

B4. Internationalisation of research and development (R&D)

Introduction

This set with annotated tables on the internationalisation of R&D presents information on the input of foreign controlled enterprises to the R&D and innovation activities in the Dutch business sector. Data is based on the *R&D and Innovation Survey*, which is conducted every even year. The data are descriptive and categorised by sector and by size class. The survey makes it possible to make innovation profiles for specific types of enterprises and compare them. A second data source about internationalisation of R&D is the *Worldwide Patent Statistical Database* published by the *European Patent Office (EPO)*. This database contains data about the applicant of a patent and the inventor(s) who performed the underlying research. This makes it possible to monitor and describe the degree of (international) cooperation between inventors.

Definitions

Foreign controlled enterprises are defined based on the question in the *R&D and Innovation Survey* about the location of the enterprise's main office.

Classification

Three sectors are distinguished:

- Manufacturing: NACE Rev. 1.1 Section D
- Services: NACE Rev. 1.1 Sections G, H, I, J, K (excluding NACE class 73) and NACE classes 90 and 93
- Other: NACE Rev. 1.1 Sections A, B, C, E and F

Data for the sector 'other' are not shown separately because the number of enterprises in this category is too small.

B4.1 R&D expenditure of foreign controlled enterprises in the business sector

The share of R&D expenditures of foreign controlled enterprises in the total R&D expenditures of the Dutch business sector indicates the involvement of foreign multinationals or investors in R&D performed in the Netherlands. Over 20 percent of the R&D expenditures in the Dutch business sector was realised by foreign controlled enterprises. This is a stable proportion over the period 2000–2006. In the services sector the share is a little larger than in manufacturing.

In all size classes the contribution of foreign controlled enterprises to the R&D performed in the Netherlands is substantial. Over the years the share of R&D performed by foreign controlled enterprises seems to be the largest in the medium-sized enterprises (50–249 employees).

Graph B4.1 shows that almost half (46 percent) of the R&D performed by foreign controlled enterprises in the Netherlands is controlled by parent companies located in member states of the EU-26. The share of affiliates of parent companies located in North America (33 percent) and in the rest of the world (21 percent) are both smaller than the EU-26 share.

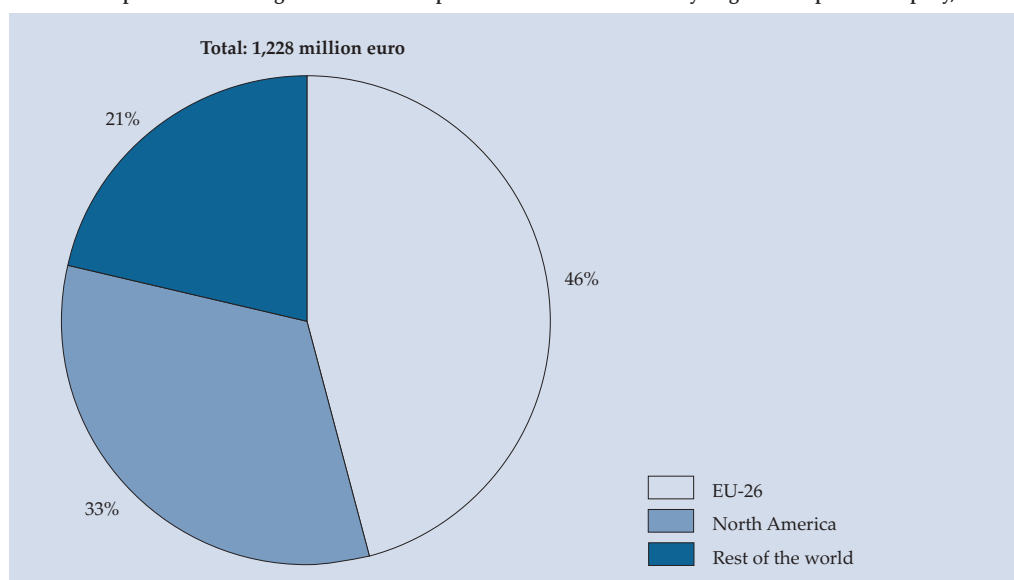
With almost 1.3 billion euro of investments in R&D activities by foreign controlled enterprises, they identify the Netherlands as a suitable location for performing R&D. This foreign controlled R&D may be the result of so called Greenfield investments (starting new R&D activities), which increases the R&D performed in the Netherlands, and has positive effects on the Dutch knowledge economy. Yet, it may also be the result of mergers and acquisitions, meaning that existing R&D activities of Dutch enterprises are taken over by foreign enterprises with the aim of getting access to certain knowledge or technologies. The latter does not increase the amount of R&D performed in the Netherlands: it just changes the ratio between R&D performed by Dutch controlled enterprises and R&D performed by foreign controlled enterprises.

