Foreign direct investment in business R&D in Belgium in comparison with other EU Member States: statistical overview and policy making

Peter Teirlinck

R&D and innovation in Belgium
Research Series

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BELGIAN SCIENCE POLICY

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Foreword

Today's increasingly global economy has brought in its wake an acceleration of the internationalisation of R&D. This internationalisation is reflected in different ways, including the international mobility of researchers and students, international cooperation agreements between countries and between research organisations of different countries, the international exploitation of research, and by means of foreign direct investment in R&D.

This study focuses on the latter aspect of internationalisation of R&D: foreign direct investment (FDI) in R&D. This phenomenon is closely related to the business enterprise sector and is dominated by multinational enterprises (MNEs). The attraction of FDI in business R&D is high on the policy agenda both at the level of the European Commission and at the level of the Member States (and their regions) since it remains a main contributor to Europe's persistent R&D deficit vis-à-vis the United States and Japan, as well as for the rise of China's R&D spending.

The small open Belgian economy is extremely sensitive to FDI (in R&D). Close to sixty percent of business R&D in Belgium is foreign-controlled and is subject to the location decisions for R&D by increasingly footloose and global multinational enterprises. These decisions are mainly inspired by market perspectives, technology perspectives, and to a lesser extent also the cost of research. Not only are the newly emerging economies attracting increasing amounts of FDI in R&D, but fierce competition also exists between the EU Member States.

This study highlights foreign direct investments in research in Belgium and benchmarks the Belgian situation with those of the other EU Member States. This comparison is performed both from a statistical perspective and from the point of view of the existence of concrete policy measures towards FDI in R&D. The study takes on board the experience of the Belgian Science Policy in support of work undertaken by the OECD and the European Commission.

The insights presented here have benefited from the contribution and supervision of the 'International Co-operation Commission' (ICC) and the 'Federal Co-operation Commission' (FCC) which reported valuable information enabling the inclusion of policy making at the regional level in Belgium.

Dr Philippe Mettens
Chairman of the Board of Directors

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Section 1
Introduction

The increasing globalisation of the economy has brought in its wake an accelerated process of internationalisation of R&D. In this process, cross-border flows of R&D tend to be spreading beyond the Triad (US, Japan and Europe), and this mainly in favour of countries such as China, India and other newly emerging economies.

Foreign direct investment (FDI) in R&D is an important driver for the internationalisation of business R&D. It has two main motivations: doing 'adaptive' R&D and getting access to 'state-of-the-art' knowledge. The 'adaptive' R&D modifies products, processes and technologies according to local needs and supports foreign production facilities. Getting access to 'state-of-the-art' knowledge means that companies invest in foreign countries with a view to benefiting from excellent local research and researchers. Market (demand), availability of researchers, and technology related factors are most frequently cited as the determining location factors for FDI in R&D (UNCTAD, 2005).

Concerning the benefits and beneficiaries, it can be noted that for an FDI recipient country the benefits include an increase in local technical capacity, potential knowledge and economic spillovers, job creation, and better tailored products. However, receiving FDI also means accepting foreign control over domestic R&D resources and loss of economic benefits if the results of R&D are exploited elsewhere. For the FDI source country, the benefits include: access to other sources of expertise, enhanced access to foreign markets, economic benefits if the results of R&D are exploited at home. But, being the source of FDI also means facing the loss of jobs, technical capability, and economic benefits if the results of R&D are exploited locally (Sheehan, 2004).

The purpose of this study is twofold. First, it gives a snapshot of statistical evidence on FDI in R&D in the EU Member States, with particular attention being paid to the Belgian case. Secondly, it confronts main policy instruments and changes in policy making towards FDI in R&D in Belgium and in the other EU Member States with the motives, trends and drivers for FDI in R&D.

To do this, section 2 benchmarks FDI in R&D in Belgium with the other EU Member States. Section 3 highlights some particularities of FDI in R&D in Belgium based on sector and micro-level evidence. For reasons of data availability, most of the evidence presented in these sections will be focused on inward FDI in business R&D.

Section 4 gives a snapshot of concrete policy measures currently applied in most of the EU Member States towards FDI in R&D. Taking on board the institutional setting in Belgium, attention is paid to sub-regional differences in policies towards FDI in R&D at the NUTS 1 (Brussels-Capital Region, Flemish Region, and Walloon Region) level.

Given the fact that FDI in business R&D is part of a broader process of internationalisation of R&D, policy actions in the field of FDI in R&D need to be framed within the broader context and objectives of a policy strategy towards the internationalisation of R&D. This forms the subject of section 5.

FDI in R&D can have both positive and negative implications for host and home countries. Some views on this are highlighted in section 6. The work concludes with reflections on how to improve the current policies in the Member States - again with particular attention to the Belgian situation - towards FDI in R&D (section 7).

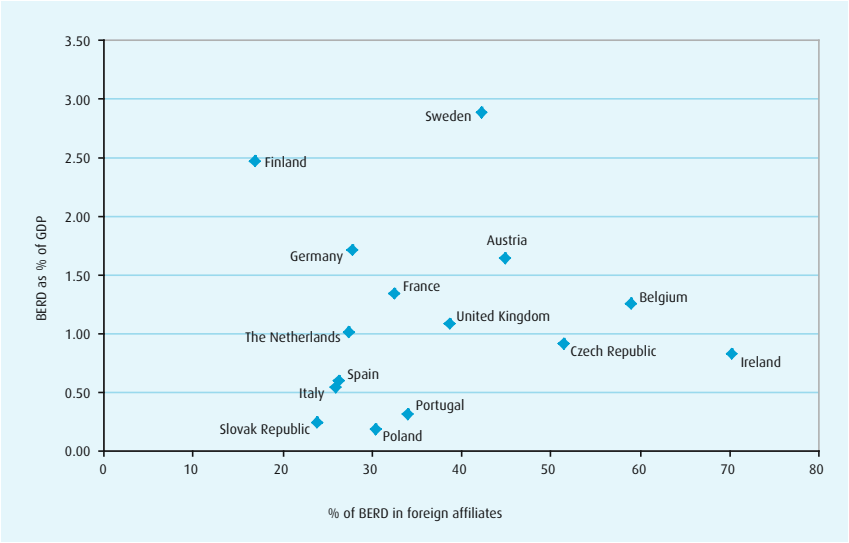
Section 2
A statistical snapshot of FDI in business R&D in the EU Member States

The statistical overview on the location of FDI in business R&D presented in the remainder of this study is based on linking the MNE's head office to the country in which the ultimate controller is located. According to the OECD's Handbook on Economic Globalisation Indicators (OECD, 2005b, p.108): 'An investor (company or individual) is considered to be the ultimate control investor if it is at the head of a chain of companies and directly or indirectly controls all the enterprises in the chain without itself being controlled by another investor.'

Figure 1 highlights the share of business R&D controlled by foreign subsidiaries in total business R&D expenditures in the EU Member States, as well as the importance of business R&D expenditures as a percentage of GDP.

Figure 1

R&D expenditures in foreign affiliates as a percentage of business R&D and business R&D as a percentage of GDP, EU Member States, 2005

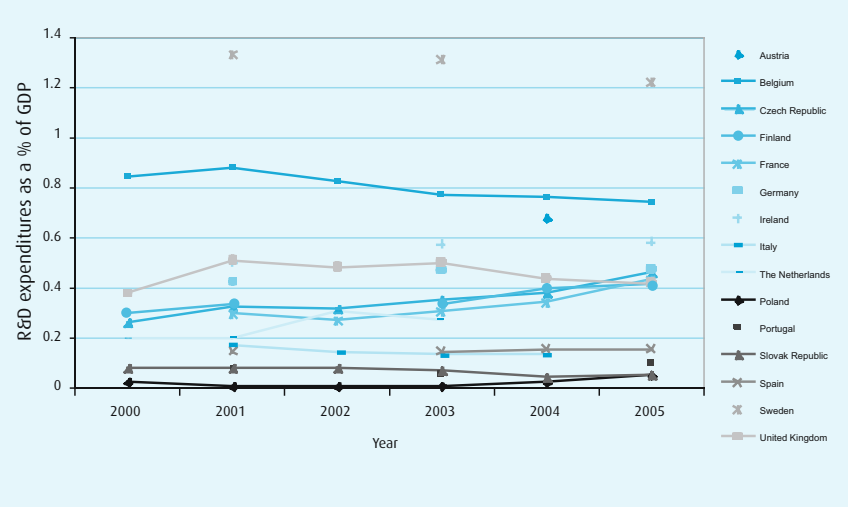


Source: OECD, MSTI, October 2007. Note: ownership criterion: ultimate control, BERD = business expenditures on R&D.

In Ireland, Belgium and the Czech Republic, over half of business R&D expenditures are under foreign control. For Austria, Sweden and the United Kingdom this is around 40%. No significant correlation could be found between the share of business R&D expenditures in foreign affiliates and that of business R&D expenditures as a percentage of GDP. This finding does not fully support the finding of Cantwell and Molero (2003) - on an earlier and more limited set of countries - that countries with a higher R&D intensity are less dependent on R&D in foreign subsidiaries than countries with a lower R&D intensity.

In terms of evolution of R&D expenditures in foreign affiliates as a percentage of GDP between 2000 and 2005 (Figure 2), an important (in absolute terms larger than 0.05% of GDP) decline can be noted in Sweden (-0.11) and Belgium (-0.09), and a high increase especially in the Czech Republic (+0.20), France (+0.12), Finland (+0.12), and Ireland (+0.08).

Figure 2
R&D expenditures in foreign affiliates as a percentage of GDP, EU Member States, 2000-2005



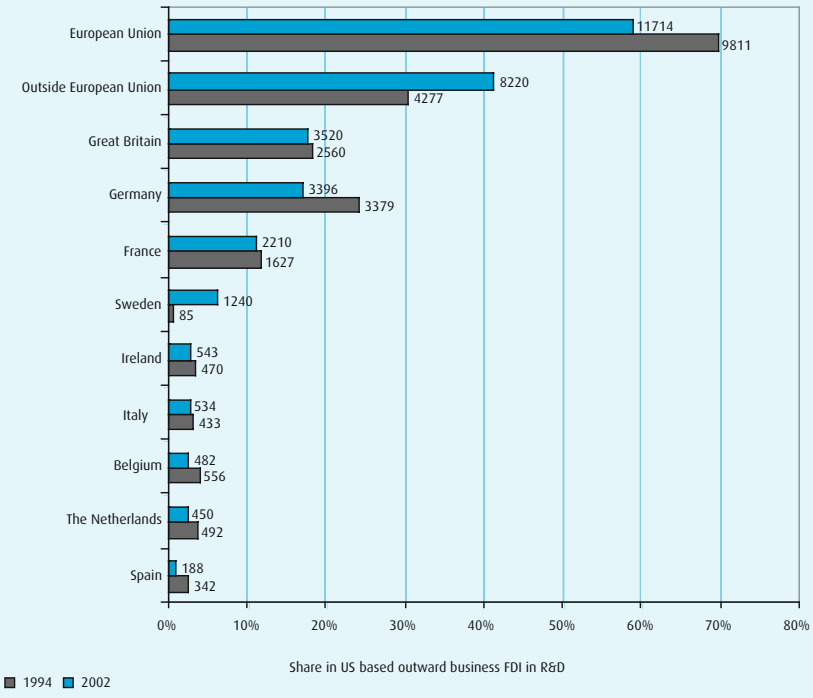
Source : OECD, Main Science and Technology Indicators, October 2007.

Taking into account that close to 30%[1] of FDI in business R&D in Europe is US-based, and in the absence of statistics on FDI in R&D flows between EU Member States, it is instructive to see the evolution of inward FDI investments in EU Member States by foreign affiliates of US-based multinational enterprises over the last decade. This is highlighted in Figure 3.

[1] Own calculations based on OECD, MSTI, October 2008.

Figure 3

Geographical spread of outward R&D expenditures by foreign affiliates of US-based companies, 1994 and 2002, in % and in € billion, current prices



Source: National Science Foundation, 2006, Table 4-51. Note: Data for Ireland and European Union for 2002 and for Italy for 1994 are based on a pro rata extrapolation of the results for 2001 (respectively 1995 for Italy).

Europe's share in total R&D expenditures by foreign affiliates of US companies decreased in the period 1994-2002 from 70% to 59% in favour of expenditures in other parts of the world. Within Europe, Great Britain passed Germany as the largest receiver of US-based FDI in R&D, and Sweden saw the sharpest increase in R&D investments. In absolute terms, the evolution was also positive in France, Ireland, and Italy. The Netherlands, Belgium and Spain witnessed a decrease in absolute terms (and in current prices) of US-based inward FDI in R&D.

Before linking these evolutions with R&D policy measures to enhance FDI in R&D in each of the Member States, in section 3 we further explore the Belgian case.

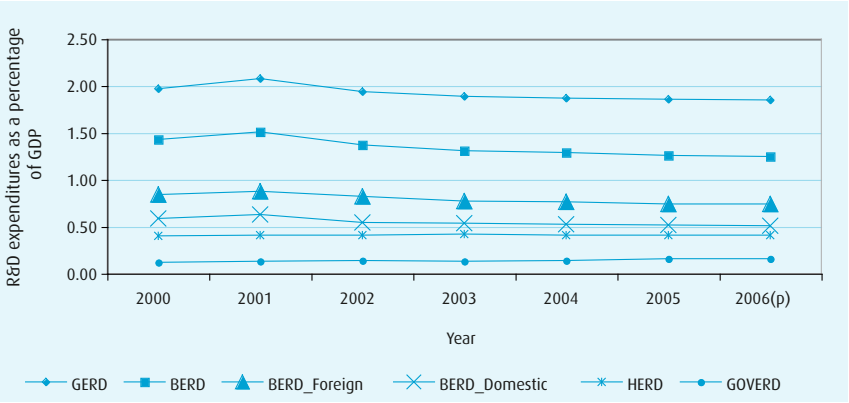
Section 3
A more detailed picture of FDI in business R&D in Belgium

In this section we take a closer look at FDI in R&D in Belgium. We consider facts and figures on the evolution of FDI in R&D expenditures, in total, by sector, and by country of origin (section 3.1). In section 3.2, a snapshot is given of the distribution of FDI in R&D expenditures at the lower geographical level in Belgium. The motives for FDI in R&D location in Belgium are dealt with in section 3.3.

By means of introduction to this section, we frame FDI in business R&D in the overall R&D efforts in Belgium. Figure 4 highlights the efforts in terms of R&D expenditures of the different research actors within the national system of innovation. Business R&D expenditures amounted to 1.5% of GDP in 2001, sharply decreased in the years 2002 and 2003, and stabilised at a level close to 1.3% in 2005 and 2006. The R&D efforts - as a percentage of GDP - outside the business enterprise sector (i.e. higher education and government sector) slightly increased over the period 2000-2006. Consequently, the dominance of business R&D in total R&D expenditures in Belgium decreased from 72.5% in 2000 to approximately 68% in 2006 (provisional data). Within the business enterprise sector, the part of R&D expenditures by foreign-controlled firms is about 1.5 times the part domestic-controlled. This dominance is more important than the share of FDI in general for employment and value added (estimated after correction for the activities of coordination centres at respectively 42% and 56% of manufacturing activity in 2002, De Backer and Sleuwaegen, 2005, p.27). This also confirms the argument made by De Backer and Sleuwaegen (2003) that affiliates of foreign-controlled firms played an important role for productivity and technological advancement (in line with earlier findings by Dunning, 1993) in Belgium.

