Turnover and output measurement for the research and development sector in the Netherlands

Mieke Berends-Ballast

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Explanation of symbols

.	= data not available
*	= provisional figure
**	= revised provisional figure
x	= publication prohibited (confidential figure)
–	= nil or less than half of unit concerned
–	= (between two figures) inclusive
0 (0,0)	= less than half of unit concerned
blank	= not applicable
2008–2009	= 2008 to 2009 inclusive
2008/2009	= average of 2008 up to and including 2009
2008/'09	= crop year, financial year, school year etc. beginning in 2008 and ending in 2009
2006/'07–2008/'09	= crop year, financial year, etc. 2006/'07 to 2008/'09 inclusive

Due to rounding, some totals may not correspond with the sum of the separate figures.

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TURNOVER AND OUTPUT MEASUREMENT FOR THE RESEARCH AND DEVELOPMENT SECTOR IN THE NETHERLANDS

Mieke Berends-Ballast

Summary

The main issue in the statistical decription of R&D in the Netherlands is that a large share of R&D is carried out in big enterprises with other main activities. The population of enterprises and institutions involved in R&D is very diverse and consists of enterprises with main activity R&D, enterprises with their own R&D, but another main activity, universities and research institutions.
In the Structural Business Statistics we describe the turnover of enterprises with R&D as their main activity rather well. Small and medium enterprises prevail. We have no information on product details, nor on prices.
The R&D Statistics focus on enterprises, carrying out their own R&D, with 10 or more employees. The R&D Statistics cover research institutions and universities as well.
The two statistics complement each other, but there is also an overlap. To get an overall picture, we have to combine data from both statistics and be careful to avoid double-counting.
To further improve our view on R&D activities it would be advisable to use the same sets of questions for all enterprises involved in R&D in future questionnaires. Another improvement would be to include enterprises with less than 10 employees in the R&D statistics.
This paper was prepared for the 2010 meeting of the Voorburg Group on Services Statistics. This group has a UN mandate to develop methodology for services statistics on turnover and prices. In the 2010 meeting, three countries presented their experiences in the statistical description of R&D activities. This paper describes the Dutch experience with turnover. Following the procedures of the Voorburg group as laid down in the Content Development Framework[1] a sector paper will be ready in 2011, combining experiences from different countries with turnover as well as prices, enriched with the results of the discussions during the 2010 meeting.

Keywords: Research and development, services statistics, turnover.

1. Introduction

A small number of very big enterprises dominates R&D in the Netherlands. Some of these enterprises have their headquarters in the country, some have moved out, some have always been foreign-based. We have already seen many mergers and take-overs, and we expect to see more.
In the last two decades or so, the organisation of R&D within the big enterprises in the manufacturing industry has changed. Instead of large centralized laboratories we now see more smaller decentralized R&D labs. Apart from the big enterprises engaged in R&D, we also see a large number of small and medium enterprises, focusing on R&D as their main activity.
We are confronted with measurement problems in the statistical description of R&D. First of all we have to trace enterprises that are engaged in R&D activities, that have another main activity. In the Business Register we have enterprises classified by their main activity only. Secondly, for the small and medium enterprises we have few possibilities for data collection, because of promises to reduce the administrative burden. Thirdly, and related to the first and second problem, we have to combine several data sources to get a complete picture of R&D in the Netherlands.

[1] Content Development Framework for Service Statistics, Voorburg group 2006

2. Definitions and methods

Two statistics

The R&D sector in The Netherlands is statistically described by:

a) The Structural Business Statistics[2]
b) The R&D Statistics[3]

partially complementary and partially overlapping, which is elaborated hereafter.

Scope of Structural Business Statistics (SBS)

In the Structural Business Statistics, enterprises are characterized and classified by their main activity, according to the NACE[4]. The enterprises classified in NACE 72 represent only part of the R&D activities in the Netherlands, because enterprises that engage in R&D activities but with another main activity are not included in NACE 72.

In the SBS we collect and publish a range of variables relating to business demography, employment, economic results and costs on a yearly basis.

Scope of Research and Development Statistics (R&D Statistics)

Next to the SBS Statistics Netherlands has specialized R&D statistics. These statistics include enterprises with their own R&D, regardless of their main activity, employing 10 or more people. Universities and research institutions are surveyed as well. On a yearly basis we collect and publish data on R&D expenditure, costs, investments and employment variables.