The R&D performed by foreign enterprises is broken down by location of the enterprise's head office and categorised into international regions. EU-26 consists of the 27 European countries excluding the Netherlands. North America consists of the United States of America and Canada. The rest of the world consists of all other countries except EU-26, the Netherlands, and North America.

Table B4.1
R&D expenditure of foreign and Dutch controlled enterprises in the business sector

	2000		2002		2004		2006	
	<i>million euro</i>	%	<i>million euro</i>	%	<i>million euro</i>	%	<i>million euro</i>	%
Total	4,348	100	4,543	100	5,071	100	5,480	100
Dutch controlled	3,276	75	3,602	79	3,907	77	4,253	78
Foreign controlled	1,072	25	941	21	1,165	23	1,228	22
<i>Industry</i>								
Manufacturing	3,385	100	3,454	100	3,898	100	4,094	100
Dutch controlled	2,613	77	2,771	80	3,009	77	3,197	78
foreign controlled	772	23	684	20	889	23	897	22
Services sector	767	100	884	100	974	100	1,200	100
Dutch controlled	487	63	638	72	722	74	884	74
foreign controlled	280	37	246	28	252	26	316	26
<i>Size class</i>								
10–49 employees	222	100	422	100	431	100	421	100
Dutch controlled	180	81	378	90	381	88	361	86
foreign controlled	42	19	44	10	50	12	59	14
50–249 employees	524	100	704	100	934	100	992	100
Dutch controlled	360	69	510	73	686	73	723	73
foreign controlled	164	31	193	27	248	27	269	27
250 and more employees	3,602	100	3,417	100	3,707	100	4,068	100
Dutch controlled	2,736	76	2,713	79	2,840	77	3,168	78
foreign controlled	866	24	704	21	867	23	900	22

B4.1 R&D expenditure of foreign controlled enterprises in the business sector by origin of the parent company, 2006



B4.2 R&D of foreign controlled enterprises: structural or not?

The table B4.2 shows that in general R&D by foreign controlled enterprises is performed on a more regular basis than the R&D of Dutch controlled enterprises. The manufacturing sector shows the largest differences in this indicator. In manufacturing over 80 percent of the foreign controlled enterprises performing R&D claim to do this on a regular basis, against 70 percent of the Dutch enterprises. The difference in the services sector is negligible.

In general larger enterprises perform R&D on a more structural basis than smaller enterprises. When comparing enterprises of the same size class, it appears that foreign controlled enterprises perform in general slightly more R&D on a structural basis than Dutch controlled enterprises.

Overall, the preconception that R&D performed by foreign controlled enterprises is less committed cannot be confirmed. They even seem to perform more R&D on a structural basis than Dutch controlled enterprises.

One of the characteristics of R&D activities is that they can be performed on a structural basis or just occasionally. This matter is addressed in the R&D and Innovation Survey where enterprises claiming to perform R&D are asked if they do this on a regular basis, meaning more or less continuously, or only occasionally.

Table B4.2
Foreign and Dutch controlled enterprises performing R&D on a structural basis

	2002–2004	2004–2006
<i>% of enterprises performing R&D</i>		
Total	72	69
Dutch controlled	67	68
Foreign controlled	72	76
<i>Industry</i>		
Manufacturing	72	72
Dutch controlled	70	70
foreign controlled	80	82
Services sector	66	71
Dutch controlled	66	70
foreign controlled	64	72
<i>Size class</i>		
10–49 employees	64	65
Dutch controlled	65	65
foreign controlled	60	70
50–249 employees	73	76
Dutch controlled	71	75
foreign controlled	78	79
250 and more employees	82	81
Dutch controlled	81	79
foreign controlled	85	85