The distribution of R&D expenditures between foreign-controlled R&D and domestic-controlled R&D over the period 2000-2006 was relatively stable. This indicates a very similar evolution (composed annual decrease of the R&D intensity of around 1.9%) both in foreign- and domestic-controlled business R&D in this period.

Figure 4
Evolution of R&D expenditures by sector of performance and as a % of GDP



Source: Belgian Science Policy Office: www.belspo.be. Note: GERD: Gross domestic expenditures on R&D; BERD: Business expenditures on R&D; HERD: higher education expenditures on R&D; GOVERD: government expenditures on R&D. Private non-profit actors are not included because this actor's R&D expenditures represent no more than 1.3% of total R&D expenditures in Belgium in the period 2000-2006.

3.1 Business R&D activity in Belgium under foreign control, by sector and by country of control

Table 1 presents FDI in R&D (in terms of expenditures) by foreign affiliates in Belgium in the period 2000-2006. In this period, the annual growth rate (before correction for inflation) of FDI in R&D equalled 0.92%, and the share of R&D expenditures of foreign affiliates in the total of the business expenditures for R&D (BERD) remained stable at around 59%. FDI in R&D from other EU Member States (and especially France and the Netherlands[2]) decreased sharply, whereas the share of inward FDI in R&D by the US increased (despite the decrease in absolute terms of investments in the period 1994-2002 – see Figure 3). Together, Europe and the US account for nearly 95% of total inward FDI in R&D in Belgium. Until 2006, FDI in R&D from emerging and developing economies in Belgium were minor. More recently, the takeovers of Arcelor by Mittal Steel and of Hansen Transmissions by Suzlon are examples with implications of foreign control by emerging economies (in this case India) over R&D expenditures in Belgium. This refers to the set-up of so-called 'catch-up' FDI in R&D (von Zedwitz, 2005).

[2] In the period 2000-2005, business enterprises with home base in France and the Netherlands had the largest control over R&D in Belgium. Whether this has to do with socio-cultural, political or linguistic factors (Leamer and Storper, 2001), or with other determinants, needs further investigation and falls outside the scope of this work.

Table 1
Intramural R&D expenditures in affiliates under foreign control, in € million, in percentage of BERD, and by country of control in percent of total

	2000	2001	2002	2003	2004	2005	2006(p)
In current prices € million	2 114,6	2 280,8	2 204,2	2 132,4	2 210,6	2 226,4	2 334,0
In percentage of BERD	58.9	58.2	60.2	59.1	59.2	59.0	59.3
Share in FDI in R&D by country of control:							
US	34.7	36.4	38.9	42.9	42.5	45.9	44.4
Japan	2.2	1.9	2.7	3.1	4.0	3.8	3.9
EU (27), of which:	61.7	60.3	56.6	52.2	52.3	49.0	50.3
France	*24.7*	*24.1*	*17.8*	*16.2*	*17.1*	*16.0*	*15.7*
Germany	*5.8*	*5.7*	*7.4*	*6.8*	*5.7*	*5.0*	*5.0*
Luxembourg	*2.5*	*2.2*	*1.7*	*1.7*	*2.1*	*2.3*	*2.4*
The Netherlands	*15.5*	*15.9*	*17.0*	*13.4*	*9.3*	*10.1*	*9.6*
Spain	*3.3*	*1.9*	*1.9*	*2.3*	*1.9*	*1.9*	*2.2*
Sweden	*1.4*	*1.0*	*1.8*	*1.9*	*1.9*	*2.0*	*1.9*
United Kingdom	*8.1*	*9.1*	*7.3*	*8.3*	*12.6*	*9.8*	*11.7*
Other European countries	0.0	0.0	0.5	0.5	0.0	0.0	0.0
Asia (non OECD-countries)	0.0	0.0	0.1	0.1	0.2	0.1	0.1
Near and Middle East	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Africa	0.2	0.2	0.2	0.2	0.0	0.0	0.0
Latin America	0.3	0.3	0.0	0.0	0.0	0.0	0.0

Source: Commission Federal Co-operation: CFS/STAT; own calculations. (p) Provision - Criterion for control: ultimate controller. Note: Agfa-Gevaert is considered to be a Belgian-controlled company. However, based on the ownership structure, it could also be argued that it is a German-controlled firm, as Belgian and German control shares are more or less equal (with some small changes during the period under consideration). Considering this firm as German-based would raise the share in FDI in R&D under German control to close to 10%.

Comparative research across countries has extensively reported on the important and persistent differences that exist between foreign subsidiaries and domestic firms (Dunning, 1993). This is confirmed for Belgium by De Backer and Sleuwaegen (2005), who found the average foreign affiliate in the Belgian manufacturing industry to be older, larger, more capital intensive, and more labour productive than the average domestic firm. These differences are found to be influenced by industry mix effects.

In order to have an idea of this kind of effects, Table 2 presents the sectoral parts in terms of business R&D expenditures in Belgium and the sector share controlled by foreign affiliates (by country of control). From this table, we note a dominance of foreign capital (more than two-thirds) in the three largest R&D sectors: pharmaceuticals, chemicals, and the sector 'audio-, video-, and telecom apparatus'. These three sectors represent close to half of total business R&D expenditures in Belgium in 2005. Pharmaceuticals and chemicals are highly US-controlled. Taking into account the results for UK-controlled R&D in Belgium, the pharmaceutical sector is almost an exclusively Anglo-Saxon matter. The 'audio-video-telecom' sector is largely dominated by multinational enterprises with their home base in France. Although it should be noted that there is an important drop in these activities (see Table 1 - this is related to the sharp decrease of the R&D expenditures by Alcatel Bell - see below).

Table 2

R&D expenditures in foreign affiliates as a percentage of sector expenditures in total business R&D and by country of control, year 2005

ISIC-Rev.3	Sector	Share in BERD	Share of R&D in foreign affiliates as a percentage of sector total								
			Total	US	EU(27)	UK	DE	FR	NL	Asia	Other
01-05	Agriculture	1.0%	94%	0%	85%	0%	58%	9%	18%	9%	0%
10-14	Extraction	0.1%	22%	6%	15%	0%	1%	0%	0%	0%	1%
15 - 37	**Manufacturing**	**80.4%**	**66%**	**32%**	**30%**	**7%**	**3%**	**10%**	**7%**	**3%**	**1%**
15, 16	Food and tabacco	3.3%	58%	25%	30%	6%	6%	2%	15%	1%	2%
17-19	Textiles and clothing	1.3%	15%	9%	5%	1%	0%	0%	2%	0%	1%
20	Wood and cork	0.1%	9%	9%	0%	0%	0%	0%	0%	0%	0%
21-22	Paper and printing	0.5%	27%	12%	16%	0%	0%	0%	0%	0%	0%
23	Petroleum refineries and products	0.7%	72%	65%	8%	1%	0%	7%	0%	0%	0%
24 (minus 24.4)	Chemicals (excl. Pharma)	12.7%	68%	46%	21%	1%	4%	11%	5%	1%	0%
24.4	Pharmaceuticals	24.3%	82%	61%	20%	17%	1%	1%	1%	1%	0%
25	Rubber and plastic	2.6%	53%	21%	21%	18%	1%	0%	1%	4%	7%
26	Stone, clay and glass	1.3%	56%	4%	22%	0%	3%	12%	4%	25%	5%
27	Iron and steel, non-ferrous metals	3.4%	38%	0%	37%	2%	0%	1%	0%	0%	1%
28	Metal and metallic products	1.7%	15%	3%	12%	4%	0%	0%	3%	0%	0%
29	Machinery (non-electrical)	5.7%	53%	12%	38%	5%	1%	0%	2%	3%	0%
30	Computer and office machines	0.5%	39%	6%	2%	0%	2%	0%	0%	31%	0%
31	Electrical machinery	3.9%	83%	3%	81%	2%	1%	14%	63%	0%	0%
32	Audio-, video- and telecom apparatus	10.7%	68%	14%	53%	0%	7%	37%	9%	0%	0%
33	Optical instruments	3.2%	26%	7%	9%	2%	6%	0%	1%	8%	3%
34	Motor vehicles	2.6%	68%	20%	20%	0%	11%	8%	1%	29%	0%
35 (minus 35.3)	Other transports (excl aircraft)	0.2%	42%	0%	37%	0%	0%	0%	37%	0%	6%
35.3	Aircraft	1.7%	90%	0%	90%	0%	0%	90%	0%	0%	0%
36-37	Other manufacturing	0.6%	9%	0%	9%	1%	1%	3%	4%	0%	0%
40-45	Utilities and construction	1.3%	49%	3%	46%	0%	0%	32%	1%	0%	0%
50-99	**Services**	**16.3%**	**24%**	**5%**	**18%**	**2%**	**0%**	**4%**	**3%**	**1%**	**0%**
50-55	Wholesales and retail	1.7%	11%	0%	3%	0%	0%	0%	1%	7%	0%
60 - 64	Transport, storage and communication services	3.9%	29%	0%	29%	0%	0%	1%	0%	0%	0%
65-74	Business services (incl. financials)	10.7%	25%	8%	16%	3%	1%	5%	4%	0%	0%
75-99	Public services	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
01-99	**Whole economy**	**100%**	**59%**	**27%**	**29%**	**6%**	**3%**	**9%**	**6%**	**2%**	**0%**

Source: Commission Federal Co-operation: CFS/STAT. Note: BERD = Business Expenditures on Research and Development.

Within the manufacturing industry, the dominance of foreign subsidiaries is less prominent in the 'medium- and low-tech' sectors (like 'wood and cork', 'metal and metallic products', 'textile and clothing', and 'other manufacturing'). This confirms the finding of Cantwell and Molero (2003) that foreign-owned firms are mainly found in high-tech sectors in the manufacturing industry. However, the low presence of FDI in R&D does not necessarily imply a poor R&D intensity in these sectors. On the contrary, an international comparison by means of a shift share analysis at sector level revealed that these medium- and low-tech sectors are strongly R&D intensive (positive intrinsic R&D effect) in Belgium (Teirlinck, 2003).

Moreover, it turned out that Belgian R&D in the (medium-) high-tech chemical sector (including pharmaceuticals) has an average R&D intensity compared to the country's principal commercial partners, the US and Japan. Although very important in terms of budgets, the high-tech sector 'ICT hardware and communication' clearly lags behind in terms of R&D expenditures on value added in the business enterprise sector in Belgium. A similar remark can be made for the sectors 'motor vehicles' and 'aircraft': a large dominance of foreign-controlled R&D and low total R&D budgets (in relation to the value added of this sector) in Belgium compared to the budgets spent in other countries (Teirlinck, 2003). These findings are in line with the argument put forward by Kokko (1996) that important foreign presence sometimes may be an indication of a weak local industry, in which local firms have not been able to absorb productivity spillovers and therefore have lost market shares in favour of foreign MNEs.

From this perspective we could wonder to what degree the concentration of R&D in foreign subsidiaries in the high-tech sector corresponds to Cantwell's (1989) finding that in industries where local firms lacked traditional technological strength, and more particularly in countries with markets too small to allow both kinds of firms to operate at efficient scale, local firms were driven out of business or pushed to market segments that were ignored by the foreign MNEs. For the local embeddedness of R&D activities, the length of time for which a subsidiary has been operating in a country is crucial (Cantwell and Molero, 2003). Of course, in this respect, one should not ignore takeovers of 'local' firms by foreign investors.

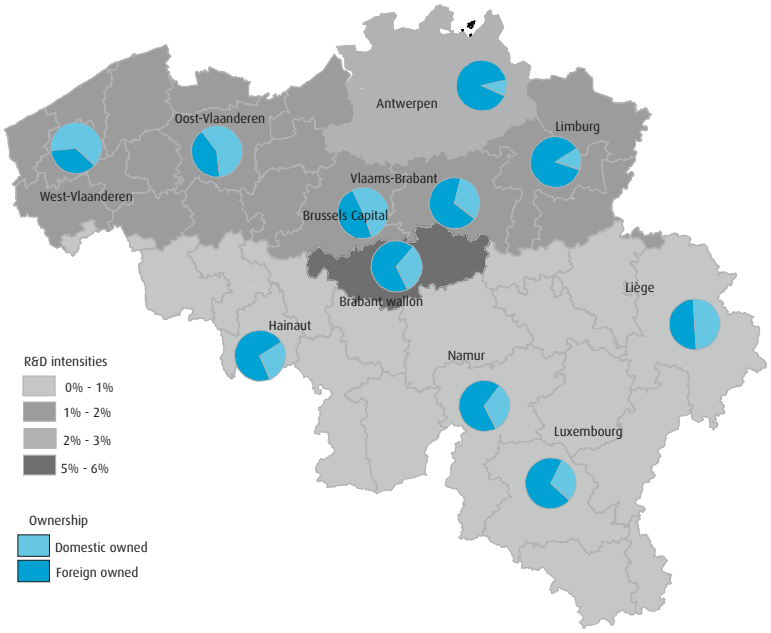
For services, a far lower share of foreign control (around one-fourth) compared to manufacturing (two-thirds) can be identified. For foreign-controlled business R&D expenditures, ultimate control mostly (over three-fourths) is EU-based (dominated by the R&D expenditures of 'SWIFT', a Spanish-based multinational enterprise, see below). Only for the in absolute R&D terms most important services sector (i.e. business services including financials) is about one-third of the foreign-controlled R&D activities US-based.

3.2 Business R&D activity in Belgium under foreign control at the regional level

As noted in the introduction, attention will be paid to differences in regional policy making towards business enterprise R&D expenditures in Belgium (as included in the EU Member States comparison in section 4). To better understand the rationale for the different approaches in policy making towards FDI in R&D between regional governments in Belgium, it is necessary to have an idea of the geographical spread of, and dependence on, FDI in R&D activities at a lower geographical level. Dealing with geographical location of R&D calls for a map of the geographical dispersion of R&D activities in Belgium. The appropriate 'spatial level' for presenting R&D geographical dispersion is difficult to establish. However, from a policy making perspective, it can be argued that the NUTS (Nomenclature of Territorial Units for Statistics)1 level is the most appropriate, since policy making in the field of R&D and innovation for business mainly occurs at this level (Nauwelaers, 2004). This level refers to the Flemish Region, the Walloon Region, and the Brussels-Capital Region. The analysis in section 4 will take into account differences in policy making towards FDI in R&D at this NUTS1 level. However, in order to give a rough idea of the concentration of these activities within the NUTS1 level - and related to location factors for R&D in general - we present a map at the provincial (NUTS 2) level. Until the year 2006, this geographical level was also the target level for Objective 1 and Objective 2 of the European Commission Structural Funds (for the period 2007-2013 it is up to the Member States to select the beneficiary zones).