Classification of activities

The classification used in the European Union to indicate the kind of activity of enterprises is the NACE. Since the implementation of the NACE Rev. 2[5] the R&D activities are classified as follows:

NACE Rev 2		ISIC Rev 4
72	Scientific research and development	72
721	Research and experimental development on natural sciences and engineering	7210
7211	Research and experimental development on biotechnology	
7219	Other research and experimental development on natural sciences and engineering	
722	Research and experimental development on social sciences and humanities	7220
7220	Research and experimental development on social sciences and humanities	7220

NACE and ISIC are compatible, but NACE Rev.2 has somewhat more detail than ISIC Rev. 4, in the breakdown of 721.

Enterprise

The enterprise is used as statistical unit; at least one person works there for 15 hours a week or more. An enterprise may encompass more than one legal unit.

Turnover

Turnover is measured as net turnover: proceeds from sales, exclusive of value-added tax (VAT), after deducting discounts, premiums, deposits and freight charges.

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[2] EU regulation 295/2008 REGULATION (EC) No 295/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 March 2008 concerning structural business statistics (recast)

[3] EU regulation 753/2004 COMMISSION REGULATION (EC) No 753/2004 of 22 April 2004 implementing Decision No 1608/2003/EC of the European Parliament and of the Council as regards statistics on science and technology, and Frascati Manual 2002: Proposed Standard Practice for Surveys on Research and Experimental Development, OECD

[4] NACE: Nomenclature des Activités économiques dans la Communauté Européenne

[5] REGULATION (EC) No 1893/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 December 2006 establishing the statistical classification of economic activities NACE Revision 2 and amending Council Regulation (EEC) No 3037/90 as well as certain EC Regulations on specific statistical domains

Data collection
All large enterprises are surveyed, both for the SBS and R&D statistics. For small and medium enterprises a sample is taken. In the R&D statistics for universities data from public sources are used, in the SBS tax data are used to complement the survey data.

3. Results

3.1. Market conditions and constraints
A large share of R&D in the Netherlands is carried out by a small number of big multinational enterprises. Their main activity is mostly in manufacturing, not in R&D.
In recent years we have seen many small starting R&D enterprises. This development is sponsored by government subsidies, and universities offering working accommodations, laboratory facilities and student coaching. Once these businesses become successful and start growing, they may be taken over by a big enterprise with another main activity than R&D. What we measure in our statistics as pure R&D enterprises (NACE 72) are mostly small, often starting enterprises.
In the manufacturing industry and the services sector we find many enterprises that have their own R&D, but because this is not their main activity these R&D activities will not be visible in statistics on NACE 72. An important recent development is that many manufacturing enterprises have started new laboratories and other R&D facilities in other countries, like China. Whereas these enterprises offshored mainly production activities until a few years ago, we now see also very high-qualified activities like R&D leave the country. This coincides with a shift in motivation of entrepreneurs to move to other countries: besides low labour costs and proximity to markets we now see motives like availability of qualified personnel and investment climate.
Another important development is that Dutch companies are merging with or taken over by foreign enterprises, as a result of which production activities but also R&D is sometimes moved to other countries as well. Government policy aims at an increase of the R&D/GDP ratio, which is still under 2% for the Netherlands.

3.2. Enterprises with R&D as their main activity (NACE 72)
In 2009 2515 research enterprises were active in the Netherlands (table 1). These data refer to enterprises with research and development as their main activity. In recent years we have seen a considerable growth of research enterprises, especially the very small enterprises with one person employed. In 2009 over 60% of the research enterprises was a one-person enterprise. The growth was rather rapid: in the early nineties there were less than 1000 research enterprises in total.

Table 1. Number of research enterprises by size, 2006 - 2009

	Number of enterprises	Number of persons employed							
		1	2	3 to 5	5 to 10	10 to 20	20 to 50	50 to 100	100 or more
2009	2515	1550	240	210	195	140	100	30	50
2008	2260	1360	255	180	195	110	90	30	45
2007	2090	1155	240	185	205	130	100	30	45
2006	1960	1115	275	130	170	115	85	30	40

Source: Structural Business Statistics, NACE 72

Most enterprises are in technical research, social sciences and non-biotech medical research.
The number of enterprises specialising in biotechnology is rather modest (table 2).

