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Rathenau Instituut

Total **Investment in Research and Innovation (TWIN)** 2012-2018

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Contents

This report by the Rathenau Instituut presents statistics on various Dutch ministries' direct and indirect expenditure on Research & Development (R&D). For the first time in this annual series, this report also includes data on innovation-related expenditure in the 2012-2018 period.

1 Summary

Total Investment in Research and Innovation 2012-2018 (in Dutch: TWIN)[1] surveys the Dutch national government's expenditure on R&D and innovation, based on the 2014 budgets of various ministries. While the report takes the budgetary measures of the 2012 Government Coalition Agreement into account, it does not include the supplementary budgetary agreements for 2014 (concluded in October 2013). We have surveyed both direct expenditure (such as institutional funding, grants, and research programme funding) and indirect expenditure (fiscal instruments). New in this year's report is the data on government expenditure intended to generate innovation. The report covers the 2012-2018 period. We have surveyed the various ministries' data on R&D and innovation expenditure for the 2014 budget year and the two previous years, and further provide a forecast for the 2015 to 2018 period.

1 The TWIN report is drawn up annually following a survey of the ministries and their budgets. The report was previously known by the Dutch acronym TOF (for Total Research Funding). The name of the report has been altered to reflect the inclusion of data on innovation in the 2012-2018 survey.

The Rathenau Instituut promotes the formation of political and public opinion on science and technology. To this end, the Institute studies the organisation and development of science systems, publishes about social impact of new technologies, and organises debates on issues and dilemmas in science and technology.

The main conclusions of the report are:

- Although R&D and innovation are becoming more closely linked - both in government policy-making and in its implementation - this tighter relationship is not seen in a larger share of government R&D expenditure being directed towards encouraging innovation. Expenditure on innovation accounted for 32 per cent of all expenditure on R&D and innovation in 2012, rising to almost 36 per cent in 2014 and then declining to 31 per cent in 2018. Because it is relatively difficult for the ministries to estimate this expenditure accurately, no firm conclusions can be drawn from this data. The ministries need more time and experience to master this procedure.
- In the 2012-2018 period, direct government spending on R&D will decline from 2013 onwards, both in absolute figures (12 per cent less) and in relative terms (from 0.78 to 0.65 per cent of GDP). This is largely the consequence of measures set out in the 2010 Coalition Agreement. The downward trend in expenditure is specifically evident in the following ministries: Foreign Affairs, Defence, Infrastructure and the Environment, Economic Affairs, and Health, Welfare and Sport. Indirect government expenditure on R&D by means of the Research and Development (Promotion) Act (WBSO) and Research and Development Allowance (RDA), which focus mainly on industry, will begin to decline after 2015.
- By and large, the trend in total expenditure on R&D and innovation, both direct and indirect (i.e. fiscal), follows the trend in R&D expenditure in that it will fall by approximately 550 million euros between 2012 and 2018. As a share of GDP, this represents a decline of 0.96 to 0.82 per cent. Indirect expenditure by means of fiscal instruments therefore does not compensate for the decline in direct R&D expenditure.
- Most government funding of R&D takes the form of institutional funding. The share of project funding will decline from 29 to 24 per cent in the years ahead, and the share of institutional funding will rise from 71 to 76 per cent.
- Viewed over a longer period (1999-2018), direct expenditure on R&D is declining as a percentage of GDP, from 0.79 in 1999 to 0.65 in 2018. The total sum of direct and indirect government expenditure as a percentage of GDP was relatively stable until 2008, increased for a few years thereafter, and will fall from 2014 onwards until below 1999 levels (0.86 in 1999 versus 0.80 in 2018).

The following table shows total estimated expenditure on R&D and innovation (both direct and indirect[2]).

Table 1 Direct and indirect government expenditure on R&D and innovation, 2012-2018, in millions of euros and percentages of GDP

	2012	2013	2014	2015	2016	2017	2018
Expenditure on R&D	4,676.8	4,607.5	4,533.8	4,296.1	4,175.6	4,135.1	4,110.7
- of which innovation-relevant	*752.0*	*710.9*	*759.5*	*653.5*	*571.7*	*541.3*	*525.2*
Expenditure on innovation not classified as R&D	229.5	299.7	247.8	224.4	177.4	145.4	137.6
Fiscal instruments for R&D and innovation	869.1	1,07.6	1,068.6	1,099.7	995.6	980.6	980.6
Total direct and indirect government expenditure on R&D and innovation	**5,775.4**	**5,982.8**	**5,850.3**	**5,620.2**	**5,348.7**	**5,261.1**	**5,228.9**
- of which direct expenditure on innovation	*981.4*	*1,010.6*	*1,007.3*	*877.9*	*749.2*	*686.7*	*662.8*
In percentages of GDP							
R&D expenditure as % of GDP (excluding fiscal instruments)	0.78	0.76	0.74	0.70	0.67	0.66	0.65
R&D and innovation expenditure as % of GDP (excluding fiscal instruments)	0.96	0.99	0.96	0.91	0.86	0.84	0.82

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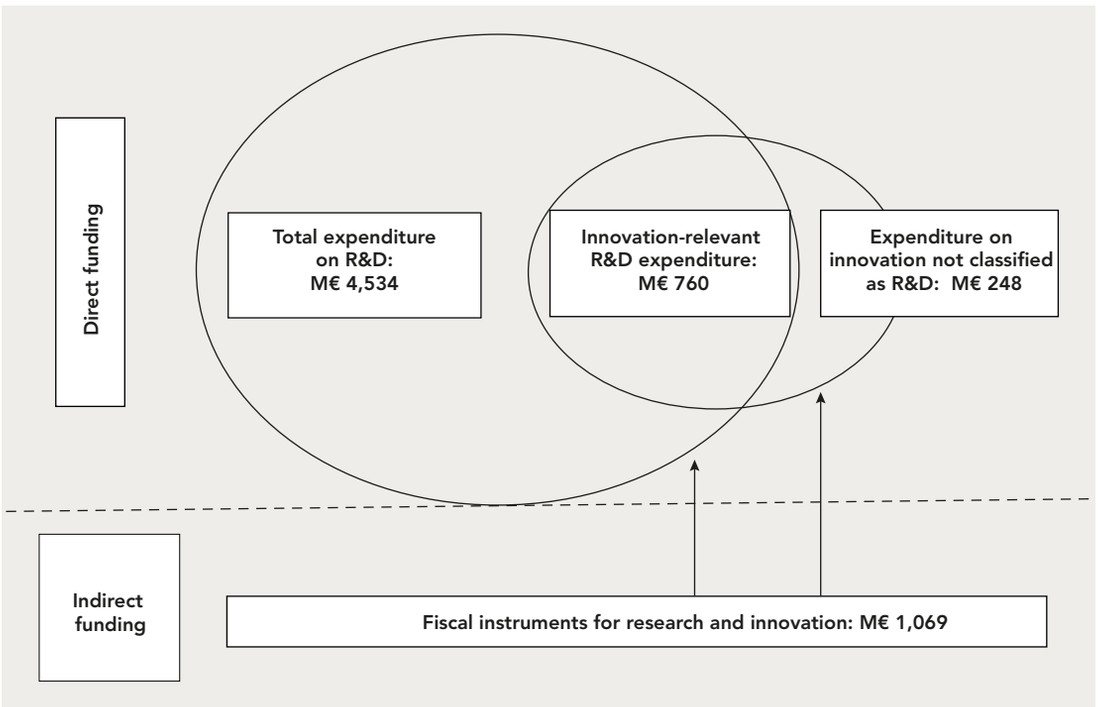
Note: direct expenditure on innovation is the sum of innovation-relevant R&D expenditure and innovation expenditure not classified as R&D

2 Strictly speaking, indirect expenditure is not government expenditure; it is actually a reduction in government revenues.