B4.3 International cooperation in research

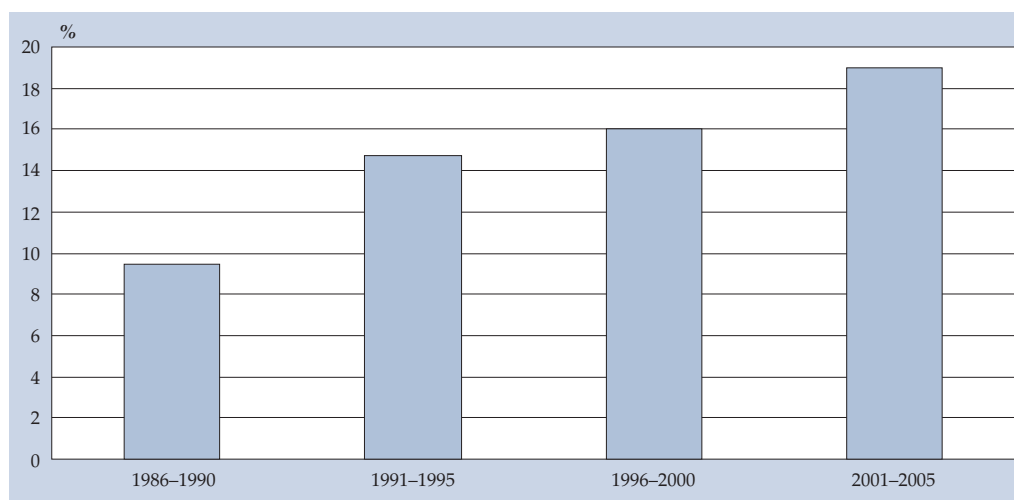
The analysis of inventions invented by inventors residing in the Netherlands reveals increasing involvement of inventors residing abroad as can be seen in table B4.3. More specifically, in 2001–2005 the share of co-invention amounted to 19.0 percent. In the period 1986–1990 this share was just 9.5 percent. The share of co-invention was on average 14.8 percent in 1986–2005.

The observed trend might be explained by the presence of large multinationals in the Netherlands. Multinationals have research facilities in several countries. More specifically, co-invention can originate from researchers working for these multinationals in research facilities located in different countries.

However, co-invention can also originate from collaboration between two inventors working for two different companies, thereby facilitating the exchange of technical skills or technological capabilities among partner firms

International cooperation in research is an indicator that represents the number of patent applications invented by an inventor residing in the Netherlands with at least one inventor located in a foreign country, divided by the total number of patents invented by inventors residing in the Netherlands. This phenomenon is also known as co-invention.

B4.3 Co-invention¹⁾



Source: EPO Worldwide Statistical Database, April 2008.

¹⁾ Patent counts (EPO: Euro-direct and Euro-PCT) are based on the priority date and the inventor's country of residence, using simple counts.

B4.4 Technological innovation profile

Foreign controlled enterprises in the Netherlands are much more active in innovation than domestically controlled enterprises. Overall 23 percent of Dutch enterprises and 46 percent of the foreign controlled enterprises innovated in the period 2004–2006. Large enterprises innovate more frequently than small enterprises, and the manufacturing sector is more innovative than the services sector.

In the services sector, the percentage of innovative enterprises is twice as high among foreign controlled enterprises compared to domestic ones. The differences between Dutch and foreign enterprises diminish slightly as the enterprises are larger in terms of the number of employees.

The figures for product innovation tell a similar story. More than one in three foreign controlled enterprises came up with product innovations compared to only one in seven Dutch enterprises. The patterns for the sectors and size classes are similar to the overall figures on innovation. In the size class of 10–49 employees, 31 percent of the foreign enterprises came up with product innovations, compared to 13 percent of the Dutch enterprises.

There is a difference in the way enterprises develop their innovations. More than 40 percent of the innovative Dutch controlled enterprises worked together with other parties or had third parties develop the innovation.

Just over 20 percent of the innovating foreign controlled enterprises worked in partnership with external parties to develop innovation.

The concept of innovation can be split into technological innovation (product and process innovation) and non-technological innovation (organisational and marketing innovation). This table shows technological innovation.