Table 2. Number of research enterprises by kind of research, 2006 - 2009

		Number of enterprises			
NACE		2006	2007	2008	2009
72111	Biotechnological agricultural research	35	35	35	30
72112	Medical biotechnological research	25	30	25	25
72113	Other biotechnological research	15	10	15	10
72191	Agricultural research (non-biotech)	250	250	275	290

72192	Technical research	550	575	640	735
72193	Medical research (non-biotech)	385	425	460	520
72199	Other R&D natural sciences (non-biotech)	170	190	205	225
7220	R&D on social sciences and humanities	535	580	610	680
72	Total	1960	2090	2260	2515

Source: Structural Business Statistics, NACE 72

The research enterprises employed 37 100 people in 2008, corresponding to 31 200 fulltime equivalents (table 3).

Table 3. Research enterprises: employees, turnover and costs, 2006 - 2008

			2006	2007	2008
Persons employed	persons	** 1000*	32,7	36,0	37,1
	fulltime equivalents	** 1000*	27,6	30,3	31,2
Revenues	total revenues	*million euro*	3476	4010	4496
	net turnover	*million euro*	3054	3501	3634
Costs	total costs	*million euro*	3287	3849	4318
	personnel costs	*million euro*	1643	1896	2004
Operating profit		*million euro*	189	161	178

Source: Structural Business Statistics, NACE 72

On average research enterprises employ 17 people or 14 fte's. Total turnover equals 3634 million euro in 2008, that means an average of 1.6 million euro per enterprise (table 4).

Table 4. Average number of employees, turnover and costs per enterprise, 2006 - 2008

			2006	2007	2008
Persons employed	persons		17	17	16
	fulltime equivalents		14	14	14
Revenues	total revenues	** 1000 euro*	1773	1919	1989
	net turnover	** 1000 euro*	1558	1675	1608
Costs	total costs	** 1000 euro*	1677	1842	1911
	personnel costs	** 1000 euro*	838	907	887
Operating profit		** 1000 euro*	96	77	79

Source: Structural Business Statistics, NACE 72

However, our approach of starting from enterprises with R&D as their main activity does not lead to a full description of R&D activities, because many enterprises with other main activities have their own R&D activities as well.

3.3. Enterprises with their own R&D (all NACE)

Therefore, in the R&D Statistics – which are carried out in accordance with the guidelines of the OECD Frascati manual – we collect data of enterprises with their own R&D and of universities and research institutions, with 10 or more employees. This results in a total number of 2676 enterprises and research institutions in 2007, that employ 61 116 people. Total R&D expenditure amounts to 5 495 million euro (table 5).

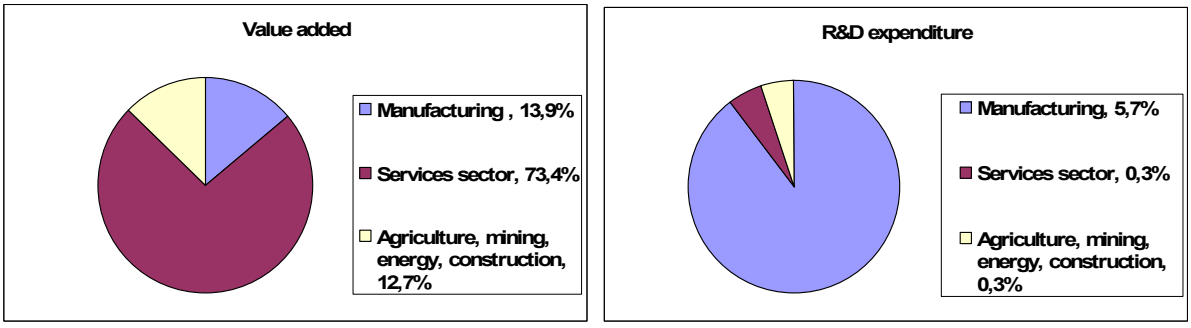
Table 5. R&D expenditure and personnel for all enterprises with their own R&D and research institutions, with 10 or more employees, 2003 and 2007

		Total R&D expenditure	Operating costs for R&D		Investments	Persons employed in R&D		Enterprises, universities and institutions
			Total costs	Labour costs				
		million euro	*million euro*	*million euro*	*million euro*	*number*	*fte*	*number*
ENTERPRISES TOTAL	2003	4804	4444	2731	361	57442	44485	3282
	2007	5495	5025	3367	470	61116	49246	2676
Manufacturing	2003	3750	3488	2034	262	39158	32080	1986
	2007	4010	3671	2360	339	37853	31584	1441
Services sector	2003	839	770	559	69	15815	10706	1140
	2007	1284	1180	870	103	20599	15419	1125
Other	2003	215	186	137	30	2469	1700	156
	2007	201	174	136	27	2664	2243	110
UNIVERSITIES	2003	2356	2073	1260	283	33581	27209	13
	2007	3589	3236	1946	353	38481	32401	13
RESEARCH INSTITUTIONS	2003	1216	1131	810	85	15957	14292	103
	2007	1259	1135	815	125	14126	12140	106