Figure 1 shows the relationship between the four components for 2014: R&D expenditure that is innovation-relevant; R&D expenditure that is not innovation-relevant; fiscal instruments; and innovation expenditure not classified as R&D.

Figure 1 Direct and indirect expenditure on R&D and innovation, 2014



This Facts & Figures publication is structured as follows.

a) explanation of data collection and most important terms used in the report;
b) R&D expenditure by the various ministries and key trends in their spending;
c) relative trend in R&D expenditure and an international comparison;
d) R&D expenditure by expenditure type;
e) indirect funding of R&D and innovation by means of fiscal instruments;
f) trend in both direct and indirect government expenditure on R&D;
g) expenditure on innovation.

2 Data collection

Data on the R&D budgets of the Dutch government has been collected for almost fifty years. The first report, the '1966 Science Budget', was compiled in 1966 by the then Ministry of Education and Science and covered the budget appropriations for R&D in 1964 and the budget as adopted for 1966. The report has changed over time from a purely budgetary statement into a policy-driven document with financial statements. Ultimately, even the budgetary data were no longer included in the report but sent separately to the House of Representatives.

In essence, the budgetary statement showing R&D expenditure has not changed. It is an itemised statement of the ministries' appropriations and outlays. More recently, data on fiscal instruments were added. The TWIN report strikes out in a new direction by also considering government expenditure on innovation. That is because the three components combined offer a more complete picture of government's efforts, and because they are also often interrelated. This report examines four components: expenditure on R&D, broken down into innovation-relevant and innovation-irrelevant; fiscal instruments; and expenditure on innovation.

Box 1: Explanation of terms

This Facts & Figures publication uses a number of terms that are not always precisely delineated. At times they may even overlap to some extent. The most important terms are Research and Development (R&D), (scientific) research, science, and innovation.

The terminology employed in this Facts & Figures publication is also used by the Dutch statistical office, Statistics Netherlands (CBS), which in turn is based on the OECD's Frascati Manual. The most recent version of the manual dates from 2002[3] work is currently under way to a new version.

In the Frascati Manual, R&D is the collective term for three types of activities carried out in the various sectors of the research system:
- basic research. This consists of experimental or theoretical work undertaken primarily to acquire new knowledge, without any particular application or use in view.
- applied research. This is research undertaken to acquire new knowledge, but directed primarily towards a specific practical aim or objective.
- experimental development. This is systematic work, drawing on existing knowledge gained from research or practical experience, which is directed towards producing new materials, products or devices or towards improving those already produced.

Science encompasses: objective human *knowledge* that has been systematically acquired (through scientific research) and organized, the process of knowledge acquisition, and the *community* in which this knowledge is acquired. That scientific community has its own set of principles, methods and conventions on which it bases its research. Scientific research consists of the activities of the scientific community and is mainly associated with basic research. Such research is conducted in the higher education sector and at non-academic research institutes. In addition, universities also undertake applied research and experimental development. Moreover, there are private companies that engage in basic research.

Innovation consists of activities that lead to new or vastly improved products, processes and services, or to administrative, organisational innovation within organisations or broader social alliances. Innovative activities that cannot be classified as R&D include the purchasing of products (e.g. software or equipment) or external expertise and activities such as industrial design. Innovation can thus be based on R&D activities but it can also take other forms. Statistics Netherlands uses R&D as one of the categories for charting innovation in the private sector.

All things considered, it is not always possible to draw a strict distinction between R&D and innovation. That distinction depends in part on the purpose of the activity whether a R&D activity can be called innovation-relevant.

In this Facts & Figures publication, we also provide statistics on government spending on innovation. We have added these data at the request of the ministries of Education, Culture and Science and Economic Affairs. The request came after the Government issued two policy memorandums concerning expenditure on research and innovation (17 October 2011[4] and 13 December 2012[5]). The aim of the TWIN survey is to provide harmonised statistical statements concerning the government's budgets for research and innovation.[6]

3 www.oecd.org/sti/frascatimanual

4 http://www.rijksoverheid.nl/documenten-en-publicaties/kamerstukken/2011/10/17/kamerbrief-rijksbreed-overzicht-innovatiemiddelen.html (in Dutch)

5 http://www.rijksoverheid.nl/documenten-en-publicaties/vergaderstukken/2012/12/13/memo-meerjarig-budgettair-beeld-innovatie-en-onderzoek-en-topsectorenbeleid.html (in Dutch)

6 In his covering letter to the Senate and House of Representatives about the TOF report 2011-2017, the State Secretary for Education, Culture and Science stated: 'In his response to the TOF Report, my predecessor therefore informed you last year that he and the Minister of Economic Affairs intended to review the possibility of integrating innovation expenditure into the TOF statement. That was not yet possible for this publication.' (see Parliamentary Document [Kamerstuk] 29 338, no. 119).

There is international consensus on the delineation of the term R&D, based on the definition given in the OECD's Frascati Manual (see Box). There is no such consensus with respect to delineating government budgets for innovation, however. That means that we must first delineate and define these budgets for ourselves. We have, however, made use of the OECD terminology for collecting data on innovation in industry. This is the first time that the Rathenau Instituut has collected data on government budgets for innovation. We will continue to refine our methodology in the years ahead.

The underlying principles for this first data collection on R&D and innovation were:
- that, owing to international agreements (based on an EU-EUROSTAT Regulation concerning the delivery of data on government expenditure on R&D), it must remain possible to distinguish between R&D expenditure and innovation expenditure that does not involve R&D;
- that the effort made on behalf of the ministries to collect the data had to be proportionate to the output;
- that the definition of innovation expenditure had to match internationally accepted definitions as closely as possible (as with the definition of R&D expenditure).

In line with the definition for R&D, we define government budgets for innovation as expenditure directed at funding:
activities (scientific, technological, organisational, commercial) that are primarily geared towards and intended to generate innovation in both the private and public sector, leading to:
- *new or vastly improved products,*
- *new or vastly improved processes / methods,*
- *new or vastly improved services,*
- *administrative, organisational or marketing innovation.*

In consultation with the ministries, it was decided, for the time being, to adhere to a relatively strict definition when gathering data on innovation budgets: **the government initiatives or interventions concerned must have the specific aim of promoting innovation or innovation-related activities in the relevant sector.** In other words, expenditure that can be linked only in part or only loosely with innovation activities would not be included.

It is not possible to draw a sharp distinction between R&D expenditure and innovation expenditure. The two overlap, for example if R&D activities are part of an innovation process. That is why a number of the budget items in the TOF reports that were (in part) relevant for innovation were not yet defined as such. In this TWIN report, we aim to examine the ministries' expenditure on R&D that is innovation-relevant, and expenditure specifically intended for innovation not classified as R&D. General expenditures that can be assumed to be related to innovation but that may only lead to innovation in the longer term will not be included. Examples include expenditure on education and General University Funds.

