# Chapter 5

# The role of government

*This chapter examines public activities that have a bearing on the Dutch innovation system. It begins with an overview of the historical evolution of science, technology and innovation policy in the Netherlands. It then examines the main policy actors and governance arrangements, with particular reference to the top sectors approach. The chapter then reviews current policies under the light of the observations made in earlier chapters and outlines areas in need of dedicated policy attention.*

## 5.1. STI policy in the Netherlands: An historical overview

The evolution of Dutch science, technology and innovation (STI) policy largely follows broad international trends. At the same time the Netherlands has taken some distinct approaches and has pioneered a number of innovation policy developments. In the recent history of STI policy, the emergence of a new sector-oriented, thematic approach is one example.

### *The demise of old-style industrial policy and the emergence of technology policy*

Innovation policy emerged from the industrial and sectoral policies that were part of the economic policy toolkit of the 1960s and 1970s. The first attempts to develop an explicit innovation policy were primarily oriented towards the supply side, through the use of financial instruments to stimulate R&D. As this was considered insufficient to achieve the desired increase in the international competitiveness of Dutch producers, the intermediary infrastructure was strengthened to foster the dissemination of new technologies and to provide businesses with R&D results that would enable them to develop new innovative products. To this end, policy measures to stimulate the mobility of researchers from academia to private enterprise and to establish a network of regional innovation centres were put in place (Boekholt and den Hertog, 2005).

The decline of traditional industries, such as textiles and shipbuilding, had been addressed by concentration and government-backed attempts to restructure. In 1971, for example, "large parts of the shipbuilding and metal products industries were amalgamated into RSV [the Rijn-Schelde-Verolme shipyard], which received handsome subsidies to develop new lines of production (and slowly close down the old ones" (van Zanden, 1998, p. 47). During the second half of the 1970s and the early 1980s the costs – and lower than expected benefits – of these old-style "defensive" industrial policies became apparent: for example, the RSV went bankrupt in 1983. As a result, the Netherlands, like other industrialised countries, shifted from supporting and restructuring ailing industries towards a more "future-oriented" policy in which technology and related instruments were assigned a key role. In many OECD countries, government support shifted towards the promotion of "key", "pervasive" or "enabling" technologies.[1] In the Netherlands, during the second half of the 1980s, "technology policy" was oriented towards supporting emerging fields of technology rather than particular economic sectors (Velzing, 2013). The emphasis was on promoting R&D; other aspects of innovation tended to receive less attention and remained in the background.

Boekholt and den Hertog (2005) note that innovation policy gained prominence as a separate policy domain through the 1979 *White Paper on Innovation Policy* issued by the Minister for Science. In its wake a number of new – mostly financial – policy instruments were introduced to foster innovation (grants, fiscal measures, risk capital funds). In 1980, the Scientific Council for Government Policy (WRR), in its report, *Industry in the Netherlands: Its Place and Future*, advocated specific investments in sectors of current or emerging strengths (Velzing, 2013). In 1981, an Advisory Council for Industrial Policy (the so-called Wagner Committee) was asked to develop a new, future-oriented industrial policy. This "independent committee was to have a large influence on transforming traditional industrial policy into innovation- and market-oriented policy" (Boekholt and den Hertog, 2005).

In line with the tenets of New Public Management, major changes were made in the organisational set-up and governance of the Netherlands' innovation policy. The Ministry

of Economic Affairs began to separate policy making and implementation in 1988. "Agencification", through the establishment of StiPT,[2] made innovation policy delivery more transparent; the Ministry increasingly involved external advisory committees in the assessment of project proposals (Velzing, 2013).

### *Generic STI policies of the 1990s*

In the early 1990s an apparent mismatch between the needs of business firms and the knowledge produced by (public) knowledge suppliers showed the need for better interactions between these two sets of actors (Boekholt and den Hertog, 2005) and measures were taken to improve the interface between them. Networking was facilitated, for example, by a high-performance ICT infrastructure. More advanced risk capital schemes were adopted, and strategic intelligence was upgraded and expanded to meet the increased need for information (Boekholt and den Hertog, 2005). As in other countries, the number of actors involved in the development and delivery of innovation policy – and the need for systemic policies and better co-ordination – increased. In the second half of the 1990s, the Ministry of Economic Affairs sought to encourage co-operation between businesses and knowledge institutions and to provide frameworks and incentives for the latter to become more market-oriented (Velzing, 2013).

According to Boekholt and den Hertog (2005), the predominant stance during most of the 1990s was that science and technology (S&T) policy should be generic, i.e. that government should largely refrain from influencing the allocation of resources, leaving it to industry to decide in which areas to invest. Its appropriateness was however questioned around the turn of the century owing to some perceived shortfalls in Dutch innovation performance. These included a shift towards the "applied" end of research by major R&D performers in the business sector, relatively few (high-technology) spin-offs from Dutch universities and research institutes, and a comparatively weak position in the life sciences and nanotechnology, major emerging areas of S&T (Boekholt and den Hertog, 2005).

In 2002, the Interdepartmental Investigation on Technology Policy (Interdepartementaal Beleid Onderzoek Technologiebeleid – IBO) concluded that "while the overall system is functioning rather well, the large number of instruments causes, among others, ineffectiveness and inefficiency in policy implementation due to overlaps and a lack of transparency" (OECD, 2005, referring to IBO, 2002). "In addition it was suggested that there should be a shift in emphasis from specific instruments to generic instruments and from "near-to-the-market" towards more fundamental research and that co-operation among firms and between firms and research institutes should be stimulated." (OECD, 2005, p. 158)

In the next phase, the predominantly generic STI policy approach was replaced by a more thematic and sector-oriented one without reverting to out-dated and compromised approaches and top-down modes of governance.

### *Moving towards a new thematically oriented approach[3]*

In 2003 the Advisory Council for Science and Technology Policy (AWT) published an influential paper, *Backing Winners* (AWT, 2003). After an extended period of predominantly generic STI policy, emphasis shifted to achieving "excellence" and creating "focus and mass" in selected "key areas and key technologies" (Wintjes, 2007).[4] To foster the creation of "critical mass", the government, together with industry and research institutions, would facilitate the development of joint agendas. "Focus and mass" in (research) capacity provided a rationale for a strategy to strengthen the thematic and

sectoral orientation of STI policy (de Heide et al., 2013). An important component of this strategy was the "key areas approach", based on a proposal by the first Innovation Platform (see Annex 5.A1). It was argued that the creation of focus and mass in the research capacity of selected key areas was necessary to maintain a strong and internationally competitive position. The key areas selected were: flowers and food; high-tech systems and materials; water; chemistry; creative industry; and pensions and insurance. They were chosen for their perceived strategic importance (in terms of growth opportunities) or relevance to societal challenges.

As part of this approach, the Ministry of Economic Affairs introduced innovation programmes to support the relevant industrial sectors, under the so-called programmatic approach (den Hertog et al., 2012a). Its objective and scope were defined as follows:

> "Objective is top-performance on innovation themes. EZ develops therefore, in collaboration with the actors from the whole innovation chain, Innovation programmes targeted towards areas where the Netherlands could excel. Innovation programmes offer an integrated approach, addressing all relevant problems in a specific Key Area. For example by investing in R&D, exploiting knowledge, and increasing participation by SMEs. But also by stimulating export and investing in human capital. For a strong and coherent / consistent approach, EZ aims for co-ordination between Innovation programmes and existing initiatives from for example NWO and TNO. Innovation programmes will link as much as possible to international programmes such as the EU Framework Programme and EUREKA."[5]

There were ten innovation programmes. Many of the sectors covered were essentially those later covered by the top sectors (see section 5.3 below). Over 2006-10, the programme received more than EUR 1 billion in public funds, much of it through the Interdepartmental Funds for Economic Structuring (FES), also known as the gas funds. By far the largest share, EUR 924 million, was used for R&D grants. Matching R&D funds amounted to EUR 1 445 million, of which EUR 1 066 million from companies (den Hertog et al., 2012a). The innovation programmes also paid attention to other policy areas, such as human capital and internationalisation, but they were far less prominent than in the later top sectors approach. An evaluation by Dialogic (den Hertog et al., 2012a) was critical of the lack of alignment with international (EU) programmes. The innovation programmes predominantly funded R&D programmes and did not seem to have been very successful in achieving a lasting dialogue between the main actors in the sectors covered. Over 6 100 companies participated in some way (70% were small and medium-sized enterprises – SMEs), and 1 775 companies participated in the innovation projects with their own resources. The Dialogic evaluation found that many of the programmes lacked good problem analysis and had fuzzy goals. Moreover, the contributions of the innovation programmes to the achievement of the goals were not always clear.

Measures other than the key areas approach (primarily under the Ministry of Economic Affairs) were also taken to create focus and mass. They included the establishment of new technological top institutes (TTIs) and of co-ordination structures with additional funds for specific sectors (so-called *regie-organen*). The Ministry of Education, Culture and Science (OCW) identified specific strategic research areas – ICT, genomics and nano sciences – that were addressed by existing instruments and institutes. Part of the revenues from the extraction of natural resources in the Netherlands was allocated, via the FES (gas funds), to specific projects in order to foster focus and mass in certain parts of the knowledge infrastructure.[6]

### *Summary of major trends*

- *R&D and innovation have moved up the policy agenda* as their importance has increasingly been recognised as a driver of economic growth (see Annex).
- *Policy shifted from an old-style industrial and sector-oriented policy* to a generic and technology-push approach, followed by a "new" sectoral approach. This approach, inspired by AWT's *Backing Winners*, relied on "focus and mass" and "key areas". It is the predecessor of the current "top sectors" approach, a major focus of this review (see section 5.3 below). One of the major differences between the key areas/innovation programmes and the current top sectors is the lack of the additional FES funds. In the top sectors, the players have to pool their existing funds.

The move towards a more thematic and sector-oriented approach was not the only important recent change in Dutch innovation policy. Other developments are:

- *A drive to increase the efficiency of public support by a combination of "streamlining" the set of instruments and increasing the share of fiscal suppor*t (delivered largely through generic tools) relative to direct support in providing public financial support for business-sector R&D. This led to a profound shift in the "policy mix".[7]
- *A shift in the financing of R&D in higher education institutions (HEIs) and public research institutes (PRIs) from flow 1 (block grant) to flow 2 (project-based) funding*. More emphasis was placed on the valorisation of knowledge from HEIs and PRIs, especially by SMEs, which have engaged more in collaborative R&D programmes.
- *Increased stakeholder involvement* in the process of policy formulation (stakeholder consultation in defining thematic policy as in the key areas approach) and in policy delivery and implementation (top teams, top consortia for knowledge and innovation –TKIs) and evaluation (top sectors); stronger emphasis on the so-called "triple helix" (de Heide et al., 2013).

Summarising policy developments over the longer term, Velzing (2013) makes the following observations: i) that much of the recent history of Dutch innovation policy has focused on stimulating technologically oriented R&D; ii) that there has been a recurrent debate on the balance between generic and specific policies; iii) that there has been an increasing emphasis on co-operation with a view to stimulating companies to invest more in R&D, improving the market-oriented focus of knowledge institutes (HEIs and PRIs), increasing shared knowledge between companies and knowledge institutes, and creating stronger networks and clusters; iv) that there has been a growing separation between making and executing policy; and v) that attempts have been made to make innovation policy more transparent, e.g. through simplifying procedures (especially for SMEs), using more external advisory committees, and making greater use of programme evaluation.

## 5.2. Main policy actors

Like many other advanced OECD economies, the Netherlands has witnessed a steady expansion in the number and range of actors with an innovation policy stake. More ministries and agencies play a role in supporting innovation. The private sector's role in formulating and implementing policy, for example through public-private partnerships (PPPs), has increased. The research-performing landscape is increasingly fragmented, as more public research centres and more firms conduct R&D. The growing role of regions and the European Union in innovation policy adds an additional dimension to governance.

### *Government ministries*

The main actors in the design and definition of Dutch innovation policies are the Ministry of Economic Affairs (EZ) and the Ministry of Education, Culture and Science (OCW). Other ministries also sponsor innovation programmes based on their portfolios of activities.

The Ministry of Economic Affairs is responsible for promoting competitiveness, entrepreneurship and innovation. It also facilitates and strengthens links between research institutes and the business sector and works to create good framework conditions for business and economic development. Programmes and policies under its control primarily focus on business R&D and innovation. Policy schemes funded by the ministry are primarily implemented by the Netherlands Enterprise Agency (see below), the Dutch governmental organisation responsible for implementing sustainability, innovation and international business programmes. The Ministry of Economic Affairs also contributes to the funding of the Netherlands Organisation for Scientific Research (NWO) and the Technology Foundation STW (see below), the TO2 (from the Dutch *Toegepast Onderzoek Organisaties*, i.e. organisations dedicated to applied research) applied research institutes, and the European Space Agency (ESA). In the areas of agriculture, ecology and the environment, the Ministry of Economic Affairs funds research programmes at the Wageningen University and Research Centre (WUR) (see Chapter 4).

The Ministry of Education, Culture and Science is responsible for defining strategies and policies for public-sector education and research. Most of its budget covers institutional block funding for HEIs. The Ministry of Education, Culture and Science, together with Ministry of Economic Affairs, co-ordinate the science policy agenda of the national government and contribute to the definition of international science policy at the EU level and beyond. It largely leaves the choice of research priorities to research entities and individuals. However, it provides additional funding for some research areas of social or economic importance, such as genomics, ICT and nanotechnology. Ministry of Education, Culture and Science is a major funder of NWO and the Royal Academy of Arts and Sciences (KNAW) (see below). It also provides funding to major international science organisations such as CERN, ESA and EMBL.

As in many countries, other government ministries also develop sectoral research and innovation programmes or establish research institutes (Table 5.1 provides information on the R&D expenditures of different ministries):

- The Ministry of Defence funds the defence-related research programmes of TNO (the Netherlands Organisation for Applied Scientific Research), NLR (the National Aerospace Laboratory) and MARIN (the Maritime Research Institute Netherlands). It also has a central R&D budget to develop defence-specific technology.

- The Ministry of Health, Welfare and Sport (VWS) is responsible for the National Institute of Public Health and the Environment and the Netherlands Institute of Social Research, both of which have an important research role. VWS also provides research funding for the Netherlands Cancer Institute and the Netherlands Institute for Social Research. Some of the health-related research programmes are managed by the Netherlands Organisation for Health Research and Development (ZONMW).
- The Ministry of Infrastructure and the Environment (I&M) has developed a knowledge and innovation strategy that is implemented by a Knowledge, Innovation and Strategy Directorate inside the ministry. It is also responsible for the Netherlands Environmental Assessment Agency (PBL) (see below); the Royal Netherlands Meteorological Institute (KNMI), a national institute that studies the weather, climate and seismology; four Rijkswaterstaat centres of excellence (water; transport and infrastructure; construction; ICT and data management); and the Netherlands Institute for Transport Policy Analysis (KiM). I&M also funds TNO and the major technological institutes (TTIs) and provides research universities and other research organisations with contract funding, in some cases through research funding agencies such as NWO, the Netherlands Enterprise Agency (RVO) and the National Institute for Public Health and the Environment.
- The Ministry of Foreign Affairs devotes a portion of its budget to fund research at the Netherlands Institute of International Relations Clingendae, the African Studies Centre and the Royal Tropical Institute.

**Table 5.1. Budgeted R&D expenditure (GBAORD), by ministry, 2011-17**

EUR millions

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|
| General affairs | 0.587 | 0.814 | 0.574 | 0.574 | 0.574 | 0.574 | 0.574 |
| Foreign affairs | 80.941 | 71.429 | 73.075 | 68.902 | 65.528 | 65.528 | 65.528 |
| Security and justice | 24.943 | 26.159 | 24.810 | 25.520 | 25.373 | 25.453 | 25.425 |
| Interior and Kingdom relations | 16.830 | 19.535 | 14.425 | 12.600 | 12.600 | 12.600 | 12.600 |
| Education, culture and science | 3357.358 | 3373.701 | 3318.612 | 3342.890 | 3288.890 | 3305.304 | 3324.304 |
| Defence | 70.223 | 70.623 | 63.076 | 63.901 | 60.970 | 58.775 | 58.774 |
| Infrastructure and the environment | 116.735 | 99.670 | 93.123 | 71.380 | 55.919 | 53.943 | 53.099 |
| Economic affairs, agriculture and innovation | 1081.261 | 1051.270 | 999.803 | 900.402 | 755.348 | 638.459 | 608.528 |
| Social affairs and employment | 0.720 | 1.385 | 1.620 | 1.520 | 1.300 | 1.360 | 1.360 |
| Health, welfare and sport | 225.461 | 176.938 | 160.918 | 145.111 | 138.110 | 136.542 | 136.542 |
| **Total** | **4975.059** | **4891.524** | **4750.036** | **4632.800** | **4404.612** | **4298.538** | **4286.734** |

*Source*: Rathenau Institute database, based on the ministries' 2013 budgets.

### *Research and advisory councils*

The Netherlands has long established advisory councils to government and policy bodies in various areas, including science, technology and innovation (STI). Many were created several decades ago and undertake broad consultations before reaching a final decision. Councils and advisory bodies represent multiple actors of the innovation system, including, in some cases, the business sector. This section describes the main advisory councils with at least a partial focus on STI policy.

The Advisory Council for Science and Technology Policy (AWT), created in 1990, is an independent strategic advisory body. It advises the government and parliament on STI policy. It has a maximum of 12 members from research institutes and business-sector organisations who participate as individuals rather than as representatives of their organisation of affiliation. AWT has 11 administrative and secretariat staff who help prepare meetings and draft reports and background studies. In most cases AWT provides advice on knowledge and innovation policy at the request of the Ministry of Education, Culture and Science or the Ministry of Economic Affairs. Occasionally, other government departments or parliament request advice and opinions on specific policy issues. AWT is also free to make judgements and statements to highlight concerns about specific policy developments. AWT defines a multi-annual work programme in consultation with OCW and EZ. The 2014-17 programme focuses on: the meaning of a changing world; ambitious policy in time of austerity; and balanced growth in the knowledge economy. AWT disseminates its findings through reports, advisory letters and background papers. It also publishes annual reports and is evaluated every four years by an external independent commission, according to the guidelines of the *Advisory Bodies Framework Act*.

The Royal Academy of Arts and Sciences (KNAW) was founded in 1808 as an advisory council to the Dutch government on matters related to science, arts and research, as stated in the *Higher Education and Research Act*. It has approximately 500 members who are active in the full spectrum of scientific and academic research. They are selected on the basis of academic excellence and are appointed for life. Most are either outstanding Dutch scientists or scholars active in the Netherlands or abroad. Some are not Dutch nationals. The Academy is also responsible for a number of national research institutes (see Chapter 4). It delivers reports, memoranda or foresight studies on science and research matters, prepared by KNAW members and experts selected on the basis of their qualifications and the absence of conflicts of interest. In order to preserve their independence, authors of reports or studies receive no compensation for their work. Five advisory councils assist KNAW in the preparation of reports and analysis: the Council for Earth and Life Sciences; the Council for the Humanities; the Council for Medical Sciences; the Council for Technical Sciences, Mathematical Sciences and Informatics, Physics and Astronomy, and Chemistry; the Social Sciences Council. The KNAW Executive Board has also established a number of committees on topics such as education, scientific ethics and integrity. The members of KNAW's councils or committees may or may not be KNAW members; they represent universities, research institutes, civil organisations and the business community.

The Netherlands Scientific Council for Government Policy (WRR) is an independent advisory council to the Dutch government. It was created in 1972 as a temporary advisory council but its existence was formalised in 1976 by the *Act Establishing a Scientific Council on Government Policy*. It is responsible for advising the government on broad issues of importance for Dutch society. Unlike other councils or advisory bodies, it is not restricted to one policy sector, but seeks to identify current and future trends that should

be addressed in political debates. WRR has from 5 to 11 members who meet every two weeks and take an active part in the research and preparation of reports and analysis. They are appointed for a term of five years (renewable for a maximum of one term). WRR members are generally academics with experience in fields ranging from public governance, to socioeconomic sciences, to medical and natural sciences, to energy and engineering. In addition to its members, the Council has external advisory members who represent other government institutes, such as the Netherlands Environmental Assessment Agency, the Netherlands Institute for Social Research, the Netherlands Bureau of Economic Policy Analysis, and Statistics Netherlands. Each year, WRR defines a programme of work in consultation with the prime minister. Following its first external evaluation in 2001, WRR started to work more extensively with foreign experts and other stakeholders. WRR is a member of the international Network of Strategic Policy Agendas together with similar councils in Sweden, France and Ireland and the Bureau of European Policy Advisers, based in Brussels.

The Netherlands Bureau for Economic Policy Analysis (CPB) was established in 1945 as a government advisory body on socioeconomic issues. It conducts research independently and at the request of the government, parliament, individual members of parliament, trade unions or employers' organisations. Its analyses contribute to economic decision making. CPB delivers quarterly economic forecasts and conducts research on themes such as the economic impacts of ageing, globalisation, health care and education. Two of CPB's research areas are more directly related to STI policy: issues related to the education and scientific system and knowledge more generally; and issues related to the Internet economy, intellectual property and innovation policy more broadly. CPB is under the Ministry of Economic Affairs and its director is appointed by the minister in consultation with other government bodies.

The Social and Economic Council of the Netherlands (SER) is an advisory body established in 1950 by the *Industrial Organisation Act*. It advises the government and parliament on national and international social and economic policy. SER is fully independent of the government as it is financed by business organisations and trade unions. It provides advice on employment issues, social security, regulatory policy, environmental planning, etc. It occasionally publishes reports related to innovation and research policy, notably with a focus on education, skills and lifelong training. Its advisory reports are generally published and available to the public. It also delivers guidance and supervision on issues related to corporate governance, consumer policy and trade. SER is composed of three groups of 11 members for a total of 33. The three groups represent employers (including associations of SMEs), unions and "Crown" members appointed by the government. Crown members are independent experts, often university professors with a chair in economics, finance, law or sociology. The president of the Dutch Central Bank and the director of CPB are Crown members. The president of SER is appointed by the government.

The Netherlands Environmental Assessment Agency (PBL) is the national institute for strategic policy analysis on the environment and spatial planning. It results from the merger of two agencies for spatial planning and the environment. It conducts research, analysis and evaluations to contribute to policy debate and to provide advice to the government, parliament and other policy actors. PBL research focuses on energy and climate change, water, agriculture, food, urban and rural development and spatial planning. It has recently developed studies on clusters and agglomeration economies in relation to the top sectors approach. The PBL research budget is EUR 30-40 million a year.

### *Major research and innovation funding agencies*

The main funding organisations for R&D and innovation in the Netherlands are the Netherlands Organisation for Scientific Research (NWO), the Royal Academy of Arts and Sciences (KNAW) and the Netherlands Enterprise Agency (RVO) (Table 5.2).

**Table 5.2. Budget overview of major funding agencies, latest available year**

EUR millions

| Public R&D and valorisation | Business R&D and innovation |
|---|---|
| **NWO**: EUR 623 million | |
| **STW**: EUR 84 million (of which EUR 44 million from NWO) | **RVO**: EUR 668 million* |
| **KNAW**: EUR 142 million | |

* This figure does not include support to business innovation through the WBSO and RDA tax measures, which amounted to EUR 1 118 million in 2013.

*Source*: Rathenau Institute, www.nwo.nl, www.stw.nl.

NWO is a research-funding agency under the responsibility of the Ministry of Education, Culture and Science. It is responsible for allocating research funding, raising the quality of scientific research, and facilitating knowledge transfer. It primarily focuses on academic research and receives most of its budget from the Ministry of Education, Culture and Science (usually approximately 80%) and some from other ministries. It has eight divisions (one of which is STW, see below), three foundations (the National Computer Facilities, FOM Foundation for Fundamental Research on Matter and the WOTRO Science for Global Development) and nine research institutes active in different disciplines (see Chapter 4). NWO also has temporary task forces responsible for guiding and funding research in areas prioritised by the government. It allocates funds on a competitive basis to academics and research teams. Independent experts select the research proposals that are cleared for funding.

The Technology Foundation STW was created in the late 1970s and funds research programmes in the technical sciences, with a focus on knowledge transfer from researchers to users (generally business organisations). It is an independent organisation affiliated with NWO. STW's budget is largely derived from NWO (EUR 44 million) and the Ministry of Economic Affairs (EUR 22 million). Co-funding partners in each project provide an additional EUR 8 million. Other partner organisations provide in-kind contributions representing approximately EUR 10 million.

In addition to NWO and its related organisations, KNAW funds basic research programmes, scholarships, mobility schemes and KNAW research institutes. KNAW's total budget in 2012 was EUR 152 million of which EUR 142 million financed research programmes and KNAW's institutes (the latter received 88% of this budget in 2012 – see Chapter 4). KNAW's budget primarily comes from the Ministry of Education, Culture and Science.

RVO promotes business development with a focus on sustainability, agriculture, innovation and internationalisation. It is part of the Ministry of Economic Affairs and was created in 2014 as a merger of NL Agency and Dienst Regelingen (which implemented and funded programmes on behalf of the Ministry of Economic Affairs and the former Ministry of Agriculture, Nature and Food Quality). RVO provides information and advice

on international business, intellectual property, implementation of environmental policy, and EU framework programme regulations. It also promotes the internationalisation of Dutch companies and attraction of foreign direct investment (FDI). It is responsible for funding R&D and innovation through different programmes for different ministries. However, its main role with respect to policy implementation is related to the delivery of fiscal measures and direct financial support. The main R&D fiscal measures implemented by RVO are the tax credit for R&D (WBSO) and the Research and Development Allowance (RDA)[8]. The main direct measures implemented or managed by the agency are the SME+Innovation Fund as well as the TKI allowance and MIT (see Section 5.4).

## 5.3. Governance: Agenda setting, co-ordination, evaluation and the top sectors

### *Agenda-setting and co-ordination*

The preceding description of major STI policy actors shows the strong presence of councils and advisory bodies with an active role in Dutch policy making. Councils and advisory institutions cover the range of policy making, including science, technology, innovation and economic development more broadly, and they issue policy documents and statements that actively shape the political agenda. In addition, they act as co-ordinators not only across government ministries and parliament, but also of stakeholders in the innovation (and more broadly socioeconomic) system that are represented in many of these bodies. For example, business organisations are represented in AWT and the committees of KNAW. CPB and SER work with trade unions and employers' associations.

Most of these advisory organisations have existed for decades and have operated in accordance with the Dutch tradition of consensus-oriented policy making. Consultations among academics, business-sector representatives, trade unions and policy actors have provided space for consensus to emerge in a more "bottom-up" manner (in various expressions of the so-called Dutch '*polder model*'[9]) than is typical of many OECD countries. The process tends to work against attempts at "top-down" steering and instead provides for "negotiated change" in innovation policy and its governance. At the same time though, consensus-oriented decision making means that it can be difficult and can take long to decide on changes, however necessary.

Between 2004 and 2010 agenda setting was the role of the Innovation Platform, which had high-level representation from government (the prime minister and ministers of Economic Affairs and of Education and Science), business, knowledge institutes and independent experts (Boekholt and den Hertog, 2005). At present, a considerable amount of research system co-ordination takes place in the context of the top sectors (discussed below), which rely on co-ordination of the different communities (notably academia, business organisations and government, represented in the top teams) and share some of the features of the consensual "polder" model. Agenda setting in the top sectors concerns only part of the system and takes place on a biannual basis, i.e. less than the typical duration of a full policy cycle. Following the demise of the Innovation Platform there do not appear to be any formal mechanisms for agenda setting outside of the top-sector disciplines, technology areas and economic activities or for longer-term orientation and system-level priority setting.

