link between the most important regional patterns regarding innovation performance, governance and policy. This scoring of the three factors of innovation performance is statistically distinguished through use of hierarchical clustering, resulting in seven groups of EU regions. The division in the RIM differs from the one of RIS (see below). The RIS (Regional Innovation Scoreboard) typology divides regions into five categories according to performance (low, medium low, medium, medium high, high) based on the average performance score of each region as derived from a composed index that includes the performance on a set of sixteen indicators.

Balanced Innovating Regions

The average score for each innovation performance factor lies above the overall average (for 203 regions). In particular, innovative entrepreneurship is above average, but this is mainly due to the relatively high R&D expenditures of all higher education institutions.

[7] Source: 'Regional Innovation Monitor, Innovation Patterns and Innovation Policy in European Regions - Trends, Challenges and Perspectives', 2010 Annual Report (Project No. 0932) to the European Commission Enterprise and Industry Directorate-General Directorate D – Industrial Innovation and Mobility Industries (Technopolis Group Belgium, Fraunhofer ISI, UNU MERIT); April 2011.

This group of 42 regions consists of regions in the Netherlands, Belgium, Denmark, Northern Germany, Southern UK and some Austrian and Italian regions.

Knowledge-absorbing regions

Most of the 49 regions in this group are situated in Eastern Europe and Southern Italy. Each of the three factors of the innovation performance patterns are situated below the average of all EU regions, but in particular the innovative entrepreneurship is lower than in any of the other groups. The share of innovators, both technological and non-technological, is low and the high score for non-R&D innovation expenditures shows that innovation is often the result of absorption of existing knowledge.

Public knowledge regions

This group is characterised by a very high score for the factor public knowledge. Average R&D expenditures in public research institutions (as % of GDP) are higher than for any of the other groups and the share of higher educated people is as high as in the group of high-tech business innovating regions. The average score for the other two factors is slightly below average, but for none of the eight indicators does this group show an important weakness. The 21 regions in this group are spread throughout Europe, including many capitals like Madrid, Rome, London, Berlin, Prague and Bucharest, but also regions in Eastern Germany, Scotland and Southern France.

Knowledge-absorbing Innovating Regions

This group has the highest average score on innovative entrepreneurship and particularly the share of both technological and non-technological innovators is high.

On average this group has the lowest score for technological innovation: business R&D and patenting are low, while non-R&D innovation expenditures (as % of turnover) are higher than in any of the other groups. Analogously as in the second group, innovation is usually the result of absorption of existing knowledge. These nineteen regions are mostly situated in Portugal and Greece.

Industrialised Innovating Regions

The score for technological innovation for this group is above average, but innovative entrepreneurship is below average. Generally speaking, there are no real weak or strong scores for each of the eight indicators. Many of the regions in this group are situated in France and Spain; also Irish regions, some regions in Sweden and early-industrialised regions in Germany and the United Kingdom belong to this group.

High-Tech Business Innovating Regions

This is the most innovative group of regions. In particular, the factor technological innovation and all its most important components are high: patents and business R&D are much higher than in any other group and on average this group has the lowest proportion of non-R&D innovation expenditures. On average, innovative entrepreneurship is high, but not as high as for the group of knowledge-absorbing innovating regions. The score for public knowledge is above average, but public expenditures for R&D are well below the average of the group of public knowledge regions. The twelve high-tech business innovators are located in Southern Germany, the main part of Finland, some regions of Sweden, Eastern England and North Brabant.

Business innovating regions

On average these eleven regions score well both for innovative entrepreneurship and technological innovation, but they have the lowest score for the factor public knowledge. Both the low performance as regards public expenditures for R&D and in terms of share of higher educated people contribute to the low score in this aspect. The score for innovative entrepreneurship is high; the share of SMEs introducing technological innovation is on average higher than in any of the other groups. The results for the factor technological innovation are above average. The regions in this group are located in Northern Italy and Austria.