The survey distributed to the ministries distinguishes between the following categories of government expenditure:
a) institutional funding of R&D (fixed amounts allocated to institutes), with the ministries being asked to indicate the innovation-relevant portion;
b) project funding of R&D (both projects and programmes), with the ministries being asked to indicate the innovation-relevant portion;
c) other expenditure on innovation not classified as R&D;
d) tax schemes for both R&D and innovation.

The first two categories formed the basis for previous TOF reports. The third category is new. The fourth category has been altered. While the reports of previous years also covered tax schemes, we have now, for the first time, included questions about tax schemes on innovation.

3 R&D expenditure, by ministry and trends

Table 2 shows R&D expenditure by ministry for the 2012-2018 period and is based on the 2014 budgets. The figures for 2012 are actual outlays. The figures for 2013 are obligations for that year insofar as known when the provisional budgets for 2014 were published (on Budget Day, 17 September 2013). For 2014, the figures are taken from the budget proposal. The figures for 2015-2018 are multi-annual forecasts.

Table 2 R&D data by ministry (cash basis), in millions of euros (gross expenditure)

	2012	2013	2014	2015	2016	2017	2018
Ministry of General Affairs	0.7	0.6	0.6	0.6	0.6	0.6	0.6
Ministry of Foreign Affairs	61.3	53.0	46,2	37,6	36.6	36.7	36.7
Ministry of Security and Justice	25.9	25.0	24.9	24.2	23.7	23.2	23.0
Ministry of the Interior and Kingdom Relations	22.8	19.6	18.8	18.5	18.0	17.8	17.8
Ministry of Education, Culture and Science	3,225.5	3,224.1	3,250.4	3,172.8	3,155.7	3,154.7	3,153.4
Ministry of Defence	70.7	63.0	62.8	59.9	57.8	57.6	57.6
Ministry of Infrastructure and the Environment	114.6	102.4	67.3	51.3	48.6	47.3	46.7
Ministry of Economic Affairs	951.6	941.1	916.5	795,8	703.9	663.8	639.0
Ministry of Social Affairs and Employment	0.3	1.5	1.3	1.4	1.4	1.4	1.4
Ministry of Health, Welfare and Sport	203.5	177.1	145.1	133.9	129.4	132.2	134.7
Overall total	**4,676.8**	**4,607.5**	**4,533.8**	**4,296.1**	**4,175.6**	**4,135.1**	**4,110.7**

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Source: Rathenau Instituut, based on data provided by the ministries

Note 1: Direct funding of universities is included in the figures for the Ministry of Education, Culture and Science. Table 2 shows the estimated portion of this funding earmarked for research. The figures for this portion include funding allocated by the Ministry of Economic Affairs to Wageningen University and Research Centre; that amount (estimated at approximately one hundred million euros in 2014) has been deducted from the figures in Table 2 pertaining to the Ministry of Economic Affairs.

Note 2: The figures for direct funding of universities also include a proportionate share of students' statutory tuition fees. These are not, strictly speaking, government expenditures, but students' private contributions.

More detailed figures (in Dutch only) for the individual budget items are available for each ministry.[7] They can be found at a special website on the Dutch Science System maintained by the Rathenau Instituut: http://www.rathenau.nl/web-specials/de-nederlandse-wetenschap/financiering/overheid/uitgaven-ministeries.html.

Total government appropriations and outlays for R&D will decline between 2012 and 2018 by 12.1 per cent, from 4.7 to 4.1 billion euros (566 million euros less). The downward trend already became evident in the TOF reports of the past few years and is the result of measures set out in the government Coalition Agreements of 2010 and 2012. Essentially, these measures mean the end of the innovation programmes supported by the Ministry of Economic Affairs and the projects funded through the Economic Structure Enhancement Fund (FES)[8] at the various ministries. The biggest decline in absolute terms is at the Ministry of Economic Affairs (313 million euros; 33 per cent in relative terms). The steepest relative decline, 59 per cent, is at the Ministry of Infrastructure and the Environment. Other

7 Examples of budget items are the funds that a ministry might transfer to an institute such as TNO or funding intended for a research programme such as the Innovational Research Incentives Scheme [Vernieuwingsimpuls] at the Ministry of Education, Culture and Science.

8 The Economic Structure Enhancement Fund (FES Fund) is part of a national incentive programme for research meant to position the Netherlands as a strong knowledge-based economy. The FES Fund is funded from the Netherlands' natural gas revenues.

sharp declines are at the Ministry of Foreign Affairs (40 per cent), Health, Welfare and Sport (34 per cent) and Defence (19 per cent).

Table 3 compares the figures from the previous TOF report with those in the present TWIN report. The years covered in both reports differ by between one hundred million and somewhat more than two hundred million euros, representing the sum total of credits and debits for each individual ministry. The biggest changes have occurred in the Ministries of Education, Culture and Science and Economic Affairs. We will look at this in greater detail in our discussion of each ministry.

Table 3 Comparison of government R&D expenditure, in millions of euros (TOF 2011-2017 versus TWIN 2012-2018)

	2012	2013	2014	2015	2016	2017	2018
TOF 2011-2017	4,891.5	4,750.0	4,632.8	4,404.6	4,298.5	4,286.7	--
TWIN 2012-2018	4,676.8	4,607.5	4,533.8	4,296.1	4,175.6	4,135.1	4,110.7
Difference	-214.7	-142.5	-99.0	-108.5	-122.9	-151.6	

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The figures are related to policy trends and (proposed) measures at each ministry. We review the most important of these below. We also zoom in on the relevant measures from the 2014 budgetary agreements. As we mentioned above, these measures have not yet been taken into account in the figures presented in Table 2. The figures do reflect the measures announced in the Coalition Agreement of October 2012, which concerned additional budgets and budget cuts (see Section 4 of the TOF report for 2011-2017).[9]
Many of the trends in the ministries' research budgets were already noticeable in the TOF reports for 2010-2016[10] and 2011-2017.

- **Ministry of Foreign Affairs**: the research budget is smaller than in the TOF report for 2011-2017, published in 2013. This is owing to cuts in the ministry's overall budget. The difference comes to almost 30 million euros, meaning the budget has been reduced by almost half. For example, the ministry will cease its contribution to the Royal Tropical Institute (KIT) in 2014, and "the research programme" budget item will be considerably reduced in size.
- **Ministry of the Interior and Kingdom Relations**: the ministry's research budget has increased, specifically in the area of housing/living environment.
- **Ministry of Education, Culture and Science**: the October 2012 Coalition Agreement contained a measure aimed at boosting basic and practice-based research through programmes (as yet undesignated) funded by the Netherlands Organisation for Scientific Research (NWO).[11] The budget will initially increase to 75 million euros in 2017 and then climb to 150 million euros a year. Starting in 2014, the sum of 22 million euros has been earmarked for this purpose in the ministry's budget for NWO, giving this intermediary organisation a narrow plus margin. The slight drop in the ministry's overall budget is due mainly to a smaller share of the funding paid directly to the universities being earmarked for research: the research coefficient used to calculate the distribution of this lump-sum amount between education and research has been modified.[12]
  The share accounted for by R&D at the Royal Academy[13] institutes is also smaller owing to an adjustment for non-R&D activities.[14]

9 http://www.rathenau.nl/publicaties/publicatie/totale-onderzoek-financiering-tof-2011-2017.html
10 http://www.rathenau.nl/publicaties/publicatie/feiten-en-cijfers-overzicht-totale-onderzoek-financiering-tof-2010-2016.html
11 NWO is the Dutch research council, an intermediary organisation that allocates government funding to universities and research programmes.
12 Based on figures provided by Statistics Netherlands. This is not an budget cut, but a shift in the scale of educational and research activities at universities. The TOF report 2011-2017 (available in Dutch only) provides a more detailed explanation of the statistical office's methodology (see Kader 2 on page 16).
13 The Royal Netherlands Academy of Arts and Sciences (KNAW) is an intermediary organisation that distributes government funding mainly to its own 19 national research institutes.
14 It was set at 95 per cent and adjusted in this report to 60 per cent based on figures from the Academy's annual report.