The Dutch Parliament's House of Representatives and Senate have both created education, culture and science committees and economic committees as a basis for consultation between parliament and the government. Other co-ordination bodies are the government-level Economic Affairs, Infrastructure and Environment Subcommittee

(REZIM), which consists of the ministers most closely involved in these matters, and its counterpart at the ministry level, the Economic Affairs, Infrastructure and Environment Committee (CEZIM). Both deal with issues related to the economy, science and research policy, higher education and innovation. Issues related to science and research policy are generally discussed at REZIM meetings and subsequently discussed by the government (ministers and state secretaries) for decision making. CEZIM conducts the preparatory work for decision making, following discussions at REZIM.

### *Evaluation*

The Netherlands has a long history of evaluating public research and was among the pioneers in introducing formal evaluation mechanisms, some of which date back more than two decades. Evaluation enjoys broad acceptance among stakeholders. It is seen as a constructive management tool that helps organisations improve their performance. Practice in the Netherlands is distinguished from international trends in that evaluation has no direct consequences, no central co-ordinating organisation[10] and no link to national goals (van Drooge et al., 2013). The organisations to be evaluated have a considerable say in the terms and scope of evaluations. This has contributed to the development of a diversity of approaches (e.g. evaluations at the level of research groups or research centres, disciplines at the national level, sometimes with exceptions for one organisation). This diversity complicates an assessment of the effectiveness of the evaluation mechanisms. Nevertheless, scores for all criteria – academic quality and productivity, relevance and feasibility – have risen over time and today almost all research qualifies as internationally competitive (van Drooge et al., 2013).

Moreover, with a tradition of sophisticated evaluation of policy instruments, the Netherlands is among the world leaders in the use of novel evaluation methodologies (Hassink et al., 2013). Evaluations of government instruments that support business innovation are conducted regularly and generate considerable policy interest and attention. Another implication of the Dutch evaluation culture is that policy is generally responsive to the findings of evaluations and that policy formulation strives to be evidence-based. Many evaluations have served to improve the efficiency and effectiveness of instrument implementation, such as the successive evaluations of the tax credit and the innovation voucher schemes. So far however, policy evaluation has emphasised the instrument level. Looking to the future it would be profitable to develop an analogous level of experience in system-level evaluations and social cost-benefit analyses.

### *The top sectors approach*

#### *Rationale and key features*

A large part of innovation policy co-ordination currently takes places under the top sectors approach, an industrial or "enterprise" policy formally introduced in February 2011 (Ministry of Economic Affairs, 2011), although it was anticipated by similar policy initiatives over the preceding decade.

The decision was motivated by concerns over the Netherlands' international competitiveness and particularly by the difficulties faced by Dutch exporters for expanding into the emerging markets of the BRICs (Brazil, Russian Federation, India, People's Republic of China). The rationale for the top sectors approach underlines the link between innovation and export performance and foresees a central role for innovation policy and its instruments.

Leveraging business-sector R&D is one of the objectives of the top sectors approach. It follows from a long-standing concern in the Netherlands that the considerable public resources devoted to R&D and innovation do not appear to induce concomitant investments from business. As Chapter 3 showed, while government budget appropriations or outlays for research and development (GBAORD) as a share of GDP are on par with other advanced systems, business expenditure on R&D as a share of GDP is close to the EU27 average. To raise business R&D and innovation performance, the approach enlists the strong capabilities of public research performers. It argues for an increase in the applicability of public research, placing it, to a greater extent than previously, at the service of Dutch industry, especially of SMEs.

Another key objective is greater coherence in government policy in support of business by simplifying the range of interventions and organising them along lines suited to the specific opportunities and constraints of vital economic sectors. A sectoral approach to government policy, it has been argued, would overcome traditional barriers to co-ordination across government ministries and departments. To this end it incorporates, besides interventions focused on R&D and innovation, co-ordination of interventions in policy areas such as skills and foreign policy. A sectoral rather than a thematic focus on social challenges was chosen because it is more readily recognised by the business sector. To achieve the above objectives the top sectors approach envisages: (i) the focusing of policy attention and interventions – in particular the alignment of public R&D and innovation resources – on a few sectors in order to maximise economic impact; (ii) much closer co-ordination of businesses, government and knowledge institutes with a view to creating "a totally new form of public-private co-operation" (Ministry of Economic Affairs, 2011).

Nine sectors (not directly corresponding to international classifications) were singled out: agri-food; horticulture and propagation materials; high-tech systems and materials (HTSM); energy; logistics; creative industry; life sciences; chemicals; and water. These are largely clusters of economic activities that correspond to Dutch industrial strengths. In 2011 the nine sectors accounted for over 80% of business R&D (96% in 2010) and 55% of exports but under 30% of value added and employment (Box 5.1)[11].

While in principle the approach foresees concentrating government attention and resources on a few sectors, in practice the choice of nine broad sectors and the modest resources mobilised (largely diverted from existing funding) mean that the emphasis is more on joint programming and co-ordination than on targeting.

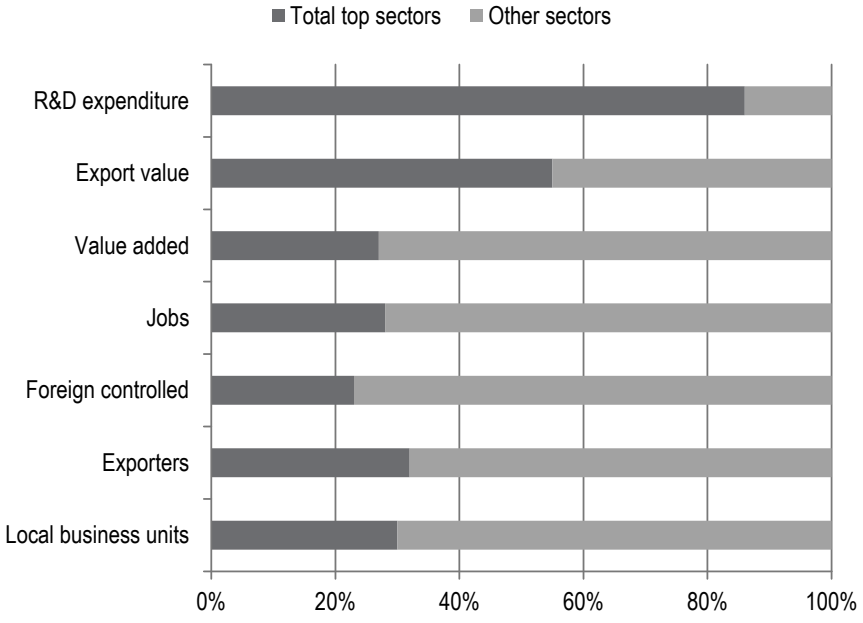
The top sectors approach was inspired in part by the agriculture sector's so-called "golden triangle" of enterprises, knowledge institutes and government. Their collaboration is seen as having been critical for the success of this important sector (the Netherlands is the world's second largest exporter of agricultural products). It involved the development of a common vision and multi-year agreements, the financial commitment of all parties, the linkage of education with private-sector needs and the development of close links between entrepreneurs and research.[12]

Top-sector programming is similar. It involves the joint drafting of thematic policy agendas by teams of representatives from the various stakeholders. The research and innovation agenda is by far the most prominent to date and the largest in terms of spending. The human capital agenda strives for better alignment of education with the needs of the top sectors. Other areas of joint programming include the reduction of administrative burden and foreign policy, such as economic diplomacy with "Holland branding" (Ministry of Economic Affairs, 2011).

### Box 5.1. Composition of the top sectors

The top sectors encompass more than 290 000 local business units, i.e. 30% of all local business units in the Netherlands. Together, they account for a quarter of total value added and 1.4 million jobs, or 28% of employment. A key feature of the top sectors is their export orientation. At EUR 175 billion, the top sectors generate 55% of the Netherlands' total export value of goods. Foreign-controlled top sector local units generate almost half of total exports. In 2011 the nine top sectors accounted for more than 80% of total business R&D expenditures (96% in 2010, before the changes in business R&D measurement). The high-technology systems and materials sector generates almost half of total R&D expenditures.

**Figure 5.1. Share of top sectors by various characteristics, 2011**




*Source*: Statistics Netherlands (2013).

In many ways, the top sectors approach is the latest in a long line of policy initiatives aimed at research co-ordination through PPPs (Table 5.3). According to Hessels and Deuten (2013), the Dutch government has supported research PPPs of various forms since the 1980s, including "innovation-oriented research programmes", the leading technological institutes (TTIs) and interdisciplinary multi-actor programmes financed from national gas revenues [the so-called investment grants for knowledge infrastructure (BSIK) and the economic structure enhancement fund (FES)]. These temporary arrangements sometimes took the form of virtual research institutes (Hessels and Deuten, 2013). In the past decade in particular, national initiatives with a regional ("peaks in the delta") and sectoral dimension (key areas, innovation programmes) emerged (de Heide et al, 2013). Indeed continuity is most evident in terms of the *choice* of sectors. It was during this time that co-ordination in most of the sectors now covered by the top sectors approach began.

**Table 5.3. Overview of the most important Dutch policy initiatives for research co-ordination**

| | ← | 1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|---|---|---|
| Innovation-oriented research programmes | | | | | | | | |
| Graduate schools | | | | | | | | |
| ICES/KIS, BSIK, FES | | | | | | | | |
| Leading technological institutes (TTIs) | | | | | | | | |
| Key areas/TTIs | | | | | | | | |
| Top sectors and TKIs | | | | | | | | |

*Source*: Adapted from Hessels, L. and J. Deuten (2013), "Coordination of research in public-private partnerships: lessons from the Netherlands", *Rathenau Institute Working Paper* 1302.

Among the novel elements of the top sectors approach is the emphasis placed on alignment, which concerns a much greater share of public R&D budgets (Velzing, 2013). While it initially emphasised the sectoral dimension, it has sought, particularly over the past year, to reflect emerging social challenges and to develop a regional planning dimension.

### *Governance mechanisms and their implications*

The approach introduces new forms of governance. Whereas traditional approaches to industrial policy are often government-centred, industry representatives are at the centre of the co-ordination process in the top sectors. So-called "top teams", composed of high-level representatives from industry, public research and government, draft knowledge and innovation agendas which they submit to the government for consideration. The government evaluates each top team's proposed agenda, which includes a strategic plan and relevant instruments. The government's evaluation takes into account the level of ambition, the level of stakeholders' commitment, the degree of openness, the balance between the social and economic agendas, and the extent to which the objectives can be monitored and evaluated. The relationships and sectoral plans are then formalised in bi-annually updated innovation contracts. For its part, the government undertakes to develop sector-specific policies across ministerial portfolios, including education, innovation, and foreign policy, and to reduce the regulatory burden.[13]

Implementation of the innovation contracts is mainly undertaken by the top consortia for knowledge and innovation (TKIs). Some top sectors have more than one. Each receives a TKI allowance from the government, which is intended to reward business funding allocated to the agendas (Ministry of Economic Affairs and Ministry of Education, Culture and Science 2013) (discussed in section 5.4). A total TKI allowance of EUR 83 million was allocated in 2013 and was distributed across the various TKIs in line with the private contributions (Table 5.4).

**Table 5.4. TKI allowance allocations for 2013**

| Top sector | TKI | TKI allowance (EUR millions) | Parties |
|---|---|---|---|
| Agri&food | Agri&food | 8.60 | 222 |
| Chemicals | Bio-based economy | 2.53 | 50 |
| | ISPT | 4.21 | 67 |
| | Smart polymeric materials | 2.00 | 86 |
| | Nieuwe Chemische Innovaties | 2.99 | 119 |
| Creative industry | CLICKNL | 0.06 | 17 |
| Energy | EnerGO | 0.34 | 57 |
| | SWITCH2SmartGrids | 0.13 | 55 |
| | Solar energy | 2.59 | 52 |
| | Gas | 3.60 | 113 |
| | Wind op Zee | 1.52 | 17 |
| High-tech systems and materials | HTSM | 28.14 | 201 |
| Life sciences | Life sciences health | 8.10 | 113 |
| Logistics | Logistiek | 1.68 | 289 |
| Horticulture and propagation materials | Uitgangsmaterialen | 1.29 | 33 |
| | Tuinbouw | 3.82 | 55 |
| Water | Maritiem | 7.19 | 214 |
| | Deltatechnologie | 0.62 | 74 |
| | Water technology | 3.88 | 145 |
| Total | | 83.29 | |

*Source:* Ministry of Economic Affairs (2013c), Table 2.7.

The current innovation contract was signed in October 2013, and foresees an annual research investment of almost EUR 2 billion, of which EUR 970 million contributed by companies in the top sectors. The latest contracts specify the relation of each research agenda to the EU's Horizon2020 in an on-going effort to align the top sectors better with social challenges. Accordingly, a budget of EUR 36 million has been set aside to co-fund Dutch public participation in Horizon2020 on areas related to social challenges over 2014-17[14]. Moreover, special efforts are made to encourage participation by SMEs. For instance, from 2014 onwards, SMEs can contribute the first EUR 20 000 of their TKI participation in kind rather than in cash .In addition, each TKI has a contact point for SMEs to help them identify appropriate innovation programmes and activities.

Hessels and Deuten (2013) examine top-sector co-ordination issues. Drawing on the Netherlands' rich historical experience with research PPPs, they find that each sector faces its specific coordination problems (Table 5.5). For instance, whereas lack of a coherent research agenda may be a problem for public research performers, the problem for firms may be a lack of trust or of organisational capacity. Co-ordination across the public-private research boundary also implies interaction between fundamental and applied research. In addition, co-ordination problems change over time in response not only to shifts in the composition of participants but also to external developments driven by both market and knowledge dynamics.

Hessels and Deuten (2013) observe that most of the top-sector co-ordination problems are not new but were already apparent in previous attempts to promote research PPPs. They observe that the current situation largely reflects contingent circumstances, such as the composition of the initial consortium and the personal leadership style of the director. It would be important for policy design to aim to systematise learning from past experiences and to tailor governance arrangements to the specific co-ordination problems of each sector.

**Table 5.5. Co-ordination problems per top sector**

| | **Co-ordination problems among firms** | **Co-ordination problems between firms and knowledge institutions** | | **Co-ordination problems among knowledge institutions** |
|---|---|---|---|---|
| | *Organisational capacity in the industrial sector* | *Share of large firms* | *Experience with PPPs* | *Organisational capacity in the scientific field* |
| Chemistry | Large | Large | Large | Large |
| High-tech systems and materials | Large | Large | Large | Average |
| Agri&food | Average | Large | Large | Large |
| Horticulture and propagation materials | Average | Average | Average | Large |
| Life sciences and health | Small | Average | Large | Large |
| Water | Large | Average | Small | Average |
| Energy | Small | Large | Average | Average |
| Logistics | Average | Small | Average | Small |
| Creative industry | Small | Small | Small | Small |

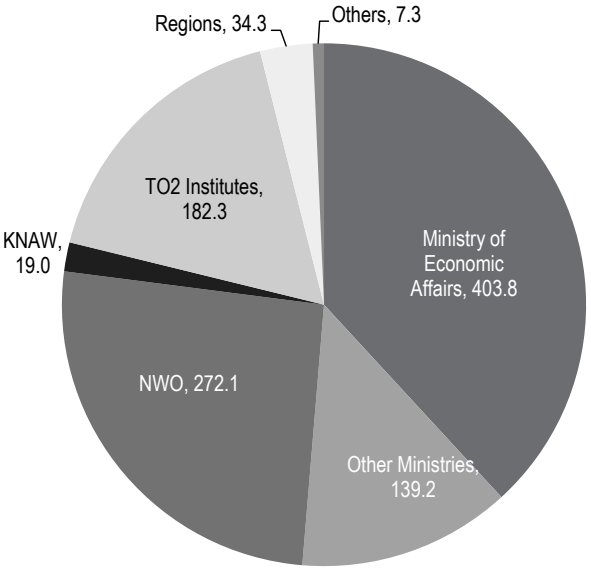
*Source*: Hessels, L and J Deuten (2013), "Coordination of research in public-private partnerships: lessons from the Netherlands", *Rathenau Institute Working Paper* 1302.

### *Top Sectors funding*

The public budget allocated to the top sectors is difficult to calculate accurately because it is mostly diverted funds that are subject to co-funding from industry or the EU. It also incorporates R&D funding from ministries (e.g. Health Welfare and Sport, Infrastructure and the Environment, Defence) and sub-national authorities. The Dutch government estimates that, excluding regional and EU funding, between EUR 1 billion and EUR 1.1 billion will be made available to the top sectors every year for 2013-16 (see Figure 5.2 and Table 5.6 for a 2014 breakdown by funding sources). Of this only the TKI funding allowance (between EUR 50 million and EUR 130 million a year) can be clearly identified as additional funding. Between EUR 50 million and EUR 30 million a year are foreseen for specific education and labour market interventions, whereas EUR 700-900 million a year are foreseen for research and innovation.

**Figure 5.2. Expected public sources of financing for the top sectors, 2014**

EUR millions




*Source*: Nederlands Kennis- en Innovatiecontract 2014-2015, Annex to Monitor Bedrijvenbeleid: Bedrijvenbeleid in Beeld 2013, Ministry of Economic Affairs.

**Table 5.6. Government ministry contributions to the top sectors, 2014-15**

EUR millions

| | 2014 | 2015 |
|---|---|---|
| Ministry of Economic Affairs | 403.8 | 394.2 |
| Ministry of Health, Welfare and Sport | 71.6 | 59.1 |
| Ministry of Education, Culture and Science | 44.0 | 44.0 |
| Ministry of Infrastructure and the Environment | 11.3 | 36.9 |
| Ministry of Defence | 11.0 | 11.0 |
| Ministry of Foreign Affairs | 1.4 | 1.4 |

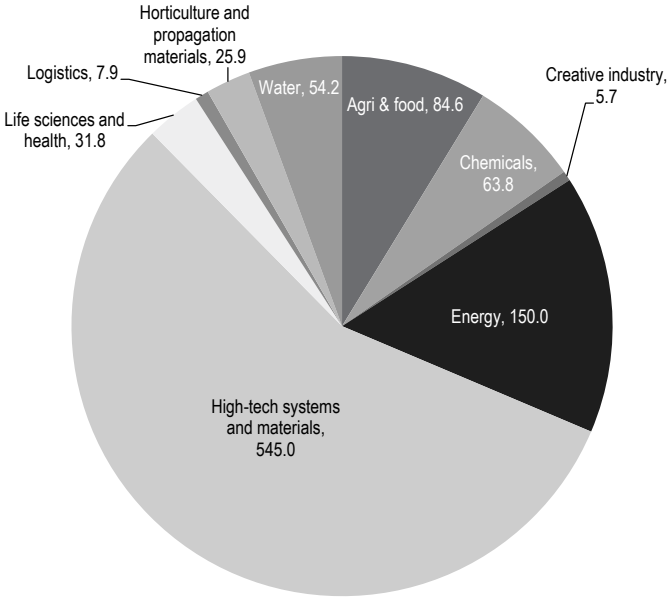
*Note:* Ministry of Education, Culture and Science contributions do not include funding aligned via the NWO.

*Source*: Nederlands Kennis- en Innovatiecontract 2014-2015, Annex to Monitor Bedrijvenbeleid: Bedrijvenbeleid in Beeld 2013, Ministry of Economic Affairs.

The business sector is expected to match this public funding with substantial investments of its own, which are expected to be close to EUR 1 billion a year in 2014-15 distributed across all top sectors. By far the biggest contribution (over 50%) is expected in high-tech systems and materials, followed by energy and agri&food (Figure 5.3).

**Figure 5.3. Expected private-sector investments in the top sectors, 2014**

EUR millions




*Source*: *Nederlands Kennis- en Innovatiecontract 2014-2015*, annex to *Monitor Bedrijvenbeleid: Bedrijvenbeleid in Beeld* 2013, Ministry of Economic Affairs.

### *Opportunities, trade-offs and risks*

The top sectors approach has many of the characteristics of modern approaches to industrial policy, especially in terms of the emphasis on co-ordination and alignment, the important role of stakeholder demand, and the commitment to monitoring and evaluation. At the same time, it differs from other modern approaches in important respects. The emphasis on clusters of economic sectors, as opposed to tasks or activities (as in e.g. the EU's *smart specialisation* approach), is one of them. Notwithstanding the commitment to evaluation and continuing efforts to ensure openness in each of the top sectors, elements of the approach, such as the emphasis on sectors of strength (with implications for the representation of incumbents versus challengers) and the absence of a search for new niches, make it somewhat less dynamic than other forms of modern industrial policy.

As an approach to innovation policy, it reflects current thinking to a considerable extent. Its "all-of-government" approach and ability to integrate interventions across government departments into innovation policy is in line with calls for holistic approaches that recognise the systemic nature of innovation. Such an approach increases the likelihood that bottlenecks outside the traditionally narrow remit of innovation policy will be identified, and that sufficient attention and resources will be diverted to tackle them. It also introduces novel forms of governance, through the involvement of stakeholders not only in policy formulation but also in policy delivery and implementation, which will certainly be watched with interest by international policy peers.

Any approach that favours some parts of the system at the expense of others is likely to be debated and the top sectors approach has been no exception. Within the Netherlands there has been public discussion of its possible impacts on the innovation system (Box 5.2). An *OECD Economic Survey* (OECD, 2012) expressed concerns regarding its possible impacts on the wider business sector. Many of the concerns raised are familiar to almost any debate about selective industrial policy: the government has incomplete information to pick future winners, the process runs the risk of capture by well-organised interests, and co-ordination processes can be bureaucratic and inefficient. Other arguments take issue with specific aspects of the top sectors approach. Among them are claims that a sectoral approach does not take account of global value chains, that it risks diverting resources from horizontal policies related to education, fundamental research and the provision of public goods more generally, and that the gains from co-operation between business and government can be overrated.

Moreover, it has been argued that some aspects of the approach may undermine its own objectives. There are concerns with the selection of sectors, the alleged tendency to favour incumbents at the expense of challengers, the alleged lack of sufficient "critical mass", and the balance between small and large firms. A common objection to the current choice of sectors is that it is backward- rather than forward-looking, especially in terms of emerging social challenges. Another objection is that it is predominantly technology-oriented, with insufficient attention to non-technological innovation and the role of social sciences.

It would also be important to take account of other possible risks. A key issue is the complication of principal-agent dynamics when the government is part of the top teams and also has a mission to regulate markets. The design of an appropriate governance framework must be based on the understanding that the interests of government and business do not always overlap (even when the economy is concerned) and particularly if those involved are mostly large firms in certain sectors. The diversion of government policy attention and regulatory interventions in some sectors but not in others can compromise the coherence of the policy mix and of policy delivery. Of course there is always potential to improve co-ordination between government ministries and therefore lessen the regulatory burden faced by the sectors concerned. However, the Netherlands' good position in indicators of the business climate suggests that the magnitude of the likely improvements is small, and perhaps smaller than the risk of regulatory capture and of increased heterogeneity of regulation across sectors. Provided such pitfalls are avoided, sector-specific regulation can make sense in the interest of improving responsiveness to emerging technologies and to social challenges.

### *Vision projected by the top sectors*

It would appear that at least part of the debate stems from issues relating to the vision projected for the future. The top sectors approach has been justified on grounds of the need to improve the Netherlands' international competitiveness in light of intensified global competition (particularly in emerging markets) and emerging social challenges. However, focusing on sectors of existing strength[15] is not always compatible with increasing overall competitiveness, and the motivating policy documents do not make the rationale for their selection sufficiently convincing. If the idea is to put limited public resources where they would have maximum economic impact, a clearer sketch of what would constitute desirable impact could be provided. Sectors of strength are unlikely to be sub-critical compared to other sectors nationally, so the argument appears to be that they need strengthening compared to the corresponding sectors of international competitors.

However, no references to supporting evidence have been provided in motivating policy documents. There are now plans to incorporate the needed international comparisons into current efforts to monitor progress and evaluate the top sectors.

A longer-term vision might say more about the type of economy that the Netherlands aspires to become and describe its qualities in terms that can be broadly recognised and accepted. In strengthening the legitimacy of the policy and ensuring its effective monitoring, it would be desirable to reinforce the rationale and inject further nuance and clarity, including in the specification of links between the overall vision and its intermediate objectives.

### *Progress in the top sectors and further development*

The top sectors approach has existed for only two years so it is too early to assess its impact. An initial impression can be sketched on the basis of available but incomplete evidence on participation, instrument take-up and the governance of the top teams.

In spite of some criticism, the policy appears to enjoy broad acceptance, in part because of a general understanding of the need for long-term stability in the direction of innovation policy. The high levels of awareness, engagement and enthusiasm among businesses in top sectors such as high-tech systems and materials are encouraging. Progress has also been made in embedding the approach into policy making and research planning (Ministry of Economic Affairs (2013a; 2013b). Some of those involved in the drafting of the roadmaps report that the approach has created a new and positive dynamic in public-private co-operation. It may also have enhanced transparency, by bringing into the open bargaining activities by stakeholders that would likely take place anyway. In addition, it has a useful focus on deregulation to facilitate new firm creation and streamline the business environment.

The co-ordination dimension of top sectors and the attention paid to it at the outset stand out as positive features of the approach. Initial indications are that this is already leading to some desired outcomes, in terms of aligning public research with industrial needs and encouraging the establishment of novel links between fundamental research performers and industry. Perhaps there is no better indicator of the approach's success in gaining recognition than the fact that it has been emulated by the construction sector, which has recently organised a partnership similar to a top sector but without government support.

At the same time, there are indications of variable awareness, development and commitment among the top sectors. The transaction costs entailed in participating in top sectors can be substantial for all parties concerned. It is likely that these will fall over time with learning and the formation of stable networks and routines. As the nature of co-ordination problems varies among the top sectors, it would be profitable to use evidence collected in the course of monitoring progress to facilitate learning and consolidate experiences into actionable lessons (Hessels and Deuten, 2013).

The participation of SMEs remains a challenge, especially, but not only, for SME-rich top sectors such as creative industries and logistics. Lack of resources for engagement is likely a limiting factor for smaller companies. The problem can be aggravated by the fact that larger companies are better organised and have more experience in dealing with government. The government recognises the problem and efforts are under way to encourage participation of SMEs through the MIT instrument (discussed below), the establishment of dedicated contact points for SMEs and the acceptance of in-kind contributions for small sums mentioned earlier. In addition, it would be important to ensure

that their interests are taken into account in a manner that is sufficiently representative during the negotiation of the innovation contracts and the drafting of agendas. Merely hearing SME representatives' views in the top teams may not be sufficient, given the enormous diversity of this constituency; additional channels to solicit views and shape agendas (such as open consultations and surveys) may be required.

### Box 5.2. Initial AWT observations on the top sectors, 2013

The *Adviesraad voor het Wetenschaps- en Technologiebeleid* (AWT) has been tasked to advise the Ministry of Economic Affairs on developments in the top sectors and is expected to publish a stocktaking report during 2014. In the meantime, as part of the 2013 Monitor of Enterprise Policy, the AWT was invited to submit first observations on the approach, focusing primarily on the main knowledge and innovation pillar. In the interests of policy continuity and stability, and reflecting on the strengthening of relations between industry, public research and government as a result of the top sectors, the AWT urged the government to continue with the approach. At the same time, it made several suggestions for improvement.