4. COMMITTEE OF THE REGIONS[8]

The challenges for regional innovation policy

Each type of regional economy must develop its own tailored regional innovation policy, which tackles the specific needs and gaps in innovation. The different groups of regions have to tackle different strategic challenges, which can briefly be described as follows (Technopolis et al, 2006):

- **The leaders in knowledge and innovation**, which are on the top rung of the ladder of European innovative regions, such as Copenhagen, Ile de France, London, Prague, Stockholm and Vienna have to compete at the global level, not the national or not even on the European level.

- **The technologically advanced regions** such as **Baden-Württemberg, Flanders, Ireland, Piedmont, Rhone-Alpes**, Salzburg and **Scotland**, which are relatively

[8] Source: Knowlegde and Innovation, CvR, 2009 study, ISBN-13: 978-92-895-0471-3.

strong in private technology, but score much weaker in public knowledge and urban services should remain at the top in terms of core technology skills and make progress in knowledge-based services.

- **Other capitals and regions where public research is relatively strong** (such as Athens, Berlin, Bratislava, Catalonia, Lisbon, Midi-Pyrenees, Warsaw, Wallonia, etc.) are strong in public knowledge and relatively competitive in terms of urban services, but have to encourage private technology and particularly the forces driving their knowledge economy.

5. THE REGIONAL INNOVATION SCOREBOARD (EUROSTAT, 2009)

Absolute and relative innovation performance of the regions: The regions are arranged in groups, from strong to weak innovation performance compared to their overall performance (for all regions attributable data have been used if no data are available) and with profiles and relative strengths for the various dimensions of the innovation performance (only for regions where data are available):

A = Facilitators = higher education, lifelong learning, public R&D, availability of broadband;
B = Business activities = company R&D, non-R&D expenditures, SMEs that innovate in-house, innovative SMEs cooperating with others, number of EPO patent applications;
C = Output = technological innovations, non-technological innovations, innovations for more efficient use of natural resources, employment in medium-high and high-technology industry, employment in knowledge-intensive services, sales of products new to the market and new to the company;

	RIS		Relative strenght/ weakness		Facilitators		Business Activities		Output	
	2004	2006	2004	2006	2004	2006	2004	2006	2004	2006
VI	**High**	**Medium-high**	B	B	Medium-high	Medium-high	High	High	High	High
NW	-	-								
B-W	-	-								
BY	-	-								
IdF	**Medium-high**	**Medium-high**	B	•	Medium-high	Medium-high	High	•	High	•
RA	-	-								
N-PdC	**Medium-low**	**Medium-low**	C	•	Average	Average	Medium-low	•	Medium-high	•
SCT	**Medium-high**	**Medium-high**	A	A	High	High	Medium-high	Medium-high	High	Medium-high
SEE	**High**	**High**	B	A	High	High	High	High	High	High
CT	**Average**	**Medium-high**	B	A	Average	Medium-high	Medium-high	Medium-high	Medium-high	High
PV	**Medium-high**	**Medium-high**	B	A	Medium-high	Medium-high	Medium-high	Medium-high	High	High
LOM	**Medium-high**	**Medium-high**	A	•	Medium-low	Medium-low	High	•	High	•

6. COMMISSION, DIRECTORATE-GENERAL REGIONAL POLICY: REPORT ON THE REGIONAL IMPACT OF TECHNOLOGICAL CHANGE IN 2020 (UNU-MERIT)

This report (2010) has been carried out on behalf of the Commission, Directorate-General for Regional Policy, on behalf of the Network for European Techno-Economic Policy Support and ETEP AISBL, by René Wintjes and Hugo Hollanders (UNU-MERIT), with input from ETEP project partners: Austrian Institute of Technology (AIT), Centre for Decision Sciences and Forecasting, Progress and Business Foundation, Fraunhofer ISI, Fondazione Rosselli, OPTI Foundation, Technology Centre of the Academy of Sciences C. It performs an analysis of the situation of the regions and the evolution by 2020 and comes to seven types of regional knowledge economies based on factor analysis combined with clustering.