- **Ministry of Infrastructure and the Environment**: cuts in the ministry's overall budget have led to a further reduction in its R&D budget compared with the TOF report for 2011-2017.
- **Ministry of Economic Affairs**: the ministry's R&D budget is set to decline over a longer period. However, compared to the TOF report for 2011-2017, the budget for 2014-2017 will increase slightly, to 55 million euros. On the minus side is the Innovation Fund[15] (the relevant funding has been transferred to innovation not classified as R&D). In addition, a number of items have been included under the 'Top Sectors'[16] category (for example the innovation performance contracts, which cover basic and applied research and valorisation). On the plus side are increases in the government premium on private-sector investment in the Top Consortiums for Knowledge and Innovation (in which entrepreneurs and researchers work together) and in the budgets for NWO's STW Technology Foundation, the Top Sectors, and international space exploration (European Space Agency).
- **Ministry of Health, Welfare and Sport**: the budget increased slightly for the first two years of the series (2012 and 2013), although this is mainly due to improved detection of research appropriations within the Ministry's budget. The budget falls slightly after 2013.

In terms of research, the 2014 Budgetary Agreements (concluded in October 2013)[17] will add one hundred million euros to the budget of the Ministry of Education, Culture and Science from 2015 forward, earmarked for NWO's open competitive programmes and other matters. At least half of this sum will be applied towards the national government's obligations under the European Union's Horizon 2020 research and innovation programme. The Agreements have not yet been incorporated into this TWIN report. Their effect on the total sum of government expenditure will be minimal (somewhat more than two per cent).

4 Direct government expenditure: relative trend

To put the figures given in Table 2 into perspective, Table 4 contains data on direct government R&D expenditure for the 2012-2018 period as a percentage of Gross Domestic Product (GDP). This is also known as the 'R&D intensity of government expenditure'. By linking the expenditure data to GDP, it becomes possible to compare the Netherlands to other countries.

The table is based on the most recent GDP data for the 2012-2014 period as issued by the Netherlands Bureau for Economic Policy Analysis (CPB), as well as a forecast of the trend between 2015 and 2018 inclusive.

Table 4 Trend in government R&D expenditure, in millions of euros and in percentages of GDP[18]

	2012	2013	2014	2015	2016	2017	2018
Government R&D expenditure (in € millions)	4,676.8	4,607.5	4,533.8	4,296.1	4,175.6	4,135.1	4,110.7
GDP (in € billions)	599.3	603	611	617	623	630	636
Total government R&D expenditure as % of GDP	0.78	0.76	0.74	0.70	0.67	0.66	0.65

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Note: GDP 2012-2014 is based on the CPB's most recent data (CPB's short-term forecasts December 2013, found at http://www.cpb.nl/en/number/cpbs-short-term-forecasts-december-2013). GDP growth after 2014 has been forecast at a volume growth of 1.0 per cent per annum.procent

15 The Innovation Fund is a fund for small and medium sized companies. It is a framework for instruments financing innovation and fast-growing innovative companies. The focus is on the stage where knowledge is converted into a final product.

16 Funding provided under the Dutch Government's Top Sector Policy (Topsectorenbeleid) is meant to encourage government, the research community and businesses in nine leading economic sectors to work together on knowledge valorisation and innovation with a view to boosting the Netherlands' knowledge economy.

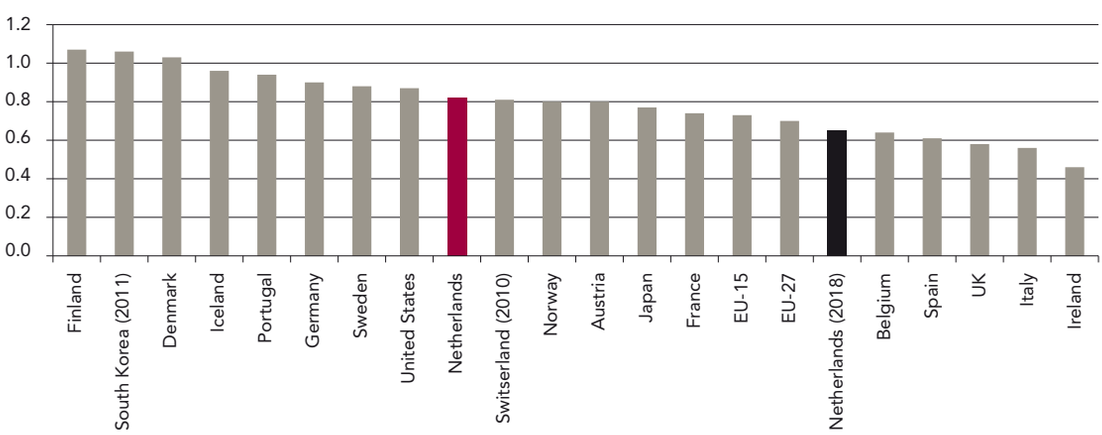
17 http://www.rijksoverheid.nl/documenten-en-publicaties/kamerstukken/2013/10/11/begrotingsafspraken-2014.html

18 This does not take into account Eurostat's planned revision of the EU's GDP, which is expected to increase GDP growth by a few per cents (http://www.euractiv.com/euro-finance/eurostat-revise-eus-annual-gdp-f-news-532830).

Table 2 shows that in the years ahead, government will invest less in direct R&D expenditure, both in actual and in relative terms. This is in line with the figures in earlier TOF reports.

The Netherlands is currently in ninth place when it comes to government investment in R&D (compared to the countries in Figure 2). There is no data on long-term government investment available for the other countries in this figure. That makes it impossible to say anything conclusive about the Netherlands' international standing in the years ahead. If other countries maintain their R&D expenditure at 2012 levels, the Netherlands would drop several places in the rankings shown in Figure 2.[19] It could also mean that the Netherlands would be unable to meet the targets to which it has agreed within the EU (i.e. an R&D intensity of 2.5% by 2020), but this also depends on investments of the private sector and foreign sources of funding.[20]

Figure 2 Direct government budgets for R&D as percentage of GDP, 2012[21]



Source: EUROSTAT

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Note: Netherlands (2018): based on the figures for 2018 in this TWIN report for 2012-2018.