Figure 5 highlights an uneven geographical dispersion of foreign-controlled R&D across the country. The data are reported for the year 2001 because this is the only year for which official detailed information is available at NUTS2 level for Belgium. The methodology and further insights into the distribution of R&D activities at the provincial level in Belgium can be found in Teirlinck and Spithoven (2005).

Figure 5
Business R&D according to ownership in Belgium, provincial level, 2001



Source: CFS/STAT. Own calculations. Note: the results for Brussels-Capital are presented within the province of 'Vlaams-Brabant'. No provinces have an R&D intensity (R&D expenditures on Gross Regional Product) between 3 and 4%.

In each of the Walloon provinces (Hainaut, Brabant-Wallon, Namur, Luxembourg and Liège) at least half of the R&D is concentrated in foreign subsidiaries. However, except for the province of Brabant-Wallon, the R&D intensity is very low in these provinces (between 0.3% and 0.8% of gross regional product). The exceptionally high intensity in Brabant-Wallon can be explained by the combination of the presence of some large R&D investing companies (see below) and a relatively low total gross regional product (less than half of the average GRP for all Belgian provinces taken together - Eurostat (2004)). All Flemish provinces, except for Antwerp (with an R&D intensity of 2.7%), present an R&D intensity between 1.0% and 1.7% of GRP. R&D in the western part of the Flemish Region (West- and Oost-Vlaanderen) is dominated by domestically owned R&D. In Antwerpen, Vlaams-Brabant and Limburg on the other hand, R&D expenditures are dominated by foreign-owned firms. These provinces, together with Brabant-Wallon, apparently are the most attractive for big-spending high-tech R&D firms active in ICT and telecommunication (Philips, Siemens Atea, Alcatel Bell), chem-

icals and pharmaceuticals (Janssen Pharmaceutica, GlaxoSmithkline Beecham, Agfa-Gevaert, UCB and Exxon Mobile). Out of the ten largest R&D spending firms in Belgium (see section 3.3), only Solvay (Brussels-Capital) and Atofina (Hainaut, but it should be noted that this firm is located right on the border with Brabant-Wallon) are not located in one of these provinces.

These findings reveal a concentration of FDI in R&D around Brussels-Capital (less activity in terms of business R&D spending within the capital can be explained by the orientation towards - less R&D intensive - services, partly induced by lack of space and the high cost of land hampering the presence of manufacturing industry), and Antwerp. This is closely related to the presence of large infrastructure (airport in Brussels, and seaport in Antwerp combined with a historical incentive for chemical industries to invest in Antwerp shortly after the Second World War (Capron, 2000; Teirlinck and Spithoven, 2005a)).

3.3 (FDI in) R&D concentration in top R&D spending firms in Belgium

To better frame the findings on sector distribution, country of control, and geographical dispersion of FDI in R&D in Belgium (sections 3.1 and 3.2), it is important to emphasise that R&D spending is heavily concentrated within a minority of firms. Table 3 presents the top 10 R&D spending firms in Belgium by name, by sector, by country where the head office is located, and by province, and this for the years 2000 and 2005.

Table 3
Top 10 R&D spenders in Belgium in the years 2000 and 2005

Ranking 2005	Ranking 2000	Company	Sector	Country of control	Province
1	1	Janssen Pharmaceutica	Pharmaceuticals	United States	Antwerpen
2	4	Glaxosmithkline Beecham Biologicals	Pharmaceuticals	Great Britain	Brabant-Wallon
3	2	Alcatel Bell	ICT-hardware and instruments	France	Antwerpen
4	5	Agfa-Gevaert	Chemicals and ICT-hardware and instruments	Belgium/Germany	Antwerpen
5	11	UCB Pharma	Pharmaceuticals	Belgium	Brabant-Wallon
6	3	Philips Innovative Applications	ICT-hardware and instruments	The Netherlands	Each of the Flemish provinces*
7	6	Procter & Gamble Eurocor	Chemical industry and refineries (excl. pharma)	United States	Vlaams-Brabant
8	10	Total Petrochemicals Research Feluy	Chemical industry and refineries (excl. pharma)	France	Hainaut
9	7	SWIFT	Telecommunication services	Spain	Brabant-Wallon
10	32	Techspace Aero	Aerospace	France	Liège
15	8	Solvay	Pharmaceuticals, chemical industry and plastics	Belgium	Brussels-Capital
24	9	Siemens Atea	ICT-hardware and instruments	Germany	Antwerpen

Source: CFS/STAT. Own calculations. Note: for reasons of confidentiality, the R&D budgets cannot be reported. *The location of R&D activities in Limburg only refers to the year 2000 because the plant (and R&D activities) of Philips Hasselt was shut down in the period under consideration.

In 2005, 32% of total business R&D expenditures in Belgium was performed in the ten largest R&D spenders. The concentration of R&D expenditures in the ten largest R&D spenders in the year 2000 amounted to 33.4%. In terms of the evolution of the R&D budgets (in current prices) of the 10 largest firms, we notice a 7% reduction of the aggregated R&D budgets spent by these firms in the period 2000-2005. This evolution is worse than the evolution of the total business expenditures on R&D (BERD), for which we note an increase of 5.2% in the same period (own calculations based on OECD, MSTI, 2008).

It is instructive to highlight the evolution and important changes in the organisation of R&D activities within these multinational enterprises. The information presented here is based on publically available sources (via e.g. the annual reports and the official websites of these companies) and has been cross-checked with insights and data provided by the biannual OECD R&D survey for Belgium (surveys 2002, 2004, 2006).

Janssen Pharmaceutica is the largest R&D spending company in Belgium. The company mainly conducts research into new drugs. The location of the firm's main research facility in Beerse was largely determined by the availability of cheap land. In the early nineteen-sixties, the company was acquired by the American group Johnson & Johnson. Over the last decade, within this group, clinical research and non-clinical development became a global organisation which has led to the transfer of part of the research activities of Janssen Pharmaceutica to the US during the reorganisation of research activities in the Johnson & Johnson Pharmaceutical Research Development organisation in 2001. Access to external innovation complementing the existing internal research programs is stressed as an integral component of the overall R&D strategy of the company. In this sense it is not surprising that Janssen Pharmaceutica was one of the first Western pharmaceutical companies that set up a factory in China. More recently, in 2007, the plant in Belgium was reorganised and 688 persons, including 200 researchers, lost their jobs.[3] The R&D downsizing was prompted by sharply declining revenues due to the expiration of major patents. The loss of research jobs can be a worrying signal because the research of today is supposed to create the (production) jobs of tomorrow.

The second largest R&D spending company in Belgium, GlaxoSmithKline Biologicals (GSK Biologicals), is also active in the pharmaceutical industry. More specifically, the company is the leading GSK plant in the field of vaccine research, development and production. No major changes in terms of R&D spending occurred over the period under consideration. Compared to Janssen Pharmaceutica, this company is more research (and less development) oriented.[4]

Also in the pharmaceutical industry, the Belgian company UCB Pharma nearly doubled its R&D expenditures in Belgium over the period 2000-2005. Following its recent acquisition of Celltech (UK), the company has restructured its R&D operations by concentrating the R&D activities in its centres of excellence in Braine-l'Alleud (Belgium) and in Slough and Cambridge (UK). The main reasons behind this reor-

[3] www.indymedia.be - accessed 20/5/2008.

[4] Based on company visit during the 'Forum of internationalisation of R&D' - organised by the OECD and the Belgian Science Policy Office - Brussels, March 2005.

ganisation were eliminating duplication of activities, higher efficiency, and maximization of the impact of R&D spending by redeploying financial resources to accelerate development of promising pipeline activities. As part of this reorganisation, the small-molecule research carried out in Boston (86 research jobs) has been transferred to Braine-l'Alleud and Cambridge.[5]

Bell Labs[6] are at the centre of Alcatel-Lucent's innovation engine. For the Bell Lab in Belgium (Antwerp) we notice a reduction by nearly 60% of the R&D expenditures in the period 2000-2005. Without having a direct link with these activities, it is interesting to see that this decrease in R&D investments in Belgium occurs at the same time as the set-up of important research labs in China (in March 2000 - centre of technical excellence and innovations supporting Alcatel-Lucent business units and customers in the China and Asia Pacific Region), in India (October 2004 - centre for fundamental and applied research in scientific fields related to computing and communications software, and for the creation of the technological innovations necessary to deploy and manage next-generation wireline and wireless networks), and in Ireland (2004 - global focal point for research in telecommunications and supply chain fields). Especially the plant set up in India in 2004 performs R&D activities comparable to those of the Antwerp plant. The research centre established in Ireland in 2004 could also have important implications for Belgium. This hub serves as a global focal point for Alcatel-Lucent's telecommunications value-chain-driven research, which is guided by all elements in the lifecycle of a product that exhibits an economic influence, i.e. from initial design through production to customer use (experience). For Alcatel-Lucent, it has helped improve time-to-market cycles for new technologies and streamline product platforms, ensuring that the manufacturing, testing and reliability process, as well as logistics and installation, are cost-effective. For Ireland, it has established an effective partnership with academia by providing industry guidance to the ambitious research agenda, including training the next generation of scientists and engineers, and producing innovations that will grow the knowledge economy of Ireland.

For Philips, also an ICT-related company, the decrease in the R&D budget can be explained by the shutting down of the Philips plant in Hasselt in 2002. Philips Hasselt was a 'development centre' for new products. The plant was located in the so-called 'ICT corridor Leuven –Eindhoven' (forming a knowledge triangle with Aachen). During the period 2000-2005, Philips relocated parts (especially those faced with declining profit margins) of its Belgian production activities to Poland. The latter country has built important competences in electronics and combines cheap labour with (most importantly) a high - especially among the young technical employees - English-speaking knowledge potential. For Belgium, this implied the end of the R&D activities specifically related to the relocated production activities. To store this specific knowledge available in this and other Philips plants, a central archiving system (SMARTEAM) has been created. Afterwards this system has been upgraded towards a 'Multi-site' solution which stores technical knowledge and research in one central

[5] http://goliath.ecnext.com/coms2/summary_0199-296880_ITM and http://pubs.acs.org/cen/news/8236/8236notw4. html - accessed 21/5/2008.

[6] The information provided here is based on the R&D data provided in the biannual OECD R&D survey and on htttp://www.alcatel-lucent.com - accessed 20/5/2008.

knowledge archive for all European production plants of Philips. The system is managed in the Netherlands. The negative evolution of research in Belgium stands in contrast to the increasing research activities of Philips in China and India and the reinforcement of its large research facilities in Germany, the Netherlands, the United Kingdom, India, the US and China.[7] The remaining research activities in Belgium (Philips Innovative Applications NV) can be seen as the Global Development Centre for Upmarket Flat Displays. These activities are integrated in a multi-site development process with the Netherlands and India, making it possible to benefit from distributed developments of core competencies in centres of excellence around the world. The adequate management of these globally distributed development projects is a key success criterion.[8]

Also in the top 10 of R&D spenders in 2000, but not in 2005, was Siemens Atea, another important research actor in the ICT sector in Belgium. R&D expenditures rose by one-third between the years 2000 and 2002, decreased sharply between 2002 and 2005, and stagnated in 2006 at a level half as high as it was (in nominal terms) in the year 2000. For this company we note a similar story as for Alcatel Bell and Philips: a sharp reduction in the R&D budgets spent in Belgium while at the same time enforced research activities in other parts of the world and increasing overall R&D budgets.[9]

Agfa-Gevaert, a company active in Chemicals and ICT hardware and instruments, has various R&D Centres worldwide, of which the largest are located in Belgium (Mortsel), the United States, Germany and China. The company has developed an open attitude towards external ideas and actively promotes out-licensing Agfa technology. This open attitude combined with global production and research network allows the company to address the specific needs of each market, reduces transportation costs, and limits the risk of currency fluctuations.[10] The apparently smooth evolution of the R&D activities over the period 2000-2005 masks important restructuring and job loss over the period.

Another interesting case is that of Eli Lilly, which closed its Belgian R&D facility while at the same time expanding research in Ireland. The decisions were supposedly based on Belgium's worsening business environment and the provision of financial incentives from the Irish government.[11] Eli Lilly has no production activities in Belgium.

But not only (some of the) foreign-controlled firms reduced their R&D activities in Belgium. Solvay, Belgium's pride in the chemical industry, reduced its R&D investments by half, and nowadays spends as much on R&D in the Netherlands as in Belgium. This negative evolution is in contrast to the 40% increase of the R&D expenditures worldwide between 2003 and 2006, and the setting up (mainly for market perspectives) of a High Performance Materials R&D centre in Shanghai.[12] The other large Belgian company in the chemical industry, UCB Chemicals, is now foreign-controlled.

[7] htttp://www.research.philips.com/profile/locations/index.html - accessed 21/5/2008.

[8] http://www.philips.nl - accessed 21/5/2008.

[9] http://w1.siemens.com/innovation/en/daten/ research_expenditures.htm - accessed 21/5/2008.

[10] http://www.agfa.com/en/co/about_us/index.jsp - accessed 22/05/2008.

[11] http://www.pharmaceuticalsinsight.com/file/42136/lilly-closes-belgium-rd-facility-expands-in-ireland. html - accessed 22/05/2008.

[12] www.solvaypress.com 14092005 - accessed 21/5/2008.

Techspace Aero (SAFRAN Group) is located in the Walloon Region and is active in aerospace. Over the period 2000-2005, the company's research activities benefited greatly from support provided under the sixth European Framework Program (more specifically the VITAL programme, which focuses on reducing the noise and CO2 emissions of aircraft engines), as well as support from regional and national authorities. Techspace Aero emphasises that this support has been essential for a number of breakthroughs achieved over the past decade.[13]

Proctor & Gamble Eurocor is a subsidiary of the Procter & Gamble Company (P&G). Of the more than 2,100 P&G researchers in Europe, 580 are located in the European Technology Centre in Strombeek. The stagnation of the firm's R&D activities can be seen in the light of the company's new overall strategy since early 2001 with respect to R&D. The firm's 'Connect + Develop program' systematically transformed the way P&G finds and brings innovation to market. The roots of 'Connect + Develop' go back to the late 1980s. At that time, P&G changed its R&D model from a centralised structure based in Cincinnati to a transnational structure where P&G laboratories were linked around the globe. This transnational approach accelerated P&G's global time to market and revolutionised the way future organisations would structure their R&D organisations. In the late 1990s, however, the company wasn't meeting its growth targets despite spending greater and greater amounts on R&D. P&G therefore began searching for the next big business model that could be applied to the innovation area (based on a company visit on 18/4/2005).