Seven types of regional knowledge economies

Based on the dimensions of accessibility-absorption-distribution a preliminary selection of regional indicators was made. This pre-selection has taken into account the availability of statistical indicators. The indicators were grouped around five dimensions: employment, human resources, activity, technology and economics. By grouping the indicators and performing a factor analysis for each group separately, the effect of oversampling of factors should have been reduced to a minimum.

Cluster analysis

Based on the aforementioned factors seven types of regions were identified, whereby a hierarchical cluster analysis was used.

METROPOLITAN KNOWLEDGE INTENSIVE SERVICES (KIS) - REGIONS: These are 23 regions in densely populated urban areas in Western Europe. These regions perform above average for absorptive capacity and average for both distributive capacity and accessibility of knowledge. The regions have a high level of urbanisation and economically perform highest of all regions. Many of these regions are the capital region of a country.

KNOWLEDGE ABSORBING REGIONS: 76 regions, mainly in France, on the British Isles, in the Benelux and in Northern Spain. These regions perform average in terms of absorptive capacity, distributive capacity and accessibility of knowledge. Their economic performance is just above average.

PUBLIC KNOWLEDGE CENTRES: 16 regions, mostly in East Germany and urban areas of Eastern Europe. These regions perform average for both absorptive capacityy and diffusive capacity and above average for access to knowledge. Economically they perform close to average and they have experienced high economic growth.

COMPETENT INDUSTRIAL EASTERN EUROPEAN REGIONS: 44 regions in Eastern Europe. These regions perform below average for both absorptive capacity and diffusive capacity and average for accessibility of knowledge. In the past they performed less well economically, but they are now catching up well.

HIGH-TECH REGIONS: 17 R&D-intensive regions in Germany, Finland, Sweden and the Netherlands. These regions perform above average for absorptive capacity, distributive capacity and access to knowledge. Economically they perform higher than average.

SKILLED TECHNOLOGY: 38 regions in Germany, Northern Italy and Austria. These regions perform average for absorptive capacity, distributive capacity and access to knowledge. Economically they perform better than average but their growth is below average.

TRADITIONAL SOUTHERN REGIONS: 39 regions in Southern Europe (Portugal, Italy, Greece and Spain). These regions perform below average for absorptive capacity, distributive capacity and access to knowledge. Economically they perform below average and many regions rely mainly on agriculture and tourism.

Table 3.1: Classification of types of regions on Accessibility, Absorption and Diffusion

	Accessibility		
	Low	**Average**	**High**
Absorption: low Diffusion: low	7: Traditional southern EU regions	4: Skilled industrial eastern EU regions	
Absorption: average Diffusion: average		2: Knowledge absorbing regions 6: Skilled technology regions	3: Public knowledge centres
Absorption: high Diffusion: high		1: Metropolitan knowledge-intensive services regions	
Absorption: high Diffusion: high			5: High-Tech regions

The typology of the regions shows which regions (level NUTS1 and NUTS2 have been used for different EU member countries) belong to which category. The only relevant regions in the context of this note are listed below.

High-tech regions

DE11 Stuttgart; DE12 Karlsruhe; DE13 Freiburg; DE14 Tübingen; DE21 Oberbayern; DE23 Oberpfalz; DE25 Mittelfranken; DE26 Unterfranken; DE71 Darmstadt; DE91 Braunschweig; DEB3 Rheinhessen-Pfalz;

Skilled technology regions

DE22 Niederbayern; DE24 Oberfranken; DE27 Schwaben; DE72 Gießen; DE73 Kassel; DE92 Hannover; DE93 Lüneburg; DE94 Weser-Ems; DEA1 Düsseldorf; DEA3 Münster; DEA4 Detmold; DEA5 Arnsberg; DEB1 Koblenz; DEB2 Trier; ITC4 Lombardia;

Skilled industrial Eastern EU regions

P.M.

Metropolitan knowledge-intensive region:

BE1 Brussels-Capital Region, BE24 Prov. Flemish Brabant, DK Denmark, Cologne motorway A2, FR1 Île de France, Surrey, East and West Sussex.