5 R&D by expenditure type

Ministries can spend their research budgets in different ways. One important variable in this regard is the difference between institutional funding on the one hand and project or programme funding on the other.

Institutional funding consists of funding allocated to institutions but not earmarked for any particular projects or programmes. The institutions do not need to compete to obtain this funding. One example is the direct funding of universities, which are at liberty to spend the funds as they see fit. **Project or programme funding** is funding allocated to a group or individual to conduct research activities that are subject to scope, budget and time restrictions. In many cases, the funds are distributed through a competition. Examples include contract research commissioned by the ministries and the calls for research proposals issued by NWO. Not all R&D expenditure falls into one of these two categories, however. Nor are the categories strictly defined; combinations are also possible. One example would be the demand-driven funding of the Netherlands Organisation for Applied Scientific Research (TNO).[22] TNO is not entirely at liberty to spend its money as it sees fit because the ministries also have a say in how research funded in this way is programmed. Nevertheless, these definitions give us a general idea of how the ministries distribute their funds and what trends are evolving in the various

19 This is difficult to estimate because some countries have risen in the rankings in recent years, whereas others have dropped.
20 In 2012, total R&D intensity (i.e. both government and private sector) was 2.16 per cent (an increase of 0.13 per cent compared with 2011)..
21 In international analyses, the government budgets are referred to as Government Budget Appropriations or Outlays on R&D (GBAORD).
22 TNO is an independent statutory organisation that conducts applied research in support of government, NGOs and the private sector.

forms of public research funding. For example, TNO's demand-driven funding is categorised under 'institutional funding' because TNO is not required to compete for these funds.

A Rathenau Instituut report on public funding of research between 1975 and 2005[23] shows that there was a sharp increase in the percentage of project or programme funding from less than 10 per cent in 1975 to approximately 25 per cent in 1990, levelling off until 2005. Later OECD project figures revealed that the increase continued in the 2000-2008 period.[24] It amounted to somewhat less than thirty per cent (the two series of figures are not entirely comparable, however).

It is interesting to consider the relationship between institutional funding and project funding and how that relationship will change in the longer term. To do this, we have allocated all ministerial expenditure to one or the other category and added them up ministry by ministry. The table below shows the trend in the percentage of project funding per ministry.

Table 5 Share of total R&D expenditure accounted for by project funding, by ministry (in percentages)

	2012	2013	2014	2015	2016	2017	2018
Ministry of General Affairs	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ministry of Foreign Affairs	89.2	92.0	99.5	99.4	99.4	99.4	99.4
Ministry of Security and Justice	24.7	23.9	25.2	23.8	23.9	24.5	24.7
Ministry of the Interior and Kingdom Relations	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ministry of Education. Culture and Science	17.8	17.5	17.4	16.0	16.0	15.9	15.9
Ministry of Defence	58.2	54.0	54.3	56.8	58.9	58.8	58.8
Ministry of Infrastructure and the Environment	54.5	57.4	31.2	22.7	23.0	23.6	23.9
Ministry of Economic Affairs	47.9	51.4	53.4	51.1	48.9	47.5	46.0
Ministry of Social Affairs and Employment	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ministry of Health, Welfare and Sport	71.9	69.0	60.4	57.8	56.7	58.6	59.4
Overall total	**29.2**	**29.1**	**28.0**	**25.6**	**24.6**	**24.2**	**23.9**

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The figures show that the share accounted for by project funding will decline in the years ahead - a trend that could have been anticipated based on the cuts in the FES Fund and the redefinition of the Ministry of Economic Affair's innovation programmes. There are also notable differences in how the ministries allocate their research funding. Some ministries work only with project funding (General Affairs, Interior and Kingdom Relations, and Social Affairs and Employment). Without exception these are ministries that have small research budgets. There are also ministries that work mainly with institutional funding (for example Education, Culture and Science). The sizeable share of institutional funding at the Ministry of Education, Culture and Science is mainly because it provides structural funding to institutions of higher education. These lump-sum amounts account for three quarters of the Ministry's research budget. Another striking trend is the sharp decline in project funding at the Ministry of Infrastructure and the Environment. Combined with the overall trend in total R&D expenditure, institutional funding of this ministry thus remains at the same level. The Ministry of Economic Affairs occupies a middle position in our list. The share accounted for by project funding will remain reasonably stable, a remarkable result given the budget cuts in programmes covered by the FES Fund and the redefinition of the innovation programmes. It means that institutional funding is declining at more or less the same rate. The TOF reports already showed that this will have consequences for the six institutes for applied research united in the TO2 Federation (TNO, the four Large Technological Institutes or GTIs - the Energy Research Centre of the Netherlands or ECN, the Maritime Research

23 Versleijen, A. (ed.), Dertig jaar publieke onderzoeksfinanciering in Nederland 1975-2005, The Hague, 2007.
24 Steen, J. van, Modes of Public funding of R&D: Towards Internationally Comparable Indicators, STI Working Paper 2012/4, OECD, Paris.

Institute Netherlands or MARIN, Deltares and the National Aerospace Laboratory or NLR - and the research institutes at Wageningen University and Research Centre).

6 Indirect expenditure on R&D and innovation: from specific to generic policy

The previous sections looked at direct government funding of R&D as channelled through institutions, programmes and projects. Alongside direct government funding, there is also an indirect form of funding, specifically through tax facilities - a form that is gaining more importance in the Netherlands and elsewhere. As indicated earlier, this is not, strictly speaking, government expenditure but rather a reduction in tax revenues.

The Netherlands first introduced a tax incentive for R&D activities in the mid-1990s. The scheme is known as the Research and Development (Promotion) Act [Wet Bevordering Speur- en Ontwikkelingswerk, WBSO]. The WBSO scheme is meant to lower wage costs associated with R&D, thereby encouraging research and development in industry, and especially in small businesses. NL Agency[25] data shows that in 2012, small and medium-sized enterprises accounted for 97 per cent of all participants in the WBSO scheme.[26]

The 2010 Coalition Agreement introduced a shift from direct funding of R&D to indirect funding, with more emphasis on fiscal instruments and less emphasis on subsidising innovation programmes such as those funded by the Ministry of Economic Affairs. In addition to boosting the WBSO scheme, the Government also introduced a new R&D-related fiscal instrument, the Research & Development Allowance (RDA), which covers non-staff expenditure. The RDA scheme allows businesses to deduct a larger amount of tax for R&D investment and commercialisation. Businesses must submit their RDA and WBSO applications simultaneously. As in the case of the WBSO scheme, NL Agency (now: the Netherlands Enterprise Agency) administers the scheme. The actual tax benefit is obtained when the relevant business files its corporate tax returns. The fiscal instruments have a particular ceiling. If that ceiling is exceeded in a given year, then the excess is deducted from the budget for the years thereafter.