Total Petrochemicals Research Feluy is the largest of three (Feluy - Belgium, La Porte - United States, Mont/Lacq - France) research centres of Total Petrochemicals worldwide, the 5th largest petrochemicals producer in the world. The international headquarters are located in Brussels. The research centre in Feluy with personnel in excess of 400 people is located close to 'Total Petrochemicals Feluy', the largest polypropylene production site in Europe, and pools catalyst expertise in petrochemicals, base chemicals, and in the development of new technologies. In collaboration with the Walloon Region and the European Union, research in the field of the synthesis of new generation catalysts is conducted by pooling the industry-science competences of the Feluy Research Centre and Certech (Chemistry Technological Resources Centre), a spin-off of the Université Catholique de Louvain-La-Neuve (set up in 1996 and based in Seneffe). This cooperative venture has as a major objective to stimulate the creation of high value-added jobs in the region in particular by anchoring the manufacture of the new catalysts in the area.[14]

For SWIFT, the only service firm in the top 10 R&D spending firms, no public information is available for positioning the R&D activities in Belgium in the overall R&D activities of the company. This could - to some extent - be related to the enduring problem of measuring and defining R&D in the services sector (OECD, 2002, 2005a).

[13] http://www.techspace-aero.be/en/Actualite/Press/boostervital.html - accessed 22/05/2008.

[14] http://www.be.total.com/content/documents/Total-in-Belgium.pdf - accessed 2008-07-01.

3.4 Motives for R&D location in Belgium by foreign-controlled firms

We conclude the section on Belgium by considering empirical evidence at the firm level on the motives for the location of R&D. A broad range of location criteria is taken into account and a comparison is made between foreign-owned companies and domestic ones.

The results presented here are provided by the biannual OECD business R&D survey organised in the year 2004 for Belgium. This survey covers R&D data for the period 2002-2003. The data are provided by the Belgian Federal Cooperation Commission, CFS/STAT. The target population for the analysis are all private firms performing R&D on a permanent or quasi-permanent basis in Belgium. In the R&D survey, information is provided on the head office of the firm. Following the OECD globalisation manual, the head office is the country in which the ultimate controller is located. This information made it possible to divide the target population into two groups: foreign subsidiaries (enterprises being part of a group with its head office outside Belgium), and domestic firms (head office in Belgium).

The business R&D survey 2004 included a question offering firms the possibility to choose from among 10 possible motives for the location of R&D activities.[15] Information is available for 501 firms, of which 159 are foreign-controlled and 342 can be considered domestic. Compared to the population of (quasi-)permanent R&D active firms, this is a coverage of 36.8%.

For the 501 firms, we have 1,310 answers on the 10 possible motives for R&D location. Table 4 regroups these possible motives for R&D location for private enterprises into its three main categories (market related motives, technology related motives, and cost related motives - UNCTAD, 2005), adds a category 'other motives' (including infrastructure and historical motives), and makes a distinction between foreign-owned companies and domestically-owned companies.[16]

[15] In the survey, there was a possibility to include an eleventh category with 'other' motives. Only 3 firms indicated a motive in the latter category. Therefore, it can be supposed that the survey covered the main motives for R&D location.

[16] Ownership is based on the criterion of ultimate control. This was asked for in the R&D survey.

Table 4

Criteria for the location of R&D in Belgium in the period 2002-2003, foreign-controlled and domestic R&D active firms - share in %

		Foreign	Domestic	Total
Market related motives	Proximity to production centres	47%	54%	51%
	Presence of clients and/or suppliers	22%	21%	21%
Technology related motives	Availability of trained personnel	42%	35%	38%
	Network possibilities	13%	11%	12%
	Presence of universities and research institutes	28%	19%	22%
Cost related motives	Financially attractive settlement motives	15%	12%	13%
	Possibility to get subsidies	25%	20%	22%
	Local legislation	20%	9%	13%
Other motives	Historical reasons	53%	35%	41%
	Infrastructure (transport/land/...)	29%	29%	29%
Number of firms		***159***	***342***	***501***

Source: OECD R&D survey for Belgium, 2004 (question 19.3). Data provided by CFS/STAT. Own calculations. Note: The classification of the different location motives (column 2) in the four presented categories (column 1) can be subject to discussion. Therefore, the analysis in the remainder of the document focuses mainly on the detailed location factors (column 2).

Based on the results presented in Table 4, it turns out that proximity to production centres is a major location motive for R&D, and this independent of the ownership structure of the firm. This means that 'hands' and 'brains' tend to be positioned close to each other.[17] The availability of trained personnel and the presence of universities and research institutes also seem important motives for R&D location. Although it should be noted that these motives (as it is the case for network possibilities) turn out to be more important for foreign-owned R&D active firms. This confirms the finding by Cincera et al. (2004) that foreign firms are well integrated into the (regional) innovation system(s) in Belgium. This with a large part of R&D cooperation and a majority of subcontracting taking place between foreign and local firms.

Cost related motives turn out to be less important than market and technology related motives for the location of R&D. Here too, however, these motives seem to be more important for foreign-owned companies, and this especially in terms of local legislation.

An interesting finding in Table 4 is that, besides the three major motives highlighted in the introduction of this work, 'infrastructure' and most importantly 'historical reasons' also determine the location of R&D in Belgium. The latter is especially the case for foreign-owned companies, for which it turns out to be the most important location factor. This could be related to the fact that Belgium historically has a high presence of foreign FDI in general, and FDI in R&D could be a side effect of this. Secondly, it can also be related to takeovers of existing Belgian-owned R&D active firms by foreign-owned companies (compared to greenfield investments). Providing a solid answer to these findings falls beyond the scope of this work.

It would be too hasty to draw conclusions based on very rough results while neglecting elements other than the origin of the ultimate controller of the firm. Therefore, we include firm specific characteristics in terms of firm size and technical complexity of the sector in which the enterprise performs R&D. For firm size, Molero and Heys (2002) find in their comparison of foreign-controlled firms and indigenous firms that are also part of a larger company group that the differences associated with the nationality of ownership have more to do with the structural composition of activity than with innovation-related differences as such. In some countries (like Spain), the larger average size of foreign-owned firms was found to be crucial for international market competition, and influenced the approach taken to facing the risks linked to innovation as well. According to Cantwell and Molero (2003), industry classification can be seen as a central factor, since foreign-owned firms are mainly found in high-tech opportunity sectors, characterised by a higher level of competition.

We refine the results of Table 4 by building a frequency table taking into account these firm specific elements and analyse the frequency table by using log-linear modelling of categorical data (Hagenaars, 1990). Log-linear modelling is an analogue to multiple regression for categorical variables. In contrast to log-linear regression models like logit and logistic regression, log-linear modelling refers to analysis of table frequencies without necessarily specifying a dependent. Rather the

[17] Because of the static character of the question on location motives, it is not possible to determine whether 'brains' follow 'hands' or 'hands' follow 'brains'.

focus is on accounting for the observed distribution of cases. The screening of the best log-linear model is done using a simple backward strategy. Starting from a saturated model where the frequency table is completely replicated ($L^2=0$), the Brown's screening method based on Akaike's and/or Bayesian information criterion (AIC and BIC) checks, in a hierarchical way, for non-significant effects. This approach penalises for complexity and sample size and thus results in the most parsimonious model (that with the lowest L^2). The p-value indicates how well the model fits the data. A balance needs to be found between this goodness of fit (p-value) and the simplicity (AIC and BIC based on the L^2-statistic) of the model (Hagenaars, 1990).

The model here considered includes the ten motives (Mj) for R&D location as presented in Table 4 (column 2) by controlling for firm-specific characteristics. These firm-specific design variables take into account the dimension, the technical complexity, and the control status of the enterprise. The dichotomous variable 'dimension' (Dk) is measured in terms of employment: small and medium-sized when fewer than 250 persons employed; and large when 250 or more persons are employed. 'Technical complexity' (Tl) is a dichotomous design variable when a firm can be classified as high-tech versus medium- or low-tech (for a classification - see Annex 1). Finally, as we did before, we take into account the differences between foreign-controlled firms and domestic firms (this is the design variable 'control status' (Ci)).

In log-linear modelling it is a common approach to present only the final model reflecting the significant associations between the observed variables. Since hierarchical log-linear modelling is used, higher-order effects necessitate the inclusion of all lower-order effects. The hierarchical model (referred to as 'CD, MT, DT, HM') that fits the data can be represented as follows:

$$F_{ijkl} = \theta + \lambda_{Ci} + \lambda_{Mj} + \lambda_{Dk} + \lambda_{Tl} + \lambda_{CDik} + \lambda_{MTjl} + \lambda_{DTkl} + \lambda_{CMij}$$

With 'Mj' the ten motives for R&D location (see Table 4 - column 2); 'Tl' the technical complexity (high-tech versus medium- and low-tech - see annex 1); 'Ci' the control status of the enterprise (foreign-controlled firms versus domestic firms); 'Dk' firm size (small and medium-sized versus large).

In this model, four significant two-way associations can be detected: 'CD', 'MT', 'DT', 'CM'. These associations refer to a significant relation between control status of the enterprise on the one hand and firm size or location motives on the other (associations 'CD' and 'CM'), and between technical complexity on the one hand and firm size or location motives on the other hand (associations 'MT' and 'CM').

Focusing on location motives, this model indicates that there is a significant association between 'technical complexity' and 'location motives', and between 'control status' and 'location motives'. Firm size (after controlling for the other variables included in the model) does not seem to influence location motives for R&D. Since our interest in this section is focused particularly on location motives, we only report this part of the outcomes of the log-linear analysis (Table 5).

Table 5
Estimates of the log-linear parameter (lambda) in the model 'CD, MT, DT, HM'

	Lambda parameters*	
Motives for R&D location	**Control: Foreign versus domestic**	**Technology: High-tech versus medium- and low-tech**
Proximity to production centres	-0.189** (2.713)	-0.345** (4.166)
Presence of clients and/or suppliers	-0.086 (0.881)	-0.064 (0.607)
Availability of trained personnel	-0.026 (0.345)	0.070 (0.895)
Network possibilities	-0.025 (0.195)	0.214 (1.708)
Presence of universities and research institutes	0.078 (0.841)	0.046 (0.461)
Financially attractive settlement motives	0.015 (0.124)	0.116 (0.938)
Possibility to get subsidies	-0.011 (0.120)	0.006 (0.063)
Local legislation	0.270** (2.318)	0.085 (0.679)
Historical reasons	0.097 (1.357)	0.035 (0.454)
Infrastructure (transport/land/...)	-0.122 (1.421)	-0.163 (1.701)

Note: Model is CD, MT, DT, CM, L^2 = 37.32; df = 47; p = 0.84; N = 1310. Model selection is based on partial and marginal association tests and differences in the likelihood ratio chi-squares between models. *Between brackets: absolute value of the ratio of the log-linear parameter estimate to its standard error. ** Significant at 5% level. Standardised deviates (= observed - expected)/SQRT (expected) - similar to z-scores) reveal no absolute values larger than 2.58, indicating a good model fit for all cells (Expected values (F_{ijkl}) are obtained by fitting the log-linear model to the observed frequencies (f_{ijkl}) by Haberman's (1972) iterative proportional fitting algorithm). Identification of extreme cells based on largest standardised deviates is not significant (at 5% level - revealing no extreme cells).

The outcomes of Table 5 highlight that, after controlling for firm size and technical complexity, foreign-controlled firms pay 1.3 times[18] more attention to local legislation for the location of R&D activities, and 1.2 times less attention to proximity to production centres than domestic firms do. The former finding is not contrary to the finding by UNCTAD (2005) that the location of R&D by multinational enterprises is mainly driven by market, technology, and availability of R&D personnel perspectives. It simply highlights that local legislation is more important as location motive for foreign-controlled firms than it is for domestically-controlled ones. For the association between technology and motives for R&D location, firms active in high-tech industries are 1.4 times less probable to indicate proximity to production centres as an important motive for R&D location.

[18] Odds ratio = exp (lambda).

Section 4
Policy frame and policy measures in Belgium and the other EU Member States

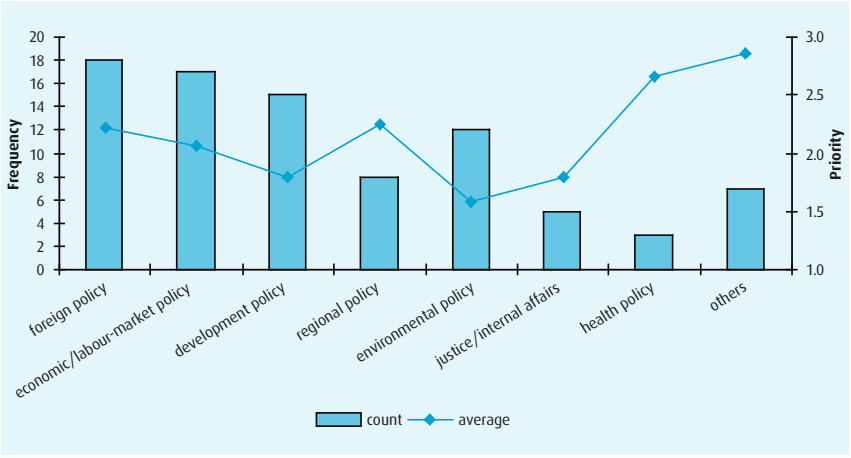
In Europe, policy measures towards FDI in R&D are primarily the responsibility of the Member States (and the regions). This section endeavours to provide insight into current policy measures applied in the EU Member States and associated countries (Turkey, Iceland, Liechtenstein, Norway and Switzerland) towards foreign direct investment in R&D. Based on a questionnaire on policy measures towards the internationalisation of R&D (see Annex 2), existing policy measures and new initiatives in the field of FDI in R&D are highlighted (topic 1.4 of the questionnaire). The survey was organised in the framework of a CREST working group related to the process of the Open Method of Coordination (OMC). It should be noted that the focus of the survey was on the relationship with third countries, i.e. countries outside the European Union. However, the overall finding of absence of discrimination between 'domestic' and 'foreign-controlled' research - based on question 1.4.2 of the questionnaire (see Annex 2) - makes it possible to extrapolate the findings towards FDI in R&D in general. The information presented in this section includes answers to the questionnaire for Austria, Belgium, Cyprus, the Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Lithuania, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, and the United Kingdom.

Per Member State, one response to the questionnaire was provided taking into account the views of different ministries, governments, and public research bodies. Policies towards FDI in R&D should be seen in the context of a broader policy towards the internationalisation of (business) research. Therefore, it can be affected by very general political framework conditions and broader policies such as e.g. FDI policies (trade, taxes, and general subsidies) and international regulation (IPR, standards, etc.) policies. Consequently, there is a need for a multidisciplinary policy approach when dealing with the topic of FDI in R&D (Edler, 2007). This is confirmed

by the results of the CREST questionnaire in Annex 2. Figure 6 highlights the - as seen by the respondents/governments - most often mentioned (other than S&T) influential policies for the policy strategies towards the internationalisation of R&D. These policies include: foreign policy (18 counts), followed by economic and labour market policy (17), development policy (15) and - some distance behind - environmental policy (12). All other policy areas, such as regional policy, justice and internal affairs or health policy, are less important for the majority of respondents.