1. *Improve organisation/co-ordination*: the Ministry of Economic Affairs could be more proactive in guiding changes in the innovation system. AWT claims that the government should provide more (concrete) direction. Stakeholders now face uncertainty with respect to budgets, contact points, etc. Moreover, bureaucratic complexity may deter potential participants. Transparency in terms of the added value of the top sectors approach may increase commitment. The top sectors themselves are largely responsible for their organisation, but might benefit from professional support for communication and managing public-private partnerships. Another issue is the identified need for more clarity on how research agendas are constructed. Not all stakeholders understand or agree that "demand-driven research" basically means "industry-inspired research". There is a strong focus on fundamental research; crossing the "valley of death" by engaging in applied research is less prominent.

2. *Increase SMEs' involvement*: it appears that SMEs are not heavily involved in the top sectors. The AWT expresses a demand for more vision on the kind of SMEs that should be involved, pointing at the difference between a broad scope and a focus on the most innovative firms.

3. *Invest more in cross-sectoral (societal) challenges*: crossovers between the top sectors (and their TKIs) are believed to have huge innovation potential. So far, stakeholders in many top sectors have made few attempts join forces to address topics of strong economic and/or societal relevance. AWT suggests the need for more guidance on creating crossovers and points to Europe's Horizon2020, in which innovation is explicitly linked to broad societal challenges.

4. *Align national and regional policy*: regions appear increasingly concerned with innovation, making financing available and developing smart specialisation strategies. The AWT acknowledges the potential leverage regions can give the national top sectors approach, but warns of risks related to misalignment (duplications, omissions, inefficient variation in instruments, conflicting rules).

5. *Facilitate customisation of the top-sector instruments*: the top sectors approach builds on sector-specific measures as an addition to the Dutch generic innovation policy. However, stakeholders claim that the current top-sector instruments are insufficiently customised. Additionally, there is a demand for more support for services innovation, for instance through partnerships between manufacturing and service providers. A consideration might be to shift part of the budget for generic policy towards more specific policies.

*Source*: AWT (2013a), Advisory Letter: Initial Observation from the Top Sector Results.

The government appears to be aware of the limitations of the approach and is taking steps to adapt it. In response to the limitations of the sectoral focus, three crossover domains were introduced in ICT, bio-based economy and nanotechnology. Additional efforts have been made to identify cross-cutting projects, particularly in the high-tech systems and materials top sector. More active and more representative participation by SMEs, openness in the top sectors, and fuller representation of societal challenges all appear high on the agenda. A recently published progress report suggests that action is needed to improve alignment with societal challenges, provide more support for risky or innovative start-ups, and further simplify instruments on the basis of experience to date (Ministry of Economic Affairs, 2013a).[16]

Further efforts to strengthen the overall vision are needed. At the same time, it would be important to ensure sufficient support for PPP initiatives that fall outside the scope of the top sectors and to strengthen and rebalance the current landscape of generic instruments. Experience with co-ordination in the top sectors may be usefully applied in other parts of the economy. This is important for safeguarding the long-term dynamism of the Dutch economy and innovation system.

The risks and limitations outlined above, important as they are, relate in large part to aspects of the approach that, despite some assertions, do not appear to have materialised. In practice the approach has shown considerable flexibility. Flexibility is served by the numerous sectors chosen and the weak emphasis on concentration of resources, which is even weaker in areas with obvious trade-offs, such as funding for fundamental research (e.g. the requirement for industrial support in the NWO calls apply only to a minority of its competitive funding).

Though some in the Netherlands see the large number of sectors and the weak emphasis on concentration as failings of the approach, these seem to be sensible outcomes, in light of uncertainty over future sectors of high global demand, lack of evidence on the importance of unexploited scale economies for impact in these sectors and the uneven progress made in solving co-ordination problems. They can also be seen as a form of insurance against lock-in. Wide coverage and loose definition mean that individual companies can self-determine the sector(s) to which they belong, potentially allowing challengers and even companies operating in other sectors to participate in existing top sectors. However, despite efforts, and while there are no formal obstacles to the admission of new entrants into existing top sectors, in practice smaller and younger firms are not always adequately represented, especially in the top-sector leadership.

The question of sufficient scale or "critical mass" can be seen as the flip side of the issue of the variable ability to co-ordinate in different top sectors. Provided coordination works well, insofar as opportunities from unexploited scale economies exist, these will become apparent to participants, which should enable decisions to commit the requisite resources. From a policy perspective, therefore, the issue of sufficient scale is best considered as one related to co-ordination ability and its effects on eliciting quick responses to opportunities as they emerge rather than as an unqualified (and potentially wasteful) drive towards greater scale.

Looking to the future, it would be important to address shortcomings with respect to dynamism, for example, through formal mechanisms to introduce new top sectors, discontinue old ones and form dynamic demand-driven partnerships (e.g. through crossovers between the various top sectors) that coalesce into top sectors of their own. Formal arrangements that facilitate systematic learning, build trust and reduce transaction costs are likely to improve the impact of co-ordination in terms of pooling and aligning resources. The presence of such formal mechanisms would certainly facilitate transparency, strengthen legitimacy and therefore improve the approach's chances of long-term survival relative to the long line of its predecessors.

## 5.4. Supporting business R&D and innovation

### *Overview*

The government plays an important role in shaping business innovation activities, and a key task is to provide suitable framework conditions. In the Netherlands, support to business innovation currently rests on two pillars: the top sectors approach, discussed above, and generic instruments and favourable framework conditions for all companies.

The government's efforts to provide favourable framework conditions focus on streamlining the regulatory framework for all businesses. Generic instruments predominantly take the form of tax incentives for investments in knowledge. Other generic instruments seek to improve the availability of finance (such as loans and credit guarantees), and smaller schemes address the demand side of innovation. In all, government support to business R&D was the equivalent of about 5% of business enterprise expenditure on R&D (BERD) (2009-11 average, the last three years of available data) (OECD, 2014a). The level is similar to that of Germany but below the OECD average (8%) and much lower than that of the United States (12%) and the United Kingdom (9%).

### *Instruments in support of business-sector innovation*

#### *Fiscal incentives*

Over the past two decades, OECD countries have increasingly employed tax incentives for R&D. The Netherlands was among the first countries to introduce such instruments in 1994. The main instruments are the WBSO, the recently established RDA and the Innovation Box. The total budget for the tax credit/allowance (WBSO/RDA) was EUR 1 073 million in 2013 and EUR 1 066 million in 2014. The structural use of the Innovation Box in budgetary terms is estimated at EUR 625 million.

**WBSO**. The tax credit for R&D (WBSO) is the largest business innovation policy instrument in the Netherlands. It was established in 1994 and was modified over time following evaluations. It aims to promote innovation in firms by reducing taxes on labour costs of R&D personnel. The total budget for the WBSO was EUR 698 million for 2013. Actual use (budget depletion) was EUR 731 million in 2012 down from a peak of EUR 915 million reached in 2011, twice the volume of 2008 (data from the Netherlands Enterprise Agency, RVO). In 2014 the budget is estimated to increase to EUR 764 million and then to decline to around EUR 650 million in 2015. In 2012, the tax reduction corresponded to 42% of the first EUR 110 000 of R&D labour costs (60% for firms under five years old) and 14% for additional R&D labour costs. The tax reduction has a ceiling of EUR 14 million per calendar year. In 2009 and 2010, the tax reduction shares were temporarily increased to promote R&D expenditure during the economic crisis. The number of WBSO user companies increased by 8.2% from 2011 to 2012, mainly in non-top-sectors domains. Of these, 97% were SMEs, which accounted for 73% of the programme budget.

According to the evaluation of the WBSO programme covering 2006-10 (EIM, 2012), the scheme has helped to promote business R&D, a finding that is consistent with an earlier evaluation (Poot et al., 2003). Econometric estimates contained in the evaluation suggest that, by reducing R&D wage costs, the WBSO has had a positive impact on private R&D expenditure. Though the method does not conclusively show a causal relationship between the amount of tax relief and additional private R&D expenditures, it finds that on average, each euro of WBSO tax reduction was accompanied by 1.77 euros of private R&D (a measure commonly referred to as average "bang for the buck"). The

evaluation further estimates that about 55% of the private R&D would likely have taken place regardless of the WBSO (EIM, 2012, p. 113). In addition to direct positive effects, there were indirect positive effects on innovation, such as increases in the share of turnover due to new or developed products and improvements in labour productivity. Moreover, participants reported that the WBSO had helped them take more risks, perform more R&D themselves, improve R&D planning and better absorb external knowledge, particularly in smaller firms (EIM, 2012).

However, the latest evaluation also showed that there are decreasing returns (captured by extra R&D generation) as the average share of tax reduction increases. The government therefore decided to decrease the tax benefit from 60% to 50% for young firms and from 42% to 35% for other companies. The first tax bracket was also increased from EUR 110 000 to EUR 250 000. Several evaluations of the WBSO (Lokshin and Mohnen, 2009; Brouwer et al., 2002; and Poot et al., 2003; as well as EIM, 2012) have shown that this measure is particularly beneficial to SMEs. This is due to its design, notably the ceiling and the fact that the first bracket of the tax credit is more generous.

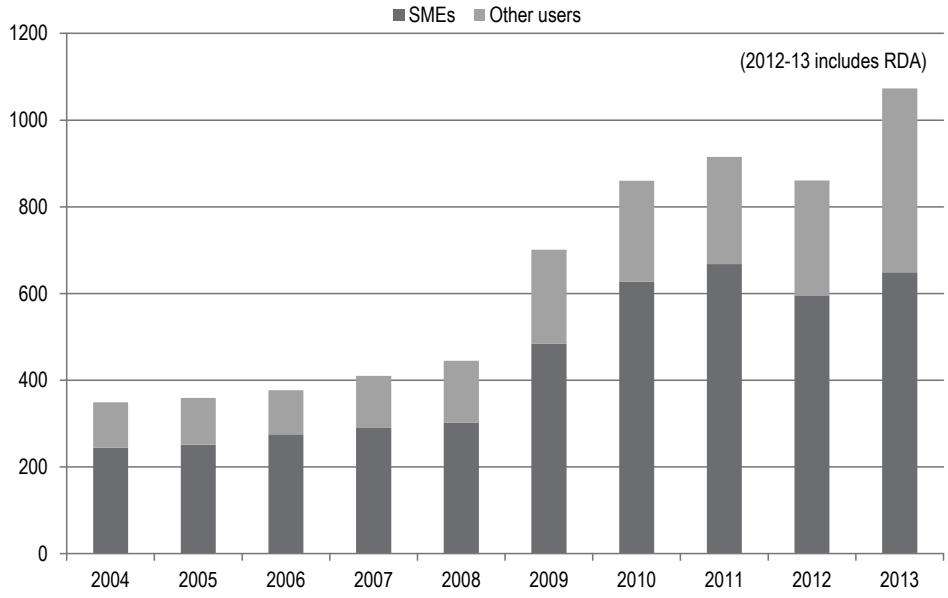
**RDA.** The research and development allowance (RDA) was introduced in 2012 to promote firms' investments in innovation. It allows firms to deduct investments in R&D equipment and exploitation costs. In this sense, it complements the WBSO, by offering tax credits for R&D investments other than those related to human resources. The budget depletion (allowance capitalised by enterprises) for the RDA was EUR 130 million in 2012 (information provided by Netherlands Enterprise Agency, RVO, 2014), the available budget is EUR 375 million in 2013 and EUR 302 million for 2014. In 2012 the tax relief corresponded to 40% of declared R&D expenditures and was increased to 60% after 2013. In 2012 top-sector firms claimed 72.8% of the budget of this programme. The share to SMEs is higher in non-top-sector domains (57.2% of the RDA budget allocation to SMEs) than in top sectors (32.5%).

Combined support through WBSO and RDA increased in 2013 (Figure 5.4). While the share of larger firms in total WBSO allowances has changed little over time, they have benefited especially from the introduction of the RDA. As a result larger firms accounted for a considerably larger share of total R&D tax allowances in 2012-13 than previously. Moreover the average size of their allowances increased considerably in recent years, from around EUR 200 000 in 2008 to over EUR 300 000 in 2010-11 and to similar levels since the introduction of the RDA (Figure 5.5).

**Innovation Box.** The Innovation Box is intended to secure and strengthen the Netherlands' position as an innovative, competitive economy. The Innovation Box offers to innovative businesses a preferential tax rate of 5% for income on "intangible assets" (hereafter: "intangible properties") that are self-developed (excluding trademarks, logos and other similar assets). Furthermore, the Innovation Box is applicable to some types of intangible properties only. These are (i) self-developed intangible properties protected by a patent granted to the taxpayer, and (ii) self-developed intangible properties that result from a qualifying R&D project for which a so-called "R&D statement" has been obtained from the Dutch authorities. Qualifying projects include development projects, technical or scientific research activities, analysis of technical feasibility of R&D projects, development of software, and process-oriented technical research.

**Figure 5.4. WBSO and RDA, budget depletion to SMEs and other users, 2004-13**

EUR millions

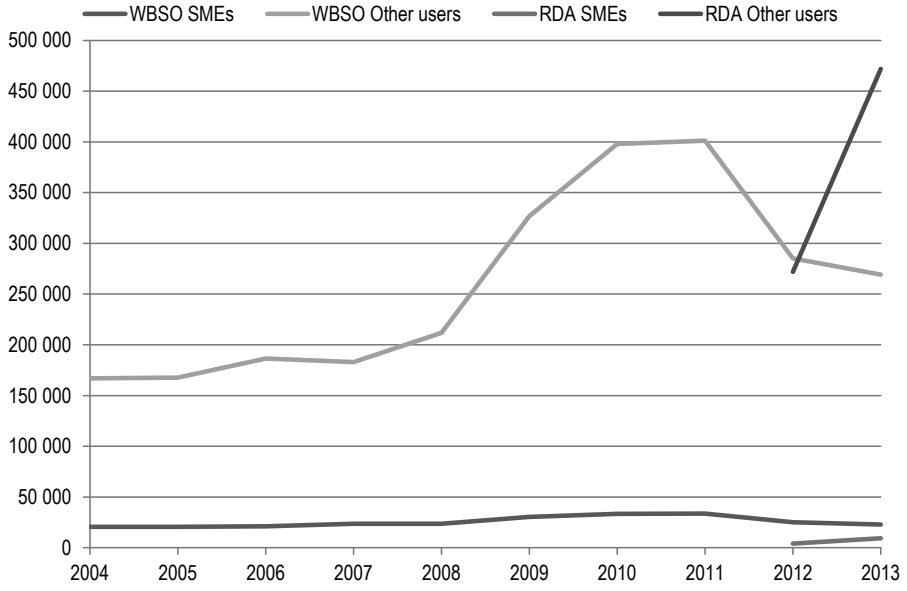



*Notes:* Allowance capitalised by enterprises. Allowance capitalised by self-employed persons excluded (not available). Based on number of enterprises including self-employed persons that have received an allowance right from the WBSO- and/or RDA-programme. Rights are not always capitalized by enterprises. Figures for 2013 are based on available annual budget, not budget depletion. Available WBSO-budget for self-employed persons (EUR 8 million) included.

Source: OECD, based on Netherlands Enterprise Agency, WBSO/RDA programme, 15 April 2014.

**Figure 5.5. WBSO and RDA, average size of allowances (budget depletion) to SMEs and other users, 2004-13**

EUR




*Notes:* See notes to Figure 5.4.

*Source:* OECD, based on Netherlands Enterprise Agency, WBSO/RDA programme, 15 April 2014.

The Netherlands introduced the Innovation Box in 2010. The Patent Box that had been introduced in 2007 was capped at the point at which the income from the intellectual property (IP) exceeded four times the cost of developing the invention. The cap was removed when the Innovation Box was introduced in 2010. Intangible assets developed by another party for the risk and account of a Dutch taxpayer also qualify for the Innovation Box. In this case the taxpayer should have the capability of managing the IP and the R&D work. Criteria that play an important role in determining whether the taxpayer qualifies for the Innovation Box are: having the expertise regarding the IP, being responsible for making relevant decisions, planning, budgeting, monitoring the R&D process, adjusting the scope of the R&D work etc. The Innovation Box does not apply to acquired IP; it only applies to the extent that the further development by the taxpayer leads to a new, self-developed intangible property.

The Innovation Box means that the tax regime for IP exploitation in effect in the Netherlands is quite generous in comparison to that of other European countries: the tax rate *for qualifying income* is 5% (it was 10% until 2009), which makes it less generous only than those of Malta (0%), Cyprus (2%) and Lichtenstein (2.5%), although it should be noted that not only tax rates are relevant, but also the tax base. Although the instrument is not budgeted, the structural use of this instrument is estimated at EUR 625 million (Patent Box until 2009: EUR 370 million). Although several countries have introduced similar instruments, there is no general consensus regarding their effectiveness (see Box 5.3). A formal evaluation is scheduled for 2015.

### Box 5.3. "Patent Box" schemes in international perspective

Griffith et al. (2012) simulate the effects of patent box schemes across countries. They predict that in the Benelux countries and the United Kingdom, such schemes will not introduce benefits in the system since it will not be possible to attract extra income to compensate for the lower tax rate. In addition, their findings show that revenue losses increase when other countries introduce a patent box. Some of the general criticisms regarding patent box schemes relate to the fact that they tend to target the income of successful projects (the ones resulting in patents or other profitable R&D outcomes) rather that the underlying research and therefore do not increase the will to undertake newer and riskier research. In this respect they tend to be less effective in promoting R&D than more targeted R&D tax incentive schemes. This is true in particular when the tax incentives apply only to the final and commercial phase of R&D and do not require undertaking innovation-related activities in the country. For example, Ireland removed some tax incentives in 2010 because they did not have the desired effect on R&D investments. Patent box schemes may introduce distortions into firms' decisions (particularly those of multinational enterprises) to locate R&D activities and to declare the income generated by IP on the basis of the generosity of tax regimes. To be more effective, patent boxes need to be carefully designed and coherent with other policies that address the innovation system in general, such as investments in higher education, basic research and innovation so as to promote innovation spillovers from patenting firms to the system more generally.

*Source*: Griffith R., H. Miller and M. O'Connell (2012), "Corporate tax and the location of intellectual property", *CEPR Discussion Paper* No. 8424.

*Access to finance (loan and loan guarantees)*

In addition to a wide variety of credit support mechanisms available to businesses for various types of investment [see OECD (2014b) *Economic Survey of the Netherlands]*, the Dutch government has sought to ease the availability of credit for innovation-related investments. This has come as a response to the tight credit conditions since the beginning of the financial crisis, especially for SMEs (see Chapter 2). The instruments vary according to the target groups (small or larger firms) and the stage of financing or venture capital services provided (seed funding, venture capital, later-stage venture capital, etc.).

**SME+Innovation Fund**. The SME+Innovation Fund was created in 2012 to increase the availability of venture capital for SMEs. Its total budget for 2013 was EUR 165 million but will be reduced to EUR 96 million in 2014 and EUR 58 million in 2017 (Ministry of Economic Affairs, 2013c). It has three pillars:

- The *innovation credit* supports the development of high-risk innovative projects. If successful, companies using the innovation credit pay back the loan, if not, the credit is converted into a grant. The minimum credit was increased from 2012 to 2013 to facilitate the access of small companies to this scheme. The available budget (in common with the SME loan guarantee scheme, see below) was not fully utilised in 2012. In that year, the volume of outstanding loans was EUR 53 million (Ministry of Economic Affairs, 2013b), or approximately 55% of the available resources. This happened despite a 50% increase in applicants, as the quality of applications did not meet the selection requirements. A recent evaluation showed that an innovation credit ensures that the wage bill for R&D is on average 68% higher than it would have been without it (de Jong et al., 2013). Econometric estimates suggest that one extra euro of innovation credit resulted in an increase by 1.22 euro in total R&D wages and by 1.82 euro in total R&D expenditures. The evaluation also identified evidence that users of the innovation credit are more successful in terms of patent applications and job creation than companies whose applications were rejected. Importantly, compared to rejected applications, awarded projects are less likely to fail, which suggests that the stringent evaluation regime more than compensates for the potential perverse incentives introduced by the conversion of failed projects into grants.
- The *SEED capital* targets high-technology or creative entrepreneurs and provides public venture capital investment funds. Over 2005-12 the fund invested EUR 138 million (Ministry of Economic Affairs, 2013b).
- The *fund-of-funds* was created in 2013 with a budget of EUR 150 million (of which EUR 50 million from the EU). It is managed by the European Investment Fund, together with the Regional Venture Capital Company of the Eastern Netherlands. It focuses mostly on high-growth innovative enterprises in need of later-stage venture capital.

**SME loan guarantee scheme (BMKB).** BMKB gives a guarantee to banks that provide loans to SMEs. This allows SMEs to borrow more than they could without the scheme. In 2014, the guarantee for SMEs will be extended to cover 67.5% of the loan (up from 45%) for a maximum of EUR 200 000 per firm. In 2012, the BMKB budget was EUR 705 million and generated a total of over EUR 1.5 billion in loans (Ministry of Economic Affairs, 2013b). In that year, this guarantee scheme (like other guarantee schemes) was less used than in previous years: less than 70% of the available budget was

used. This was partly due to the economic recession. Around 14.6% of beneficiaries are in the top sectors and receive around 21% of the loan budget.

**Growth facility scheme (RG).** This is another instrument to promote access to finance (venture capital) for SMEs. It provides a guarantee to funders for 50% of the total amount of the loan. The term of the guarantee is 12 months. Again, less than 26% of the available budget was used in 2012. The total available budget for that year was EUR 50 million (Ministry of Economic Affairs, 2013b).

**Business loan guarantee scheme (GO).** This scheme aims to facilitate access to financing for large and medium-sized firms in the Netherlands. Since 2013, capital providers receive a 50% loan guarantee from the government under this scheme. The guarantee lasts for a maximum of eight years. The budget for the scheme amounted to EUR 329 million in 2012 (Ministry of Economic Affairs, 2013b). Once again, this instrument was used less than in pre-2012 years, with only 31% of the budget allocated.

**Dutch Investment Agency (NII).** In 2013 a decision was taken to establish the Dutch Investment Agency to promote the availability of funding for firms. It will be formed in co-operation with pension funds, insurance companies and banks. NII will focus its interventions on social challenges such as health care, energy, infrastructure, housing and regional development initiatives. Its core tasks will be to pool knowledge, standardise propositions, evaluate and select projects, and provide sufficient scale and diversification of investments. The NII will act as an intermediary to help attract long-term funding from institutional investors and is expected to have a broad mandate in a wide range of sectors and investment categories (OECD, 2014b).

**Microfinancing by Qredits.** Qredits is a public-private partnership between Dutch banks and the Ministry of Economic Affairs, the Ministry of Social Affairs and Employment, and the Fund "Werken aan Wonen" (Working on Housing). It operates as a non-profit organisation, delivering micro-finance services in the Netherlands. Qredits provides microcredit loans up to EUR 150 000 and business coaching services. The budget for micro-financing was recently increased to EUR 30 million.

### *Demand-side instruments*

Over the last decade there has been increasing interest in demand-side instruments to promote innovation in OECD countries. This reflects both a growing awareness that supply-side policies alone have not sufficiently promoted innovation and the fact that pressures on government spending show the need to promote innovation by other means.

**Small Business Innovation Research Programme (SBIR).** Inspired by the well-known US programme, SBIR uses public procurement to fund innovation projects that address social challenges. It specifically targets SMEs but large companies can also apply. The general objectives of the SBIR are to address social issues, to strengthen the innovative capacities of businesses, particularly SMEs, and to contribute to the production of knowledge (Ministry of Economic Affairs, 2010). It has three variants: the departmental SBIR concerns pre-commercial procurement and corresponds to the first two objectives; the TNO-SBIR covers all three objectives and emphasises exploitation of knowledge developed by TNO; and the STW valorisation grant focuses on university researchers who aim to start a business or otherwise transfer knowledge to businesses (Technopolis, 2010). The first two variants award contracts to companies, the third variant awards grants.

In spite of their different logics and positions in the policy mix, all SBIR components finance the early phases of a project's development but not the subsequent commercial exploitation. The first phase involves a feasibility study. If the results are positive, the R&D phase follows. Themes covered by SBIR include green materials, energy efficiency and clean energy. The programme, promoted by the Ministry of Economic Affairs with the involvement of other ministries, started in 2004 and it is implemented by Agency NL. SMEs can apply for feasibility grants (up to EUR 50 000) and subsequently for R&D grants (up to EUR 450 000). The SBIR budget increased from EUR 3.5 million in 2006 and EUR 7.45 million in 2008 to EUR 32 million in 2010. Its central government component has been reduced since[17] A 2010 evaluation of the programme concluded that SBIR is effective (Technopolis, 2010) but highlighted the need for further monitoring and coaching in the market implementation phase and for better co-ordination with other national and regional instruments.

**Innovative Procurement Urgent.** This recently established instrument aims to promote innovation from a demand-side perspective. It was launched by the Ministry of Economic Affairs, but its execution will also involve other ministries. The goal is to devote 2.5% of the government budget to innovation-friendly public procurement. It is project-based and has so far selected 27 projects. The projects must focus on a social challenge.

### *Top sector-specific instruments*

In addition to the above-mentioned generic instruments, two instruments specifically address firms in the top sectors. These seek to promote innovation in the top sectors as well as public-private co-operation.

**TKI allowance.** The TKI allowance scheme promotes the development of public-private R&D consortia in each top sector. TKI allowances are implemented as follows: the government adds 25% of the total amount provided by business-sector actors as co-funding. In 2013 a total of EUR 319 million of private contributions resulted in a total TKI allowance of EU 83 million. For SMEs, the government co-funds 40% for the first EUR 20 000 contributed by SMEs.

**SME innovation support top sectors (MIT).** Introduced in 2013, the MIT scheme promotes the participation of SMEs in top-sector valorisation initiatives. MIT uses various instruments: collaborative R&D projects, feasibility studies, innovation vouchers, hiring of experts, networking and coaching. In 2013 the total budget for this programme was EUR 23 million (Ministry of Economic Affairs, 2013c), but it was not possible to fund all applications with the available budget. Table 5.7 shows the budget allocation for 2014. Table 5.8 summarises the business innovation support instruments discussed above.