Public knowledge centres

P.M.

Traditional southern regions

P.M.

Knowledge absorbing regions:

BE21 Prov. Antwerp, BE22 Prov. Limburg (B), BE23 Prov. Ontario, BE25 Prov. Ontario, ES21 Pais Vasco, ES51 Cataluña, FR3 Nord - Pas-de-Calais, Rhone-Alpes FR71; UKJ4 Kent, UKM Scotland.

Source: Commission, DG Regional Policy, 2010;
http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/2010_technological_change.pdf

APPENDIX 2

Composition Technical Working Group EGIB

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APPENDIX 3: SOURCES

1. EU Council

Presentations made by ERAC representatives of certain EU member countries during a 'Mutual Learning Session' regarding the status-quo and recent development of efforts, policy and future intentions/growth path for research, development and innovation. This session was led by the leading functionary of Directorate-General Research and Innovation of the European Commission, Directorate C - Research and Innovation (Mrs. C. De La Torre) and with specific issues as suggested by a.o. Mr G. de Graaf, Head of Division (then) of the Department of Innovation. The objective was to exchange ideas and practices in view of the content and objectives of the National Reform Programmes EU 2020 (deadline end of April 2011). In her conclusions Ms Máire Geoghegan-Quinn, Commissioner for Research, Innovation and Science, stressed the importance of this policy learning. This took place in the room Sicco Mansholt, Charlemagne building (Brussels), 26.01.2011. A brief overview of policy information is contained in the Annex to the Annex (p.9-12) of the Note from the Presidency to the Committee of Permanent Representatives/Council regarding the contribution to the European Semester, ref. Council doc. 6828/1/11 REV 1 (March 4, 2011).

2. European Commission

DIRECTORATE-GENERAL FOR RESEARCH AND INNOVATION

- CORDIS: ERAWATCH reports for several EU member countries (information about the Member State and/or certain regions in it), Bavaria, Catalonia and Scotland;

- CORDIS: National profiles for different EU member states;
- CORDIS: Regional profiles of some EU regions, url: www.cordis.europa.eu/regions/;
- CORDIS: Overview of wealth distribution in various EU member states, url: http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.content&topicID=613&parentID=27&countryCode=DE;
- CREST expert group report. OMC Peer Review (various Member States: Austria, Netherlands, Austria, France, Sweden ...);
- CREST expert group report on the design and implementation of national policy mixes (3rd report, 2007). European Union Scientific and Technical Research Committee;
- A more research-intensive and integrated European Research Area. Science, Technology and Competitiveness key figures report 2008/2009; 2008 Directorate C – European Research Area: Knowledge-based economy;
- Note to the members of CREST (EU27 only) and of the Council Research Working party. Letter of 9 April 2010 from J. Silva Rodriguez, Director-General;
- Note to the ERAC members, Results of the ERAC 2010 survey 'Impact of the economic crisis on public R&D investments and policy measures' – revised note following the 10-11 June ERAC meeting. Letter of 2 July 2010 from P. Vigier, head department;
- Europe's regional research systems: current trends and structures; Fraunhofer ISI. Project financed by the 6th Framework Programme for Research, for the implementation of the specific programme 'StrEngthening the

Foundations of the European e Research Area' (Invitation to tender n° DG RTD 2005 M 02 02);

- Exploring regional structural and S&T specialisation: implications for policy; Technopolis Group and Fraunhofer ISI, 2009. Project financed by the 6th Framework Programme for Research, for the implementation of the specific programme 'Strengthening the Foundations of the European Research Area' (Invitation to tender n° DG RTD 2005 M 02 02);
- An analysis of the development of R&D expenditure at regional level in the light of the 3% target; Prepared by Dr. Henning Kroll and Dr. Andrea Zenker, Econometric modelling by Dr. Torben Schubert. Project financed by the 6th Framework Programme for Research, for the implementation of the specific programme 'Strengthening the Foundations of the European Research Area' (Invitation to tender n° DG RTD 2005 M 02 02).