Figure 6

Other than S&T policies influencing the internationalisation of S&T towards Third Countries



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex 2). Note: The average importance has been calculated as the average over the responding countries: low importance (=1); medium importance (=2); and high importance (=3). This approach has the disadvantage of incorrectly presuming an equal distance between the different categories of importance.

The highest priority is attributed to the residual category 'others', which was marked seven times, however, from three countries only. Among other not specified policies, the following entries were subsumed under this category: agricultural policy (the Netherlands); higher education policy (the Netherlands); telecommunications and infrastructure policy (the Netherlands); policy on the High North (Norway); polar research (Norway). Health and regional policy as well were generally seen as important influencing categories. The former by France, the Netherlands and the UK. The latter - not surprisingly - e.g. by Belgium.

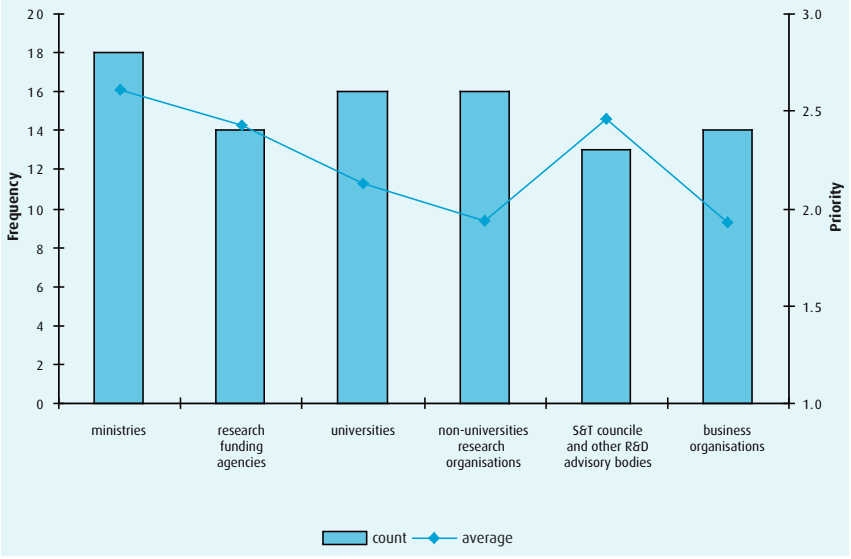
In all but a few countries, the coordination of the development of a national strategy for the internationalisation of S&T lies within the authority of either the relevant science ministry or another national S&T body. There are just a few exceptions which mirror different national jurisdictions and division of powers (e.g. in Greece the

General Secretariat for Research and Technology is under the responsibility of the Ministry for Development; in Belgium there are federally organised assignments across different competencies). In the case of the Netherlands, two ministries share responsibilities.

The implementation of the S&T internationalisation strategies is very often organised by a division of labour across different organisational constituencies, of which ministries, universities, non-university research organisations, and business organisations are the most frequently cited (Figure 7).

Figure 7

Involvement of stakeholders in the development of a national strategy for the internationalisation of R&D



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex 2). Note: The average importance has been calculated as the average over the responding countries: low importance (=1); medium importance (=2); and high importance (=3). This approach has the disadvantage of incorrectly presuming an equal distance between the different categories of importance.

S&T internationalisation strategies were or are mostly developed cross-governmentally, often by inclusion of important institutional stakeholders with representative functions (Denmark, Finland, Spain, UK) and individual experts (e.g. Austria, Portugal). Ministries were always included. Only in Poland and Romania did the inclusion of ministries not receive the highest priority. In these countries, highest priority was assigned respectively to universities and university associations. Universities and non-university research organisations (or their institutionalised representation bodies) were almost always included, but higher priority was attributed to the universities. Although frequently involved, business organisations were perceived as being

comparatively less important (same as non-university research organisations) for the development of a national policy strategy towards the internationalisation of R&D. Besides ministries, very high priority levels were attributed to the inclusion of S&T councils and other R&D advisory bodies and research funding agencies. However, they were less often mentioned, which could be due to the fact that such organisations do not exist in all of the countries.

In what follows we concentrate on a snapshot of concrete policy measures towards FDI in business R&D applied in the Member States. It is not the purpose to go into detail about the policy measures of each of the Member States separately. Only in the case of particularities in policy approach in a Member State will some further explanation be provided on the country's strategy towards FDI in R&D. Given the particular interest in Belgium in this work, and taking into account the institutional context, when relevant, the analysis includes differences in policy approaches between the three (NUTS 1) regions in Belgium (the Brussels-Capital Region, the Flemish Region, and the Walloon Region).

Most Member States actively pursue a broad range of policy measures to attract business R&D capabilities from abroad

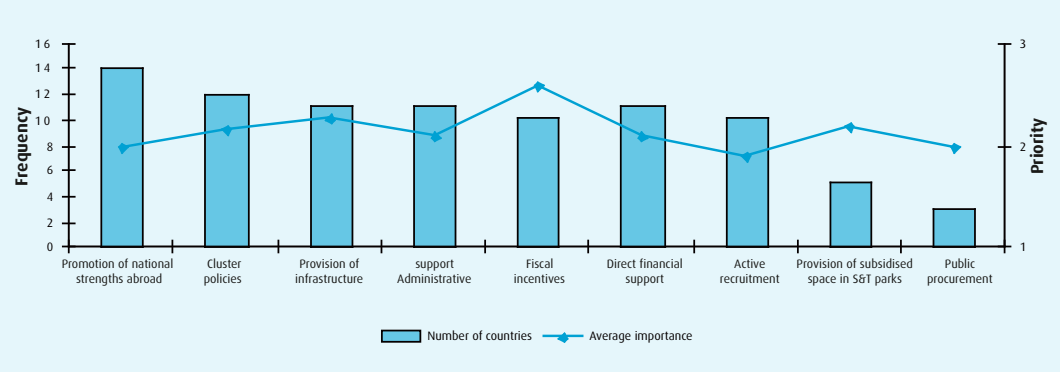
Based on the results of the CREST questionnaire, it turns out to be a common practice among EU Member States to pursue specific measures supporting the establishment of new business R&D activities from Third Countries in one's own country. Only Cyprus, Denmark and Lithuania form an exception to this. This finding is in contrast with the findings by OECD (2005) and Dachs et al. (2005) that, although most countries emphasise the promotion of favourable conditions for R&D, only a few mention attracting foreign R&D investment as a strategic objective or take specific policy measures towards such goal.

In general, no discrimination (positive or negative) is in place for R&D performed by affiliates owned by Third Countries vis-à-vis domestic R&D active institutions. Romania forms an exception here: in this country differences exist in terms of administrative support and openness towards public-private partnerships and projects. This is in line with the strict application of the state aid regulations in the country.

In terms of policy measures applied to attract inward FDI (Figure 8), in over half of the 16 countries pursuing an active policy towards inward FDI in R&D one or a mixture of the following policy measures are applied: promotion of national strengths abroad; cluster policies towards the attraction of FDI in R&D; administrative support; provision of infrastructure; active recruitment; direct financial support; and fiscal incentives. Less frequently used measures include the provision of subsidised space in S&T parks (often aimed at bringing together public and private actors) and public procurement. In most Member States, these measures are implemented as a package in order to create a positive environment, and it is difficult to separate the effect of one over another.

Figure 8

Applied policy measures and their importance for the attraction of inward FDI in R&D



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex 2). Note: The average importance has been calculated as the average over the responding countries: low importance (=1); medium importance (=2); and high importance (=3). This approach has the disadvantage of incorrectly presuming an equal distance between the different categories of importance.

Based on the results presented in Figure 8, policy makers perceive actions in the field of fiscal incentives as being the highest priority. These fiscal measures vary in design and are implemented using a reduction of the flat rate or volume-based tax reduction (UK, Italy, the Netherlands, Denmark), or an incremental rate, based on the increase in R&D spending (Belgium, France), or a mixture of these (Austria, Portugal, Spain, Hungary).

A differentiation of applied measures by Member State is presented in Table 6. Focusing at the Belgian situation, the broad range of measures in favour of FDI in R&D is the outcome of important differences in applied policy measures between different policy levels with responsibilities in the field of FDI in R&D. At the Federal level, no specific measures targeting FDI in R&D exist. The attraction of FDI in R&D is part of broader policies in favour of inward FDI in general. In the Flemish Region, specific measures to attract FDI in R&D include: the provision of infrastructure; an active recruitment of foreign firms; and the promotion of national strengths abroad. In the Brussels-Capital Region, the same specific measures as in the Flemish Region exist. But extra efforts are made in terms of administrative support, provision of subsidised space in S&T parks, as well as cluster policies towards the attraction of FDI in R&D. In the Walloon Region, all of the above-mentioned measures are included as well. In addition, direct financial support for the establishment of new inward FDI in R&D activities is provided.[19]

[19] The information for the different regions is collected based on the CREST questionnaire (Annex 2) which has been completed by each of the three regions (Flemish Region - Mr Bart Laethem (EWI); Brussels-Capital Region - Mr Paul Van Snick (IRSIB); Walloon Region, Mr Pierre Villers (DGTRE)) as well as at the Federal Government level (Ms Monnik Desmeth and Mr Hendrik Monard (BELSPO)).

Table 6

Specific measures at Member State level to support the location of new R&D activities through inward FDI

	Direct financial support	Fiscal incentives	Administrative support	Provision of infrastructure	Provision of subsidised space in S&T parks	Public procurement	Active recruitement	Promotion of national strengths abroad	Cluster policies
Austria	x		x	x			x	x	
Belgium	x	x	x	x	x		x	x	x
Czech Republic	x	x	x	x			x	x	x
Finland	x						x	x	x
France	x	x	x	x	x	x	x	x	x
Germany							x	x	
Greece	x	x			x			x	
Ireland	x	x	x	x			x	x	x
The Netherlands		x	x	x		x	x	x	x
Norway			x	x			x	x	x
Poland								x	
Portugal	x	x	x	x					x
Romania	x	x	x	x	x	x	x		x
Spain	x	x	x	x	x			x	x
Sweden								x	
Turkey		x		x					x
United Kingdom	x		x					x	x

Source: Policy questionnaire on the internationalisation of R&D - CREST WG on policies towards the internationalisation of R&D (Annex 2). Note: the Table includes measures targeting inward FDI in R&D. Absence of this objective does not mean that the presented measure does not exist in a country (e.g. direct financial support for R&D exists in the Netherlands, but it is not considered - by the policy makers that have responded to the questionnaire - as a tool for attracting inward FDI in R&D).

Most countries put in place instruments to attract FDI in R&D, but only a limited number of countries implement specific policy instruments to profit from spillovers from FDI in R&D

Out of the 16 responding countries, only three mention the implementation of policy instruments to profit from spillovers from inward and/or outward FDI in R&D. These countries are: Greece, Ireland, and Romania. The 'Investment Law' in Greece supports the realization of long term (2-5 year) investment plans by enterprises (that have been incorporated for at least five years) relating to processing and mining projects of a minimum total cost of € 3 million and projects for software development of a minimum total cost of € 1.5 million. These projects may include technological, administrative, organisational and business modernisation and development as well as the necessary actions for the training of the employees. One of the objective(s) of the 'Investment Law' is the relocation of production/research activities from abroad to Greece. The amount of the grant depends on the firm size and the geographical zone the investments are located in.

In Ireland, various initiatives are in place regarding the embedding of inward FDI in R&D. 'Science Foundation Ireland' has developed CSETs (Centres for Science,

Engineering and Technology) that act as a key instrument in encouraging interaction between foreign MNEs based in Ireland, indigenous enterprises and the third level sector. MNEs were not attracted to sectors for which the country had traditionally an advantage, but to high-tech industries. Therefore, the significant growth in - mainly greenfield investments or expansions - FDI inflows over the last decade resulted in a structural shift in sectoral terms in the Irish industry.

Romania gives strong support to larger scale projects in the field of R&D and innovation, which are initiated by strategic foreign investors and developed either within national R&D and innovation programmes or on the basis of public-private partnership. The projects are treated in full accordance with the provisions of the new EU State Aid Framework for R&D and innovation.

A large number of countries have recently revised their policies and/or are envisaging new initiatives towards FDI in R&D

In recent years FDI in R&D has received increasing attention from policy makers. Consequently, a large number of countries have recently revised their policies and/or are envisaging new initiatives (see Table 7).

Table 7
Major changes and new initiatives in policy measures towards FDI in R&D in different Member States

	No new initiatives	New initiatives
No recent major changes in existing policy measures	Belgium - Cyprus Liechtenstein - Portugal Lithuania - Poland	Norway Sweden
Recent major changes in existing policy measures	Finland France	Austria - Czech Republic Germany - Greece Ireland - The Netherlands Romania - Spain Turkey - UK

Source: Policy questionnaire on the internationalisation of R&D - CREST WG on policies towards the internationalisation of R&D (Annex 2).

Examples of major changes and new initiatives include:

- The adoption of an R&D Headquarters Programme by the Austrian Research Promotion Agency and the opening of a China-Austria Technology Park in Vienna;

- The approval in the Czech Republic in 2003 by the government of a Framework Programme for the support of Technology Centres and Centres of Strategic Services of the Ministry of Industry and Trade, managed by CzechInvest (Investment and Business Development Agency);
- An active promotion of FDI in R&D as a policy instrument in Finland;
- The initiative 'Invest in Germany' launched in 2002 with a major objective of attracting foreign S&T investments. This was enforced by the introduction in 2005 of the initiative on research marketing of the Federal Ministry of Education and Research (BMBF) and the launch of an 'Excellence Cluster Competition' for stimulation of regional innovation processes building on internationalisation of S&T activities to attract foreign knowledge through S&T cooperation, individual high-qualified scientists, capital and investments ...;
- A proactive strategic approach focused on the acquisition of R&D-, innovation-, high-tech-, and other knowledge-intensive investments in the Netherlands;
- The introduction of the 'Invent in Norway scheme' aimed at stimulating foreign investments in R&D in Norway and the location of R&D activities in the country;
- The support of UK Trade & Investment (UKTI - a government organisation) to the international success of UK-based companies by providing a range of expert services tailored to the needs of individual businesses.