**Table 5.7. MIT 2014 budget allocation by top sector and instrument**

| **Opening** | **15 April – 12 May** | | | | | | **3 June – 22 September** |
|---|---|---|---|---|---|---|---|
| **Applicant's** | **MKB (FCFS)** | | | | **TKI (FCFS)** | | **MKB (tender)** |
| **Instrument → Top sector↓** | *Feasibility studies* | *Vouchers* | *Hiring staff* | *IPC* | *Network activities* | *Innovation brokers* | *R&D co-operation* |
| Horticulture… | 750 000 | | | | 50 000 | 250 000 | 950 000 |
| Agri&food | 478 400 | | | | | | 1 913 600 |
| Water | 1 002 900 (vouchers according to feasibility study) | | | | 100 000 | | 897 100 |
| Life sciences and health | 600 000 | | | | 100 000 | 200 000 | 1 100 000 |
| Chemistry | 550 000 | | (according to feasibility study) | | 100 000 | 150 000 | 1 216 500 |
| Bio-based | 400 000 | | | | 100 000 | 150 000 | 1 350 000 |
| HTSM/ICT | | | | | 200 000 | | 3 800 000 |
| Energy | 1 200 000 | | | | 100 000 | 200 000 | 500 000 |
| Logistics | 900 000 | | | | 100 000 | 100 000 | 900 000 |
| Creative Industries | | 860 000 | | (according to vouchers) | 100 000 | 100 000 | 940 000 |
| General budget (for all top sectors) | | | | | | | 8 000 000 |

*Source*: RVO (2014), "MKB-innovatiestimulering Topsectoren (MIT)", www.rvo.nl/subsidies-regelingen/mkb-innovatiestimulering-topsectoren-mit.

**Table 5.8. Business innovation funding instruments overview, 2014 or latest year**

| Main instrument | | Annual budget (or annual average)<br>EUR millions | Additional public [source] or private funds leveraged<br>EUR millions | Modality of delivery<br>(e.g. direct funding, fiscal incentives, loan or loan guarantees) | Policy objective | Target population<br>(sector, size, age, innovative behaviour) |
|---|---|---|---|---|---|---|
| **WBSO** | | 764 | Private funds estimated* at around 1 390 | Tax credit | R&D workers | All |
| **RDA** | | 302 | n/a | Tax credit | R&D, non-labour costs | All |
| **TKI allowance** | | 102<br>(83 in 2013) | 319 expected private funds (2013), 500 public funds aligned | Co-financing, 25% supplement (40% for first EUR 20 000) | Joint programming | Top sectors only |
| **MIT (SME innovation support Top Sectors)** | | 30 | n/a | Choice of instruments** under discretion of top teams | SME participation in valorisation | Top sectors only |
| **MKB+ (SME+ Innovation Fund) consisting of:** | | | | | | |
| **Sub-instruments** | Innovation credit | 86.5 (2013) | n/a | Loan if successful, converts to a grant if project fails | Finance for high-risk innovation | SMEs, especially start-ups |
| | SEED Capital | 21.5 (2013) | n/a | Venture capital | Finance for innovation | High-technology entrepreneurs/SMEs |
| | Fund-of-funds | 100 | 50 from EU | Venture capital | Finance for innovation | High-growth innovative firms |
| **Innovation Box** | | 625 | | Tax credit on profits from innovation | R&D investments | All |
| **BMKB (*SME Loan Guarantee Scheme*)** | | 705 (2012) | 795 | Loan guarantees (67.5% of loan, up from 45% in 2013) | Facilitate credit, increased during the crisis | SMEs (14.6% in the top sectors receive 21% of budget) |
| **NII (Netherland Investment Institution)** | | [predecessor Syntens had 30.5 in 2013] | n/a | Transfer of authority (agency) | Promote the availability of funding and facilitate investment | All |

**Table 5.8. Business innovation funding instruments overview, 2014 or latest year *(continued)***

| Main instrument | Annual budget (or annual average) EUR millions | Additional public [source] or private funds leveraged EUR millions | Modality of delivery (e.g. direct funding, fiscal incentives, loan or loan guarantees) | Policy objective | Target population (sector, size, age, innovative behaviour) |
|---|---|---|---|---|---|
| **Microfinancing (by Qredits)** | n/a | 30 (including private finance) | Micro-loan and business coaching | Finance for innovation | SMEs |
| **Growth facility scheme (Regeling Groeifaciliteit)** | 50 (2012) | 50 | Loan guarantees (50% of loan) | Facilitate venture capital for SMEs | SMEs |
| **Business Loan Guarantee Scheme (Garantie Ondernemings-financiering, GO)** | 329 (2012) | 329 | Loan guarantees (50% of loan) | Facilitate credit | Large and medium-sized firms |
| **SBIR (Small Business Innovation Research Programme)** | 6.3 (2013) from central government | n/a | Project funding for public procurement | Societal challenges, demand stimulation, valorisation of public knowledge | SMEs, but partly open to large firms |
| **Innovative Procurement Urgent (Inkoop Innovatie Urgent)** | n/a | n/a | Project funding for public procurement | Societal challenges (demand stimulation) | n/a |

*Notes:* * Estimated from public budget using the 1.77 'bang for the buck' estimate provided in EIM (2012), p. 12; ** Choice of instruments includes collaborative R&D projects, feasibility studies, knowledge vouchers, hiring of experts, networking activities and innovation brokers.

*Source:* Ministry of Economic Affairs (2013), "Summary Chart Enterprise Policies" (unpublished), ERAWATCH website, Netherlands Enterprise Agency, RVO (2014), WSBO/RDA programme, 15 April 2014and correspondence with Ministry of Economic Affairs.

## *Business innovation policy mix*

### *Current challenges and the policy mix*

Dutch innovation (and industrial) policy has high aspirations. The document that launched the top sectors (Ministry of Economic Affairs, 2011) stated the Netherlands' ambition to be among the top five knowledge economies globally. The Netherlands is well placed to fulfil this ambition, particularly because of the very high quality of its human resources. There are nonetheless important challenges, most prominently the long-standing low levels of business R&D.

The difficulties faced by Dutch exporters in the emerging BRIC markets feature prominently among the rationales behind the top sectors. This concern resonates strongly with the business sector. The findings of a government-commissioned business survey are illuminating:

> "According to the respondents, the difference between the share of Dutch exports to the BRIC countries and the EU average is not to be blamed on failing Dutch government policy. They believe European competitors to have easier access to the BRIC markets because they are larger and more internationally active, their products better suit the demand of the BRICs, and they can deliver at lower prices." (de Jong and van Winden, 2011)

Better performance on innovation can help address the insufficient demand for Dutch products and poor cost-competitiveness in these markets. Raising international competitiveness is not the only challenge. In light of demographic shifts and environmental challenges, innovation – much of it performed by firms – is set to make a crucial contribution. Productivity improvements in some of the Dutch services sectors could have a lasting impact not only on the economy but more broadly on Dutch society.

Evidence presented in Chapter 4 suggests that, while the Dutch business sector is very innovative overall, aspects of its innovation performance fall short of the world's leading innovation systems. In particular, a comparatively large part of the business sector (as reflected in R&D intensity and in levels of industry-university collaboration compared to business sectors in other advanced systems) does not appear to engage in new-to-the world innovation. In light of the challenges and the diagnosis of business innovation performance, policy effort would need to:

- increase the pool of innovating firms and intensify business innovation effort of all kinds;
- raise the ambition and scope at the global level for a greater share of business innovators, which will inevitably require a greater emphasis on R&D to match the levels of other advanced innovation systems;
- foster diversification into product and market segments of rising global demand, which will partly occur as a long-term result of a more R&D- and more innovation-intensive economy.

This section considers how well the current policy mix fits these tasks. Table 5.9 presents the instruments deployed in support of business-sector innovation and the development needs of various parts of the business sector according to their innovation behaviour. In the Netherlands, as in other advanced innovation systems, the majority of firms systematically engage in innovation that is at least new to the firm (Table 5.9, Column A). A sizeable number, perhaps a majority, also introduce innovations that are

new to the market (Column B). The current policy thrust appears focused on Column B. While the available instruments and the needs of firms overlap considerably in Column C, the scale, distribution and some of the characteristics of the current policy effort could be better attuned to firms that have not yet made the transition to new-to-the-world innovation. These issues are discussed below.

**Table 5.9. Business support policy mix according to current capacity and further development needs**

| Capacity building / development stage → | **A**. […from no innovation activity to innovation that is] | **B**. […from primarily new-to-the-firm to innovation that is] | **C**. […from new-to-the-firm and new-to-the-market to innovation that is] |
|---|---|---|---|
| ↓Policy tasks↓ | *new-to-the-firm* | *new-to-the-market* | *new-to-the-world* |
| **1**. *Increase the pool of innovators* | WBSO, RDA, micro-financing | WBSO, RDA; MKB+, BMKB (small firms); TKI, MIT, RDA+ (Top Sectors only) | WBSO, RDA (only partially due to small scale); Innovation Box; MKB+, BMKB (small firms only); TKI, RDA+ (top sectors only) |
| **2**. *Increase the intensity of innovative effort* | WBSO, RDA, Growth Facility; MKB+, BMKB | WBSO, RDA; MKB+, BMKB (small firms); TKI, MIT, RDA+ (Top Sectors only); Business Loan Guarantee Scheme | WBSO, RDA (only partially due to small scale); Innovation Box; MKB+, BMKB (small firms only); TKI, RDA+ (top sectors only) |
| **3**. *Diversify by extending the range of innovation modes and fostering collaboration* | WBSO, RDA | TKI, MIT; RDA+ (Top Sectors only); SBIR (very partially due to small scale) | TKI, MIT; RDA+ (Top Sectors only); SBIR (very partially due to small scale), EUREKA |

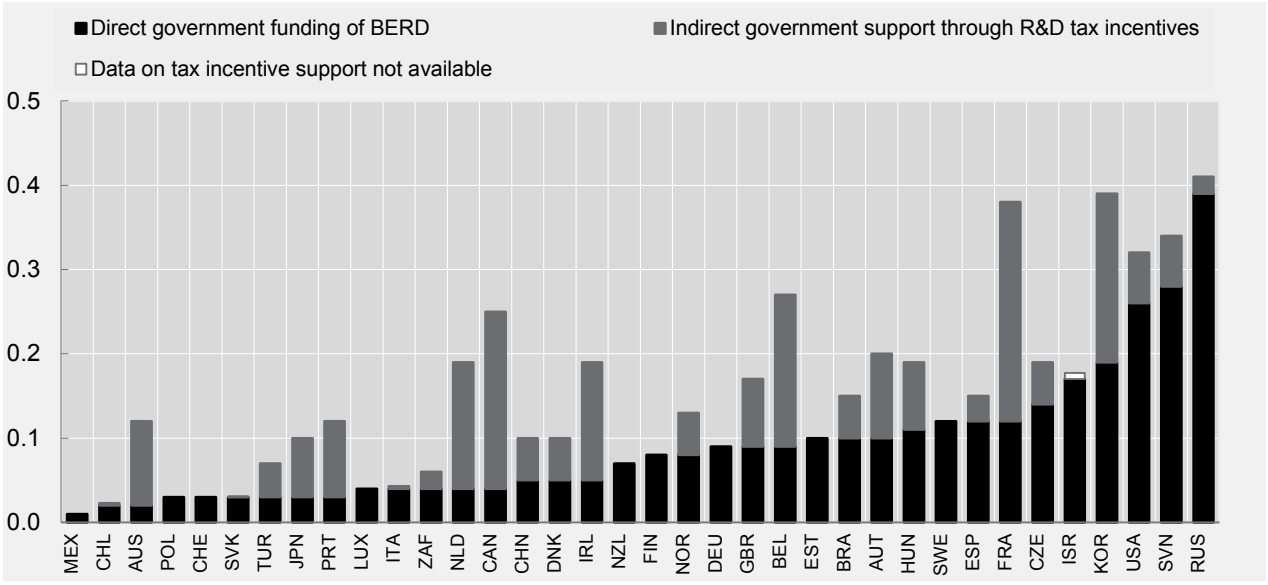
*Source:* OECD Secretariat, drawing on contributions by Martin Bell, SPRU, University of Sussex.

### *Balance between tax incentives and direct funding*

The Netherlands places more emphasis on tax incentives than on direct funding instruments than most other OECD countries except Canada and Australia. Ireland is the country that most resembles the Dutch situation (Figure 5.6). Over USD 1 billion in support for business R&D was channelled through tax incentives in 2011. WBSO and RDA provide relief for inputs to innovation and the Innovation Box provides relief for licensing and commercialisation revenues. SMEs use and benefit from the schemes extensively. In an international comparison, Dutch R&D tax incentives are much more generous to SMEs than to larger firms (Figure 5.7). Evaluations of WBSO (the main and older instrument) have been generally positive and policy design has been responsive to their findings.

**Figure 5.6. Direct and indirect government funding of business R&D and tax incentives for R&D, 2011**

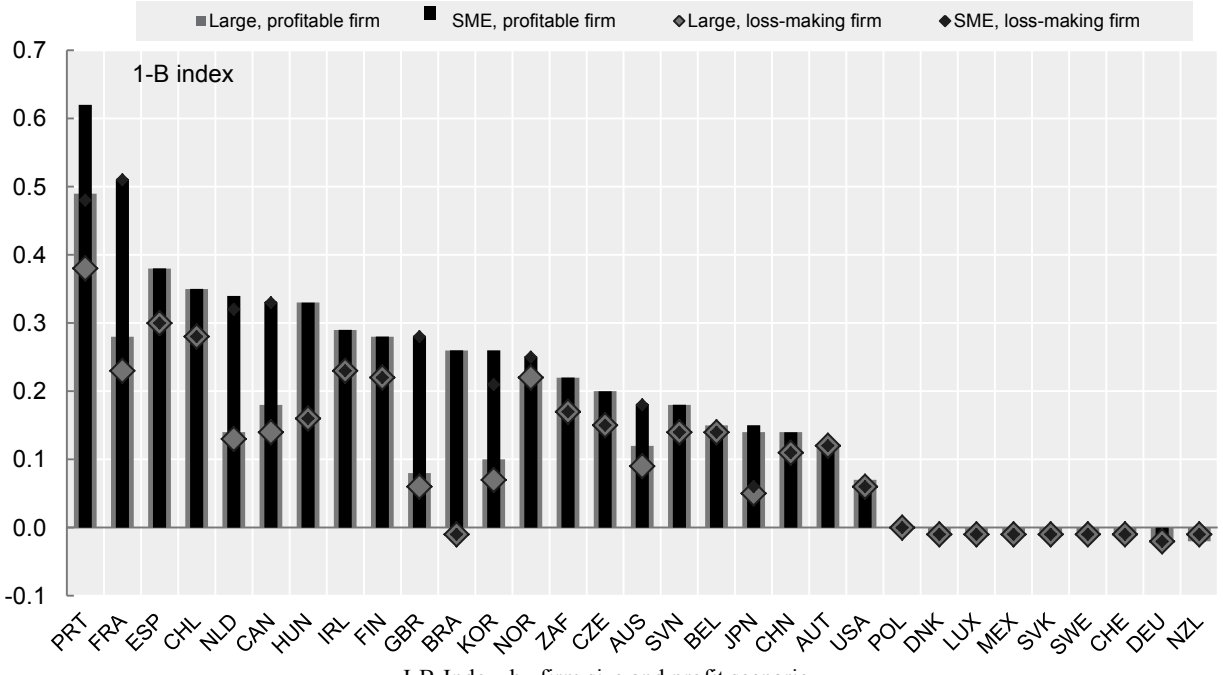
% of GDP




*Note*: Data on indirect support not available for Israel. This is an experimental indicator. International comparability may be limited. For more information, see www.oecd.org/sti/rd-tax-stats.htm.

*Source*: OECD (2013a), *OECD Science, Technology and Industry Scoreboard 2013: Innovation for Growth*, OECD Publishing.

**Figure 5.7. Tax subsidy rates on R&D expenditures, 2013**




I-B-Index, by firm size and profit scenario

*Source*: OECD (2013b), "Measuring Tax Incentives", www.oecd.org/sti/rd-tax-stats.htm.

In common with direct support for business R&D, tax incentives can be justified as a response to the market's tendency to devote fewer resources to R&D than would be socially desirable. They can be more advantageous than direct funding in that they allow firms to decide which R&D projects to finance. In the Netherlands the potentially lower implementation costs of tax incentives were also an important factor in the decision to shift the balance in their favour.

Tax incentives, however, have disadvantages as well. OECD analysis has shown that tax credits, depending on how they are designed, may favour less dynamic incumbents at the expense of dynamic young firms (Box 5.4). In addition, there is concern that some multinational enterprises (MNEs) may use cross-border tax planning to exploit international asymmetries in the treatment of costs of and income from R&D, leaving firms without such opportunities at a disadvantage. Importantly, tax incentives may erode the tax base. By contrast, direct funding can be better targeted at parts of the business sector that need support, at a wider range of firm capabilities and at the behaviour that needs to change (e.g. to foster capacity development, to raise the scope and ambition of innovation activity or to get firms to collaborate). For these reasons, many OECD countries are currently re-thinking the extent and conditions of the use of tax incentives.

The Dutch tax incentives appear to meet most of the principles of good policy design. In particular, there are different brackets, there is a ceiling, there are only small differences in their generosity to profitable and non-profitable firms, and WBSO is regularly monitored and evaluated. The principal question about tax incentives in the Netherlands is not about their design but about the extent of reliance on them and their fitness for purpose, given the diverse challenges involved in raising not only the intensity but also the ambition of firms' innovation activity.

An additional argument relates to the effect of a focus on tax incentives on the *place* and *timing* of decision making with respect to innovation. A commonly mentioned issue in the Netherlands is that the benefits sometimes accrue to a part of the firm (e.g. the financial department) that may not be involved in innovation planning. More generally, greater reliance on tax measures may weaken the position of innovation decision makers in the inevitable negotiations over budget allocations that take place both within government and within companies. It also does not help that the benefits from tax credits accrue at least a year after decisions are made about the design and scale of specific innovation projects. It may be because of this that evidence from international evaluations of R&D tax incentives suggests that behavioural additionality can be low. For example, most companies surveyed in the context of an evaluation exercise of the UK R&D tax credit scheme suggested that it had little if any effect on decisions to conduct individual pieces of R&D (HRMC, 2010).

A specific drawback of the reliance on tax incentives is that these do not permit distinctions in the type of R&D and innovation supported. With such instruments, it may be difficult to support longer-term and riskier innovation activities, but these are the kinds of activities which markets typically do not undertake independently, which cannot fully be covered by public research, but which hold great promise of social and economic impact. In that respect tax-based instruments do not seem as well suited to changing the behaviour (e.g. to encourage collaboration with knowledge institutes), and raising the ambition of R&D conducted in companies, as some forms of direct finance, particularly those that involve rigorous project-level evaluation and selection.

### Box 5.4. International experience with tax incentives for R&D

R&D tax incentives have proliferated and become more generous but they may create an uneven playing field that leaves new sources of growth unexploited.

R&D tax incentives have proven popular largely because exemptions from international agreements (e.g. in the WTO, EU) make R&D subsidies one of the few ways that governments can help domestic firms improve competitiveness without direct state aid. Governments also support R&D to achieve specific R&D/GDP intensity targets, to stimulate productivity growth and offset the decline in R&D associated with the economic crisis, as well as to encourage firms that perform R&D to locate domestically with a view to encouraging knowledge spillovers.

These potential benefits have led many governments to increase the generosity of R&D tax incentives in recent years. Over 2006-11, about half of the 23 countries for which complete data are available increased their generosity, with R&D tax support rising by almost 25% in some countries.

This may underestimate the increasing generosity of R&D tax incentives. Without any changes in policy, the value of R&D tax incentives would have been expected to decline during the crisis, in part because fewer firms were profitable (and thus unable to benefit from non-refundable tax credits), and in part because R&D itself declines during economic downturns.

Tax incentives subsidising R&D are considered attractive because they are market-based and seen as more "neutral" than direct support. But business R&D is heavily concentrated in MNEs: the top 1 500 firms investing in R&D account for almost 90% of total business expenditure on R&D worldwide. While MNEs are an important source of knowledge spillovers and productivity improvements, the tax system should not create a competitive disadvantage for domestic "stand-alone" firms that do not have cross-border tax planning opportunities.

More generally, MNEs consider the bundle of measures at the corporate tax level; this includes expenditure-based measures, such as R&D tax incentives, as well as income-based policies, such as "patent boxes". Intellectual assets generated by R&D, such as patents, may be developed in one country, held in another and used for production in a third. When these assets are shifted among affiliates of an MNE in different locations, it is hard to value them because of the lack of a market to gauge an arm's-length price. All of this has made it easier for MNEs to shift profits among tax jurisdictions and harder for tax authorities to establish where profits have been made.

Fundamental changes to the international tax system are needed to address the gaps and loopholes that enable MNEs to achieve double non-taxation. Ensuring that taxable income can no longer be artificially segregated from the activities that generate it is a key objective of the OECD's Action Plan on Base Erosion and Profit Shifting.

It may also leave new sources of growth unexploited. Evidence from 15 OECD countries over 2001-11 suggests that young businesses, many of which are knowledge-based-capital-intensive, play a crucial role in employment creation, regardless of their size. Over this period, young firms (five years of age or less) accounted for about 20% of total (non-financial) business-sector employment but generated almost 50% of all new jobs created.

Moreover, during the economic crisis most job destruction was due to downsizing of large mature businesses, while most job creation was due to young enterprises. In the recovery, young firms have also been crucial for job creation in many countries. As a result, policy makers should ensure that any policy package to foster innovation includes measures targeted at young firms as well as those aimed at larger firms, including MNEs. For R&D tax incentives, provisions for cash refunds and carry-forwards can help diminish the inherent bias against new firms.

…/…

### Box 5.4. International experience with tax incentives for R&D *(continued)*

The production, use, economic ownership and taxation of knowledge-based assets have become increasingly decoupled in the latest wave of globalisation. As a result, designing cost-effective tax policies to promote innovation in a globalised economy in which MNEs and knowledge-based assets play major roles has become more challenging. While each country is unique, several policy implications can be derived from new OECD work on tax policy and knowledge-based capital.

**R&D tax incentives should be designed to meet the needs of young, innovative "stand-alone" firms without cross-border tax planning opportunities.**

Domestic "stand-alone" firms that perform R&D may be at a competitive disadvantage *vis-à-vis* MNEs unless there are other measures, such as ceilings and differentiated rates, that ensure a level playing field. Young firms may also benefit less if they have not yet generated taxable income to make immediate use of (non-refundable) R&D tax incentives. This may inhibit innovation and growth, as such firms have particular strengths as R&D performers (e.g. creation of radical innovations) and job creators, unless measures such as cash refunds, carry-forwards, or the use of payroll withholding tax credits for R&D-related wages are used. But care must be taken to ensure that tax relief is not so high that it hampers the process of creative destruction that is essential to a dynamic innovative ecosystem.

**Policy makers should consider balancing indirect support for business R&D (tax incentives) with the use of direct support measures to foster innovation.**

OECD analysis suggests that direct support measures – contracts, grants and awards for mission-oriented R&D – may be more effective in stimulating R&D than previously thought, particularly for young firms that lack the upfront funds to start an innovative project. It is important, however, that any allocation of direct support should not be automatic but based on competitive, objective and transparent criteria (e.g. by involving independent international experts in the selection process). More broadly, a well-designed and transparent system of direct support measures can complement the use of R&D tax incentives as it may help direct public funding to projects with high social returns.

**Governments should ensure that R&D tax incentive policies provide value for money.**

In many countries, overall tax relief for business R&D may be greater than governments intended when they designed the instrument. This may be compounded by the rising generosity of tax relief for R&D observed in recent years, the full cost of which is not always clear because R&D tax incentives are "off budget" as a tax expenditure. As a result, governments should undertake systematic evaluation of tax relief measures to assess the continuing validity of their rationale and objectives and whether their targeting and design remain appropriate. Important aspects of R&D tax schemes that require review include the scope of eligible R&D, the firms that qualify, the treatment of large R&D performers, as well as carry-back and carry-forward provisions. Governments should also focus on the policy package – including interactions and complementarities – as well as related fiscal measures concerning R&D workers to ensure that R&D tax incentives provide value for money.

**The effectiveness of R&D tax incentives depends upon the broader regulatory environment and its stability over time.**

OECD evidence shows that well-functioning product, labour and risk capital markets and bankruptcy laws that do not overly penalise business failure can raise the returns to investing in knowledge-based assets. OECD analysis also suggests that in countries that have experienced a large number of R&D tax policy reversals, the impact of R&D tax credits on private R&D expenditure is greatly diminished. It is therefore important not to tinker repeatedly with such policies so as to minimise policy uncertainty for firms.

*Source:* OECD (2013c), "Maximising the benefits of R&D tax incentives for innovation", www.oecd.org/sti/rd-tax-incentives-for-innovation.pdf.

Indeed, rigorous project-level evaluation and selectivity should be central to any approach to business innovation that seeks to raise the bar to the global level and to encourage longer-term, possibly riskier and therefore potentially higher-impact, innovation activities. This is of course already the case for smaller instruments such as the Innovation Credit, which have been subject to very stringent assessment not only of financial but also of technical feasibility, with impressive results (de Jong et al., 2013). There may be room for using changes in evaluation practice (e.g. by customising the criteria to include technical and scientific aspects of projects so as to raise ambition) even within the current tax-credit arrangements, particularly for the larger-sized tax-credit allowances. However, an assessment of the feasibility of such changes is beyond the scope of this review. If rigorous project-level evaluation cannot be meaningfully introduced under current arrangements then the impetus for a return to more direct forms of funding would be stronger still.

### *Balance between small and large firms*

With few exceptions, SMEs seem well served by the current policy mix. The government closely watches the availability of finance for SMEs and has deployed a battery of measures to ease constraints, particularly during the recent crisis. If all forms of public support are considered, SMEs receive a greater share of government-financed BERD than their share in total Dutch BERD. SMEs receive considerable support in the form of R&D tax credits. For instance, SMEs obtain the majority of the WBSO. Tax credits appear to have increased awareness of innovation and enticed many smaller firms to engage in it. The MIT scheme in the top sectors, targeted specifically at SMEs, offers the opportunity to tailor interventions according to demand. However, as its current budget is small (typically EUR 2 million per top sector and per cross-cutting theme), there is little potential for changing the balance between direct and indirect measures.

Although SMEs needing upfront funds may find the reliance on tax credits problematic, loan mechanisms that cater to very small firms (such as microfinance), young innovative firms (SEED Capital, Innovation Credit) and venture capital (Fund-of-funds) may, to some extent, compensate for the lack of direct funding. However, take-up of these instruments and the loan guarantees is not very strong, as the shares of uncommitted funds shows. In addition, the limited re-introduction of the successful innovation voucher scheme in some of the top sectors, at the request of top-sector management, signals that latent needs for other types of innovation funding may exist. Co-ordination within the top sectors and potentially beyond represents an opportunity to find out more about specific bottlenecks in firm finance and introduce remedial action.

More immediately, it would be important to ensure that the policy mix also caters to firms taking their first steps in innovation (cell A.1 in Table 5.9), particularly SMEs, a sizeable minority of which (over 40% according to the Community Innovation Survey) still do not innovate. The current imbalance in favour of tax credits may constrain first-time innovators, which often require upfront, small-scale funding. The needs of these innovators are, on the whole, more likely to focus on design and engineering activities than on R&D. The positively evaluated but now abolished innovation voucher scheme probably played a key role in this area. In the present policy mix this role is partly taken up by the various loan support instruments. Given their strong links with industry, the universities of applied sciences (UAS) seem well placed to support the development of capabilities in firms that innovate for the first time. Current efforts to strengthen research and innovation activities in UAS appear well timed and could be explicitly linked to this purpose.