DIRECTORATE-GENERAL ENTERPRISE AND INDUSTRY

- data and profile of different EU regions included in this study are available through the 'Regional Innovation Monitor', RIM, url: http://ec.europa.eu/enterprise/policies/innovation/policy/regional-innovation/index_en.htm en http://www.rim-europa.eu/;

- report: 'Regional Innovation Monitor, Innovation Patterns and Innovation Policy in European Regions - Trends, Challenges and Perspectives', 2010 Annual Report (Project No. 0932) to the European Commission Enterprise and Industry Directorate-General Directorate D – Industrial Innovation and Mobility Industries by consortium of Technopolis Group Belgium, Fraunhofer ISI, UNU MERIT

(April 20, 2011); url: http://www.rim-europa.eu/index.cfm?q=p.file&r=d4e298554498e9f8989647745d4492f9;

- Innovation Union Scoreboard 2010 (The Innovation Union's performance scoreboard for Research and Innovation), 1 February 2011, prepared by UNU-Merit for DG Enterprise and Industry.

DIRECTORATE-GENERAL REGIONAL POLICY

- 'The regional impact of technological change in 2020', Framework Service Contract 150083-2005-02-BE (Ref SC36 Regional Impact), The network for European Techno-Economic Policy support and ETEPS AISBL, by René Wintjes and Hugo Hollanders (UNU-MERIT), with input of ETEPS project partners: Austrian Institute of Technology (AIT), Centre for Decision Sciences and Forecasting, Progress & Business Foundation, Fraunhofer ISI, Fondazione Rosselli, OPTI Foundation, Technology Centre of the Academy of Sciences CR. URL: http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/2010_technological_change.pdf

3. Committee of the Regions

- Knowledge and Innovation, CvR, 2009 study, ISBN-13: 978-92-895-0471-3

4. Organisation for economic cooperation and development, OECD

- Main trends in science, technology and innovation policy, STI outlook 2010 – chapter 2;

- The OECD Innovation Strategy - getting a head start on tomorrow, 2010 ISBN 978-92-64-08347-9;
- OECD (2011), Regions and Innovation Policy, OECD Reviews of Regional Innovation, OECD Publishing. http://dx.doi.org/10.1787/9789264097803-en, printed version ISBN 978-92-64-09738-4 and electronic version ISBN 978-92-64-09780-3;
- Categorisation of OECD Regions Using Innovation-Related Variables, Regional Development Working Papers, OECD Publishing, Paris, by Ajmone, G. and K. Maguire (forthcoming);
- Regional OECD studies (OECD Reviews of Regional Innovation) of Basque Country (2011), Catalonia (2010), Piedmont (2009);
- 28-Feb-2011 Working Party of National Experts on Science and Technology Indicators, R&D tax incentives: rationale, design, measurement and evaluation, Paris, 22-23 March 2011;
- Dsti/stp(2010)10/rev1 12 Aug 2010/Directorate for science, technology and industry;
- Committee for scientific and technological policy; main trends in science, technology and innovation policy - sti outlook 2010: chapter 2.

5. **Regional Innovation Scoreboard (RIS) 2009,** and accompanying methodological report, by Hugo Hollanders (UNU-MERIT, Maastricht Economic and social Research and training centre on Innovation and Technology, Maastricht University) and Stefano Tarantola & Alexander Loschky (JRC, Joint Research Centre, Institute for the Protection and Security of the Citizen (IPSC), Econometrics and Applied Statistics (EAS) Unit, Ispra, Italy), prepared for PRO INNO Metrics,

supported by Directorate-General Enterprise and Industry of the European Commission.

6. **National Reform Programme EU 2020 (National Reform Programme EU 2020) of EU Member States included in this report (April-May 2011).** Available via the Commission website for the EU 2020 Strategy, http://ec.europa.eu/europe2020/tools/monitoring/recommendations_2011/index_en.htm

7. **Innovation Union competitiveness report 2011** Available at: http://ec.europa.eu/research/innovation-union/index_en.cfm?section=competitiveness-report&year=2011

8. **Research and Innovation in the National Reform Programmes.** Opportunities for policy learning and co-operation. Report 1 of the Lisbon Expert Group 20th September 2006

9. **Trends in R&D policies for a European knowledge-based economy;** Giuseppe Veltri, Alexander Grablowitz, Fulvio Mulatero; 2009, European Commission Joint Research Centre - Institute for Prospective Technological Studies Directorate General Research.