The most impressive results in attracting FDI in R&D can be found in Ireland. In this country, the attraction of R&D-intensive FDI projects is - in addition to cultural and language advantages - built on a strategy developed over many years for attracting FDI projects generally. Ireland's FDI effort is led by its Investment Promotion Agency (IDA Ireland) which strongly emphasises bringing together all of the other actors (government departments, funding agencies, regulatory authorities, academia and existing enterprises) to ensure that all parties play their part in creating the type of environment demanded by world-leading research-intensive global enterprises. IDA Ireland leads the effort to attract R&D-intensive projects based on the sectoral expertise it has developed over many years in areas such as ICT hardware and software, medical devices, pharmaceuticals, financial and other international service activities. A combination of direct financial supports and/or fiscal incentives is available to encourage the establishment of new R&D projects in Ireland and to encourage existing MNEs to increase their research capacity in Ireland. These incentives are part of a broader mix that also involves:

- the supply of skilled researchers (doctoral and post-doctoral level) in disciplines of relevance to existing and emerging FDI clusters in Ireland;
- a growing network of public and private applied research centres that act as a magnet for R&D-intensive FDI projects;
- investments in people and facilities by Science Foundation Ireland including partnerships with a number of large multinational enterprises in a number of CSETs (Centres for Science, Engineering and Technology) which seek to align the interests of researchers and enterprises in a small number of niche areas.

Section 5
Broader policy objectives towards the internationalisation of R&D

Inward and outward FDI in R&D are part of the broader process of internationalisation of (business) R&D. As such, policy measures in the field of FDI in R&D should not be seen independently of broader policy objectives towards the internationalisation of R&D.

Based on the results of the CREST questionnaire (Annex 2), nine of the 19 European countries providing information on their policy strategy towards internationalisation of R&D indicated that they already have a comprehensive national strategy on internationalisation of S&T. Of these, three mentioned that this strategy is part of a broader strategy on globalisation (see Table 8). Seven countries stated that they are in the process of developing a national strategy focused on the internationalisation of S&T. Just three countries indicated that they neither have nor plan to have a national strategy on internationalisation of S&T (Cyprus, the Czech Republic and Lithuania) for the time being. Norway is the only country which already has a focused strategy on international S&T at hand, but which is also preparing to strategically incorporate this matter into a broader globalisation strategy.

Table 8
Availability of an International S&T Strategy

	Strategy exists	Strategy under development	No strategy
Focused strategy	Finland France Norway Portugal Sweden United Kingdom	Austria Ireland Germany The Netherlands Spain	Cyprus Czech Republic Lithuania
As part of a broader strategy towards globalisation	Belgium Denmark Romania	Greece Poland	

Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex 2).

The reasons for the three countries which do not have and which are not developing any internationalisation strategy in the field of S&T are diverse: in the case of Lithuania, they are connected with limiting structural issues of their own national research and innovation systems. In the Czech Republic it is simply not in the work programme, and Cyprus seems to get along well with the existing instruments (especially bilateral S&T agreements and actions supported under the European Framework Programmes for RTD) without needing to develop a purposeful strategy as some kind of policy superstructure.

The most recent changes regarding national S&T strategies on internationalisation (respectively changes regarding the development of such strategies) take the form of the inclusion of either new instruments or the expansion of existing instruments to other countries. Very often the latter choice concerns the adoption of new intergovernmental S&T agreements. Other changes include:

- That the internationalisation strategy on S&T itself is seen as most important recent change (e.g. Finland, Spain, UK);
- That a stronger focus on target countries (Belgium - Walloon Region, Portugal) or regions (e.g. Malta's orientation on the European-Mediterranean research and innovation cooperation) is applied;

- That a stronger focus on priority topics is applied, eventually leading to specific 'target-country strategies' (e.g. Germany's strategic partnership with the Russian Federation);
- The emergence of relevant sub-national strategies (e.g. in Belgium: the development of a global strategy in the 'Marshall Plan' for the Walloon Region, and an opposite, mainly bottom-up driven approach in the Flemish Region).

The major objectives of Member States regarding internationalisation of S&T towards Third Countries can be summarised as follows:

1. To increase the quality and absorption capacity of domestic S&T through international S&T partnerships, allowing access to foreign knowledge and S&T resources (this subsumes the explicit aim to support 'excellence' but also the less ambitious aim to push forward the internationalisation of domestic R&D and thus to raise the quality and absorption level in general);
2. To gain access to new markets and to increase the competitiveness of one's own innovation system (in this respect, internationalisation of S&T is often perceived as an important complementary approach to other international economic activities);
3. To enhance the readiness to engage in solving global problems which cannot be tackled in an efficient way by a single country (in this sense, a certain commingling with global development goals deriving from development cooperation, e.g. Millennium Development Goals, can be observed).

It can be roughly summarised that all three dimensions have been almost equally perceived as important for the internationalisation of S&T with Third Countries. It also turned out that these objectives are not exclusive, as most Member States have mixed objectives for their internationalisation policies in the field of S&T. The highest priority, however, is placed on facilitating access to foreign markets and raising competitiveness.

Section 6
Implications for host and home countries

Since foreign direct investment in R&D by MNEs is increasingly internationalised and is expected to be even more so in the decade to come, it is important to know which countries are benefiting from it as a host country, and which are benefiting as a home country.

According to Veugelers (2005), in order to benefit from the technology acquired by its own MNEs, home economies should develop their absorptive capacity and networking with the technology sourcing MNEs. Also, they should be able to attract innovative companies, R&D institutes and R&D workers from abroad, so as to compensate for the internationalisation of R&D investment by its domestic firms, institutions and national R&D workers moving abroad. In the case that the host locations are selected in a technology sourcing strategy, the scope for potential benefits from increased technology transfers to the host countries will be higher, since more technology transfers to the host locations are likely to occur.

So the role subsidiaries will play in the innovative process of the MNEs depends on the level of technological capabilities and the strategic importance of the host market. At the one extreme, subsidiaries have a purely implementing role for projects requiring low levels of technological expertise and with a low strategic importance of the market. In this case, the technology transfer is imported into the local market. Once the location reaches a high level of technological capability for a particular innovative project, it can be assigned a contributing role to develop generic central know-how, or even play a more crucial leading role as a 'centre of excellence', with a 'global product mandate' (Poynter and Rugman, 1982).

Consensus exists that host country spillovers by multinational companies vary systematically between countries and industries, and that the positive effects of foreign investment are likely to increase with the level of local capability and competition (Blomström and Kokko, 1998; Cantwell, 1989; Kokko, 1994, 1996). This has much to do with the change in purpose of the creation of foreign subsidiaries over time. In the early post-war period, the primary aim of MNEs was the conquest of new markets through the adaptation of products to local consumer preferences. Since the 1960s, however, the closer international corporate integration in the leading MNEs aims to establish geographically dispersed networks for the purpose of the transfer of technology, skills and assets across national borders between the parent company and its subsidiaries (Cantwell and Piscitello, 2000).

The fact that firms locate R&D activities more and more by the need to develop interactions with the local systems of technological competence and end users leads to both inward and outward learning and reverse and interactive technology transfers between different organisational and geographical locations. For these reasons, concern has been raised both for net recipient and net source countries. Policy makers of net recipient countries could fear foreign-owned firms, since they may reduce the national technology and production base, while keeping the core of their innovative activities in their home countries. On the other hand, net recipients of foreign R&D investment could be worried that the internationalisation of R&D may 'hollow out' the domestic knowledge base, because foreign affiliates may export technology developed at home and because fewer R&D activities are undertaken at home (Veugelers, 2005). Therefore, the previously described trends in FDI in R&D should be looked at rather in terms of whether or not countries are likely to benefit from the internationalisation of R&D. Some remarks can be formulated about this.

Firstly, it is interesting to verify whether R&D jobs being created abroad result in a one-for-one loss of the same positions domestically or whether they are supplemental. Based on empirical evidence by Van Welsum and Reif (2005) and Jaffee (2004), no serious effects are expected on job levels (and income) due to off-shoring in the coming decade. However, on a longer-term basis (within the next fifty years) and for the US economy, both Jaffee (2004) and Freeman (2005) do not exclude the possibility of either a shifting of comparative advantage or increased off-shoring of initially non-tradable goods and services, which could create adverse effects. For Europe, Kirkegaard (2005) argues that off-shoring and outsourcing are more of an opportunity than a threat, and advises governments to ensure that they realise a net gain. Also, economic theory of international trade states that in the case where production takes place in a location possessing a comparative advantage for it, both countries will end up with higher welfare. One of the most important reasons for R&D off-shoring can be found in the access to skilled labour that may not be present in a sufficient way at home. In the latter case, the off-shoring of R&D does not necessarily move away jobs at home at all. As such, at least in the short term it can be supposed that the moves are experimental in many cases, so the jobs are supple-

mental. It is not likely that firms will really pick up their R&D activities and move them all over to another place. On the other hand, one could expect that R&D money spent abroad will not continue to be spent at home. So this could hamper further increases in R&D spending in the home country. What is more certain is that firms do 'what is best for shareholders', and that is to have the most efficient development organisation, while maintaining the quality it takes to be an innovator in the industry. From this perspective, firms are more inclined to act from a system integrated approach where asymmetries in space result in nodes of high value-added activities and nodes of developing activities at the lower end of the value chain.

Besides job arguments, a second concern about off-shoring R&D can be found in the possible deterioration of domestic innovation capacity, on the one hand, and loss of comparative advantage on the other, should new innovations be increasingly developed outside the home area. The former can result in the loss of local spillover effects if R&D is conducted off-shore and skilled labour may increasingly start moving to more attractive locations following off-shored R&D. The latter relates to the fact that the actual location of R&D may not be a decisive factor for innovation capacity, as the overall innovation capacity is a much broader concept and the ability to quickly adopt new innovations - even those that are developed somewhere else - is the most important.

However, one of the rare studies focused on the effects of R&D off-shoring by 'EU-based' multinational enterprises (LTT Research, 2007) revealed no reasons to try to prevent the globalisation of business R&D functions. The study analysed the effects of internationalisation of R&D, based on a survey of 158 EU-based companies which have recently offshored R&D (LTT Research, 2007). The results indicated that nearly 70% of the companies had increased their R&D offshoring over the last five years (the base year was 2004) and almost 75% intended to do so in the next five years. While some companies perceived R&D abroad as complementary to domestic R&D, others indicated that internationalised R&D may come at the expense of R&D at home. The main benefits of off-shoring R&D were considered to be increased cost efficiency in the innovation process, the ability to learn about R&D conducted by other companies/institutions, more rapid commercialisation and a positive impact on the firm's innovation capacity. Moreover, close to 90% of respondents estimated that R&D offshoring had a positive effect on the general innovation capacity of EU-based firms.

The main fear about off-shoring business R&D outside the EU is a decreased innovation capacity of the European firms. This would in turn lead to sluggish aggregate productivity development and slower economic growth, resulting in lower economic welfare in the EU, as well as several negative short-term effects like a reduced level of employment. The LTT Research (2007) study found no reasons to expect R&D off-shoring to lead to any of these. Further, the study did not reveal any implications of EU-based firms losing their competitiveness. In fact, the results suggest that EU firms have either maintained or improved their competitiveness by engaging in glo-

bal R&D operations. It is of course possible that negative short-term effects also arise, but the long-term effects of R&D off-shoring appear to be positive for the EU economy. According to Levchenko (2004); Trefler (2005); and Acemoglu, Antras and Helpman (2005), countries with good institutions should be more prone to innovation, even as their specific R&D is off-shored to a different place. R&D off-shoring is a modern way for global EU companies to leverage the creativity of the rest of the world (LTT Research, 2007).

The process of internationalisation of R&D creates opportunities for developed countries as well. Countries like China, India and Brazil will by no means monopolise growth in overseas R&D investment in the years to come. Western countries like the US, the UK and Germany, will remain important locations for R&D investments in the coming years. Each of these countries has an established record as an R&D powerhouse and offers a history of R&D success, established infrastructure, strong academic links and robust IP laws, and are highly active in international scientific collaboration (The Economist Intelligence Unit, 2004a).

Table 9
Benefits and drawbacks of foreign direct investment in R&D

	On host country	On home country
Positive impact	- Increased local technical capability - Potential knowledge & economic spillovers - Job creation - Better tailored products	- Tap into other sources of expertise - Enhance access to foreign markets - Economic benefits if the results are exploited at home
Negative impact	- Foreign control over domestic R&D - Loss of economic benefit if the results are exploited elsewhere	- Loss of jobs - Loss of economic benefits if results are exploited locally - Loss of technical capability

Source: Sheehan (2004). Note: In addition to the benefits and drawbacks proposed by Sheehan - besides job creation or loss of jobs - other positive or negative macro effects in terms of GDP, evolution of the tax base and revenues for governments can be added.

For the above-mentioned reasons, developed countries (due to a further improvement in skills levels in the emerging markets) need to be aware of a shift in the years to come from more easily defined development activities in overseas locations, towards more complicated R&D activities. An important implication of this will be a claim for more R&D spending in emerging economies, while more expensive loca-

tions will need to focus on high-end R&D at the top of the value chain. Therefore, efforts should be made to help companies in developed countries to attract and keep skills that rely on more than financial incentives alone. Although the US has been most successful in attracting the world's sharpest minds, visa applications are becoming ever more cumbersome since 9/11, and this can dissuade foreign talent entering the US. It may even happen that the US will witness a reverse brain drain (NSF, 2006).

Also, emerging and developing economies should be aware that foreign direct investment in R&D is not an a priori condition for economic success. The potential direct benefits of R&D related FDI for host countries depend on whether or not knowledge and skills can be isolated from their surrounding host environment in the long term. In the case where MNEs create high-technology enclaves with little diffusion of knowledge into the economy, the benefits for the host country will be limited. The fragmentation of R&D and the increasing specialisation of individual units can make the scope for transferring broad knowledge narrower; reinforcing the enclave nature of R&D units. Moreover, FDI in R&D may also divert scarce local R&D resources from local firms and research institutions (UNCTAD, 2005).

Section 7
Concluding reflections on how to improve policy making in Europe towards FDI in R&D

The MNEs' dominant position in terms of R&D (close to 50% of world R&D and over two-thirds of global business R&D - UNCTAD, 2005) combined with the Lisbon objective of obtaining an R&D investment as large as 3% of GDP (of which two-thirds financed by the private enterprise sector) for Europe as a whole (and translated by most Member States into a national 3% objective), put the attraction of FDI in R&D at the core of S&T policy making in Europe over the past decade.

Policies towards attractiveness for (foreign) R&D were at the heart of the launch of the Lisbon strategy in March 2000, and their importance was re-confirmed in the mid-term review of the Lisbon strategy in 2005 (European Commission, 2005), as well as in the recently launched Green Paper on the European Research Area (European Commission, 2007). It was also reflected in the concrete policy measures towards FDI in R&D by the Member States (see section 4).

In this concluding section, some reflections on how to improve current policies towards FDI in R&D are put forward. These thoughts will be built around two main topics. First, in section 7.1, policy making at the Member State level towards FDI in R&D will be confronted with location motives for R&D by multinational enterprises. Second, the strong focus in the ERA strategy on attractiveness will be questioned (section 7.2).

7.1 Reflections on existing policy measures in the EU Member States towards FDI in R&D

Current policy measures in the EU Member States are biased towards the attraction of inward FDI in R&D and are not guided by a comprehensive understanding of the process of internationalisation of business R&D

Most of the EU Member States have recently put in place or revised their policies with the aim of increasing their country's attractiveness for inward FDI (see section 4). A wide range of policy instruments are used to do this. The most frequently applied measures include: the promotion of location strengths abroad; active recruitment; cluster policies towards the attraction of FDI in R&D; administrative support for foreign investors; provision of infrastructure; direct financial support; and fiscal incentives. Since these measures are usually implemented in a package, their individual effects are difficult to separate.