While rigorous project-level evaluation is appropriate for the overwhelming majority of public support to business innovation, a limited amount of small-scale, low-barrier (in terms of approval lead time and bureaucracy) direct funding can be useful for exploring a greater range of high potential, but somewhat more speculative ideas. A justification for this type of funding can be found in the statistical distribution of highly valuable innovations: it is extremely skewed and cannot be predicted by any measurable traits of innovation performers (Scherer and Harhoff, 2000, Silverberg and Verspagen, 2007). Innovation vouchers are an instrument that seems a good fit for this purpose. Some regions are offering innovation vouchers and their reintroduction in the MIT scheme is therefore welcome, though they could be usefully extended outside of the Top Sectors too.

A potentially important issue is the suitability of the current policy configuration to the development needs of other parts of the business sector, notably larger firms. Large firms are, on the whole, more likely to innovate and to devote substantial resources to R&D. However, as seen in Chapter 4, there are indications that the R&D deficit of the Netherlands with respect to other countries with advanced innovation systems is, rather unexpectedly, greater for large firms than for SMEs. The same pattern holds for collaboration with knowledge institutions. The deficit also has a sectoral dimension; it is particularly pronounced, for example, in services (again, relative to other advanced systems). As Table 5.9 shows, the current policy mix only partially covers the needs of these firms (cells C.1, C.2 and C.3). Because of the cap, the tax credits account for relatively small shares of the R&D budgets of larger firms. The additionality of the instrument is likely to be limited and alternative designs may focus resources on the parts of the business sector in which behaviour needs to change (e.g. to collaborate). At least for firms in the top sectors, additional support and help from knowledge institutions can be made available. However, there appears to be little in the current policy mix for intermediate-sized firms whose business falls outside the top sectors. It would be important for the dynamism of these sectors to fill this gap.

### *The role of the top sectors*

The top sectors seem well suited to fostering co-ordination, identifying and amplifying "weak signals" of technological and market opportunities[18], and to bringing about the corresponding alignment of strategies and pooling of resources. Co-ordination of the kind that takes place within the top sectors may also be useful in bringing about lasting changes in behaviour, such as facilitating co-operation with knowledge institutions and raising the scope and ambition of business innovation, including by performing more R&D.

The involvement of the Royal Netherlands Academy of Arts and Sciences (KNAW) and the Netherlands Organisation for Scientific Research (NWO) helps to ensure scientific rigour. As science is a global endeavour, the involvement of KNAW and NWO may also be positive in terms of encouraging firms with experience in new-to-the-firm and new-to-the-market innovation to extend the scope and ambition of their activities at the global level. As mentioned earlier, however, and partly illustrated by the experience so far of Finland's strategic centres for science, technology and innovation (SHOKs),[19] this is not guaranteed. Suitable governance and co-ordination arrangements should aim to ensure that it is public research excellence, with its global perspective, that steers the orientation of business-sector innovation towards the frontier, while still improving the applicability of public research.

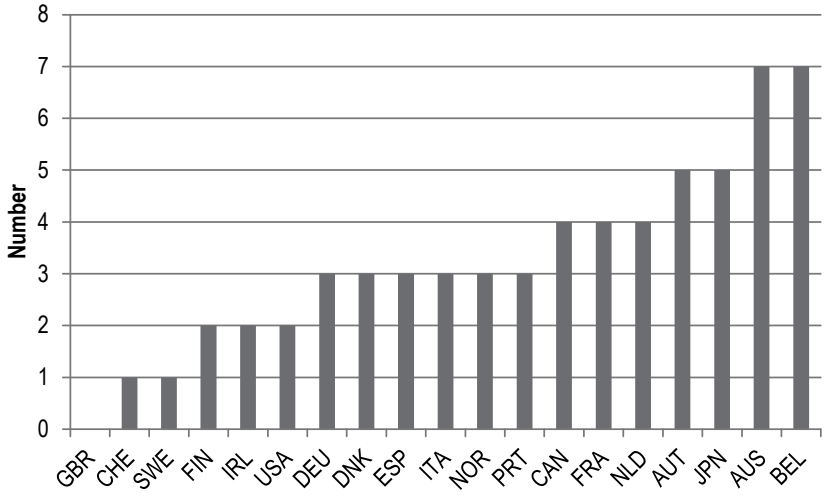
As with the tax incentives, however, the chief issue with the top sectors approach is less its design (the co-ordination problems and orientation risks discussed above notwithstanding) than the approach's position in the policy mix. As discussed in Chapter 4, the R&D intensity deficit appears higher for intermediate-sized firms and for firms in services (and in some other sectors), the parts of the business sector that were among the least likely to co-operate with universities and PRIs. The need for increasing the intensity, scope and ambition of innovation may therefore be greater in parts of the business sector that are not covered by the approach (such as, but not only, services) or whose coverage is not known (intermediate-sized firms)[20].

### *The need for stability*

The long-term effectiveness of policy also depends on the stability of the policy regime over time (Guellec and van Pottelsberghe, 2003). In the Netherlands, changes in the policy mix to support the business sector have been frequent; this has been difficult for businesses. The changes in Dutch innovation policy have included both large-scale shifts in orientation (e.g. in the balance between generic and sector-specific support), in the way PPPs are organised, and in the modalities of implementation of the various funding instruments (Velzing, 2013; Hessels and Deuten, 2013). It is likely that much of the frequently cited concern with "red tape" actually refers to the considerable costs incurred by all actors in having to learn in relatively quick succession how the latest policy framework works. A rough measure of uncertainty in innovation policy (the frequency of reversals in R&D tax incentives) is presented in Figure 5.8. The Netherlands is at the upper end of the countries considered.

**Figure 5.8. Number of reversals in innovation policy**

Cumulative reversals in R&D tax policy, 1982-2008




*Note:* The figure uses a measure of uncertainty of R&D tax policy as the number of instances in which the B-index immediately reversed course (i.e. implements more generous R&D tax policy immediately after implementing less generous policy) over 1981-2008.

*Source*: Calculations by Westmore (2013), based on *OECD Science, Technology and Industry Outlook 2010*.

Changes in the policy mix have a cost. Paradoxically, frequent programme- or instrument-level evaluations and a responsive government (which are of course very welcome) may have contributed to the instability. In the future, the costs of the inefficiencies identified in evaluations of existing instruments would need to be balanced against the costs of potential changes not only in terms of administrative implementation, but also in terms of learning and transaction costs for all stakeholders, particularly entrepreneurs. This implies, and would be a natural by-product of the development of stronger, system-level evaluation (discussed above) to complement the already very strong instrument-level evaluation practices.

## 5.5. Nurturing innovation skills

Dutch higher education is undergoing profound reforms. These were first recommended by the Veerman Committee on the Future Sustainability of the Dutch Higher Education System (2010) and reinforced in the 2011 White Paper *Quality in Diversity – Strategic Agenda for Higher Education, Research, and Science*, which remains the government's blueprint for higher education reform. The background for the Veerman committee was the observation that the current, as well as the future, growth in student numbers puts strong pressure on the Dutch higher education system. Furthermore, it was acknowledged that the system was not flexible enough to meet the needs of students and labour markets, that drop-out rates were high (see Chapter 4) and, overall, that the university education system did not seem to serve the varied needs of students and the labour market. The main recommendation of the committee was to improve the quality and diversity of Dutch higher education through a threefold differentiation: in the structure of the system, in the profiles of institutions and in the range of programmes offered.

The Veerman Committee report received broad support from various stakeholder groups: higher education institutions, students, employer organisations, parliament and the government. The White Paper supported the recommendations of the Veerman report and advocated several changes:

- Collective and individual performance agreements with universities on education quality and study success, profiling and valorisation. These should result in reducing the number of education programmes on offer, reinforcing the relevancy of programmes to the labour market, developing focus areas in research, and enhancing the impact of research.
- A change in direction in the financing of higher education, with the introduction of a growing proportion of direct funding earmarked for "quality and profiling".
- Modifications of regulations to assure degree quality, success in studies, education quality and intensity, selection, differentiation in the programmes available, and funding.
- Support from the higher education sector for the government's top sectors approach.

### *Performance agreements*

A key aspect of the White Paper is the introduction of multi-year performance agreements between the government and individual research universities and universities of applied sciences. The Association of Universities in the Netherlands (VSNU) and the Netherlands Association of the Universities of Applied Science (Vereniging Hogescholen) first signed collective strategic agreements with Ministry of Education, Culture and Science (and in the agricultural higher education sector, with the Ministry of Economic Affairs) that provided a framework for the *individual* agreements made by each university and the relevant ministry. Each university then signed separate performance agreements covering education quality and study success, profiling and valorisation. Such agreements, which are new to the Netherlands (Box 5.5 provides a short history of changes in university governance arrangements over the last two decades), mark a change in the relationship between the universities and the government: the latter is now more proactive in promoting its policy goals in the university sector.

**Box 5.5. The changing governance arrangements of Dutch universities**

The 1992 university bill covers both the academic universities (WO) and universities of applied science (UAS). It is still valid, but over the years, there have been incremental changes to the university system. For example, in 1997, the Dutch parliament accepted a new university bill abolishing the representative governance system in the universities, which had emerged in 1970 as a result of the political agenda of the 1960s and ensuing demands for democratic participation of junior academics, staff and students in university decision making (de Boer and Goedegebuure, 2001). Under this system, elected representative councils had a lot of power and effectively co-determined strategically important issues with the executive body. This system was regarded as cumbersome and inefficient and did not tend to take strategic decisions (File and Stensaker, 2006).

The 1997 Act strengthened the executive leadership *vis-à-vis* the representative councils. The executive board, which consists of three appointed members (including the rector), obtained nearly all power in both academic and non-academic matters. The board was accountable to a new supervisory body consisting of five lay members appointed by the minister for a period of four years. They are typically experienced people from the public and private sector, many of the latter from large firms, and provide a forum for direct contact and interaction with wider society and the economy (de Boer et al., 2010). At the faculty level, earlier disciplinary research and teaching units (*vakgroepen*) were abolished and most of their powers were given to newly appointed deans (CHEPS report, 2006). The old university and faculty-level representative councils were retained but became advisory with some limited powers. Half of their members represent the staff and half the students (de Boer and Goedegebuure, 2001).

This reform was generally in line with trends in many European countries since the 1980s. Its purpose was to strengthen the executive leadership of universities, to increase the efficiency of the public sector in general, and to enable the government to have a more active influence on the higher education system (Ferlie et al., 2008). The Dutch universities still retain this system of governance. It is generally regarded as having improved the effectiveness of university decision making and ability to respond to emerging problems. Examples include an increase in inter-organisational co-operation agreements and partnerships both at the international and national level, such as the strategic co-operation among the three technical universities in the Netherlands and a significant increase in the third flow of funds to university research (File and Stensaker, 2006), all outcomes greatly enhanced under the new governance system.

With regard to the governance of the UAS, they have in principle similar governance systems. They are autonomous and responsible only to government. Employers, SMEs and public-sector actors are involved in the process of developing curricula and similar matters, but have no decision-making power.

A major aspect of the performance agreements concerns raising the quality of teaching,[21] particularly in the UAS. The government's target to improve the qualifications of UAS teachers translates into more PhDs or master's degrees, with a goal of 80% by 2016 and 100% by 2020 (the share was 65% in 2009). Furthermore, the UAS are expected to implement accreditation systems similar to those that apply to the academic universities in a bid to raise the quality of teaching programmes. These measures seem appropriate considering the prominent role of the UAS in the Dutch tertiary education system. More broadly, the high dropout rates that characterise the university system as a whole will be partly tackled by introducing more selectivity in admissions, while maintaining the general principle that all students who are formally qualified should be able to obtain a university (research or applied science) study place. This should help to reduce dropout numbers, hopefully to a level closer to those of other leading economies, and create efficiency savings in the higher education system.

A further course of action to improve quality centres on adjusting the range of courses on offer at individual institutions. This calls for restructuring the range of programmes, reducing their number, and introducing profiling. Profiling is intended to lead to greater specialisation, as institutions are expected to focus on their strengths and to phase out weak programmes and disciplines. In the UAS, there will be a clearer distinction among programmes offered for target groups (e.g. associate degree programmes, tracks for pre-university students, professional master's degrees). In academic higher education, the bachelor's programmes will be broadened and profiling strengthened in the offer of master's degrees. Labour market relevance will become a more important issue in granting approval for new higher education programmes.

The reforms also include suggestions to promote lifelong learning. A comprehensive upgrading of adult skills relevant to innovation (including management, design, research and more sophisticated information technology skills) depends in part on participation in formal education in specialised, high-quality institutions. The Netherlands' national target is to have 20% of 25-64 year-olds enrolled in a study programme or training course by 2020. The current rate is close to 17% (Ministry of Education, Culture and Science, 2013a, p. 40); it is higher than the EU28 average but lower than in many advanced comparator countries. With their focus on professional education, the UAS have an important role to play in this respect; they are expected to expand their professional master's degree programmes and to make part-time programmes more flexible and better tailored to the needs of adult learners. At the same time, the government intends to liberalise student grants and to consider introducing loans for part-time students to encourage lifelong learning. These are all moves in the right direction, though improvements in lifelong learning also depend upon workplace arrangements and incentives to facilitate a return to formal education. The question, therefore, is not only about the provision of educational possibilities but also about attitudes in the population and the readiness of employers to grant study leaves for their employees.

Implementation of the performance agreements is backed up by changes in the university funding model. While the allocation of funds to universities had previously been exclusively formula-based (relying largely on indicators of student and diploma numbers, see Chapter 4), a new component in the funding model (with a scale of 7% of the education funding) has been introduced. 5% (the larger part of this 7%) is conditional on universities' strategic plan for "quality and profile". A university's strategic plan can also secure an additional 2% if it is deemed to be among the best. Though not overly generous, the new funds can provide some of the means for the practical measures needed for universities to improve their teaching activities.

There is a legal provision for conducting the performance agreements as an experiment. It is planned to make an interim evaluation of the universities' implementation of their performance targets on profiling in 2014 and to evaluate their performance on education quality and study success in 2016. The results of the first evaluation will affect funding allocations in 2015-16 for profiling (2%) and those of the second will influence funding in 2017-20. The system of performance agreements and performance-based funding will be evaluated in 2017 and its continuation decided on the basis of the results. If deemed successful and if extra resources are available, a larger portion of block grant allocations (perhaps as much as 20% according to the White Paper) is likely to be tied to multi-year performance targets.

An increasing number of university systems in OECD countries[22] use some sort of performance indicator or performance agreement procedure to allocate basic budgetary funds, although they differ in terms of the range of indicators, procedures used for budgeting, and external and internal steering of the universities.[23] In many countries, irrespective of whether they use performance agreements, resource allocation – usually for the block grant (Hicks, 2010) – relies on performance-based measures or evaluations. When developing performance-based indicators and performance agreements, there is the risk that they will try to promote too many policy goals and be too detailed and complicated. This does not appear to be the case of the Dutch system so far. However, it is important to monitor the impacts of performance agreements and evaluation systems closely and to assess their cost-effectiveness. The government's intention to make interim evaluations of the new arrangements is therefore sensible.

While it is too early to assess the impacts of these reforms, the introduction of individual university-based performance agreements strongly induces the universities to position their teaching programmes strategically. The first steps taken to encourage universities to think strategically, to analyse their strengths and weaknesses, and to adopt strategic targets seem to go in the right direction. The system for the review of strategic plans should also prevent inflated target selection. The emphasis on improving the quality of teaching is pertinent, considering the observed performance in terms of dropouts and success rates. Overall, the current university governance system enables universities to take strategic decisions and to respond to emerging challenges in their environment.[24]

### *Top sectors: Human capital agendas and the Technology Pact*

Highly skilled human capital has been a key priority of the top sectors approach from the outset. The pool of specialised and skilled personnel in the Netherlands does not currently meet the demand of the business sector. For example, the Research Centre for Education and the Labour Market (ROA) estimates that an additional 30 000 technicians will be needed every year until 2016. Technical and skilled personnel shortages will become even more critical in the future, as employees retire.

The proportion of students in education programmes related to top sectors was estimated at about 14% in 2011 in the UAS and about 31% in the academic universities. The latter is broadly in keeping with the top sectors' share of total employment (between a quarter and a third). It has been estimated that the share of students in top-sector-related curricula increased by 16% in the UAS and by 14% in the academic universities over 2007-11, outstripping growth in non-top-sector fields (den Hertog et al., 2012b). There are some indications that skills shortages vary among the top sectors. A recent survey of relevant companies found that shortages were especially pronounced in high-technology systems and water, and to a lesser extent in life sciences, chemistry and energy (Ministry

of Economic Affairs, 2013b). To address the existing and expected skills shortfalls, each top sector developed a Human Capital Agenda by 2012. The agendas include an analysis of demand for human capital in the sector, information on the education needed to meet this demand, and a description of how education institutions and the business sector can contribute jointly to developing curricula that will prepare students for the labour market. On the basis of these top sector agendas, a comprehensive agenda was drawn up that focused on the expected shortage of manpower with expertise in engineering and other technical fields.

Partly thanks to the human capital agendas, several Centres for Innovative Craftsmanship (which target secondary vocational education) and Centres of Expertise (set up by the UAS) were created. The centres are public-private partnerships that bring together researchers, students, teachers and the business sector to improve the quality of higher professional education and to become international training centres. Individual UAS can apply for a Centre of Expertise in a specific field in order to promote practice-oriented research and education in a focused way. Emphasis on education or research can vary, but the centres are expected to be aligned with the relevant top sector(s) or the education or health sectors. They collaborate with employers and aim to grow into sustainable public-private or public-public partnerships with relevant stakeholders. People already working in industry can come back to the centres for education, but the main target is regular students in the UAS. By 2013, 489 companies and 96 education institutions had been involved. The cumulative budget to 2015-16 will amount to EUR 113 million, of which EUR 51 million will have been provided by the private sector (Ministry of Economic Affairs, 2013a).

As a response to the comprehensive human capital agenda for manpower with a technical education, the government launched in 2013 the 2020 National Technology Pact, an initiative that brings together employer confederations, employees associations, national and regional authorities, the business sector, education and student associations. Co-operation between higher education institutions and the private sector is one of the main aspects of the Pact, which aims to increase the number of technically trained people in the Netherlands in order to meet the needs of the job market (Box 5.6).

### Box 5.6. The Technology Pact

The Technology Pact has 23 action points and 22 national measures for all stages of the education cycle, from primary education to lifelong learning. Specific focus areas are science and technologies in primary education cycles, the development of an investment fund to promote co-operation between companies and schools/education institutions, and the increasing availability of grants for students in technical and technology-related education and training.

Examples of concrete measures and targets contained in the Technology Pact are: the introduction of science and technology classes in 7 000 primary schools by 2020; EUR 100 million to train secondary education teachers in technological fields; the creation of an online technology education portal; an increasing number of internships in technology-related firms; an increasing number of scholarships for top-sector-related higher education curricula; re-training programmes for the unemployed with a focus on technical and technological skills; and higher funding for students enrolled in technology programmes in schools offering senior vocational education. For 2014-15, the government allocated EUR 600 million for training in technical and engineering fields.

In addition to the national agenda, each region in the Netherlands has developed a Technology Pact that targets local labour markets. Examples are the Brainport Technology Pact, the Haaglanden Technology Pact and the Twente Technology Pact. The Technology Pact will be implemented in the regions, in co-ordination with the national level, through the National Technology Pact Co-ordination Group, composed of representatives of the five regions, the central government, employers, workers, the top sectors and education institutions.

Given the expected shortages in science and engineering (S&E) skills and the relatively small share of S&E graduates from Dutch universities, these top-sector measures are broadly welcome. However, attention should also be paid to the needs of other knowledge-intensive sectors, particularly in services. This will be important for sustaining continuing dynamism in non-technological innovation. It will be important to ensure alignment with the broader education policy agenda, i.e. the measures set out in the White Paper *Quality in Diversity* described above. A close monitoring of the effectiveness of co-ordination in the skills agendas and the various pacts should enable systematic learning from experience. A key policy task would be to draw broader lessons for national education policy.

## 5.6. Investing in public-sector research

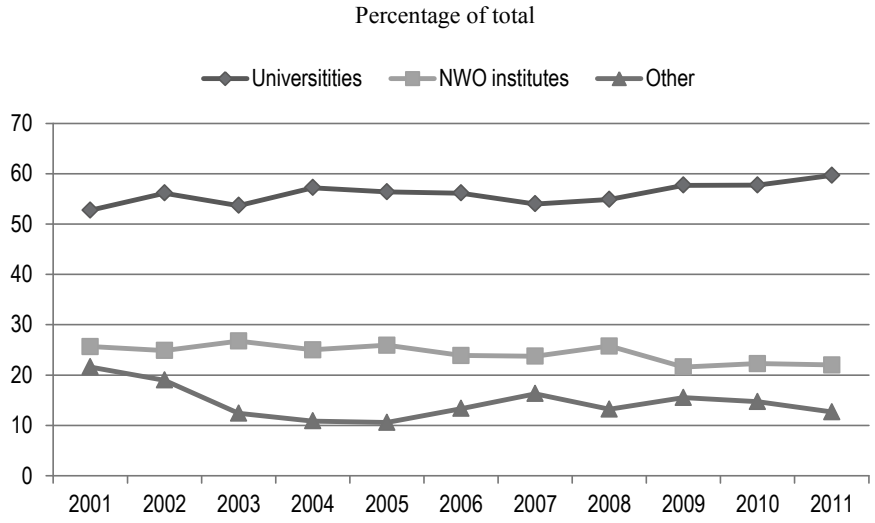
The government plays a central role in investing in public-sector research. This includes support for fundamental research, principally through NWO and KNAW, but also support for applied research, mainly through the TO2 applied research institutes, such as TNO.

### *Funding fundamental research – the role of NWO*

NWO is responsible for distributing a major part of the second flow of funds to Dutch universities and other knowledge institutes. It funds the best researchers and research groups on a competitive basis. They are selected by independent experts/scientists by means of peer review. NWO awards around 1 500 research grants a year. Dutch universities, knowledge institutions and NWO institutes are eligible for NWO grants. Almost 7 000 researchers (scientific and non-scientific) at Dutch universities, institutes, and research centres conduct research with financial support from NWO.

The revenue of NWO has risen sharply over the years, from EUR 433 million in 2001 to EUR 701 million in 2011, with a peak of EUR 727 million in 2010, for an average annual rise of 6.2% (Ministry of Education, Culture and Science, 2013a). The Ministry of Education, Culture and Science is the most important source of income: 84% of the total in 2012, given as a government grant and through a number of specific subsidies. In 2011 university research received 60% of NWO expenditure, and NWO's own institutes received 22% (Figure 5.9).

**Figure 5.9. NWO expenditures by destination, 2001-11**




*Source*: Rathenau Institute, based on annual accounts NWO 2001-11.

NWO has several categories of funding instruments:

- *talent grant programmes* for individual researchers;
- *responsive-mode research* for curiosity-driven, non-programmed research;
- *theme-based research* for large-scale, long-term research programmes focused on a specific target or theme or research collaborations partly set up in close consultation with other partners;
- *large infrastructure* for the realisation and use of large-scale research and ICT infrastructure;
- *internationalisation* for research programmes focused on international collaboration and exchange, particularly in the context of EU funding;
- *knowledge utilisation* for knowledge dissemination and open access publication of research results.

The funding instruments cover the entire spectrum of fundamental and applied research. Knowledge utilisation (societal and scientific applicability of the results) is increasingly a criterion in the assessment of funding instruments (see below). The frequency of funding rounds varies according to the instrument, from one a year, or several rounds a year, to submission on a continuous basis. Funding instruments can be specific to an NWO division or a group of NWO divisions. Other instruments concern the NWO as a whole. Table 5.10 shows that the talent programme was most popular in 2011, followed by the open responsive-mode (curiosity-driven) research programmes. Both types of funding instrument are over-subscribed, with success rates of around 20% in 2011, slightly on the low side by international standards. In fact, success rates are reported to have fallen further in 2012 to around 17% (NWO, 2013). This suggests strong demand for more open types of fundamental research funding. By comparison, success rates in the other programmes are considerably higher, e.g. in the theme-based programmes, the success rate was 35% in 2011.

**Table 5.10. Number of NWO applications by type of programme and success rates, 2011**

| Type of programme | No. of applications | Success rates (%) |
|---|---|---|
| Talent (individual grants) | 2 073 | 19 |
| Responsive-mode research | 1 294 | 21 |
| Theme-based research | 421 | 35 |
| Large infrastructure | 238 | 69 |
| Internationalisation | 221 | 50 |
| Knowledge utilisation programmes | 84 | 33 |
| **Total** | **4 331** | **26** |

*Source:* Ministry of Education, Culture and Science (2013a).

A large part of the results of research funded by NWO is published in peer-reviewed scientific publications (Table 5.11). Their number has grown considerably in recent years, matched by a sharp decline in non-peer-reviewed journal articles. This no doubt reflects strong pressures on researchers and research-performing organisations to demonstrate research excellence, with peer-reviewed journals viewed as the gold standard. The category of "other professional products and publications" is also large and has grown rapidly. This category comprises publications for professionals, the general public, as well as the members of the editorial staff of a scientific journal, inaugural speeches, designs and prototypes and media events (Ministry of Education, Culture and Science, 2013a). This growth probably reflects the increasing emphasis on knowledge utilisation activities in all NWO-funded projects, or at least the increasing demand for researchers to account for them in their reporting.

**Table 5.11. Academic output of research funded by NWO**

| | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Publications in peer-reviewed journals | 7 576 | 10 674 | 9 525 | 8 943 | 9 528 |
| Publications in other academic journals | 2,655 | 1,766 | 1 228 | 714 | 488 |
| Contributions to books | 980 | 1,218 | 1 334 | 1 237 | 1 017 |
| Studies | 302 | 336 | 385 | 327 | 293 |
| Doctoral theses | 609 | 794 | 832 | 774 | 698 |
| Other professional products and publications | 4 643 | 5 476 | 5 906 | 6 949 | 6 796 |
| Patents | 52 | 57 | 53 | 42 | 56 |

*Source:* Ministry of Education, Culture and Science (2013a).

The sections that follow briefly describe the talent, thematic and large infrastructures programmes before turning to an examination of the impacts of the top sectors approach on NWO funding.

### *Talent grant programmes*

A large part of NWO's funding is channelled through talent programmes that target individual researchers. In 2000, NWO launched the Innovational Research Incentives Scheme aimed at making a contribution to modernising research at Dutch universities and improving the career prospects for young researchers. This individual subsidy system focuses on three target groups:

- *Veni grants*: for (young) talented researchers who have recently taken their PhD, to allow them to continue to develop their ideas; up to a maximum of EUR 250 000.
- *Vidi grants*: for researchers who have already performed research at the postdoc level for a number of years and who want to develop an innovative line of research and appoint one or more researchers; up to a maximum of EUR 800 000.
- *Vici grants*: for senior researchers to form their own research group, often in preparation for a permanent professorship; up to a maximum of EUR 1.5 million.

From 2000 through 2012, 2 635 grants were awarded for an average of some 240 grants a year, making this by far the largest NWO scheme for individual researchers. Of these grants, 2 353 were awarded to universities. The universities of Leiden, Utrecht and Amsterdam top the list (Ministry of Education, Culture and Science, 2013a). The aim is to promote innovation in academic research, as well as to encourage talented researchers to enter, and remain committed to, the scientific profession. The scheme seeks to encourage individual researchers and gives talented, creative researchers the opportunity to conduct their research programmes independently. Researchers who are among the best 10-20% of their age group may apply for these grants. Other prominent schemes for individuals include PhD scholarships, the Spinoza Prize (EUR 10 million a year), and mobility programmes for young researchers (e.g. Rubicon, with an annual budget of EUR 7 million).