In addition to the WBSO and RDA tax schemes, there is also the 'Innovation Box'. Part of the primary corporate tax structure, the Innovation Box is a special tax regime for income generated from self-developed intangible assets for which a patent exists or for which an R&D certificate[27] has been issued in the research phase. Under certain conditions, the net income so generated is taxed at a rate of five per cent. The Innovation Box is not counted as budgeted tax expenditure[28] and therefore does not appear among the tax expenditures listed in Appendix 5 of the Budget Memorandum or other multiyear budget statements. When the Innovation Box regime was introduced, the annual structural cost to government was estimated at 625 million euros. In 2010, the cost to government was 324 million euros. For 2011, the cost to government was estimated at 567 million euros, based on the returns filed.[29]

Figure 3 is a financial statement showing the Netherlands' R&D-related fiscal instruments over the course of twenty years. These instruments also serve to encourage innovation. The Innovation Box is not included in this figure because it falls under the primary corporate tax structure and is not a budgeted tax expenditure. What the figure shows is that the amounts deducted under the WBSO and RDA fiscal instruments rise sharply from 2008 forward and then decline again from 2016 onwards. That is because the Ministry of Economic Affairs will be obliged to curtail its fiscal innovation policy, with long-term cuts of up to 275 million euros in 2017 and thereafter. How the Ministry will actually make the necessary cuts in 2015 and later has not yet been decided; for now, it has only recorded the necessary reductions technically. The ratio between instruments shown in Figure 3 may therefore change from 2015 onwards.

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25 On 1 January 2014, NL Agency merged with the Dienst Regelingen to form the Netherlands Enterprise Agency [Rijksdienst voor Ondernemend Nederland, RVO.nl]. The agency helps entrepreneurs obtain grants, find business partners, identify know-how and comply with laws and regulations. Part of the Ministry of Economic Affairs, it works at the instigation of ministries and the European Union.

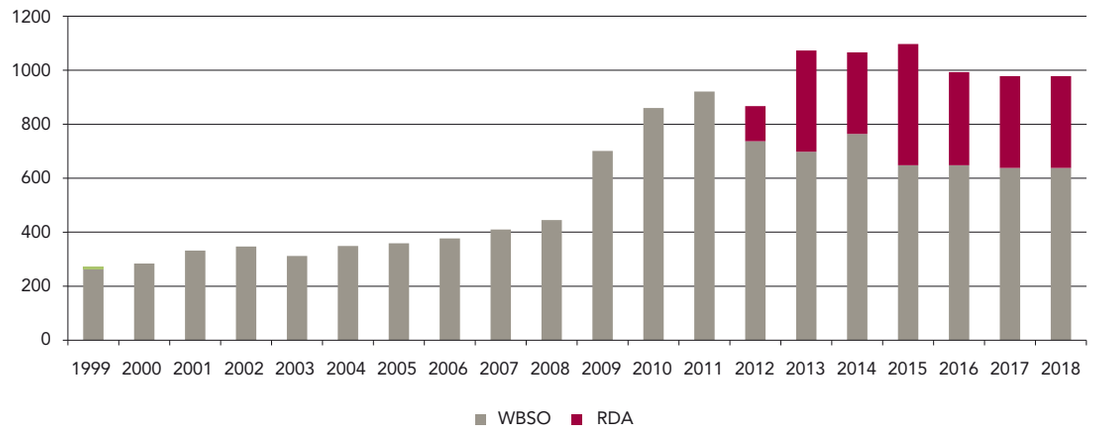
26 http://www.rvo.nl/sites/default/files/Focus%20op%20speur-%20en%20ontwikkelingswerk%20van%20de%20WBSO%20RDA%20in%202012.pdf

27 NL Agency/ RVO.nl issues R&D certificates for R&D activities to which the WBSO tax incentive applies.

28 A budgeted tax expenditure means that the government budget (Budget Memorandum) has identified a budget for the relevant tax facility.

29 The appropriation for 2011 is based on the memorandum that the State Secretary for Finance sent to the House of Representatives on 12 July 2013 about the evaluation of the Innovation Box (http://www.rijksoverheid.nl/documenten-en-publicaties/kamerstukken/2013/07/12/kamerbrief-over-stand-van-zaken-evaluatie-innovatiebox.html).

Figure 3 Fiscal instruments for R&D and innovation, in millions of euros



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Source: NL Agency (1999-2011) and Ministry of Economic Affairs (2012-2018 budget)

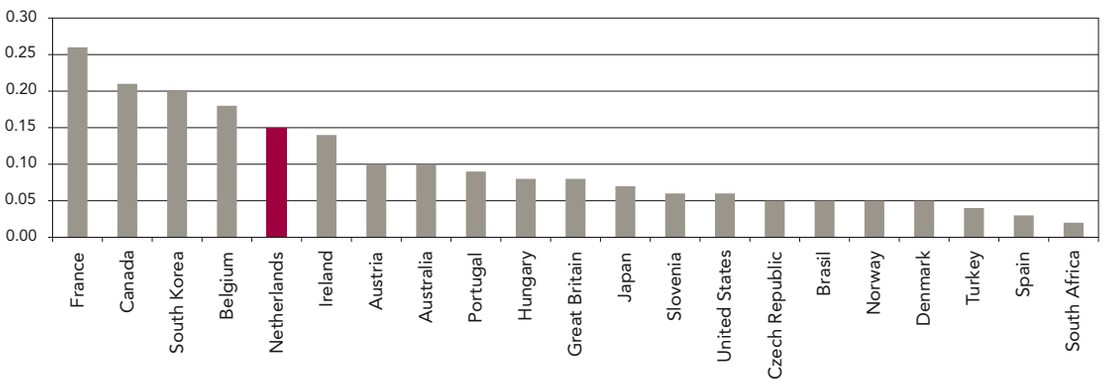
Note: The RDA amount underspent in 2012 has been carried over to the 2015 budget
Excluding the Ministry of Infrastructure & the Environment's fiscal schemes owing to the limited size of those schemes

There is international consensus that looking exclusively at direct R&D funding produces an incomplete picture of total public support for R&D. This realisation has not yet led to any standard statistics that combine the two and then use them to calculate the R&D and innovation intensity of government expenditure.[30] However, increasing efforts are being made to document the indirect expenditure of the various member states of the Organisation for Economic Co-operation and Development (OECD).[31] OECD data show that a growing number of these countries - 27 at the moment - are making use of fiscal instruments. Some, such as Finland, Sweden, Germany and Switzerland, do not do so. What hampers analysis is that some countries do have such instruments but cannot provide any estimates of the amounts involved. Figure 4 shows both direct and indirect government support for business R&D. The OECD data reveal major differences between the countries, both in the direct and indirect funding categories. The figures indicate that the Netherlands is in the vanguard when it comes to indirect government funding.

30 Including fiscal schemes does not have a direct effect on a country's total expenditure as a whole because what those measures cost government in terms of revenue is precisely equal to what businesses save on R&D. The assumption, however, is that the tax incentives will encourage businesses to spend more on R&D (that is, after all, the whole point of the exercise), and that their spending will impact a country's total R&D expenditure.

31 See the OECD's STI Scoreboard 2013 and the policy brief *Maximising the benefits of R&D tax incentives innovation* (www.oecd.org/sti/rd-tax-incentives-for-innovation.pdf).