Despite this broad range of measures, for the time being it appears that policy in most EU Member States is not guided by a comprehensive understanding of the process of internationalisation of business R&D by means of FDI. This is reflected in several ways. First, in contrast with the main motives for business R&D (re)location, policy makers perceive actions in the field of fiscal incentives as having top priority (section 4). From a longer-term perspective, it is important not to emphasise too much the use of financial incentives to attract FDI in R&D. It can result in harmful financial support of competition between countries to attract 'footloose' - and beyond control of the government - R&D investment by multinational companies. Up to now there is very little empirical evidence on the effects of these measures on firms' location decisions for R&D. Looking at the impact of tax credits on firms' foreign R&D investments, Bloom and Griffith (2001) found that increasing tax incentives shifts R&D to those countries. On the other hand, empirical work considering location motives for R&D found that these incentives were not dominant for R&D by multinational enterprises (Thursby and Thursby, 2006; and for Belgium: Teirlinck, 2005, see also section 3.4). One danger with this kind of incentives is that countries use them as a strategic trade tool and start to compete with each other for firms' R&D. This leads to a Prisoner's dilemma, whereby all countries are actually worse off if they pursue independent (and competing) R&D policies. Moreover, tax incentives can create distorted incentives and result in counterproductive R&D because of the benefits associated with R&D off-shoring and the absorption of spillovers from abroad (Griffith et al., 2004). In such a policy context of fierce competition between Member States (and regions) for inward FDI in R&D, Belgium, a country with a historically high presence of FDI (in R&D), is in a vulnerable position (De Backer and Sleuwaegen, 2005).

In addition to the high priority put on fiscal incentives, analysis of the CREST policy questionnaire yields the impression that most policy instruments applied in the EU Member States towards FDI in R&D are still based on inward market-seeking ele-

ments, while the knowledge-seeking elements, both inward and outward, are far less developed. Also, no policy measures could be identified in any of the Member States to profit from outward FDI in R&D by MNEs. This could lead to an undesirable scenario whereby countries would, on the one hand, try to attract as much as possible foreign R&D, while on the other envisage preventing domestic firms from increasing their R&D investments abroad. In such a scenario, defensive measures could include attempts to discriminate against firms that offshore activities, e.g. by withdrawing public support, or discouraging such firms in other ways, whereas offensive measures could include harmful tax and financial support competition to attract R&D intensive FDI. These measures could invite retaliation and create the potential for a destructive series of 'tit for tat' actions and reactions that would diminish the effectiveness of the global innovation system (Mowery, 1998).[20] Therefore, an improvement of policy measures in the field of FDI in R&D could be reached by a better inclusion (at least in terms of priorities) of business organisations in the policy making debate and by a better understanding by policy makers of the drivers and motives for the location of FDI in R&D.

Third, even if policy-makers seem to know about the situation in their own countries, they are far from clear as to what policy can or should do about it (Edler, 2007). Therefore, not surprisingly, only a few countries take into account that foreign direct investment in R&D is not an a priori condition for economic success, and little attention is paid by policy makers to the benefits and drawbacks of foreign direct investment in R&D. The CREST questionnaire (section 4) revealed that only gradually are countries recognising that FDI in R&D is not a condition sine qua non for economic success and they are increasingly starting to pay attention to the enhancement of the positive outcomes of these investments. This is in line with the view that the potential direct benefits of R&D-related FDI for host countries depend on whether or not knowledge and skills can be integrated into the host economy in the long term. If not, there is a risk that increasing internationalisation of R&D erodes or 'hollows out' the domestic knowledge base (Veugelers, 2005). Also, R&D may divert scarce local R&D resources from local firms and research institutions. As a result, efforts need to be made not only to attract FDI in R&D, but also to absorb spillovers created both by inward and by outward FDI in R&D. Therefore, the creation of policy instruments designed to better link inward and outward FDI in R&D to the 'home basis' by means of an enabling environment for spillovers and a better embedding of foreign-controlled R&D into local chains of production is necessary.

Fourth, from a broader perspective of internationalisation of R&D, concrete policy actions towards FDI (and especially its focus on the attraction of inward FDI and the neglect of the use of international knowledge spillovers) are not fully in line with the three major objectives of Member States regarding internationalisation of S&T towards Third Countries (see section 5). Especially the exchange of knowledge with outside countries, access to new markets, and the readiness to engage in solving global problems efficiently by a single country, can be questioned.

[20] This view is supported by a recent study by the European Commission that concluded that the main fear from off-shoring business R&D outside the EU is the decreased innovation capacity of the European firms (LTT RESEARCH, 2007). This would in turn lead to sluggish aggregate productivity development and slower economic growth. The result would be lower economic welfare in the European Union as well as several negative short-term effects like a reduced level of employment. However, based on the findings from the study, it was concluded that there are no real reasons to expect R&D off-shoring to lead to any of these developments. Further, the study did not reveal any implications of European firms losing their competitiveness. In fact the survey results suggest that EU firms have either maintained or improved their competitiveness by engaging in global R&D operations. Similar ideas on R&D outsourcing can be found in Jaffee (2004) and Kirkegaard (2005).

In summary, national policy should pay more attention to setting up adequate measures to exploit more intensively the potential of FDI in R&D in order to profit from inward FDI in R&D by generating spillovers into the local environment and by avoiding the hollowing out of the local research base. Also, the role of outward FDI in R&D by stimulating and capturing spillovers of foreign generated knowledge to domestic R&D environments, both by public and private research institutions, should be better recognised. Thirdly, national policy measures towards FDI in R&D should be targeted more on comparative knowledge advantages rather than on cost competition, in order to ensure a better sustainability. And finally, measures need to be developed for the benefit of the entire EU rather than focusing too narrowly on location competition measures between Member States.

7.2 Reflections on an ERA strategy focused on attracting FDI in R&D

A policy view too narrowly focused on attractiveness does not fully take into account the reality of a changing R&D landscape in which Europe will occupy a less dominant position

A policy view focused on attractiveness does not fully take into account the reality of a changing R&D landscape in which Europe will occupy a less dominant S&T position (and this both in terms of input (R&D investments and R&D personnel) and output (especially export of high-tech products and products in high-tech sectors, and to a lesser extent also in terms of patenting and publications; European Commission, 2007a)). In terms of FDI in R&D in particular, this is reflected in increasing FDI (also by EU-based multinationals) in the newly emerging economies of (in absolute terms especially) China and India. It has also resulted in a stagnation of inward FDI in R&D in Europe from (in absolute terms most important) US-based multinationals.

The more modest role of Europe in terms of world R&D will make it necessary to revise a strategy mainly focused at the attractiveness of R&D. It will force Europe and its Member States to pay more attention to better linking the European economy to foreign sources of knowledge. This idea was confirmed by the 'Expert Group Knowledge for Growth' on 'Globalisation of R&D' (European Commission, 2006).

At present, there is no ERA strategy for dealing with the changing RTD landscape outside the EU borders. The current strategy is mostly inward looking and focused on the input side.[21] However, an exclusively inward looking strategy no longer responds to the needs of Europe as a global player and too much focus on the input side (production of knowledge) denies the higher economic and societal importance of the valorisation of research results.

Therefore, policy responses to the internationalisation of business research need to combine measures towards attractiveness for FDI in R&D with measures enhancing the access and utilisation in Europe of research developed outside the

[21] With its Green Paper 'The European Research Area: New Perspective' published on 4 April 2007, the European Commission addresses the future orientation of the ERA as one of the cornerstones for implementing the renewed Lisbon strategy. Unfortunately, the main focus of this Green Paper remains on the internal market, and the opening of the European Research Area to the rest of the world did not receive much attention.

European borders. The former policy measures need to focus on attractiveness towards FDI in R&D and stimuli for MNEs to keep their research in Europe. This policy has a clear focus on the European territory. The latter measures give higher importance to the commercialisation of research and take into account that Europe neither has a dominant position in world research nor is excelling in translating its own research into economic success (referred to as the 'knowledge paradox' or even the 'European innovation paradox', European Commission, 2003). From this perspective, it is as important to have access to worldwide frontier research and to be able to use/transform both 'domestically' and 'foreign' produced knowledge into commercially successful outputs. Therefore, a combination of a policy of attractiveness for R&D with a more open policy surpassing the European dimension is needed.

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Annex 1
List of 'high tech' and 'medium and low tech' industries

High tech	
Aerospace	Food and tabacco
Audio-, video- and telecom apparatus	Iron and steel, non-ferrous metals
Computer and office machines	Machinery (non-electrical)
Computer and related activity services	Metal and metallic products
Optical instruments	Motor vehicles
Pharmaceuticals	Other manufacturing
Post and telecommunication services	Other transports (excl aerospace)
R&D services	Paper and printing
	Petroleum refineries and products
	Rubber and plastic
Medium and low tech	Stone, clay and glass
Agriculture	Textiles and clothing
Business services (excl. High-tech knowledge intensive services)	Transport and storage services
Chemicals (excl. Pharma)	Utilities and construction
Electrical machinery	Wholesales and retail
Extraction	Wood and cork

Based on OECD (2003) for manufacturing and Eurostat for (high-tech knowledge intensive) services classifications.

Annex 2
CREST questionnaire on national policy measures for the internationalisation of R&D towards countries outside the EU

Introduction

Based on a decision of CREST (The European Scientific and Technical Research Committee), practicing the open method of coordination a CREST Working Group was set up by Member States and Associated States in order to facilitate a mutual learning process among them on the national policy approaches to the internationalisation of S&T towards Third Countries outside the EU/Associated States.

Here, internationalisation is defined as a proactive national response to the challenges of the globalisation of S&T in order to make optimum use of worldwide knowledge and scientific resources and to reduce possible disadvantages like brain drain, IPR misuse etc..

This Working Group will provide contributions to future national policy making and will prepare the ground for coherent and coordinated policy approaches of Member States and Associated States (Turkey, Iceland, Israel, Liechtenstein, Norway and Switzerland) towards Third Countries (all other countries).

This **Questionnaire** is developed in order to get an overview of the most important policy measures of the national administrations. Building on the analysis of the responded questionnaires, in-depth looks will be taken to identify good practice, common objectives and open questions, which require further discussion.

This questionnaire consists of four major sections:

Part 1:	Concrete policy measures towards the internationalisation of R&D
Part 2:	Comprehensive national strategies and embedding of R&D policies in the broader policies towards internationalisation
Part 3:	Trans-national coordination of R&D policies towards Third Countries and strategies towards international organisations
Part 4:	Monitoring and evaluation of international activities

We would welcome if relevant policy papers or other documents are added to the responses.

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This Questionnaire was filled in by:

name: and

organisation:

phone:

email:

In case of additional questions please contact:

☐ myself (i.e. the first person mentioned above)

☐ name:

organisation

phone:

email:

Part 1
Policy measures towards the internationalisation of S&T

The process of internationalisation of S&T materialises through four important areas. These include:

International collaboration in S&T of institutions (universities, public research institutes and industries) from more than one country

International in- and outward mobility of individual scientists aiming at carrier development and human capacity building

The international exploitation of research and the issue of knowledge Protection versus dissemination

Foreign direct investments in R&D i.e. the inward and outward investments in R&D systems

For each of these topics some concrete questions are formulated below. Please answer these from the perspective of policies specific to your country and in relation to Third Countries (i.e. outside EU and Associated States (AS)).

1.1 International S&T collaboration of public and private institutions

1.1.1 Do national policy measures exist to enhance collaboration in S&T with (public or private) partners in Third Countries?

☐ Yes

☐ No

If 'Yes',

1.1.1.1 Which of the following measures exist?
Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	**Funding for projects with S&T partners in Third Countries, through:**	
☐	participation of foreign institutions in national S&T programmes without funding participation of foreign institutions in national S&T	
☐	programmes with funding (opening of national funding schemes)	
☐	small scale funding for stimulating international S&T cooperation (mobility, ...)	
☐	Fiscal incentives for projects with S&T partners from Third Countries	
☐	**Promotion of your national S&T in Third Countries, through:**	
☐	Embassies	
☐	Dedicated Agency(ies)	
☐	Foreign Branches of national S&T organisations/institutions	
☐	Promotion/Research Marketing Campaigns	
☐	**Technical advice for S&T collaboration**	
☐	**Support to find partners in Third Countries**	
☐	**Joint funding of the establishment of large scale S&T infrastructure with partners in Third Countries**	
☐	**Joint funding of running costs of large scale S&T infrastructure with partners in Third Countries**	
☐ Other measures		

Which of the existing measures do you consider to be most successful? Please give a brief explanation:

Measure	Why do you consider it to be successful?

1.1.1.2 Please classify Third Partner Countries for S&T cooperation?

Priority countries	**S&T agreement**
1.	☐
…	
Non-priority countries	**S&T agreement**
1.	☐
…	

1.1.1.3 Please describe the procedure to select partner countries:

1.1.1.4 What are the three major criteria to select partner countries?

If relevant, please indicate priority S&T domains for major partner countries and respective major cooperation measures (see 1.1.1.1) in the matrix below
☐ (Not relevant)

	Country 1	**Country 2**	**Country 3**
Country			
Major priority S&T domains per priority partner country	1. 2. 3.	1. 2. 3.	1. 2. 3.
Major three measures per priority partner country	1. 2. 3.	1. 2. 3.	1. 2. 3.

If relevant: How does your government collect systematic information on S&T in Third Countries?
(☐ Not relevant)

Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	National embassies in Third Countries	
☐	National liaison offices in the following Third Countries	
☐	Affiliates ofnational R&D institutions in the following Third Countries	
☐	Systematic reviews/studies	
☐	Regular bilateral workshops/conferences	
☐	Systematic analysis of project reports from bilateral programmes with Third Countries	
☐	Systematic analysis of participation of Third Countries in European/international programmes	
☐	In cooperation with other European governments	
Other measures		
☐		
☐		

Room for comments:

1.1.1.7 Are there differences (referring to subquestions 1.1.1.1 till 1.1.1.6) in the policies for cooperation with on the one hand small and medium sized enterprises and on the other hand large companies?

☐ Yes

☐ No

If 'Yes', please specify

1.1.1.8 Are there differences (referring to subquestions 1.1.1.1 till 1.1.1.6) in the policies for cooperation with private and non public research organisations (including universities) on the one hand and industries on the other hand?

☐ Yes

☐ No

If 'Yes', please specify

1.1.2 Are there different policy measures for S&T partners (public or private) within EU (incl. AS), and those outside EU?

☐ Yes

☐ No

If 'Yes', please explain (if relevant you could use the different measures listed in question 1.1.1.1):

1.1.3 How do Community instruments (mainly the Framework Programmes) affect your respective policy measures towards S&T cooperation with Third Countries?