Table B4.4
Technological innovation profile; foreign and Dutch controlled enterprises, 2004–2006

	Innovation	Product innovation	Product innovation with whom	
			internal	external
	<i>% of enterprises</i>		<i>% of innovators</i>	
Total	25	16	62	38
Dutch controlled	23	14	59	41
Foreign controlled	46	36	78	22
<i>Industry</i>				
Manufacturing	42	32	69	31
Dutch controlled	39	29	66	34
foreign controlled	66	54	81	19
Services sector	22	14	62	38
Dutch controlled	21	13	58	42
foreign controlled	40	31	75	25
<i>Size class</i>				
10–49 employees	21	14	60	40
Dutch controlled	20	13	58	42
foreign controlled	41	31	76	24
50–249 employees	38	26	66	34
Dutch controlled	35	23	60	40
foreign controlled	52	41	80	20
250 and more employees	56	43	68	32
Dutch controlled	54	38	62	38
foreign controlled	61	52	77	23

B4.5 Cooperation profile

Many innovative enterprises do not develop their innovations independently. Cooperation during the innovation process may be with others within the enterprise or enterprise group, or with external partners. More than 40 percent of the innovative foreign controlled enterprises actively worked together with a partner in order to innovate. Of the Dutch controlled enterprises, this was 35 percent.

Yet, in manufacturing industry, almost 60 percent of the foreign controlled enterprises cooperated with others, compared to 40 percent of the Dutch controlled enterprises. In the services sector, on the other hand, there was no difference between foreign and domestically controlled enterprises.

More than 80 percent of the innovating foreign controlled affiliates, in both manufacturing and services, worked together within the enterprise group. The percentages are lower, around 60 percent, for the Dutch enterprises. However, the group of large Dutch controlled enterprises behave in the same way as large foreign controlled enterprises.

Three quarters of the innovating and cooperating foreign controlled enterprises work together with their suppliers on innovations. This percentage is slightly higher in manufacturing and in the large enterprises. Nonetheless, the Dutch controlled enterprises innovate even more in cooperation with their suppliers.

Half of the cooperating innovators worked together with their customers. The percentages for the foreign controlled enterprises are slightly higher than for the Dutch companies. Cooperation with customers is a more common way of innovating in the manufacturing sector in comparison with the service sector.

The cooperation profile describes how many of the innovating enterprises cooperate and with whom they cooperate.

Partners in innovation in addition to the parent company or enterprise group itself include suppliers and customers. Other possible partners such as universities, other research institutes or governments play a less important role.

Table B4.5
Cooperation profile; foreign and Dutch controlled enterprises, 2004–2006

	Cooperation	Cooperation within the enterprise group ¹⁾	Cooperation with	
			suppliers	customers
	% of innovators	% of cooperating innovators		
Total	36	65	80	49
Dutch controlled	35	58	81	49
Foreign controlled	41	81	75	52
<i>Industry</i>				
Manufacturing	44	66	80	59
Dutch controlled	40	56	81	58
foreign controlled	58	83	78	62
Services sector	32	67	78	45
Dutch controlled	32	61	80	45
foreign controlled	32	83	71	44
<i>Size class</i>				
10–49 employees	32	60	79	47
Dutch controlled	31	55	80	48
foreign controlled	33	78	72	44
50–249 employees	43	66	81	51
Dutch controlled	42	56	83	49
foreign controlled	45	83	75	55
250 and more employees	64	79	84	60
Dutch controlled	63	76	85	57
foreign controlled	66	84	82	65

¹⁾ As percentage of cooperating innovators actually being part of an enterprise group.

B4.6 Non-technological innovation

Foreign controlled enterprises in the Netherlands are much more active in non-technological innovation than Dutch controlled enterprises. Overall, the pattern of non-technological innovations is quite similar to the pattern of technological innovations (see the first column of table B4.4).

Overall 22 percent of Dutch controlled enterprises and 42 percent of the foreign controlled enterprises innovated in the 2004–2006 period. Both in manufacturing and services, foreign controlled enterprises are much more innovative. Yet, for large enterprises, measured by the number of employees, the difference between Dutch and foreign enterprises vanishes.

The figures found for organisational innovations tell a similar story. One in three foreign controlled enterprises created organisational innovations compared to one in five Dutch controlled enterprises. The pattern for the sectors and size classes is similar to the overall figures on non-technological innovations. The foreign controlled enterprises also had a higher percentage of changes in organisational or management structure, which are a part of organisational innovations.