Figure 4 Indirect government funding of business R&D, as a percentage of GDP, 2011

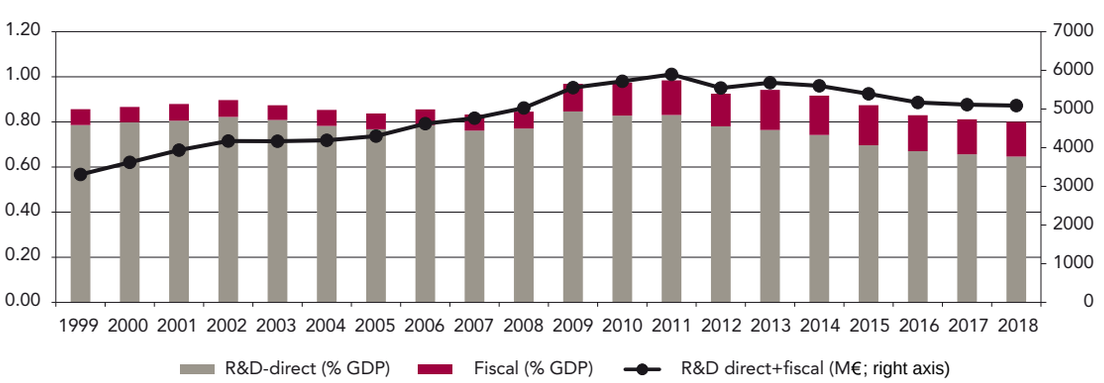


Source: OECD, STI Scoreboard 2013 (http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-scoreboard-2013_sti_scoreboard-2013-en)

7 Direct and indirect funding of R&D

This section combines direct and indirect government funding of R&D and considers the trend from 1999 onwards (Figure 5).

Figure 5 Direct and indirect government funding of R&D, as a percentage of GDP and in millions of euros



Sources: for direct government funding, Rathenau Instituut; for indirect government funding, Ministry of Economic Affairs

The figure shows that as a percentage of GDP, direct and indirect expenditure was relatively stable in the 1999-2008 period (0.83-0.90 per cent), rose to 1 per cent in the 2009-2011 period in part owing to some crisis measures, and is set to decrease starting in 2014 until it falls below the 1999 level (0.86 in 1999 versus 0.80 in 2018).

Table 6 Direct and indirect government funding of R&D, in millions of euros, 2012-2018

	2012	2013	2014	2015	2016	2017	2018
Direct government expenditure on R&D	4,677	4,608	4,534	4,296	4,176	4,135	4,111
Indirect government expenditure on R&D: WBSO	737	698	764	648	648	638	638
Indirect government expenditure on R&D: RDA	130	375	302	449	345	340	340
Indirect government expenditure on R&D by the Ministry of Infrastructure and the Environment	2.1	2.6	2.6	2.7	2.6	2.6	2.6
Direct and indirect government expenditure on R&D, total	**5,546**	**5,684**	**5,603**	**5,396**	**5,172**	**5,116**	**5,092**

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8 Government expenditure on innovation

As indicated in Section 2, this Facts & Figures publication attempts to survey government expenditure on innovation. Spending on innovation is divided into three categories:

a) R&D expenditure that is also innovation-relevant;
b) expenditure meant for innovation not classified as R&D; and
c) fiscal instruments for R&D and innovation.

Table 7 Innovation and innovation-relevant R&D expenditure by government, in millions of euros, 2012-2018

	2012	2013	2014	2015	2016	2017	2018
Innovation-relevant R&D expenditure, by							
- Ministry of Security and Justice	11.1	10.5	10.2	10.1	9.6	9.2	9.1
- Ministry of Education, Culture and Science	22.6	13.9	10.2	8.0	8.0	8.0	8.0
- Ministry of Defence	70.7	63.0	62.8	59.9	57.8	57.6	57.6
- Ministry of Economic Affairs	647.6	623.5	676.3	575.5	496.3	466.5	450.6
Total innovation-relevant R&D expenditure	**752.0**	**710.9**	**759.5**	**653.5**	**571.7**	**541.3**	**525.2**
Expenditure on innovation (not classified as R&D), by							
- Ministry of the Interior and Kingdom Relations	9.5	10.2	1.0	-	-	-	-
- Ministry of Defence	10.0	-	-	-	-	-	-
- Ministry of Infrastructure and the Environment	2.1	5.0	4.1	6.8	1.0	-	-
- Ministry of Economic Affairs	124.6	194.3	169.8	157.8	107.7	97.2	95.2
- Ministry of Health, Welfare and Sport	82.3	90.1	72.9	59.8	68.8	48.2	42.4
Total expenditure on innovation (not classified as R&D)	**229.5**	**299.7**	**247.8**	**224.4**	**177.4**	**145.4**	**137.6**
Fiscal instruments for R&D and innovation	**869.1**	**1,075.6**	**1,068.6**	**1,099.7**	**995.6**	**980.6**	**980.6**
Total innovation and innovation-relevant R&D expenditure	**1,850.6**	**2,086.2**	**2,075.9**	**1,977.6**	**1,744.7**	**1,667.3**	**1,643.3**
As percentage of all expenditure on R&D and innovation	32.0	34.9	35.5	35.2	32.6	31.9	31.4

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In the sum total of all expenditure on R&D and innovation (fiscal and non-fiscal), expenditure on innovation accounted for 32 per cent in 2012, rising to almost 36 per cent in 2014 and then declining to 31 per cent in 2018. The experimental nature of these figures makes it difficult to get to any firm conclusions as yet. The innovation figures presented are not accurate enough owing to the difficulty of estimating such expenditures. A number of ministries have indicated that they need more time and experience and believe that they will do better in that respect in the future.

The following ministries have indicated that they do not have innovation expenditure or innovation-relevant expenditure, or that they are not able (up to now) to provide data on such expenditure: Ministry of General Affairs, Ministry of Foreign Affairs, and Ministry of Social Affairs and Employment.

The ministries below do spend part of their budgets on innovation:

- **Ministry of the Interior and Kingdom Relations**: the Ministry has various innovation schemes related to the built environment.
- **Ministry of Education, Culture and Science**: various units within the ministry have indicated that they have no innovation-relevant expenditure within the context of R&D funding. However, some of the funds earmarked for education ultimately go to support innovative activities because education prepares pupils and students for the labour market. Some of the funding earmarked for research also ultimately impacts innovative activities, a factor that also applies for the funding that NWO is using within the context of the Top Sectors policy. For the time being, we have not labelled these NWO expenditures as such. Based on our definitions, no clear distinction can be made between the elements of the NWO budget that are and are not relevant for innovation.
- **Ministry of Defence**: this Ministry's total expenditure on R&D (in Defence's terminology: research and technology) is categorised as innovation-relevant. The Ministry also funds innovation that is not classified as R&D through the channel of the CODEMO innovation fund (Defence Material Development Committee). The fund is budgeted under the Defence Investment Plan (DIP). At the proposal of the House of Representatives, the fund was given a lump-sum increase from five to ten million euros. The scheme offers financial support to small and medium-sized enterprises that are willing to convert innovative ideas into products useful to the Ministry. Once a business qualifies for the scheme, the Ministry will cover half the development costs. If the development is successful, the Ministry can function as a launching customer; by purchasing the product, it may encourage the business to launch it on the market. The royalties are reinvested in the fund.
- **Ministry of Infrastructure and the Environment**: the Ministry has some expenditure on innovation not classified as R&D. It has also indicated that it will be better able to provide data on innovation expenditure for the following report (based on the 2015 budget).
- **Ministry of Economic Affairs**: most items are labelled as innovation-relevant, with the percentage varying. In total, innovation-relevant expenditure accounts for two thirds to three quarters of the Ministry's expenditure. It also has innovation expenditure not classified as R&D, for example spending associated with the Innovation Fund.
- **Ministry of Health, Welfare and Sport**: this Ministry labels a number of budget items as innovation expenditure not classified as R&D. Most of this expenditure falls under the heading Life Sciences & Health Top Sector and is destined for programmes run by RIVM as well as InTraVacc, ZonMw[32] and FES programmes. Because these items were included in the Ministry's previous statements as innovation expenditure and to ensure consistency with earlier TOF reports, we have labelled them 'innovation expenditure not classified as R&D', and not 'R&D expenditure, innovation-relevant'.