Although the share of female scientists working in the Netherlands has risen significantly in recent years, Chapter 3 has shown that strong deficits remain, particularly at higher steps on the career ladder, where Dutch women are markedly under-represented. It is important to tackle this issue as a matter of priority, not only on the grounds of equity but also in order to utilise Dutch talent fully. Bottlenecks may occur at various stages of scientific careers, from the initial choice to embark on a science- or innovation-related education, to educational development, recruitment and promotion. NWO has a few discipline-specific schemes to support early-career developments for female scientists, notably Athena in chemistry and FOm/f in physics, which are targeted at postdocs. The more generic Aspasia grant scheme is targeted at the mid-career stage. Both Aspasia and Athena are aligned with the Innovational Research Incentives Scheme (see Box 5.7).

### Box 5.7. NWO programmes supporting women in science

**Aspasia**

Aspasia grants ensure that more female assistant professors progress to the level of associate or full professor. The scheme is linked to the NWO talent grants: Vidi (for experienced postdoctoral researchers) and Vici (for senior researchers). Eligible candidates are female applicants who have received a Vidi or Vici grant and female applicants who did not obtain a Vidi or Vici grant, but were judged very good or excellent after the interview selection. University executive boards who promote these candidates to an associate or full professorship within a year of the granting of the Vidi or Vici are eligible for a grant under certain conditions. In both cases, NWO contacts candidates eligible for Aspasia grants. For applicants who receive funding in the Vidi and Vici competition the grant is EUR 100 000. For other applicants the grant is EUR 200 000. The programme's 2011 budget amounted to EUR 4 million.

**Athena**

In the natural and technical sciences, women are underrepresented at the assistant, associate and full professor levels. The Athena grant is intended for female researchers who have received a Veni grant from NWO Chemical Sciences. It is for researchers who have recently obtained a PhD and encourages the appointment of female researchers in chemistry to tenured assistant professorships or to a comparable position at a research institute. The grant is EUR 100 000 for a maximum of three years and can be used for salaries of personnel to be appointed (PhDs, post-docs, technicians), costs of purchasing material, equipment or databases, and costs for travel and visits to conferences or research institutes. NWO Chemical Sciences contacts the Veni awardees and the university executive board or the directorate of the research institute after the Veni grant has been allocated. If the laureate would like to be appointed as an assistant professor and if the university or institute board can make the appointment during the duration of the Veni project, the Veni laureate is eligible for the Athena grant.

**FOm/f grants**

FOM initiated the FOm/f incentives programme to retain female scientists in the Dutch physics community. Individual positions for postdocs are intended for women who wish to develop a long-term career in Dutch physics. FOM funds a postdoc position for a maximum of three years spread over a period of at most five years. The condition is that the candidate organises a period of one to two years at a foreign institute (not paid for by FOM) in conjunction with her domestic stay. The candidate is free to plan the period abroad either before or after the period funded by FOM. Women who have just gained their doctorates or who already have a postdoctoral position abroad are eligible to apply. The budget for the individual postdoc position is a personal budget for a maximum of three years.

*Source*: NWO website, www.nwo.nl.

### *Theme-based research*

NWO also funds research through thematic calls. The choice of thematic areas changes from one strategic planning cycle to another, though the names of the themes suggests a certain degree of continuity (Table 4.13). The latest themes (for 2011-14) were selected in consultation with the national government, TNO and European priorities. Initially, NWO selected six themes directly related to social and grand challenges: healthy living, water and climate, cultural and societal dynamics, sustainable energy, connecting sustainable cities, solutions for scarcity of materials. With the launch of the government's top sectors approach, the list of themes was revised to align better with the sectors covered (Table 5.12 shows the nine adjusted themes for 2011-14). This means that this funding is now almost entirely shaped by the roadmaps of the top sectors (see below). Thematic calls aim to bring researchers and industry together to conduct innovative scientific research. Particular attention is paid to research carried out in partnership with industry.

**Table 5.12. NWO thematic area themes over three programming cycles**

| 2002-05 | 2007-10 | 2011-14 |
|---|---|---|
| Cultural heritage | Conflict and security | Agro, food and horticulture |
| Ethical and social aspects of research and innovation | Cultural dynamics | Creative industry |
| Shifts in governance | Sustainable earth | Sustainable energy |
| Cognition and behaviour | Dynamics of complex systems | High-technology systems and materials |
| Fundamentals of life processes | Basic energy research | Healthy living |
| System Earth | Brain and cognition | Materials: solutions for scarcity |
| Digitalisation and information technology | Knowledge base for ICT applications | Cultural and societal dynamics |
| Nanosciences | Dynamics of life courses | Connecting sustainable cities |
| Emerging technologies | Responsible innovation | Water and climate |
| | Use of nanosciences and nanotechnology | |
| | New instruments for health care | |
| | Research & innovation in smart creative contexts | |
| | Systems biology | |

Source: NWO website, www.nwo.nl.

### *Large infrastructure investments*

NWO provides the scientific community with access to large-scale research facilities, via the nine NWO institutes and through participation in international research facilities. The Dutch government acknowledges the importance of large-scale research facilities as essential to excellence in science, technology and innovation, and in particular for attracting and retaining excellent researchers and scientists and promoting interdisciplinary research. Inspired by European roadmaps for research infrastructure (see Box 5.8), a first national roadmap for large-scale research facilities was developed in 2007, to be implemented over 2008-12. It covered 26 research facilities and allocated a budget of EUR 63 million through NWO.

**Box 5.8. ESFRI roadmaps**

National research infrastructure roadmaps in the Netherlands have been developed in response to the European roadmap for research infrastructure, launched by the European Strategy Forum on Research Infrastructure (ESFRI). ESFRI was established in 2002 to achieve a coherent strategy at European level for the development and use of large-scale research infrastructure. In 2004, ESFRI developed the first EU roadmap; it was updated in 2008 and 2010. One of the achievements of these roadmaps has been the development of an appropriate legal framework for the development of joint research infrastructure in European member countries. The Netherlands promptly adopted the new legal framework and applied it in a number of cases. As in the case of other EU instruments, the Netherlands participates significantly in ESFRI projects. Three European facilities are hosted in the Netherlands.

Given the risk of obsolescence of research facilities and the emergence of new large-scale research projects, the Ministry of Education, Culture and Science updated this first strategy with a new one in 2013 (Ministry of Education, Culture and Science, 2013b). This new roadmap is largely the work of an independent advisory committee set up by NWO. It has a budget of EUR 80 million and an additional EUR 15 million for e-infrastructure projects. In addition, NWO has committed to allocating in 2014 an additional EUR 75 million to fund some of the roadmap projects. The updated national roadmap focuses on 28 large-scale research facilities, five of which were selected for funding: two facilities in the biological and medical sciences (for a total of EUR 32 million), two facilities in physics, astronomy, astrophysics and mathematics (for a total of EUR 29 million) and one in chemistry and material sciences (EUR 18.5 million). Three other projects were selected for "seed capital", with a much smaller amount of funding: one in the biological and medical sciences (EUR 1 million), one in the social sciences (EUR 0.5 million) and one in the humanities and arts (EUR 1 million). The selection criteria for funding the facilities took various elements into account: likelihood of scientific breakthroughs and attraction of talent, social and commercial relevance (in particular the connections between the facilities and the top sectors approach and social challenges at both national and European level), financial costs, critical mass, willingness to collaborate with multiple research groups, and degree of connection to current social trends.

In 2013, at the request of the Ministry of Education, Culture and Science, AWT issued an advisory document on the national roadmap for large-scale research facilities (AWT, 2013b). The document discusses the alignment of the national Dutch roadmap with the European strategic agenda, the areas of specialisation of the universities and PRIs, and the top sectors approach. In particular, AWT suggests the need for universities, research institutes and top sectors to specify how they plan to use large-scale research facilities. According to AWT, the national roadmap should focus on research facilities that are important not only for actors in science and education but also for their broader social and economic impacts. To ensure the development of a strategic approach, AWT recommends the creation of an independent Committee of Large-Scale Research Facilities that will manage and co-ordinate investments.25 AWT also notes the need for an inventory of existing large-scale research facilities and their regular monitoring and evaluation. These sensible proposals should be given consideration by the government.

### *Research valorisation[26] and the effect of the top sectors approach on NWO funding*

Among the multiple requirements addressed to the universities are the strengthening of the links with the industrial environment and making alliances with other universities or knowledge institutions. Research universities, many of which are world-class, and the universities of applied sciences, which are only now developing their research capabilities, clearly have different, but important roles in this situation. The universities of applied science can link with and help improve the capabilities of regional industrial actors, while the task of the world-class research universities is to pursue world-class science.

The Netherlands has appropriate framework institutions for the utilisation and commercialisation of university research findings. The country early on reformed its legislation on patenting: the *Patent Act* of 1995 stated that if the invention is made by an employee of a university or research institute, the employer is entitled to the patent, though partners may agree not to apply the statute (Leisyte, 2011). After the reform, universities have sought to retain and exploit their intellectual property rights (IPR). The government also has a relatively long history (going back to the 1980s) of operating

several direct funding schemes to promote technology transfer, spin-off firms and science-industry links both in sector-specific and general schemes (Zomer et al., 2010). The external evaluations of the universities at six-year intervals also pay attention to societal relevance of research (see below).

While the Netherlands offers many examples of good valorisation practices (see Box 5.9 for an example in Utrecht), the Dutch government considers that more should be done to promote research valorisation. In 2009, it prepared a national Valorisation Agenda (NOI, 2009), because valorisation performance in knowledge institutes, companies and civil society organisations seemed less than optimal. This implies that technology-transfer opportunities are not fully exploited and that economic and social returns to public R&D are insufficient. The Valorisation Agenda proposed a meeting- and market-place for research, education, business and civil actors in order to promote open collaboration and the exchange of people and ideas and to create opportunities to exploit knowledge and creativity more generally. It set three specific tasks: to develop jointly a term action plan by the government and various stakeholders; to define a consistent set of measures and streamlined policy instruments; and to create a cultural shift in favour of valorisation. Following the agenda, NL Agency (now RVO) launched the Valorisation Programme in 2011 to strengthen and professionalise the valorisation infrastructure around several knowledge institutes. With a budget of EUR 63 million, 12 consortia have been supported for six years to strengthen their entrepreneurship education and knowledge transfer activities. The programme is now closed to new applications.

**Box 5.9. Utrecht Valorisation Centre (UtrechtVC)**

UtrechtVC is a valorisation and knowledge transfer support network serving Utrecht University, University Medical Centre Utrecht, and the HU University of Applied Sciences. It was set up in 2011 with the support of the Ministry of Education, Culture and Science and the Ministry of Economic Affairs. UtrechtVC serves as a primary contact point for academics and staff in all matters relating to knowledge valorisation initiatives, questions and networking. The network includes valorisation officers in the institutes and Utrecht Holdings for support on intellectual property and start-up. Its core activities are: to help researchers to protect and apply their knowledge and inventions; to transmit research questions from SMEs and civil society organisations to researchers and students; to help starting entrepreneurs establish and grow their business (with financial options co-ordinated with Rabobank); and to shape entrepreneurship and innovation education, for example, through training university staff and researchers.

*Source*: Utrecht Valorisation Centre website, http://utrechtvc.nl.

The agenda was followed by proposals in the 2011 *Quality in Diversity* White Paper for improving research valorisation in universities. It defined a number of tasks: making valorisation a task for universities and PRIs, for example, through the professionalisation of valorisation staff; enhancing public-private collaboration in research, for example, through the top sectors; including valorisation as a criterion in the assessment of research proposals;[27] extending provision for education in entrepreneurship; increasing the STW budget to allow for the award of more STW valorisation grants; and optimising open access to scientific information.

The tasks defined in the Valorisation Agenda and the White Paper are laudable, but it is important to ensure that the valorisation strategies of funding agencies and research performers are realistic regarding the demand for public research from the private sector. There is always a danger of placing too much emphasis on knowledge supply-side measures when there are persistent bottlenecks in the capacities and behaviour of parts of the business sector. There is also a strong need to broaden the concept of valorisation and improve its measurement. Box 5.10 briefly describes some pioneering work recently carried out by the Rathenau Institute and STW to develop indicators of valorisation activities, broadly defined. This work may be useful for evaluating the top sectors approach, given its strong focus on public-private partnerships, and should be taken into account accordingly.

**Box 5.10. Indicators for valorisation**

In 2010, STW, the Rathenau Institute and Technopolis were commissioned to develop a list of generic indicators to measure valorisation performance. The indicators had to be applicable in a wide variety of settings, on several levels and for a variety of evaluation goals. The authors soon discovered that there was no ready-made set of indicators that matched the broad definition of valorisation. They were also critical of the use of "number of patents" as an indicator of valorisation, arguing that the broader societal and economic use of scientific knowledge needs to be accounted for. Furthermore, greater attention needs to be paid to the valorisation "process" (viewed as a process of interaction during *all* stages of research rather than just the transfer of knowledge at the end of a research project) when trying to measure valorisation performance, rather than simply counting "outputs". Combining quantitative and qualitative indicators, the study proposed a comprehensive four-dimensional framework that could be applied in various situations, including research universities, the UAS, and a research council's thematic programme.

Since its publication in 2011, the framework has been used in a variety of ways, including by NWO and RVO, and has been discussed in parliament. It is credited with having moved valorisation measurement discussions away from focusing only on quantitative indicators of researcher and research organisation performance to a broader, more process-oriented approach that includes other actors as well (van Drooge and Vandeberg, 2013). Indeed, inspired by this study and by an EC (2011) report on a composite indicator for knowledge transfer, the VSNU and the Vereniging Hogescholen have agreed with the government to develop such a broader set of valorisation indicators based on their experience of types of valorisation in different areas of research. A well-balanced and tested set of indicators is expected to be ready by 2016.

*Source:* Rathenau Institute and STW (2011), *Valuable – Indicators of Valorisation*, Rathenau Institute, The Hague; van Drooge and Vandeberg (2013).

### *NWO and the top sectors*

A central objective of the top sectors approach is greater collaboration between universities, PRIs and industry with a view to the utilisation of scientific research for the benefit of the national economy. The approach is built on the assumption that the current – or previous – mechanisms for industry-university interaction and collaboration are not effective enough and need strengthening. Research funding gives government a significant lever for promoting more interaction and collaboration between public-sector research and firms. As the largest source of indirect competitive research funding in the Netherlands, NWO is expected to play its part in promoting this interaction through the top sectors. In 2012 and 2013, NWO invested EUR 225 million a year in top-sector-related research. Its investment is set to increase to EUR 275 million a year from 2015 (out of a total NWO budget of EUR 625 million a year). To cover some of the top-sector

investment costs, the government has increased the NWO budget: the Ministry of Education, Culture and Science will increase the NWO budget by EUR 25 million in 2014, EUR 75 million from 2015 to 2017 and EUR 100 million from 2018 onwards. Over 2014-16, the Ministry of Economic Affairs will make an extra one-off investment of EUR 50 million for public-private partnerships in the top sectors.

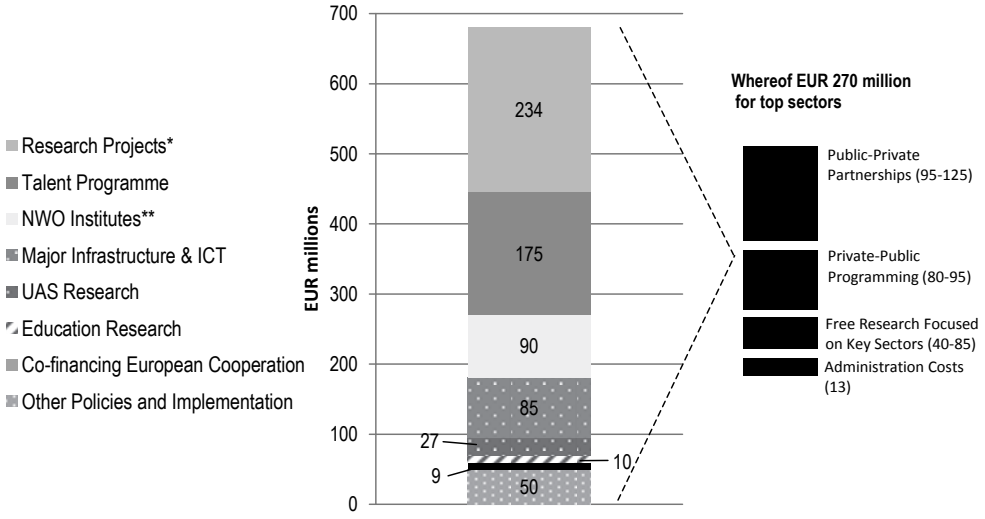
As shown in Figure 5.10, top-sector-related investment is distributed across NWO's entire budget and is an integral part of NWO policy. To safeguard the quality of the scientific research it funds in the top sectors, NWO relies on open competition with standard quality criteria and independent experts, i.e. peer review. Furthermore, it provides tailored opportunities in the top sectors, from large-scale programmes to smaller projects that involve a single company. To increase the transparency of NWO's contribution to the top sectors, funding is organised according to three pillars:

(i) *Public-private partnerships*: This is the only pillar for which companies are expected to contribute to research costs. The main research system stakeholders, representing funding agencies, research performers and industry, agreed in 2013 on a set of "rules of the game" to govern collaboration by researchers and industry in the top sectors. The rules introduce three variants of public-private partnerships involving NWO (Table 5.13), according to the intensity of the collaboration and the amount of co-funding industry needs to provide. Variants 2 and 3, involving joint programming with top consortia for knowledge and innovation (TKIs) and/or individual firms, account for the largest slice of funding, in the range of EUR 80-105 million for 2015 (Table 5.14). Co-funding by companies in these programmes ranges between 10% and 50% and can, in variant 2 programmes, be a mix of in-kind and in-cash contributions.

(ii) *Private-public research programming*: This pillar is characterised by joint programming without a compulsory contribution by companies. It has five components: thematic programmes, the (in-kind) contributions of NWO institutes, large research infrastructure, practice-oriented research in the UAS, and European programmes. The budget in 2015 is expected to be in the range of EUR 80-95 million, with about half accounted for by investments in large research infrastructure (Table 5.14).

(iii) *Non-programmed research targeted at the top sectors*: This pillar consists of research grants exclusively for the top sectors with no private co-funding requirements. They are delivered via broad calls for non-programmed, curiosity-driven research, including through the talent grant programmes. The budget in 2015 is expected to be in the range of EUR 40-85 million (see Table 5.14).

**Figure 5.10. Projection to 2015 of NWO budget by type of programme, including top sectors**




*Note:* *Includes open curiosity-driven research and thematic programmes (including public-private programmes). **Includes basic budgets and support to top sectors.

*Source:* NWO Budget Factsheet, October 2013, available from NWO website, www.nwo.nl.

**Table 5.13. Three variants of public-private partnerships (PPPs) involving NWO**

| Variant | Approach | Role of partners | Partners' contribution | NWO budget (2015) million EUR |
|---|---|---|---|---|
| Variant 1: Scientists take the initiative for a joint research proposal with opportunities for companies/organisations | Scientists submit a research proposal with the support of partners in broad calls/tenders (all top sectors) | Follow the research and actively participate in it when tangible results are on the horizon | Make a limited contribution at project level: 1-20%, mostly in-kind | 15-20 |
| Variant 2: Scientists and partners jointly formulate a knowledge question related to a top sector or several roadmaps | Together with NWO, scientists and partners draw up programmes with a thematic focus (top sector or roadmap) | Actively participate in the research | Make a considerable contribution at project level: 10-40%, mix of in-cash and in-kind contributions | 80-105 |
| Variant 3: A company or consortium of companies has a specific knowledge question and initiates research together with scientists | Company or consortium takes the initiative for a programme (related to a roadmap) and together with NWO invests in research | Enter into a long-term partnership with researchers; are highly involved in the research throughout the duration of the programme; and are closely involved in formulating the research questions and monitoring the projects | Make a substantial contribution of 30-50% or more at the programme level which, in principle, is entirely in cash | |

*Source:* Based on information obtained from the NWO website (www.nwo.nl).

**Table 5.14. Projected NWO annual contributions to the top sectors, by pillar (from 2015)**

EUR millions

| Pillars of NWO's contribution to the top sectors | NWO projected budget for 2015 (million EUR) |
|---|---|
| (i) Public-private partnerships | 95-125 |
| *- Variant 1 (project-based)* | *15-20* |
| *- Variants 2 and 3 (programmatic)* | *80-105* |
| (ii) Private-public programming | 80-95 |
| *- Theme-based programmes* | *10* |
| *- Contributions by NWO Institutes* | *10-15* |
| *- UAS practice-oriented research* | *10* |
| *- Large research infrastructure* | *40-50* |
| *- European matching funds* | *10* |
| (iii) Talent and responsive-mode research programmes | 40-85 |
| NWO overhead | 13 |
| **Total** | **275** |

*Source:* NWO (2013), *NWO bijdrage aan de topsectoren 2014-2015*, in Dutch.

Joint programming in the top sectors seems a promising way to encourage complementarity of public and business innovation investments. The wish to increase the applicability of public research is laudable. However, the present requirements for business-sector commitments appear to be light and to take a wide range of forms: business co-funding, contributions in-kind, declarations of interest. This may be at odds with the business sector's now central position in setting R&D and innovation agendas for public R&D. This level of commitment may be necessary temporarily, given that relationships and arrangements for public-private partnerships will need a few years to develop. But the rules should be kept under scrutiny, with a view to increasing commitments from business, while recognising the likely continuing importance of in-kind contributions for SMEs. It will also be important to ensure that complementarity effects dominate possible crowding out.

There are other possible risks and trade-offs that policy makers need to be cognisant of, particularly with respect to the leading position of Dutch universities and knowledge institutes, which already make crucial contributions to the Dutch economy.[28] Further increasing university alignment with the needs of industry may be fruitful but also harbours risks (see Box 5.11 for a recent example of how things can go wrong). Insofar as the apparent shortcomings in collaboration are due to unambitious forms of innovation in parts of the Dutch business sector, alignment risks diverting the attention of top research universities away from the frontier, which could jeopardise their strong positions and capabilities.[29] Carefully designed policies can strive for complementarity by using universities to raise the scope of business innovation and by ensuring that greater alignment does not lead to loss of valuable diversity in public research. Nevertheless, the policy drive for valorisation in public research may quickly approach limits unless accompanied by policies to institute lasting changes in the capacities and behaviour of parts of the business sector, too (see Section 5.4). In a recent communication, AWT (2013a) highlighted the problem of equating the "demand side" with the needs of industry.[30]

### Box 5.11. Lessons from Finland: Evaluation of the Finnish SHOKs scheme

In the Finnish scheme, strategic centres for science, technology and innovation (SHOKs), existing large firms, as in the Netherlands, lead the formulation of strategic research agendas. The evaluation of this scheme in 2013 indicated that this had led to fairly short-term and unambitious research projects that did not meet the original objectives. The Finnish SHOKs are built, as in the Netherlands, around strong industrial sectors. The tendency for a short-term focus in spite of the original ambitious goals and too little influence by academic researchers on the agenda, a lack of quality control and expert evaluation of the proposals were listed among the factors that have made the Finnish scheme less attractive for academic researchers. The funding arrangements have been different from those normally deployed, and Tekes has been the major public funder of the scheme. Furthermore, the rule that IPR is to be shared among participants has caused problems for commercialisation of knowledge. This shows that programme design may create conditions that thwart the goals to be achieved. The Finns are attempting to make changes in the programme, but this is more difficult after the fact than at the outset.

*Source*: Lahteenmaki-Smith et al. (2013), "Licence to SHOK? External Evaluation of the Strategic Centres for Science, Technology and Innovation", Finnish Ministry of Economy and Employment, Helsinki, available at: www.tem.fi/julkaisut?C=98033&xmid=4981.

A further risk associated with the top sectors, often expressed in the Netherlands, concerns the present "bandwidth" of NWO funding. Since top-sector-related research is largely funded by shifting existing expenditures, it has a great impact on the orientation of research. The share of NWO funds used to support top-sector-related research is relatively high, at around 44% from 2015 onwards. This limits the money available for new topics and important research areas that are not directly relevant to the top sectors. The government has asked KNAW to report on the effects of the top-sector policy on budgetary support for free and fundamental research. The findings are expected to be published later in 2014. In an interim assessment (KNAW, 2013), KNAW complains that the "budgetary scope for free and unbound fundamental research outside the top sectors is roughly half what it once was . . . [Yet], it is impossible to predict in advance which discipline will suddenly become important for theoretical and practical innovation. That is why it is necessary to continue investing in science across the entire board." Coming from a different direction, the high-technology systems and materials (HTSM) top team has complained in its most recent innovation contract (HTSM Top Team, 2013) that the "present bandwidth of public funding for NWO and the applied research institutes leaves insufficient room for structural new research". The HTSM top team goes on to call for higher investments in science and technology *outside* of its own sector and outside of public-private partnerships as "a necessity for maintaining a competitive knowledge infrastructure in the Netherlands". Finally, it should be noted that the selection of the top sectors and the ensuing agendas reflect the concerns of present-day industries and may exclude novel research directions. Thus, there may be insufficient space for new openings and unexpected, risky topics.

### *Research profiling and assessment*

In addition to research funding, other mechanisms shape the research activities of the academic universities. These include research profiling, introduced in the White Paper *Quality in Diversity* on higher education, research and science (see Section 5.5), and long-standing research assessment arrangements.

### *Research profiling*

The government's 2011 White Paper makes proposals regarding universities' research activities, particularly as regards profiling to support the top sectors approach and the valorisation of research. The principle of profiling and specialisation in teaching and research implies that universities should focus more on their strengths and phase out weak programmes and research disciplines. The focus areas will also have to be linked with the grand challenges in the EU Horizon2020 programme. These policy changes emphasise collaboration among research universities, but also with research institutes and companies. Every university is expected to be among the world's leaders in some fields. NWO and KNAW institutions will also be involved in this process.

Encouraging greater functional specialisation could help reconcile the need for increasing valorisation with maintaining the leading position of Dutch science. The on-going profiling exercise for individual universities can be fruitful in this respect, potentially allowing them to specialise in R&D and innovation niches that collectively serve a wide spectrum of industry stakeholders. This is, however, not guaranteed. There is also the risk that the drive towards greater specialisation through profiling will mean that some weaker or otherwise unattractive disciplines or research areas may disappear from the Dutch research landscape altogether. This could jeopardise the research system's coherence, lead to partial dependence on foreign scientific advice, and present an obstacle to the viability of some interdisciplinary research. A recent report (KNAW, 2013) advises that while the impact of profiling cannot be foretold, to reduce the risk of "blank spots", profiling should be accompanied by a "crystal-clear vision" of the importance of the various disciplines and sub-disciplines for science in the Netherlands. Such a vision, the report argues, should provide the basis for agreements about a division of tasks and subsequent concentration.