Source: R&D Statistics, all NACE

The manufacturing industry spends relatively large amounts on R&D: 4010 of the total of 5495 million euro spent in 2007. Compared to the value added in the economic sectors we see that R&D expenditure in manufacturing amounts to 5.7%; in the services sector and the combined agriculture/mining/energy/construction sector R&D expenditure is 0.3% of value added (figure 1).

Figure 1. Value added and R&D expenditure by economic sector, 2007

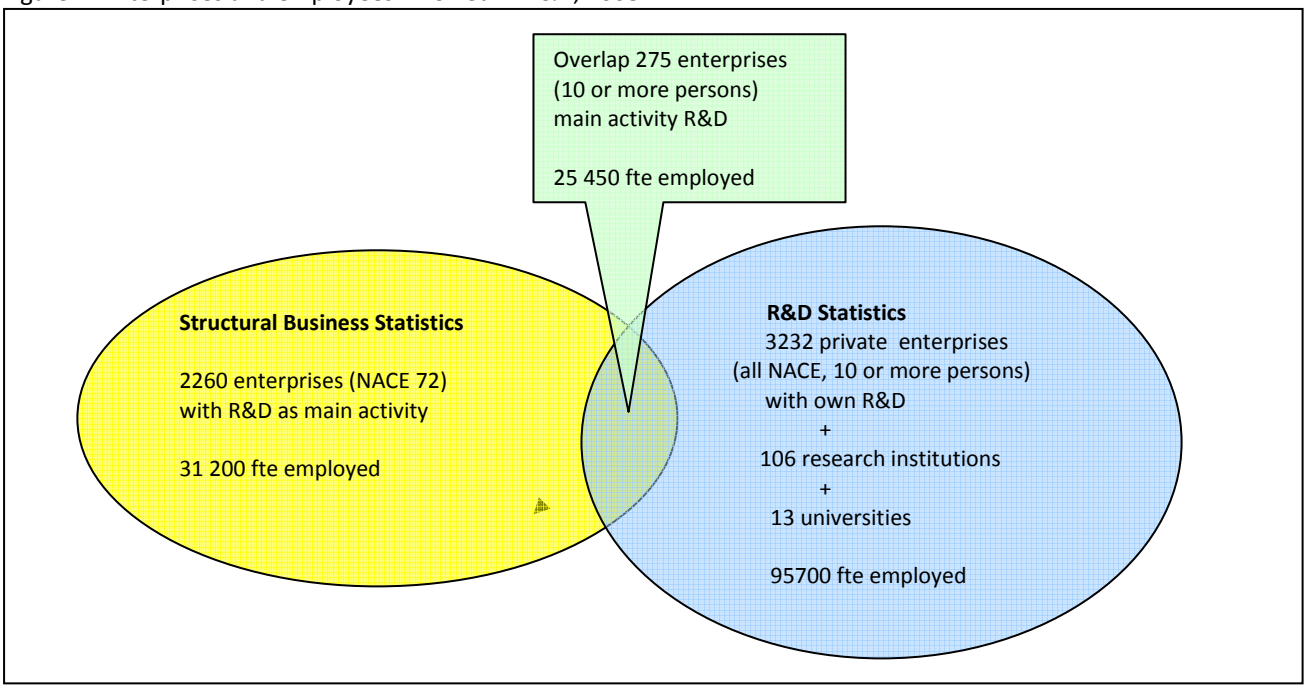


Source: R&D Statistics, National Accounts

3.4. Enterprises involved in R&D, total

In order to get a full overview of R&D in the Netherlands we have to combine several data sources (figure 2). From the Structural Business Statistics we learn that the majority of the research enterprises are one-person enterprises. We find 31 200 fte employed in enterprises with R&D as their main activity. From the R&D Statistics we learn that 95 700 fte are employed in R&D, in enterprises with 10 or more employees, research institutions and universities. The overlap between the Structural Business Statistics and the R&D Statistics is the group of 275 enterprises with R&D as their main activity and 10 or more employees. From the size class information in the Structural Business Statistics we can estimate the number of employees in this overlap at approximately 25 450 fulltime equivalents.