In all of the above cases, we must be aware that the figures given are estimations. That is also the case for R&D, although there is a much longer history of expenditure in that area.

For itemised figures, see the spreadsheet available (in Dutch) at http://www.rathenau.nl/web-specials/de-nederlandse-wetenschap/financiering/overheid/uitgaven-ministeries.html.

In seeking out the ministries' innovation funding, we also came across 'innovation-specific procurement' (see also Box 2). Two types of procurement instruments are available: innovation-specific contracting and the Small Business Innovation Research Programme (SBIR),[33] meant to encourage businesses to develop innovative solutions to issues facing society.

32 RIVM: National Institute for Public Health and the Environment; InTraVacc: Institute for Translational Vaccinology; ZonMW: Netherlands Organization for Health Research and Development.

33 The SBIR programme is administered by the Netherlands Enterprise Agency.

In innovation-specific contracting, the government acts as a 'lead customer' that spends money in order to deploy innovation and the innovative capacity of industry to solve the problems facing society. At the same time, government wants to encourage the domestic market of innovative businesses. When government acts as a lead customer, it can play a key role in initiating innovation in those areas in which it dominates the demand side of the market. The government has developed a programme for this purpose with projects covering eight areas of society that demand attention. 'Contracting' is broadly defined within the SBIR scheme, so it is not yet clear to what extent such contracting belongs in this report. While the amounts for procurement processes have been surveyed, not all of them are also directed at getting the market to generate innovations.

Box 2: Innovation-specific procurement

Innovation-specific procurement is when government specifically looks for an innovative solution or gives commercial parties scope to develop and furnish an innovative solution. Government asks for innovations in order to meet a societal demand, for example in the area of sustainability.

'Specific' can be viewed in two different ways:
1. The contracting government service is looking specifically for innovative solutions as part of its purchasing policy, or
2. The contracting government service's purchasing strategy does not explicitly involve a search for innovation, but it is seeking an innovative solution within the context of a specific procurement procedure.

The national government aims to spend 2.5 per cent of its budget for purchasing on innovation-specific contracting.

The 2011 survey shows that innovation-specific procurement procedures have been undertaken mainly in soil management, road building and marine engineering, transport, packaging, insurance, computerisation/telecommunications, consulting and flexible work practices, commercialisation, and building and systems management.

In 2011, 3.8 to 9.1 per cent of all national government procurement procedures involved a search for an innovative solution, and in 2.5 to 6 per cent of cases, the procurements were also innovation-specific. Between 2.2 and 5.3 per cent of all procurements actually led to an innovation.

The Small Business Innovation Research scheme (SBIR) allows government to contract R&D in order to solve problems in society. Government uses the scheme to challenge businesses to develop and market products in short order. Government can then purchase the products itself. The Ministry of Economic Affairs developed this scheme for R&D procurement. SBIR is based on procurement, meaning that businesses compete against one another. Only the businesses with the best tenders are awarded the contract to conduct a feasibility study (phase 1). The businesses with the most promising feasibility studies are then contracted to continue developing their product (phase 2). In phase 3, the businesses prepare their innovation for market launch. Government no longer provides funding. Expenditure channelled through the SBIR can mainly be found under item 16 of the budget for the Ministry of Economic Affairs ('Competitive, sustainable, safe agricultural, fishery and food chains').

The next TWIN report based on the 2015 budget (TWIN 2013-2019) will have more information on both forms of innovative procurement.

9 Concluding comments

As previous TOF reports have already made clear, direct government investment in R&D will decline in the years ahead, under the condition of unchanged policy. It will go from 4.7 billion euros in 2012 to 4.1 billion euros in 2017 (a decline of 543 million euros or 12 per cent). This reduction is the logical result of the policy adopted by the Government in 2010, which involves shifting from direct to indirect expenditure, and from a specific to a generic policy. This decision means there will be a stronger emphasis on business R&D and innovation activities. The project funds will decline, with the share of project funding shrinking from 29 to 24 per cent of total expenditure. Most of the expenditure on R&D will take the form of institutional funding, which is set to increase in the 2012-2018 period.

Within the various ministries, there will be a downward trend in R&D expenditure at the Ministries of Foreign Affairs, Defence, Infrastructure and the Environment, Economic Affairs, and Health, Welfare and Sport.

Indirect government R&D expenditure (the WBSO and RDA tax schemes) increased sharply starting in 2008 and will peak in 2015. The combination of direct and indirect R&D expenditure rose from 2009 forward (due in part to the temporary measures introduced to combat the economic crisis), reached their peak in 2011, and declined again thereafter.

Although compilation of innovation data is still in the early stages, the figures must be used with some caution. Future calculations are likely to produce outcomes similar to the present ones, given that expenditure on innovation is following the same trend as R&D expenditure.

Previous editions of Facts and Figures:

Facts & Figures 1 Steen, J. van (September 2008) *Facts and Figures: Universities in the Netherlands*. The Hague: Rathenau Instituut.
Facts & Figures 2 Steen, J. van (February 2009) *Facts and Figures: Public research institutes in the Netherlands*. The Hague: Rathenau Instituut.
Facts & Figures 3 (Dutch only) Meulen, B. van der, J. Dawson, J. van Steen (February 2009) *Organisatie en governance van wetenschappelijk onderzoek, een vergelijking van zes landen*. The Hague: Rathenau Instituut.
Facts & Figures 4 (Dutch only) Steen, J. van (April 2011) *Overzicht Totale Onderzoek Financiering (TOF) 2009-2015*. The Hague: Rathenau Instituut.
Facts & Figures 5 (Dutch only) Steen, J. van (April 2012) *Overzicht Totale Onderzoek Financiering (TOF) 2010-2016*. The Hague: Rathenau Instituut.
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Facts & Figures 8 (Dutch only) Steen, J. van (March 2013) *Totale Onderzoek Financiering 2011-2017*. The Hague: Rathenau Instituut.
Facts & Figures 9 Drooge, L. van, S. de Jong, M. Faber, Don D. Westerheijden (May 2013) *Twenty Years of Research Evaluation*. The Hague: Rathenau Instituut.
Facts & Figures 10 (Dutch only) Horlings, T. Gurney, J. Deuten, L. van Drooge (November 2013). *Patenten van kennis-instellingen*. The Hague: Rathenau Instituut.

About this publication

This is the eleventh publication in the Science System Assessment Facts and Figures series. This edition surveys the Dutch national government's expenditure on R&D and innovation in the 2012-2018 period. The data were collected from the various ministries and are based on their 2014 budgets.

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