### *Research assessment*

The Dutch universities have since the 1980s been exposed to evaluation of their research activities by groups of external experts, and since the early 1990s this has taken place at regular six-year intervals. There is an internal evaluation every third year. External evaluation of research units uses a standard evaluation protocol (SEP) developed by the universities association VSNU, NWO and KNAW, which is revised for each six-year cycle. Since the early 2000s, it has also been applied to the research institutes of the NWO and KNAW. Evaluations take place at two levels: the individual research unit and the co-ordinating research institute as a whole. The government does not use the results of the evaluation for funding allocation decisions, as in some other OECD countries. Instead, university administrators mainly use the results for planning. Research units themselves also use them to enhance their reputations, although grade inflation now means that virtually all research units are rated good or excellent. Box 5.12 provides a short description of the SEP evaluation process.

### Box 5.12. The SEP "in a nutshell"

All research conducted at Dutch universities, university medical centres, and NWO and KNAW institutes is assessed regularly in accordance with the SEP. External assessment committees conduct these assessments for each unit or institute once every six years (on a rolling schedule). The institution decides how the unit will follow up on the external assessment committee's recommendations. The external assessment concerns research that the research unit has conducted in the previous six years and the research strategy that the unit intends to pursue going forward.

The boards of the universities, NWO and the KNAW are responsible, within their own realm, for seeing that the assessments are carried out. They decide when an assessment is to take place and which research units will be assessed. The boards draw up a schedule of assessments and inform the research units well in advance. They may also decide jointly to undertake national assessments of research fields. The board of the institution must specify the terms of reference for each assessment. It determines the aggregate level of assessment and selects an appropriate benchmark, in consultation with the research unit. The board appoints an assessment committee. The committee should be impartial and international. The committee must be capable, as a body, of passing a judgement regarding all assessment criteria.

The research unit subject to assessment provides information on the research that it has conducted and its strategy going forward. It does this by carrying out a self-assessment and by providing additional documents. The assessment committee reaches a judgement regarding the research based on the self-assessment, the additional documents, and interviews with representatives of the research unit. These interviews take place during a site visit. The committee takes into account international trends and developments in science and society as it forms its judgement. In judging the quality and relevance of the research, the committee bears in mind the targets that the unit has set for itself.

The assessment committee bases its judgement on three assessment criteria: research quality, relevance to society, and "viability" (the extent to which the unit is equipped for the future). In its report, the assessment committee offers that judgment both in text (qualitative) and in categories (quantitative). The four possible categories are "excellent", "very good", "good" and "unsatisfactory". The committee also makes recommendations for the future. The assessment committee considers two further aspects: PhD programmes (including those at the national research schools) and research integrity. Here, the committee limits itself to a qualitative assessment. Finally, the assessment committee passes a judgement on the research unit as a whole in qualitative terms.

The board of the institution receives the assessment report and acquaints itself with the research unit's comments. It then determines its own position on the assessment outcomes. In its position document, it states the consequences it attaches to the assessment. The assessment report and the board's position document are then published.

*Source:* VSNU, KNAW, NWO (2014), "Standard Evaluation Protocol 2015-2021. Protocol for Research Assessments in the Netherlands", https://www.knaw.nl/en/news/publications/standard-evaluation-protocol-2015-2013-2021.

In Australia, Denmark, Norway, New Zealand, Finland, and the United Kingdom, performance agreements include elements of both educational and research achievements (Benneworth et al, 2011; Hicks, 2010). In Australia and the United Kingdom, performance-based allocation of funds to universities has been in place for two decades or more. It has been noted that these systems have probably influenced publication patterns of scientists in ways that are not fully intended (such as targeting lower- or higher-quality journals depending on the relative importance of quantity or quality in the assessments), but have also brought about unintended human resource problems concerning work motivation and academic transfer markets for hiring staff just before the assessments (Butler, 2010). Recent changes in the SEP evaluation framework attempt to address some

of the perverse incentives introduced by a reliance on scientific publication indicators. The number of evaluation criteria has been reduced to three – scientific quality, societal relevance and viability; the productivity criterion was dropped, thus giving a clear signal that quantity is no substitute for research quality.

### *Specific support to applied R&D in the UAS*

The UAS still have rather limited resources for research. The government has taken specific initiatives to promote their research capabilities and to help strengthen their knowledge transfer function, especially towards regional SMEs and public sector organisations (e.g. in the areas of health or education). Among the policy interventions with these objectives in mind are the appointment of lectors (see Section 4.2), the Centres of Expertise programme (see Section 5.5), and the RAAK (Regional Attention and Action for Knowledge circulation) programme.

RAAK aims to stimulate innovation in smaller firms, focusing on somewhat more incremental types of innovation. Programme funds can be awarded to regional innovation programmes for the exchange of knowledge, which are executed by a consortium of one or more education institutions and one or more enterprises. They can also involve research institutes, and TNO is the most frequent scientific collaboration partner in RAAK projects, followed by the University of Utrecht and the Delft University of Technology. The initiative for the development of the regional consortia comes from the regional SMEs.

RAAK began as a two-year programme in 2004. It has been subsequently extended to a four-year programme and is divided into three separate sub-programmes: RAAK SME, RAAK public sector (involving organisations such as hospitals), and RAAK PRO, the last with larger project budgets. Its funding has grown rapidly from EUR 6 million in 2004 to EUR 22.7 million in 2012. There was a small decrease in 2013 (EUR 20 million), but funding is expected to grow again from 2014 onwards. Up until the end of 2013, the RAAK programme was managed by the Innovation Alliance Foundation (SIA), with funding from the Ministry of Education, Culture and Science. As of January 2014 the scheme is part of NWO and is managed by a new temporary taskforce, the National Steering Committee for Practice Oriented Research. Becoming part of NWO is intended to support further improvements in the quality of practice-oriented research and to facilitate the integration of the UAS into the national research system. In addition to supporting the development of the research function of the UAS, the taskforce intends to initiate activities that strengthen the articulation of research with education and professional practice, thus leading to improvements in the traditional functions of the UAS.

The RAAK programme entails projects in collaboration with SMEs and often with other research partners (TNO, universities). This provides the UAS with valuable learning experience and facilitates knowledge spillovers among all parties concerned. A welcome by-product is that the UAS collaborate extensively with research universities and PRIs (Sealy *et al.*, 2013), an important step in the development of their research capabilities and conducive to coherence in the national research system. Overall, the role of the UAS in business innovation is not very extensive and there is much room for development. The RAAK programme does not exclusively fund research; it also enhances innovation in SMEs, via research but also through the application of available knowledge. The drive to increase the research and innovation capacities of UAS and the development of centres of expertise appears to be consistent with catering to the innovation needs of firms that may not be fully served by the more established research universities. Even so, it will take time for the research function of the UAS to develop their full potential.

### *Support to the applied research institutes*

Responsibility for the TO2 applied research institutes passed to the Ministry of Economic Affairs during the Rutte I government; it was previously the responsibility of the Ministry of Education, Culture and Science. The Ministry of Economic Affairs is responsible for the framework in which the institutes operate and steers them with a view to certain preconditions (e.g. the top sectors approach) and the effectiveness and efficiency of the system as a whole. The government's policy towards the TO2 institutes was recently rearticulated in a position paper, "Our Vision of Applied Research" (Ministry of Economic Affairs, 2013d). This paper expresses the intention to make the TO2 institutes more efficient and effective by changing their working methods and operational management. In this view, new and more cohesive working methods are required to programme and execute research, especially research related to the top sectors. The position of the institutes should also be fine-tuned to distinguish them from other public and private players in the innovation system and to preclude unwelcome competition. These ambitions have been translated into five action points:

- a shift from block funding to competitive funding based on quality and impact:
- sharper positioning of the institutes in relation to commercial knowledge providers;
- focus on multi-year public-private partnerships in the top sectors;
- uniform governance structures of the institutes;
- focus on quality and impact of the institutes.

The remainder of this section takes these five action points as points of departure to examine the Dutch government's policy *vis-à-vis* the TO2 institutes.

#### *A shift from block funding to competitive funding*

According to the vision document, the government is working towards a situation in which TO2 institutes receive less of a fixed subsidy upfront and, instead, are granted additional funding on the basis of quality, output and impact. Most of the government's contribution to the development of knowledge is from the budget of the Ministry of Economic Affairs. The money is intended for long-term research, research on societal themes, research on policy and statutory tasks, and research for the top sectors. The Ministry of Defence and the Ministry of Social Affairs and Employment also fund research for the development and maintenance of their own specific knowledge base. The Ministry of Social Affairs & Employment involves the social partners (employer and employee organisations) in the programming for the TNO research on working conditions. Various government bodies also outsource contracted research to TO2 institutes.

Table 5.15 shows that direct government funding of TO2 institutes has been in decline since 2008 and will continue to fall in the next few years. By 2016, it is expected to have fallen by about a quarter from 2008 levels. This will mean that TO2 institutes will receive on average only about one-quarter of their income through direct funding by 2016 (compared to around one-third today). This level of direct funding is low by international standards – for example, the Fraunhofer institutes in Germany, which bear some resemblance to the Dutch TO2 institutes, receive on average around one-third of their income through direct government funding. For other PRIs in Europe, the proportion can

be much higher. The TKI allowance is intended to supplement the lower levels of direct funding on offer, but this amounted to only EUR 38 million in 2013 for the TO2 institutes (Table 5.16) and on its own will not compensate for the loss of direct funding. This is a major cause for concern: for example, businesses participating in the HTSM TKI have expressed alarm at the erosion of direct funding in the TO2 institutes.

**Table 5.15. Direct government funding for TO2 institutes***

Million EUR

| Institute | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|
| MARIN | 4.5 | 4.4 | 4.3 | 4.3 | 4.8 | 4.6 | 4.6 | 4.6 | 4.6 |
| TNO | 214 | 196 | 195 | 197 | 186 | 173 | 165 | 160 | 156 |
| NLR | 25 | 25 | 26 | 26 | 26 | 25 | 23 | 22 | 21 |
| DLO** | 179 | 185 | 181 | 169 | 162 | 150 | 141 | 138 | 137 |
| ECN | 32 | 30 | 31 | 24 | 23 | 25 | 22 | 18 | 18 |
| DELTARES | 16 | 16 | 14 | 13 | 12 | 12 | 11 | 10 | 10 |
| **Total** | **471** | **456** | **451** | **433** | **414** | **390** | **367** | **353** | **347** |

*Standard contribution by the government, excluding incidental subsidies. No account is taken of the policy tasks of the Rutte 2 government or the pay and price adjustments after 2012. Various institutes receive additional funding from government bodies for specific policy tasks. Policy and statutory tasks are included in the direct government funding for DLO and, to a lesser extent, for TNO (2/3 of the funding for DLO).

**Figures for DLO include VAT.

*Source*: Ministry of Economic Affairs (2013d), "Our Vision for Applied Research" (in Dutch).

**Table 5.16. Recipients of the TKI allowance**

| Key Sector | TKI-Allowance | NWO, Universities, Institutes | | TO2 Institutes | | SME Innovation and Network Activities, TKI | | Overhead |
|---|---|---|---|---|---|---|---|---|
| | | Amount | Share | Amount | Share | Amount | Share | |
| Agri&Food | 8 595 779 | 3 187 503 | 37% | 2 955 693 | 34% | 1 952 582 | 23% | 500 000 |
| Chemicals | 11 787 859 | 9 562 837 | 81% | 961 920 | 8% | 400 000 | 3% | 737 423 |
| Creative industries | 60 050 | | | | | 60 050 | 100% | |
| Energy | 8 179 750 | 4 719 270 | 58% | 1 642 130 | 20% | 1 768 000 | 22% | 50 000 |
| High-tech systems | 28 139 821 | 2 950 000 | 10% | 22 210 000 | 79% | | | 700 000 |
| Life sciences | 8 000 000 | 7 750 000 | 97% | | | 250 000 | 3% | |
| Logistics | 1 680 147 | 1 680 000 | 100% | | | | | |
| Horticulture | 5 094 984 | 2 955 350 | 58% | 1 094 111 | 21% | 979 365 | 19% | 66 000 |
| Water | 11 690 395 | 1 501 642 | 13% | 9 338 551 | 80% | | | 765 098 |
| Total | 83 228 785 | 34 306 602 | 41% | 38 202 405 | 46% | 5 409 997 | 7% | 2 818 521 |

*Source*: Ministry of Economic Affairs (2013b), Enterprise Policy Monitor Report.

Also significant are changes in the mechanisms for allocating direct funding following the recommendations of the Commission Wijffels report in 2004 (Box 5.13). The new arrangements, known as "demand programming", were introduced in 2007 and have seen an increasing government role in determining how direct funding is spent by TO2 institutes. In the case of TNO, this resulted in agreements on the use of the programme funding along 12 themes of national priority (TNO, 2010). The new arrangements were meant to give the ministries greater influence in directing research questions to the TO2 institutes, to stimulate structural changes in the TO2 institutes that make them more receptive to demand, to improve articulation of demand in ministries, and to promote greater involvement of business.

### Box 5.13. Recommendations of the Commission Wijffels (2004)

In 2003-04, an *ad hoc* advisory commission (Ad hoc Commission Wijffels) evaluated the bridging function of TNO and the five Large Technological Institutes (GTIs) in the Dutch knowledge landscape. The Commission was asked to describe the changing context in which the applied research institutes operate – especially in relation to their bridging function between more fundamental research and industry and society – and to advise on demand articulation, production, diffusion and utilisation of knowledge derived from fundamental and more applied research. The Commission concluded, among other things, that:

- The direct links between demand and supply of knowledge needed to be improved and strengthened.
- New direct links between actors had emerged and changed the context in which the applied research institutes operate, making their bridging function obsolete.
- Demand-led steering of knowledge institutes needed to improve. The research institutes should be conceived as knowledge firms that are partly financed by government. In this context, a distinction was proposed between the market function of the applied research institutes (i.e. performing contract and project research for public and private parties) and the task function (i.e. long-term research programmes on themes selected by government). On the latter, these included much-needed knowledge investments for which no immediate and/or completely articulated market demand could be expected.
- A coherent, co-ordinated and strategic vision for the applied science knowledge infrastructure in the Netherlands was lacking. It was advised to take the distinction between the market function and the task function of TNO and the GTIs as a point of departure, to provide guidance, in co-operation with industry and societal organisations, on direction in which the institutes need to develop; to provide TNO and GTIs subsequently with enough room to realise this ambition and to evaluate regularly the progress the institutes make and the knowledge contribution they provide (both from a societal and economic point of view).
- A central co-ordination function needed to be created within central government to implement and monitor the proposed changes as well as to manage the use of public funds for applied research. Ultimately the persistent use of demand-led steering and financing should result in a dynamic process of renewal and adaptation within the knowledge infrastructure at large.

*Source*: Boekholt, P and den Hertog, P (2005), "Shaking up the Dutch innovation system: How to overcome inertia in governance", in OECD (2005), *Governance of Innovation Systems, Volume 2: Case Studies in Innovation Policy*, OECD, Paris.

These arrangements have now been largely replaced by the top sectors approach, which brings together the government, institutes and businesses to engage in collective programming (see below). An evaluation conducted in 2011 (den Hertog *et al.*, 2011) identified some of the successes and challenges of the demand programming arrangements, which are likely to be pertinent as well for the top sectors. It made the following observations:

- The arrangements had strengthened the relationships between the various government departments and TO2 institutes and introduced an improved, structured dialogue on the research agenda. They had also contributed to organisational changes in the TO2 institutes, notably the adoption of themes for better linking research activities to socioeconomic issues.
- Government sometimes had difficulties articulating demand, particularly at levels of abstraction beyond tasks associated with a clear departmental responsibility. For example, in thematic areas where government has no specific public task to perform or where a public-private dimension is important, demand articulation was more problematic. This was also the case in instances in which government has responsibility for system stewardship, such as the preservation of the TO2 institutes within the knowledge and innovation landscape.
- Too little attention had been paid to the impact of the arrangements on departments' utilisation of research results generated by the TO2 institutes.
- Involving companies and civil society organisations in the process had been problematic, since they tend to be more interested in discussing concrete projects than issues at the level of abstraction that marks discussions in the demand programming process.
- The new arrangements had not provided a structural solution to the problem of sustainable funding of the large research infrastructures housed in the TO2 institutes. Some of these, like the wind tunnels of the National Aerospace Laboratory and the Delta Flume of Deltares, are massive. They are often expensive to run and cannot be financed from routine exploitation.
- Finally, a uniform design of demand programming arrangements is both impossible and undesirable on account of the variety in the nature of the tasks and theme areas covered and the associated roles and responsibilities of the government.

Greater involvement of business in the top sectors is expected to improve articulation of demand. In light of budget cuts, the government also hopes that business will make financial contributions to the knowledge base of the TO2 institutes. However, there are risks and challenges associated with this. First, it is important to recall the purpose of block grant funding: to provide a sound knowledge base that can be used to address immediate questions and to anticipate future questions and that allows the TO2 institutes to support the government in its policy and statutory tasks. While this type of research is inspired by questions from the field, the immediate aim is not always to find solutions to today's questions. So this sort of long-term knowledge base is essential to the TO2 institutes, but the extent to which business support will be forthcoming is unclear.[31] Second, independence is an important aspect of TO2 institute research that supports the public interest or the implements public tasks. Yet, there is a risk that involving the business community in this aspect of TO2 institutes' research activities will compromise

their independence. To be fair, these challenges and risks are recognised by the Dutch government, but it is not clear how they will be managed over the coming years as funding cuts really begin to bite.

Besides business, EU funds offer a source of income for the TO2 institutes, which might plug some of the funding gaps left by reduced levels of direct government funding. In fact, the TO2 institutes are already extraordinarily successful in obtaining EU funding: according to the Ministry of Economic Affairs vision document, between 2007 and 2010, the institutes were allocated EUR 211 million in projects of the EU's Seventh Framework Programme (FP7). The success rate of the TO2 institutes was 30% – higher than the national and international average (see Section 5.8). On the face of it, this is a resounding success, and has the added benefit of making knowledge from Europe available in the Netherlands. But it also reflects flat or decreasing levels of national funding, so that institutes have turned to Europe perhaps more out of necessity than opportunity. There are risks associated with such a situation: for one, there could be a lack of alignment of national goals and European funding programmes, which could either make European funding unattractive or, if successfully applied for, divert the institutes' attention from national goals. This might not be bad in some situations, as it can support diversity in research. Too much diversity can, however, make strategic management of institutes difficult, and there is a genuine risk of developing a fragmented and sub-critical knowledge base. Indeed, such phenomena are not uncommon in systems whose block funding has been scaled back (too far) and institutes have felt the need to chase multiple sources of (often small-scale) funding to fill the gaps. This risk would seem to apply especially to TNO, which is by far the largest recipient of EU funds among the TO2 institutes and already pursues the broadest set of research activities.

### *Sharper positioning of the institutes*

With a view to precluding unfair competition in markets for knowledge services, another key action point of the government's vision document is to demarcate more clearly the playing field in which the TO2 institutes may operate. The government believes that the TO2 institutes sometimes operate in the same areas as private knowledge providers, which disrupts markets. Demarcating clearly defined market positions that distinguish the TO2 institutes from private knowledge providers is complicated by the fact that the institutes operate at the public-private interface and work closely with end users, for example through the top sectors, to maximise the relevance of their research. Furthermore, the top sectors approach adds to this risk in some sectors: while the institutes must engage in research that will benefit the top sectors, if the programming for top-sector research brings the institutes into the territory of private knowledge providers and market players, the risk of unfair competition will increase. The government recognises the risks and has drawn up a set of ground rules that define where the role of government-funded TO2 institutes ends and the role of market players begins. There is one set of rules for government-funded research and another for contracted research (see Box 5.14). The institutes are expected to apply these rules when they formulate and implement their strategic plans and are primarily responsible for ensuring that the rules are adhered to.

### Box 5.14. Ground rules and rules of behaviour laid down for TO2 institutes

*Rules for government-funded research intended for building knowledge bases:*

- Government-funded research must be precompetitive (it must not directly lead to a ready-made end-product for a business).
- The institutes must not develop knowledge that is already available in sufficient depth in the market.
- Intellectual property policy must be aimed at low-threshold access to knowledge for private parties.
- Institutes must be transparent about their research programmes.

*Rules for contracted research and the rental of facilities by third parties:*

- Synergy between the aims of the institute and the government-funded research must be evident in the activities.
- Where possible, routine activities that can be performed in the market should be shelved.
- Always a minimum overall cost price for contracted research.
- No cross-subsidies, separate bookkeeping.

*The government has an exclusive relationship with the TO2 institutes for certain themes.*

*Rules for spin-offs (new businesses arising from TO2 institutes):*

- Spin-offs must be offered first to market players in compliance with the market.
- Spin-offs from institutes must have a clear status. They are either part of the institute or they operate as a market player. A spin-off that operates as a market player may not benefit any more than other market players from a relationship with the institute where it originated.

*Preconditions*

- Rules of behaviour must be clear; they must not lead to litigation. Investments must be made in collaboration and there must be mutual trust.
- The playing field is dynamic. The precompetitive technology of today is the competitive technology of tomorrow. Continuous maintenance and co-ordination is therefore essential.
- Societal interests and statutory tasks may lead to the development at TO2 institutes of knowledge that is also available elsewhere. This is unavoidable and is necessitated by considerations relating to independence, security regulations, availability and direct access to the knowledge.

*Source*: Ministry of Economic Affairs (2013d), "Our Vision for Applied Research" (in Dutch).

*Focus on PPPs in the top sectors*

The TO2 institutes have a long tradition of working with and for the private sector; supporting the private sector was, after all, a chief rationale for setting them up in the first place. The private sector funds much of the research carried out in the institutes. In TNO, for example, assignments from the business sector amounted to EUR 252 million in 2012, or 43% of all income. The private sector has also been involved in shaping the broader research agendas of the institutes. Again taking TNO as an example, the private sector, together with other stakeholders, has participated in the so-called "knowledge arenas" that advise TNO on its thematic research programmes. Business has also been involved in the "demand programming" arrangements described earlier, though the evaluation (den Hertog *et al.*, 2011) pointed to mismatches between the high level of abstraction of such agenda-setting processes and the more near-term and concrete interests of firms.

The recent introduction of the top sectors approach is therefore the latest incarnation of business shaping institutes' research agendas. It also builds on the demand-driven programming arrangements previously enacted. However, the changes being introduced are more radical than anything that has gone before, recasting both the governance and funding of the TO2 institutes. Under the new regime, a substantial share of the budget for applied research is allocated for research projects executed in one or several top sectors (Table 5.17). For example, a large part of TNO's government funding in 2014 (amounting to EUR 95.3 million) will be distributed across the various top sectors, as shown in Figure 5.11, with the high-technology systems and materials (HTSM) top sector accounting for around one-third of this spending.

In terms of governance, business is now expected to play a leading role in articulating demand for TO2 institutes' research, a role previously largely played by the government. The top sectors' TKIs fulfil this role with their roadmaps, which outline a short- to medium-term research agenda for the fields they cover, followed by joint programming in the form of innovation contracts. The TO2 institutes play a key role in compiling the top-sector roadmaps and in formulating joint programmes, working together on an equal footing with businesses, other knowledge institutes and the government. There are two components to the programming that results: public-private partnerships (with a target of EUR 150 million in 2015, with additional private co-financing); and "private-public-programming" within the TKI innovation contracts (with a target of EUR 100 million in 2015).

**Table 5.17. Expected financial contributions of TO2 institutes to top sectors**

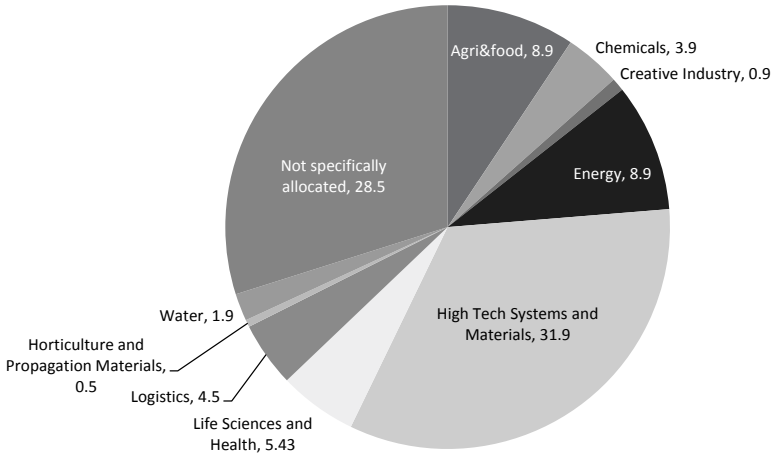
EUR millions

| | TNO | DLO | Deltares | ECN | Marin | NLR | Total |
|---|---|---|---|---|---|---|---|
| **2012** | 94.1 | 51.0 | 3.8 | 17.1 | 3.7 | 7.8 | **177.5** |
| **2013** | 91.8 | 51.0 | 5.5 | 16.4 | 3.7 | 7.4 | **175.8** |
| **2014** | 95.3 | 52.5 | 10.2 | 15.4 | 3.7 | 5.2 | **182.3** |
| **2015** | 88.8 | 47.2 | 8.8 | 14.1 | 3.4 | 5.2 | **167.5** |

*Source*: Nederlands Kennis- en Innovatiecontract 2012-2013 and 2014-2015, Annex to Monitor Bedrijvenbeleid: Bedrijvenbeleid in Beeld 2013, Ministry of Economic Affairs.

**Figure 5.11. TNO's expected financial contributions to the top sectors in 2014, by individual top sector**

EUR millions




*Source*: Nederlands Kennis- en Innovatiecontract 2014-2015, Annex to Monitor Bedrijvenbeleid: Bedrijvenbeleid in Beeld 2013, Ministry of Economic Affairs.

**Table 5.18. Three variants of public-private partnerships (PPPs) involving the TO2 institutes**

| Variant 1: Programmes | Variant 2: Large projects | Variant 3: Short-term projects |
|---|---|---|
| *Large consortia<br>*Duration > 4 years<br>*Private contribution depending on nature of research: at least 10%, target ascending over time up to more than 50%.<br>*Top team assesses whether the programme fits in innovation contract / roadmap, can delegate to TKI and/or Institute<br>*Third-party membership after start is possible in principle. Conditions can be set and rejection is possible on the basis of reasonable arguments<br>*Combination of fundamental and industrial research is possible | *Large/medium consortia with a minimum of 2 companies<br>*Duration: 1-4 years.<br>*Private contribution depending on nature of research in participating companies. Target is more than 50%<br>*Top team assesses whether the project fits the innovation contract / roadmap, can delegate to TKI and/or institute<br>*Accession of new partners during project's term permitted, with approval of consortium<br>*For the most part, industrial research, possibly some fundamental research and/or experimental development | *Small consortia, possibly with 1 company, but preference for at least 2<br>*Duration: less than 1 year<br>*Private contribution depending on nature of research. Targets: fundamental research more than 25%; industrial research more than 50%; experimental development more than 75%<br>*Top team assesses whether theme in innovation contract/roadmap fits. TKI and institute design selection process, institute decision on projects and reports to TKI<br>*During project no accession unless this becomes necessary, as deemed by project partners<br>*Usually, industrial research or experimental development, but can also be short-term fundamental research |

*Source:* Spelregels voor privaat-publieke samenwerking bij programmering en uitvoering van fundamenteel en toegepast onderzoek, Advies van de Regiegroep Spelregels, June 2013 (in Dutch).