Figure 2. Enterprises and employees involved in R&D, 2008



In table 6 we compare the coverage and present the results of the Structural Business Statistics (SBS) and the R&D Statistics for the year 2008.

Table 6. Comparison of the coverage and results of different statistics, 2008

Statistics		SBS	R&D		
Coverage		All enterprises NACE 72	Enterprises with their own R&D, all NACE, 10 or more employees	Universities	Other institutions
Enterprises, total	*number*	2260		13	106
Enterprises with 10 or more employees	*number*	275	3232	13	106
Employees in R&D	*number*	37100	60300		14100
Fte's in R&D	*fte*	31200			
Years of employment	*years*		48600	33000	12100
Net turnover	*million euro*	3634			
Total R&D expenditure	*million euro*		5325	3904	1256
Personnel costs	*million euro*	2004	3263		813

Using total R&D expenditure as a proxy for turnover, total turnover from R&D activities can be calculated as the sum of:

a) net turnover of enterprises with R&D as their main activity
b) R&D expenditure of enterprises with own R&D regardless of main activity
c) R&D expenditure in universities
d) R&D expenditure in research institutions

minus the overlap between the Structural Business Statistics and the R&D Statistics.
Total R&D turnover amounts to € 11 187 million, generated by 99 400 fulltime equivalents in 5 536 enterprises, universities and research institutions in 2008 (table 7).

Table 7. Total R&D, 2008

		Enterprises, universities and institutions	Employees *1000 FTE	Turnover million euro	Turnover per employee * € 1000
Enterprises with R&D as main activity	+	2260	31.2	3634	116
All enterprises with own R&D, 10 or more employees	+	3232	48.6	5325	110
R&D in universities	+	13	33.0	3904	118
R&D in other institutions	+	106	12.1	1256	104
Overlap	-	275	25.5	2932	115
TOTAL	∑	5336	99.4	11187	113

Strictly speaking, in this total we still miss R&D activities of small enterprises (less than 10 employees) outside NACE 72. However, we were not able to calculate these and we expect them not to be substantial.

3.5. International aspects

The phenomenon of manufacturing companies offshoring R&D to foreign affiliates is rather important in the Netherlands, because of the relatively large number of head offices of multinational companies. But it is not always easy to describe on the basis of official statistics. To ensure the correct measurement of R&D services between enterprises or subsidiaries belonging to the same enterprise group, whether or not established in the same country, we have set up a special project to analyze intracompany services. A pilot survey was carried out to test the feasibility of questions on intracompany R&D and other auxiliary services, including a question on prices charged. It turned out that enterprises are able and willing to answer these questions. We plan to implement these questions in future regular questionnaires for enterprises in NACE category 7010: activities of head offices.
Imports and exports of R&D and of royalties and manufacturing rights are measured in our Statistics on International Trade in Services (table 8). The share of these imports and exports related to R&D enterprises and/or enterprises with their own R&D, however, is not known. In interpreting these data it is important to realize that royalties sometimes have no relationship to R&D, e.g. music rights or trademarks.

Table 8. Imports and exports of R&D, royalties and manufacturing rights, 2005 - 2009

		Imports			Exports		
		Total	EU	Not EU	Total	EU	Not EU
		mln euro			mln euro		
Research and development	2005	3575	2129	1446	3731	1152	2579
	2006	2528	1504	1024	3135	995	2140
	2007	2167	1163	1004	3056	1195	1861
	2008	1915	950	965	2664	998	1665
	2009 *	1746	832	914	2161	808	1353
Royalties and manufacturing rights	2005	6901	1504	5397	8234	4214	4021
	2006	6088	1151	4937	8207	4198	4008
	2007	7345	2127	5218	10029	4731	5297
	2008	9770	915	8854	13405	8943	4462
	2009 *	11725	1817	9907	14974	10510	4464

Source: Statistics on International trade in services

3.6. National Accounts concepts and measurement issues

The investments[6] in R&D are calculated by National Accounts while anticipating the new SNA guidelines. Once the revised SNA guidelines come into force, these data will be officially registered in the National Accounts. For the time being they are published as experimental tables[7]. Data from the R&D statistics are used as source data for calculating investments; the translation process to SNA guidelines includes revaluation: capital expenditure on research equipment is replaced by user costs of capital. [8] Investments in intangible assets are about 50% higher than investments in tangible assets in the manufacturing industry. Intangible assets in the electrotechnical and chemical industry are mainly R&D, whereas brands are more important in the food sector and in publishing.