☐ hey are the main frame for collaboration with Third Countries
☐ They complement national policy initiatives towards Third Countries
☐ They are not considered an essential part of the national strategy towards collaboration with Third Countries
☐ Others:

1.1.4 Please estimate the total share of the Framework Programme's contribution to the S&T cooperation of your research communities with Third Countries in % of the total amount spent for your research communities for international Third Country cooperation:

☐ below 25%
☐ between 25% and 50%
☐ between 51% and 75%
☐ above 75%

1.1.5. Please estimate the relevance of S&T cooperation with Third Countries compared with S&T cooperation with EU partner countries

	more relevant	equally relevant	less relevant	far less relevant
	than EU partner countries			
US/Japan	☐	☐	☐	☐
Other industrialised Third Countries	☐	☐	☐	☐
Developing Third Countries	☐	☐	☐	☐
Less developed countries	☐	☐	☐	☐

Room for comments:

Have there been any major changes in policy measures towards collaboration in S&T with Third Countries during the last years?

☐ Yes

☐ No

Major Changes:

Are there new initiatives to be envisaged

☐ Yes

☐ No

New initiatives:

1.2 International in- and outward mobility of individual scientists

1.2.1 Do national policy measures exist to enhance mobility of researchers and S&T students with Third Countries, which are implemented through public funds?

☐ Yes

☐ No

If 'No',

1.2.1.1 Why not?

If 'Yes',

1.2.1.2 Which of the following types of mobility are envisaged with respect to Third Countries?

Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	Increasing the attraction of foreign students	
☐	Increasing the attraction of foreign researchers	
☐	Increasing the retention of 'national' researchers working abroad	
☐	Increasing the international circulation of national researchers	
☐	Increasing the international connection of national researchers	
Other measures		
☐		

1.2.1.3 Which of the following policy measures are applied with respect to Third Countries (by type of mobility)? Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	Preferential immigration legislation for foreign researchers	
☐	Provision of spousal work visas	
☐	Decreasing administrative burden to obtain working permits	
☐	Reduction of income taxation	
☐	Provision of incoming fellowships	
☐	Provision of outgoing fellowships	
☐	Enhanced accreditation of qualifications	
☐	Raising attraction of universities and research institutes	
☐	Enhancement of individual mobility under S&T agreements	
☐	Measures towards the internationalisation of the national research community (including e.g. multi-linguistic research environments)	
☐	Specific measures towards 'star' scientists	
☐	Provision of return programmes	
Other measures		
☐		

Which of the existing measures applied towards Third Countries do you consider to be most successful? Please give a brief explanation:

Measure	Why do you consider it to be successful?

1.2.2 Are there different policy measures for mobility of researchers/ S&T students within EU (incl. AS) and outside EU?

☐ Yes

☐ No

If 'Yes', please explain (if relevant you could use the different measures listed in question 1.2.1.2):

1.2.3 How do Community instruments (programmes for international mobility of researchers and S&T students) affect your respective policy measures towards Third Countries?

☐ They are the main frame for international mobility of researchers
☐ They complement national policy initiatives
☐ They are not considered an essential part of the national strategy towards international mobility of researchers and S&T students
☐ Others:

Have there been any major changes in policy measures for mobility of researchers towards Third Countries during the last years?

☐ No

☐ Yes

Major Changes:

Are there new initiatives to be envisaged?

☐ No

☐ Yes

New initiatives:

1.3 The internationalisation of the exploitation of research

There are cases, where governments actively support the international transfer and the utilisation abroad of intellectual property and other S&T results of their S&T institutions on the basis of common interest with foreign partner institutions. Also, policies can exist to exploit at the national base the results of research generated abroad.

1.3.1 In general, how could you describe your government's attitude towards the international exploitation of research and especially the de-linking of the place where the commercial exploitation of the outcomes of R&D takes place with the place where the R&D is performed?

☐ Open (i.e. in favour of dissemination of knowledge towards other countries)
☐ Closed (i.e. in favour of protection of nationally produced knowledge)
☐ Balanced (between dissemination and protection)
☐ I have no clear opinion

Room for comments:

1.3.2 Besides multilateral agreements, do policy measures exist to regulate the exploitation of knowledge in Third Countries produced in your country (including protection - intellectual property rights - of domestically produced knowledge)?

☐ Yes

☐ No

If 'Yes', which measures exist? Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select priority
☐	Bilateral agreements with Third Countries for protection of intellectual property	
☐	Bilateral agreements for technology licensing	
☐	Specific measures to promote the protection of knowledge generated by your universities (e.g. by facilitating patenting processes)	
☐	Specific measures to promote the protection of knowledge generated by your research institutes (e.g. by facilitating patenting processes)	

☐	Specific measures to promote the protection of knowledge generated by your SMEs	
Other measures to protect the knowledge base of universities, research institutes and SMEs:		
☐		
☐		

1.3.3 Do policy measures exist to enhance the national exploitation of knowledge produced in Third Countries?

☐ Yes

☐ No

If 'Yes', which measures exist?

Which of the existing measures referred to in 1.3.2 an 1.3.3 do you consider to be most successful? Please give a brief explanation:

Measure	Why do you consider it to be successful?

1.3.4 Are there different policy measures for the international exploitation of knowledge within EU (incl. AS) and outside EU?

☐ Yes

☐ No

If 'Yes', please explain (if relevant, you could use the different measures listed in question 1.3.2):

Have there been major changes in policy measures for the exploitation of national research in Third Countries during the last years?

☐ No

☐ Yes

Major Changes:

Have there been major changes in policy measures for stimulating the exploitation of research developed in Third Countries in your own country during the last years?

☐ No

☐ Yes

Major Changes:

Are there new initiatives to be envisaged (referring to questions 1.3.5 and 1.3.6)?

☐ No

☐ Yes

New initiatives:

1.4 Foreign direct investment in R&D

On the one hand this question relates to policies of your government that target investments of foreign institutions (mainly multinational enterprises) in R&D activities in your country (inward FDI). On the other hand policy measures are concerned, that aim to benefit from investments of your country or private sector in R&D activities in Third Countries (outward FDI).

1.4.1 Are there any specific measures that support the establishment of new R&D activities from Third Countries in your country through foreign direct investment?

☐ Yes

☐ No

If 'No',

1.4.1.1 Why not?

If 'Yes',

1.4.1.2 Which of the following measures exist? Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	SelectPriority
☐	Direct financial support	
☐	Fiscal incentives (tax breaks, R&D tax credits ...)	
☐	Administrative support	
☐	Provision of infrastructure (including premises)	
☐	Provision of subsidised space in Science and Technology Parks	
☐	Public procurement	
☐	Active recruitment of foreign firms and/or universities	
☐	Promotion of national strengths abroad	
☐	Cluster policies towards attraction of FDI in R&D	
Other measures		
☐		
☐		

Which of the existing measures do you consider to be most successful? Please give a brief explanation:

Measure	Why do you consider it to be successful?

1.4.2 Is there any positive (e.g. more advantageous fiscal regime or more direct R&D funding) or negative (e.g. exclusion of R&D funding or of specific research programmes) discrimination in place for R&D performed by affiliates owned by Third Countries compared to R&D performed by 'domestic' institutions?

☐ Positive discrimination
☐ Negative discrimination
☐ No discrimination

If discrimination exists, please clarify:

1.4.3 Are there policy instruments to profit from spillovers from FDI in R&D (both inward and outward)?

☐ Yes

☐ No

If 'Yes', which of the following measures exist?

☐ Policy incentives to enhance the embeddedness of inward FDI in R&D in your country in the national environment (e.g. by means of stimuli to cooperate with local research institutes/ firms, identification of suitable local suppliers for foreign R&D players; identification of appropriate partners and projects, local capacity and capability building in relation to FDI in R&D...)

☐ Policy incentives to stimulate knowledge feedback from outward FDI in R&D in a Third Country into the national innovation system of your country

☐ Other

If you ticked one of these options, please explain:

Have there been major changes in policy measures towards FDI in R&D during the last decade?

☐ No

☐ Yes

Major Changes:

Are there new initiatives to be envisaged?

☐ No

☐ Yes

New initiatives:

Part 2
Comprehensive national strategies and embedding of S&T policies in the broader policies towards internationalisation

Some countries have recently introduced wider policy strategies towards globalisation in general, or even more specific strategies towards the internationalisation of S&T. These strategies integrate various policies into a coherent and coordinated national approach.
Other countries have indicated that such strategies are currently under development.

2.1 Does a comprehensive national strategy on internationalisation of S&T already exist or is under development?

☐ Yes, a specific national strategy on internationalisation of S&T already exists
☐ Yes, a national strategy on internationalisation of S&T already exists, but it is part of a broader strategy on globalisation
☐ Yes, a specific national strategy on internationalisation of S&T is under development
☐ Yes, a national strategy on internationalisation of S&T is under development as a part of a broader strategy on globalisation

☐ No

If 'No',

2.1.1 Why not?

If Yes

2.1.2 Have there been any major changes in the national strategy recently?

☐ No

☐ Yes

Major Changes:

2.1.3 Are there new initiatives to be envisaged?

☐ No

☐ Yes

New initiatives:

2.1.4 What are the major national strategic objectives of internationalisation of S&T with Third Countries?

Which other policies do influence your policy on internationalisation of S&T to-wards Third Countries? Please indicate the priority using 1 (low priority) up to 3 (high priority)?

Select	Measure	Select Priority
☐	Economic and Labour-market policy	
☐	Foreign Policy	
☐	Development Policy	
☐	Regional Policy	
☐	Justice and Internal Affairs	
☐	Environmental Policy	
Other Policies :		
☐		
☐		

2.1.6 Which institution coordinates the development of the national strategy for the internationalisation of S&T?

2.1.7 How did your government develop a national strategy?

2.1.8 Which stakeholders are involved in the development of the national strategy for the internationalisation of S&T? Please indicate the priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	Ministries	
☐	Research Funding Agencies	
☐	Universities or University Associations	
☐	Non-university research organisations or associations	
☐	S&T Councils and other R&D Advisory bodies	
☐	Business Organisations	
Others:		
☐		
☐		

Which stakeholders are implementing the national strategy for the internationalisation of S&T?

- ☐ Ministries
- ☐ Public Agencies
- ☐ Science Organisations
- ☐ Research Councils
- ☐ Business Organisations
- ☐ Others:

2.2 How do you assure coordination and commitment of the various stakeholders from the S&T community, industries and policy making?

If relevant due to a decentralised (i.e. federal) system:
How do you assure coordination among the national/federal government and regional political stakeholders? not relevant

Room for comments:

Part 3
Trans-national coordination of R&D policies towards Third Countries and strategies towards international organisations

3a Coordination of R&D policies towards Third Countries between EU-MS/AS

Section 3a aims to get an insight in the mechanisms of joint activities of several MS/AS to coordinate their strategies/measures with or towards Third Countries.

3.1 Are there mechanisms applied by your national administration for a trans-national coordination of national policies for an internationalisation of S&T towards Third Countries? (Remark: The participation in the present CREST OMC-Working Group on Internationalisation is not considered, here.)

☐ Yes

☐ No

If 'No',

3.1.1 Why not?

If 'Yes',

3.1.2 What are the major objectives of policy coordination in the field of S&T between EU-MS/AS towards Third Countries?

3.1.3 Which of the following measures are applied? Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	bilateral consultations with EU-MS/AS on joint activities in Third Countries on a regular basis, with the following countries:	
☐	bilateral consultations with EU-MS/AS on joint activities in Third Countries on a sporadic basis	
☐	regular networking of the science counsellors at your Embassies with EU colleagues in the following Third Countries:	
☐	participation in Community instruments supporting the coordination of EU-Member States activities towards international cooperation with Third Countries(ERA-NETs, SSA)	
Other measures:		
☐ ☐		

Which of the existing measures do you consider to be most successful? Please give a brief explanation:

Measure	Why do you consider it to be successful?

3.2 What are the major changes in policy measures for trans-national coordination of R&D policies towards Third Countries during the last years?

Major Changes:

How strong is the need from your side for a coordination of S&T policies and activities of MS/AS towards Third Countries?

☐ very strong ☐ strong ☐ indifferent ☐ weak ☐ no need

3.3. In case of future coordination mechanisms, is there any initiative envisaged or proposed by your side?

New initiatives:

3.4. What are the most important barriers for a trans-national coordination?

There are no barriers

Major barriers are:

3b Strategies towards international organisations

Section 3b addresses proactive approaches of MS/AS to the participation in S&T relevant international organisations outside the EU.

3.5 Which non-European international bodies are of utmost importance for S&T policy in your country? Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	OECD (CSTP/TIP)	
☐	G8/Carnegie-Group	
☐	UNESCO	
☐	UNCTAD	
☐	IAEA	
☐	FAO	
☐	UNIDO	
Others:		
☐ ☐		

3.6 Which of the following measures does your administration apply in order to actively participate in S&T relevance international bodies? Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	Active delegation of civil servants or national experts in governing boards, management councils, advisory groups etc.	
☐	Awareness raising, promotion and information dissemination of job offerings	
☐	Preparation and practical assistance to experts from your country, which will take over jobs in international organisations	
☐	Using the expertise of national experts returning from international organisations i.e. through job offerings	
☐	Secondment of national experts (paid by national funds)	
☐	Active communication and cooperation of your administration with experts from your country working in international organisations	
Others:		
☐		
☐		

3.7 Are there any measures of your administration to coordinate your S&T related activities in international bodies with other countries?

☐ Yes

☐ No

If 'Yes', which ones:

3.8 Which of the existing measures referred to in 3.7 and 3.8 do you consider to be most successful? Please give a brief explanation:

Measure	Why do you consider it to be successful?

3.9 Have there been major changes in policy measures for a proactive participation in international organisations during the last years?

☐ No

☐ Yes

Major Changes:

3.10 Are new initiatives to be envisaged?

☐ No

☐ Yes

New initiatives:

Part 4
Monitoring and evaluation of international S&T activities towards Third Countries

There is a clear trend towards systematic monitoring of policy measures in most countries. However, the evaluation of international instruments has its own characteristics and might be different from evaluation of national instruments.

4.1 Do you monitor and/or evaluate the implementation of national policy measures supporting the internationalisation of S&T?

☐ Yes

☐ No

If 'No',

4.1.1 Why not?

If 'Yes',

4.1.2 Which aspects of the policy measures do you evaluate?

4.1.3 What type of evaluation method do you apply including main indicators and tools?

4.1.4 What type of evaluators is involved?

☐ External evaluation panel consisting of national experts, only
☐ External evaluation panel involving international experts
☐ Independent contracted organisation
☐ Internal evaluation panel/unit
☐ Others:

4.1.5 Are there monitoring/evaluation reports available?

☐ Yes (If 'Yes', please enclose a summary in English, German or French)
☐ No

4.2 If you do not monitor and/or evaluate the implementation of national policy measures supporting the internationalisation of S&T, do you plan to establish such a monitoring/evaluation?

☐ Yes

☐ No

Research Series

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