Also in marketing innovations, the percentage of enterprises creating marketing innovations is twice as high for the foreign affiliates in most size classes and sectors. 17 percent of the foreign affiliates implemented marketing innovations, against 8 percent of the Dutch enterprises. Of the largest enterprises, one in five Dutch companies implemented marketing innovations, against one in four foreign affiliates.

Non-technological innovations can be divided into organisational and marketing innovations. Organisational innovations are major changes in the company structure or management methods. A marketing innovation is the implementation of new or significantly improved product designs or sales methods.

Table B4.6
Non-technological innovation; foreign and Dutch controlled enterprises, 2004–2006

	Non-technological innovations	Organisational innovations	Marketing innovations
<i>% of enterprises</i>			
Total	24	22	9
Dutch controlled	22	20	8
Foreign controlled	42	37	17
<i>Industry</i>			
Manufacturing	31	27	12
Dutch controlled	29	25	11
foreign controlled	48	42	22
Services sector	24	22	9
Dutch controlled	22	20	8
foreign controlled	41	36	16
<i>Size class</i>			
10–49 employees	21	19	7
Dutch controlled	20	18	7
foreign controlled	37	32	15
50–249 employees	36	32	12
Dutch controlled	33	30	11
foreign controlled	47	41	19
250 and more employees	54	50	22
Dutch controlled	54	51	20
foreign controlled	54	48	26

B4.7 Barriers to innovation

Enterprises often experience difficulties during or even before the actual start of the innovation process. The two problems mentioned most often are a lack of financial means to innovate, and difficulties of hiring qualified employees. Among innovative enterprises, 42 percent of all Dutch controlled enterprises have a lack of qualified employees. Yet, 33 percent of the foreign controlled enterprises were facing lack of qualified employees as the most prevalent factor that hampered their innovative activities during the period 2004–2006.

Lack of funds within the enterprise or enterprise group was a problem for 36 percent of Dutch controlled enterprises. And again, 26 percent of foreign controlled enterprises faced this barrier.

However, foreign controlled enterprises with more than 50 employees reported financial problems as often as Dutch controlled enterprises did.

The reason *not* to innovate among enterprises without any innovative activities was usually lack of qualified personnel. This motivation was reported as a barrier for not being an active innovator by 44 percent of non-innovating Dutch controlled enterprises and 32 percent of non-innovating foreign controlled enterprises.

The second reason not to innovate among enterprises without any innovative activities was usually lack of financial means within the enterprise or group. The difference between Dutch and foreign controlled enterprises is much smaller for this barrier than for lack of qualified personnel. Nonetheless, financial constraints was most prevalent among both Dutch and foreign controlled non-innovating enterprises in the manufacturing industry.

The CIS survey included a list of factors that may hamper innovation. Enterprises could indicate the importance of these factors (high, medium, low or 'not experienced'). The statistics listed in table B4.7 are the number of enterprises that have experienced these factors, summed over high and medium importance.

Table B4.7
Barriers to innovation; foreign and Dutch controlled enterprises, 2004–2006 ¹⁾

	Innovators		Non-innovators	
	lack of qualified personnel	lack of financial means within enterprise or group	lack of qualified personnel	lack of financial means within enterprise or group
	% of innovators		% of non-innovators	
Total	41	34	43	28
Dutch controlled	42	36	44	28
Foreign controlled	33	26	32	26
<i>Industry</i>				
Manufacturing	42	38	30	50
Dutch controlled	43	38	30	51
foreign controlled	37	38	25	41
Services sector	40	32	28	42
Dutch controlled	42	35	28	42
foreign controlled	31	17	25	34
<i>Size class</i>				
10–49 employees	40	36	27	44
Dutch controlled	42	38	27	44
foreign controlled	28	19	21	30
50–249 employees	41	30	33	40
Dutch controlled	42	29	32	40
foreign controlled	39	32	40	39
250 and more employees	40	32	23	19
Dutch controlled	44	31	22	14
foreign controlled	33	33	28	34

¹⁾ The survey included a list of factors that may have hampered innovation, or that may have been reasons not to innovate. Enterprises could indicate the importance of these factors (high, medium, low or 'not experienced'). The statistics included here are the number of enterprises that have experienced these factors, summed over high and medium importance.