R&D investments give a good indication of how innovative an economy is. Therefore, the OECD uses the R&D/turnover ratio as an indicator for growth potential. Based on this indicator, we see that the electrotechnical industry, the chemical industry and the machine industry are the most R&D-intensive in the Netherlands.

National Accounts includes R&D in private enterprises only. From the viewpoint of the R&D Statistics however, also R&D in universities and governmental or semi-governmental research institutions has to be taken into account. This results in a higher figure for the R&D/GDP-ratio.

[6] These investments according to the new SNA should not be confused with the investments shown in table 5, where we present the traditional definitions of expenditures and investments

[7] De Nederlandse groeirekeningen 2008, Statistics Netherlands (2009) – only available in Dutch as yet; the next publication will be published in English in November 2010

[8] M. van Rooijen-Horsten et al.: R&D Satellite Accounts in The Netherlands, a progress report, OECD (2007)

Below we show some preliminary results, based on the new SNA definitions (table 9).

Table 9. R&D and BBP, new definitions, preliminary data, 2007 and 2008

		2007	2008
Research and development, total	1000 mln €	10.3	10.5
- enterprises		5.5	5.3
- research institutions		1.3	1.3
- universities		3.6	3.9
Research and development, total	% GDP	1.8	1.8
- enterprises		1.0	0.9
- research institutions		0.2	0.2
- universities		0.6	0.7

Source: R&D Statistics and National Accounts

4. Discussion of classifications and definitions

Classification of activities

Enterprises with R&D as their main activity are rather well described in the Structural Business Statistics, due to the new NACE classification (NACE Rev. 2), which enables us to distinguish between types of research, as shown before in table 2. This is a considerable improvement compared to the former NACE classification (NACE Rev. 1.1).

As stated before, the Structural Business Statistics on NACE 72 provide only a partial insight in total R&D in the Netherlands. An important part of total R&D is carried out not in enterprises with R&D as their main activity, but in other enterprises, as well as in universities and research institutions.

By means of the R&D statistics, we can dispose of statistical data for R&D in enterprises in all NACE categories, universities and research institutions in terms of personnel, costs and finance. Total costs can be used as a proxy for turnover.

Product details

Product details are not available. The EC Regulation (No 451/2008) on the classification of products by activity (CPA) does not oblige, nor recommend, EU Member States to produce any product detail in this area.

Turnover and output

As described before, we do have turnover figures for the enterprises that have R&D as their main activity. For the other enterprises with R&D activities, and for universities and other research institutions, we can use total costs as a proxy for turnover. As a proxy for output we can use the number of employees in R&D.

Because we have no price data, we can not deflate the turnover data to get an indication of the volumes produced.

There are also no Independent data on the output of R&D available, but there is some information on patents and other intellectual property rights. However, we cannot relate this information to the enterprises carrying out the R&D activities yet.

Price indices

We have no price indices for R&D services in the Netherlands. Therefore we can not compare turnover/output data with price indices.

5. Conclusions

R&D activities amount to a total turnover of € 11 187 million in the Netherlands. Over 5 300 enterprises, universities and research institutions and 99 400 employees are involved.
The main issue in the statistical decription of R&D in the Netherlands is that a large share of R&D is carried out in big enterprises with other main activities. The population of enterprises and institutions involved in R&D is very diverse and consists of:
a) Enterprises with main activity R&D; these enterprises are described in the Structural Business Statistics (NACE 72);
b) Enterprises with their own R&D, but another main activity; the population of these enterprises with 10 or more persons employed is described in the R&D statistics (all NACE);
c) Universities, also described in the R&D statistics;
d) Research institutions, also described in the R&D statistics.
In the Structural Business Statistics we describe the turnover of enterprises with R&D as their main activity rather well. Small and medium enterprises prevail. We have no information on product details, nor on prices.
The R&D Statistics focus on enterprises, carrying out their own R&D, with 10 or more employees. The R&D Statistics cover research institutions and universities as well.
The two statistics complement each other, but there is also an overlap. To get an overall picture, we have to combine data from both statistics and be careful to avoid double-counting.
To further improve our view on R&D activities it would be advisable to use the same sets of questions for all enterprises involved in R&D in future questionnaires:

- The questions on turnover and costs from the Structural Business Statistics;
- The questions on imports and exports of R&D services from the Statistics on International Trade in Services;
- The questions on intracompany R&D services from the statistics on Holdings and intracompany services.

Another improvement would be to include enterprises with less than 10 employees in the R&D statistics.