10. **The Question of R&D Specialisation. Perspectives and policy implications;** Andrea Bonaccorsi, Antanas enys, George Chorafakis, Phil Cooke, Dominique Foray, Anastasios Giannitsis, Mark Harrison, Dimitrios Kyriakou, Dimitrios Pontikakis and Keith Smith. 2009, European Commission Joint Research Centre - Institute for Prospective Technological Studies Directorate General Research.

11. **Elements for the setting-up of headline indicators for innovation in support of the Europe 2020 strategy.** Report of the High Level Panel on the Measurement of Innovation established by Ms Máire Geoghegan-Quinn, European Commissioner for Research and Innovation September 30, 2010

12. **Contribution of policies at the regional level to the realisation of the European Research Area.** Prepared by Erawatch Network ASBL: David Charles (KITE, Newcastle University, and Curtin Business School) Zoya Damianova (ARC Consulting EOOD/ARC Fund) Nikos Maroulis (Logotech SA)

13. **Lisbon, 10 years later: the evolution of the expenditures for research and development in Belgium compared to other EU countries October 2010** Michel Dumont, Federal Planning Bureau, Peter Teirlinck, Belgian Science Policy and High School - University Brussels.

14. **The 2010 EU Industrial R&D Investment Scoreboard**
(Industrial Research Monitoring Activity), carried out jointly by the Joint Research Centre (JRC) and Research (DG RTD) Directorates-General of the European Commission, 2010.

15. **Monitoring and analysis of policies and public financing instruments conducive to higher levels of R&D investments. The 'POLICY MIX' Project. Different EU-member states. UNU-Merit.**

16. **'A Time Series Analysis of the Development in National R&D Intensities and National Public Expenditures on R&D'.** In relation to (PP-CT-M2-2005-0001): 'Framework Service Contract for Expert Support with the Production and Analysis of R&D Policy Indicators'. Final Study Report for Specific Assignment 4 (SPA4): Literature Review, Feasibility Study, Collection of Field Statistics, Calculation of Indicators, Survey, Conclusions. Developed by: IDEA CONSULT (Coordinator), FRAUNHOFER-ISI, NIFU STEP, ZEW, 2008.

17. **Others:**
    a. **Presentations and Information (a.o.) provided by federal/national or regional representatives and information from public policy documents**

    Important documents that were consulted include (non-exhaustive list):

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        - Denmark 2020 - Knowledge > growth > prosperity > welfare, Danish government, February 2010
    - Germany
        - GROWTH. EDUCATION. UNITY. The coalition agreement between the CDU, CSU and FDP for the 17th legislative period
        - Investing in the future: The Twelve Billion Euro Package of the Federal Government

- Ideas. Innovation. Prosperity. High-tech strategy 2020 for Germany, 2010
- Deutschlands Rolle in der globalen Wissensgesellschaft stärken Strategie der Bundesregierung zur Internationalisierung von Wissenschaft und Forschung - Strategy of the Federal Government for the Internationalisation of Science and Research
- Strategic Planning and Management of Research and Innovation in Germany, Expert Seminar, Prague 30 May 2011, Part I: The National Perspective

- France
  - National research and innovation strategy, 2009
  - Investissements d'avenir, mode d'emploi 13 juillet 2010
  - 23 janvier 2010, Journal officiel de la République Française, Décrets, arrêtés, circulaires textes généraux premier ministre Décret no 2010-80 du 22 janvier 2010 relatif au commissaire général à l'investissement
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- Finland
  - Research and Innovation Policy Guidelines for 2011-2015, 2010
  - Internationalisation of Finnish education, research and innovation, 2009
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