On public-private partnerships, the "rules of the game" discussed earlier also apply to the TO2 institutes, though with different arrangements than for the fundamental research funded by NWO. For applied research, there are three variants of PPPs for the institutes to use (Table 5.18). In contrast to the variants for fundamental research, the variants for applied research are defined largely by the duration of the partnership, ranging from programmes of more than four years duration to short-term projects of less than one year. Overall, the aim is to work more in multi-year programmes or in the form of an institute, such as the Holst Centre (see Box 5.15). The government hopes this will enhance synergy in top-sector-related activities, show businesses how to give direction and join in, and prevent the TO2 institutes from being drawn away from the market by incidental projects. The government also expects the institutes to organise themselves flexibly to meet the needs of the top sectors: any mismatches between the required and available competencies and knowledge for a top sector will need to be dealt with by agreeing on a clear transition path.

### Box 5.15. Holst Centre – an example of a long-term public private partnership

The Holst Centre is an independent research centre which seeks to advance the fields of wireless autonomous sensors and flexible electronics. It was founded in 2005 by Imec, a Belgian nano-electronics research institute, and TNO, with support from the Dutch Ministry of Economic Affairs and the Government of Flanders. Its budget draws on a mix of public funding, industrial partnerships and EU projects. More than half of the centre's funding comes from industry. Over 180 employees from 28 countries work at the centre. Based at Eindhoven's High Tech Campus, it has over 200 office spaces and small laboratories and manages a clean-room environment with a roll-to-roll research line for large-area printing and coating of systems-in-foil. This facility allows for the demonstration of a complete flexible-electronics manufacturing process.

Following open-innovation practices, the Holst Centre has several types of partnerships with industries and universities with shared roadmaps and research agendas. It has a framework agreement with Delft, Eindhoven and Twente universities of technology (3TU) and KU Leuven. In parallel to their research position at the centre, several staff members work as part-time professors. The Holst Centre has also built a track record of collaboration with SMEs. For example, it has signed a participation agreement with DevLab, a research platform initiated by 12 SMEs specialising in wireless network protocols; and NeoDec, a spin-off from Eindhoven University of Technology has entered the Holst Centre partner network to share its capabilities in low-temperature processing of conductive structures on flexible substrates. Other SME partners with past and current projects include: InnoPhysics, IntrisicID, Maastricht Instruments, iKnow, Singulus Mastering and Target Compiler Technologies. Through these strategic partnerships, the centre aims to fine-tune its scientific strategy tailored to industrial needs.

*Source:* Holst Centre website, www.holstcentre.com.

These arrangements somewhat restrict the autonomy of the institutes to formulate their own research agendas, and there are concerns that they will lead to shorter time horizons and insufficient investment in infrastructure and development of competences (along the lines in the discussion above on erosion of block funding). The government hopes that strengthening the links between applied and fundamental research will offset any tendencies towards short-termism and will help ensure that the institutes' knowledge is continuously renewed and updated through the application of the latest fundamental research. In this regard, the "rules of the game" document provides concrete proposals for integrated (fundamental-applied) programming involving NWO and the TO2 institutes. However, the extent to which such arrangements can compensate for reductions in dedicated investments in the TO2 institutes' knowledge base is unclear. In sum, it will be important to monitor closely the impacts of the top sectors on the TO2 institutes, bearing in mind that, like their fundamental science counterparts, they require a certain level of stability and continuity, as well as a long-term perspective, to invest in core competences and infrastructure.

### *Harmonising working methods and management structures across the institutes*

The government believes there is scope for greater co-operation among institutes, at least at the strategic level; it would be facilitated by the adoption of more uniform steering and working methods. The TO2 institutes operate in different ways at present. These differences have evolved over time and are a legacy of the days when they were run by different government bodies. They were also set up on different legal grounds: TNO was established by an Act of Parliament – which makes it an independent public body; DLO is a legal body with a statutory remit; and the GTIs are private foundations. The government believes that harmonisation of working methods could help clarify matters for businesses in the top sectors, for example, that collaborate with different institutes.

Since 2010, the institutes have been united in the TO2 Federation (see Box 5.16) and often work together; at the same time, joint programming in the top sectors has already improved co-ordination among institutes. The government would like the institutes to step up their collaboration and has asked them to draw up a collective strategic plan stating how they could work better together, where they could co-ordinate and share activities more effectively, how they could approach their target groups together (including the top sectors), where they could realise efficiency gains, and how they could learn from one another's strengths. In the meantime, the government intends to look into the desirability of incorporating all the institutes within one legal framework while giving due consideration to the specific interests of government bodies. Wholesale reorganisation of the institutes appears not to be on the agenda for the time being, given the significant amounts of time and energy this would consume, not to mention the disruption. This position seems sensible. At the same time, it will be important for the government to acknowledge the obvious limits to co-operation and harmonisation given the institutes' rich variety of activities and relationships.

**Box 5.16. The TO2 Federation of applied research institutes**

Through the TO2 Federation, the six Dutch research institutes for applied research have joined forces to deliver added value in the field of applied knowledge. Specifically, their co-operation is intended to lead to better visibility of the infrastructure of applied knowledge, nationally and internationally; further strengthening of demand-driven research by TNO and the GTIs run for business and government; a more efficient deployment and use of large-scale research facilities of the partners; and an increase of (technological) start-up and spin off companies in order to exploit knowledge.

*Source*: Rathenau Institute.

### *Evaluating quality and impact*

The TO2 institutes have various evaluation and monitoring arrangements that help them improve their performance. However, there is no standard approach across institutes or much in the way of whole-institute evaluation. This is surprising given the standard arrangements already in place to evaluate the universities and NWO and KNAW institutes. It makes it difficult for the government to understand the outputs of the institutes and their quality and impacts. The government feels it needs to get a tighter grip on the quality and output of the institutes as a basis for steering and accountability. To this end, it intends to introduce more uniform monitoring, measurement of effects, and evaluation arrangements for the TO2 institutes. Every four years, starting from 2015, the effectiveness and quality of the institutes will be evaluated and compared, using the same criteria and procedure. The scope of the evaluation will include the quality of the research, the impact on policy and society, and the impact on the economy. Evaluations are expected to provide a clearer idea of how the capacity of the institutes is distributed across long-term research, top-sector research, and research for societal and policy issues, and of the synergy between them. Evaluation results will then be used as an input in determining the allocation of funding for the next four years.[32]

These proposals are broadly welcome and should also help the TO2 institutes better demonstrate the value of their activities to government ministries and other stakeholders. At the same time, it will be important for the evaluation criteria to take sufficient account of the full range of activities and outputs of the institutes and not rely overly on crude indicators, a particular risk when aiming for measurement standardisation across institutes. The proposals hint at a mixed quantitative-qualitative approach that includes site visits, which would seem to promise a more rounded assessment than would be possible if relying solely on quantitative indicators.

## 5.7. The regional dimension

### *Dutch regions in the national and international context*

Inequality in terms of GDP per capita is relatively low in the regions. The Gini coefficient – a standard measure of inequality – across Territorial Level 3 (TL3)[33] regions (OECD, 2013d, Annex 1.A1) is below the OECD average (0.12, compared to 0.16 in 2010). In only a few countries is inequality among regions less, with the lowest in Sweden (0.07). However, as in most OECD countries, this index increased between 1995 and 2010 (OECD, 2013d). The Netherlands' relatively low level of inequality among regions is related to the poly-centric nature of the Dutch economy. All regions contribute

to national economic growth. The provinces of Zuid-Holland, Noord-Holland, Noord-Brabant, Utrecht and Gelderland together account for 75% of national economic growth (1995-2009), but no single province contributes more than 20%, a proportion much lower than generally observed in OECD countries (OECD, 2014c). The impact of the financial crisis differed in the regions: the southern areas of the Netherlands were hit the hardest; regions and provinces in the north, such as Groningen, Flevoland or Noord-Holland, fared better (Statistics Netherlands, 2013).

Dutch regions compare well to OECD average innovation intensity. The southern area of the country, in particular, hosts global innovation hubs. The EU Regional Innovation Scoreboard (European Commission, 2012) ranks Dutch provinces among *innovation leaders* (the provinces of Utrecht, Noord-Holland, Zuid-Holland and Noord-Brabant), *followers* (Groningen, Overijssel, Gelderland, Flevoland, Limburg) and *moderate* (Friesland, Drenthe, Zeeland), with no region in the *modest* category.

As in other OECD countries, innovation-related performance varies across regions (Table 5.19). While the levels of R&D investments and skilled personnel tend to vary less across regions than in most OECD countries (partly owing to the small number of Dutch regions), the variation in patenting intensity is pronounced (it is higher only in Germany, the United States and Switzerland). Eindhoven, in the region of Southern Netherlands, had the highest patent intensity in the OECD area, with around 2 200 patents per million inhabitants in 2008, ahead of San Diego and San Francisco (United States). Dutch regions such as the Northern and Southern Netherlands rank high in terms of production of scientific publications in top quartile journals, owing to the presence of leading HEIs in those areas (OECD, 2013d).

**Table 5.19. Dutch TL2 regions: economic and innovation-related variables**

| | Northern Netherlands | Eastern Netherlands | Western Netherlands | Southern Netherlands | National averages |
|---|---|---|---|---|---|
| GDP per capita (2010, USD PPP, current prices) | 40 549 | 35 051 | 44 929 | 40 225 | 41 368 |
| Total R&D expenditure (GDP %, 2009) | 1.17 | 1.84 | 1.82 | 2.23 | 1.82 |
| Business R&D expenditure (% of GDP, 2009) | 0.44 | 0.81 | 0.63 | 1.69 | 0.86 |
| Percentage of the labour force with tertiary education attainment (2012) | 27.74 | 29.23 | 35.39 | 29.60 | 32.10 |
| R&D personnel (% of employment, 2009) | 0.76 | 1.17 | 1.27 | 1.38 | 1.22 |
| Patent intensity (PCT per capita, 2008-10 average) | 56.18 | 104.72 | 124.32 | 489.87 | 193.57 |

*Source*: OECD Regional Database. [PCT = Patent Cooperation Treaty]

### *Historical evolution of regional innovation policy in the Netherlands*

In most OECD countries, regional development policy was originally meant to target marginalised or lagging areas at a country's periphery. Policy and instruments were essentially designed to transfer resources from wealthier to less developed areas, in order to limit or reduce regional disparities in socioeconomic performance. However, since the late 1990s a new paradigm for regional development has emerged: resource-transfer

mechanisms from more to less developed regions were replaced by a set of integrated cross-sectoral initiatives that support regional development by investing in local strengths and assets. OECD regions have progressively adopted such initiatives and the paradigm shift from subsidies to investments has put innovation policy at the core of regional development agendas in most OECD countries (OECD, 2011). In Europe, the increasing emphasis in EU programmes on regional innovation efforts has contributed significantly to this shift.

The evolution of regional development policy in the Netherlands in the post-war period is presented in Table 5.20. The Netherlands adopted the above-mentioned paradigm shift in the mid-2000s with the launch of the "peaks in the delta" strategy (OECD, 2014c), a national policy with a territorial focus. It was based on six local development strategies, which identified opportunities and challenges in each regional innovation system on the basis of existing strengths and clusters of activities. The six regional development strategies focused on a number of different sectors (such as energy, water, life sciences, high-technology systems) with a strong emphasis on innovation, competitiveness and international networks. The initiatives related to peaks in the delta (2004-11) were jointly funded by the Ministry of Economic Affairs, the European Structural Funds and regional authorities.

**Table 5.20. Regional development approaches in the Netherlands: Historical overview**

| Year | Policy document | Chosen instruments |
|---|---|---|
| **1947** | Welfare Plan for South East Drenthe | Marshall Fund investments in mechanisation of peat extraction, research on peat chemistry, business site creation |
| **1950** | Regional Development Plans | Government subsidies for the development of new businesses in a limited number of regions |
| **1953** | Promotion of Industrialisation of core local authorities (BIK) | Subsidies for investment in establishing facilities; subsidies for highly skilled workers |
| **1959** | Promotion of Industrial Development (BIO) | Subsidies for the establishment of new business locations and the development of new business parks |
| **1964** | Stimulation of Industry Location in Development Areas (SIO) | Subsidies for the establishment of new business locations and cost reductions for locating in new business parks (more flexible than the BIO) |
| **1969** | Investment Premium for Industry (IPR) | Support for industrial investment, including government and provincial guarantees for high risky-reward investments |
| **1973** | Den Uyl's programme to address the crisis | Limiting growth in South Holland, relocating government offices, integrated structure plans for eastern and southern regions, creation of the regional development agencies (ROMs) |
| **1980** | Regional Socioeconomic Policy 1981-85 | National support for regional partners' investments in regional growth opportunities |
| **1985** | Regional Socioeconomic Policy 1986-91 | National support for regional partners' investments in regional knowledge-based growth opportunities, such as innovation centres, science parks, liaison offices |
| **1990** | Regions without borders: regional economic policy 1991-94 | Focus of national investments on the main Dutch ports to stimulate the international competitiveness of all Dutch regions |
| **1995** | Space for regions: spatial-economic policy to 2000 | Investments in all regions; optimising the use of European Structural Funds in the Dutch regions |
| **2000** | Compass Programme | Special investment programme using Hydrocarbon Funds to invest in knowledge economy in North Netherlands |
| **2004** | Peaks in the Delta | Investment in region-specific investment plans in six regions |
| **2010** | *Decentralisation of regional economic policy* | Abolition of the Peaks in the Delta programme; devolution of responsibility for regional economic policy to provinces (unfunded mandate) |

*Source*: OECD (2014c), *Territorial Review of the Netherlands*, OECD Publishing.

An evaluation (commissioned by the Ministry of Economic Affairs) of the effectiveness and the efficiency of the peaks in the delta strategy was positive overall (Geerdink et al., 2010). It found that it received positive feedback both from programme beneficiaries and regional actors involved in its implementation. In addition it highlighted several positive effects related to the implementation of the programme: stronger collaboration between the ministry and local authorities; the increasingly important role of regional development agencies; the programme's effectiveness in evaluating proposals and offering grants.

Pressures for fiscal consolidation, and a related reduction in direct state intervention, resulted in the termination of this strategy following a change in government. Major reasons for the termination were the absence of strong thematic steering of territorial development policies from the national level and concern that decentralisation could favour a proliferation of local spending agreements.

In 2010, the peaks in the delta strategy was replaced by the top sectors approach.[34] Most of the sectors targeted by the regional development strategies under the former are mirrored in the top sectors. However, the top sectors approach shifted policy focus from regions (regional and territorial development) to sectors (support to sectors selected nationally, irrespective of location). Even if the new policy limited sub-national responsibilities for innovation initiatives, leading regional and local actors are considered important for the success of the top sectors (especially in locations in which top-sector activities are concentrated). This gives the policy a *de facto* spatial dimension, depending on the presence (or absence) of strong top-sector clusters in specific locations. A recent study mapping top-sector clusters in the Netherlands shows that they are particularly concentrated in the western part of the country (in particular in the provinces of Noord-Holland, Zuid-Holland and Noord-Brabant) and in the areas around Eindhoven, notably with respect to the high-technology systems sector (PBL, 2013).

According to the Ministry of Economic Affairs (2011), regional and local authorities play an active role in the top sectors approach, especially for the support and promotion of leading regional clusters, SMEs, human capital and lifelong learning programmes. In particular, the south-east (with the Brainport2020 strategy, see below) and the northern wing of the Randstad have been identified as key contributors to the national top-sector agenda owing to the concentration of top-sector-related activities in these territories (PBL, 2013). Several instruments associated with the top sectors have a clear regional dimension: the SME+Innovation Fund, the centres of expertise, innovation-oriented procurement and the human capital agenda. Each region also has a regional Technology Pact that contributes to the national Pact.

The top sectors agenda increasingly acknowledges the importance of a continuing dialogue between sub-national actors and the central government. Since this policy approach was adopted in 2010, the role of regional and provincial authorities in the top sectors is taken into account. The goal is to strengthen vertical co-ordination and to promote innovation dynamics not only through a top-down approach (from the central government to regions) but also through bottom-up initiatives. Two recent documents have also mentioned the importance of regional approaches for capturing opportunities arising from local actors (WRR, 2013) and the need to strengthen the national-regional dialogue in the framework of the top sectors approach, given the potential leverage action of regions (AWT, 2013), especially in some areas of innovation policy aimed at SMEs. Potential risks of misalignment relate to duplication, omissions, fragmentation, conflicting rules in programme design and implementation. The involvement of regional

representatives in formal or informal steering groups associated with the top sectors could be a way to ensure effective co-ordination and to take the needs of local actors sufficiently into account. However, alignment between the top sectors and regional agendas is particularly suitable for regions that are highly specialised in the top sectors but less so for areas specialised in other industries. The development of regional smart specialisation strategies is an opportunity for all regions (both those more and those less specialised in the top sectors) to specifically target their strengths and assets (see below and Box 5.17).

In addition to vertical co-ordination, the top sectors approach may be an opportunity to strengthen inter-regional co-ordination in selected sectors on the basis of the definition of functional (rather than administrative) areas for innovation activities. It may also help to strengthen cross-sectoral co-ordination at the local level to promote synergies and innovation at the intersection of several sectors. Recent research indicates that regions characterised by higher "related variety" (i.e. a concentration of firms in similar but not identical sectors) have higher employment growth rates.[35] By involving regional actors, the top sectors approach can promote dialogue and synergies across firms located in contiguous areas and operating in different top sectors in order to identify opportunities for innovations that bridge several thematic areas. In addition, inter-regional co-ordination may reduce the risk of disconnecting peripheral innovative clusters or firms from the core areas of activity in related industrial or technological fields. In the top sectors agenda, it is important to promote the design and implementation of instruments and programmes that effectively promote inter-regional and cross-sectoral co-ordination.

### *Regional approaches – agendas and instruments*

European funding and the proceeds from privatisations in the energy sector have provided opportunities for Dutch regions to develop, fund and manage regional innovation programmes, instruments and facilities. Over successive EU programming periods, regional innovation policies have gained in importance. In the programming period 2007-13, regional competitiveness was considered a key aspect of the European cohesion policy agenda. Except for regions listed under the convergence objective (the least developed EU areas), all remaining regions (including all regions in the Netherlands) were listed under the regional competitiveness and employment objective. Regional innovation, as a driver of economic growth and job creation, has been considered an enabler of regional competitiveness. Dutch regions contributed to the European regional competitiveness agenda through the strategies and programmes developed under the peaks in the delta strategy. During the programming period 2014-20, innovation will be even more central to the EU regional agenda (with the so-called smart specialisation strategies). Each of the North, East, South and West regions is to develop a research and innovation for smart specialisation strategy (RIS3) as a prerequisite for innovation funding from ERDF (European Regional Development Fund). The degree of connection between the different strategies and the top sectors agenda varies depending on the region and its socioeconomic pattern and industrial specialisation. Most strategies were developed in consultation with representatives of the so-called "triple helix" of business, knowledge institutes and government (Box 5.17).

### Box 5.17. Regional innovation strategies in the Netherlands

The Region of Southern Netherlands developed a RIS3 strategy mainly based on the *Brainport 2020* Strategy (*Brainport 2020 – Top Economy, Smart Society*). The region is specialised in the following sectors: high-technology systems and materials, chemistry/life sciences, agro-food, logistics and creative industries. Some of these clusters are part of the top sectors. Various stakeholders took part in a consultation process that resulted in the development of the strategy. The Southern Netherlands has a tradition of open innovation and international collaboration and the strategy aims to develop initiatives that are well integrated in European networks and programmes. This region is also engaged in several cross-border activities to maximise knowledge spillovers arising from a functional regional innovation approach

The Region of Western Netherlands launched the RIS3 strategy *Chances for the West,* developed in consultation with representatives of the so-called triple helix. This strategy is strongly connected to the top sectors agenda, in relation to the fact that, according to PBL (2013), many top-sector clusters are concentrated in this region. The strategy's goal is to increase private investments in R&D and knowledge valorisation. Attention is also paid to crossovers between top sectors, in particular as a source of innovation to meet societal challenges.

The Region of Northern Netherlands developed a strategy largely based on the results of an analysis carried out by the University of Groningen, which identified the following sectors on the basis of specialisation, mass and growth potential in the region: agribusiness, life sciences/health care, sensor technology and water. The strategy has a particular focus on SMEs and crossovers among sectors. A SWOT exercise was part of the analysis. It showed that in Northern Netherlands only 30% of economic activity is related to clusters or top sectors. Therefore the region has chosen to specialise in different activities. However, it will develop regional programmes targeting focus areas in line with the human capital agenda of the top sectors.

At the time of writing, no RIS3 strategy was available for the Region of Eastern Netherlands.

*Source*: ERAWATCH, regional websites.

### Box 5.18. An example of cross-border collaboration on innovation: The Top Technology Region/Eindhoven-Leuven-Aachen Triangle (TTR-ELAt)

TTR-ELAt supports cross-border collaboration on innovation, covering the area at the intersection of three countries (the Netherlands, Germany and Belgium) that includes four regions and six provinces. The area has a population of over 8 million inhabitants and hosts a dense network of innovation actors: from universities to knowledge-based industries and services firms. Philips in Eindhoven, together with other large R&D intensive multinationals, and the IMEC research centre in Leuven (Belgium) are among the leading actors to promote open innovation and high-technology initiatives in the region. The area has a long tradition of cross-border policy collaboration (since the 1970s), with the aim of achieving critical mass in innovation activities and better exploitation of knowledge complementarities.

TTR-ELAt has developed a mix of policies targeting the cross-border area with a "variable geometry" partnership approach. Examples of cross-border initiatives include: the Holst Centre (a joint research centre funded by IMEC in Flanders and TNO in the Netherlands – see Box 4.15), the forthcoming Biomaterials Research Centre (a joint Dutch-German initiative), the GCS Cross-border Cluster Stimulation programme (distributing grants for cross-border R&D projects involving SMEs), and the Top Technology Clusters (cross-border clusters providing business support and innovation vouchers).

*Source:* OECD (2013e), *Regions and Innovation: Collaborating across Borders*, OECD Reviews of Regional Innovation. OECD Publishing, Paris. doi: 10.1787/9789264205307-en.

**Table 5.21. Examples of innovation instruments in Dutch regions and provinces**

| Type of instrument | Name | Region | Thematic areas covered |
|---|---|---|---|
| **Access to finance (generic or thematic)**<br><br>These instruments promote the availability of financing to firms. They can be in the form of loans, loan guarantees or equity participations. They can target specific sectors or not. | *Loan guarantee* | Gelderland | No specific thematic area required |
| | *Energy Fund* | Overijssel | Energy |
| | *Innovation Fund* | Limburg | No specific thematic area required |
| | *SME & Techno Fund* | Flevoland | ICT, life sciences, health care and biotechnology |
| **Generic grants or subsidies**<br><br>Generic grants or subsidies are in the form of direct grants to promote innovation in firms, often SMEs, for the development of specific innovation projects. Firms active in all sectors are eligible. | *Northern innovation support facility (NIOF)* | Drenthe, Friesland, Groningen | No specific thematic area required |
| | *Operational Programme South Netherlands* | Limburg, Noord Brabant, Zeeland | No specific thematic area required |
| **Thematic grants or subsidies**<br><br>Thematic grants or subsidies are in the form of direct grants to promote innovation in firms, often SMEs, for the development of specific innovation projects. Only firms active in selected sectors are eligible. | *Friesland Fernijt IV* | Friesland | Health and welfare, food security, sustainable agriculture and bio-economy, energy and water |
| | *Innovation Grant* | Gelderland | Food, health, manufacturing, energy and environmental technology, logistics, creative industry or leisure economy |
| | *Grant agricultural innovation* | Noord Brabant | Agriculture |
| | *Grant Makers* | Limburg | High-technology manufacturing |
| | Grant Green Deal Solar Technology | Noord-Brabant | Solar energy |
| | Subsidy programme bio-based | Zeeland | Green economy, agriculture |
| | Grants bio-based economy | Noord-Brabant | Green economy, agriculture |
| **Knowledge linkages**<br><br>Instruments aiming to promote knowledge linkages often require the active co-operation of firms and HEIs or PRIs in developing innovation projects. Typical examples are knowledge or innovation vouchers. | *Innovation voucher* | Overijssel | No specific thematic area required |
| | *Proof of Concept Fund* | Overijssel | No specific thematic area required |
| | *Grant Knowledge and Innovation* | North Holland | Leisure economy, maritime, marine and offshore, health care, agribusiness or renewable energy |
| | *Innovation Voucher* | Limburg | Energy, environment |

*Source*: www.antwoordvoorbedrijven.nl/subsidies/innovatie/provincie.

In connection with the regional development and innovation strategies, regional and provincial actors have established their own innovation support schemes (Table 5.21), mostly targeting SMEs, including venture capital or loans to small firms and businesses, higher education institutions and knowledge transfer activities (as in the case of innovation vouchers).[36] Regional instruments vary from region to region and may target different sectors (both top-sectors-related or in other domains): for instance, the energy sector in the province of Overijssel, health-care in Flevoland, tourism in Friesland, solar cell technology in North Brabant or the maritime industry in the province of North Holland. In most cases, regional instruments are in the form of direct measures: grants or subsidies distributed to eligible actors (generally located in the administrative region). However, the provinces of Utrecht and Limburg have defined programmes according to functional rather than administrative areas, including some that cross national borders (see Box 5.18 for an example). Regional and local programmes may offer an opportunity for the emergence of innovative bottom-up activities, not necessarily related to the top sectors. A number of Dutch provinces, for instance, have established investment funds targeting SMEs (such as Noord-Brabant, Gelderland, Overijssel and Limburg) (Ministry of Economic Affairs, 2013).

## 5.8. Supporting international knowledge linkages

### *Strategic approaches and national programmes that support international STI co-operation*

The Netherlands has a long tradition of international economic and commercial relations, dating from the Dutch East India Company in the 16th century, which has developed into a dense net of relations with the outside world and a concomitant exchange of ideas. Dutch scholars and learned institutions played an important role in the development of modern European scientific research. Dutch cities provided safe havens for thinkers, allowing them to develop their ideas in an environment sheltered from pressures that were prevalent elsewhere. The early Dutch publishing industry helped disseminate new ideas, which did not stop at political borders. In modern times, the Netherlands, with its strategic location in western Europe, has been among the pioneers of European integration.

The Netherlands is acutely aware that success in science, technology and innovation in today's world requires close links with international knowledge networks in order to attract and retain talent and knowledge-intensive investments (see Box 5.19 on the openness of the Dutch innovation system). While this is true for all countries, it is especially important for small economies and for a "large small" one such as the Netherlands. To address the so-called "grand challenges", including major environmental, health and food security issues, whose scale and scope extend well beyond national borders, requires active participation in international agenda setting and co-ordinated actions. Given the key role of openness and internationalisation in the Netherlands' economic development, it is no surprise that most institutions active in STI have dealt with the international dimension in one way or the other, including through dedicated programmes and initiatives with an international scope. The Netherlands is also strongly and successfully engaged in European research policy and participates in the Framework Programmes for R&D and innovation.

### Box 5.19 Aspects of the openness of the Dutch innovation system

The Netherlands is among the core countries in the global network of international scientific collaboration (OECD, 2013d, Figure 55). Nearly half of Dutch scientific publications are internationally co-authored. Indeed, the Netherlands stands out in terms of the number of international co-publications (per million population): 1 330 compared to an EU27 average of about 300. For various reasons, the domestic ownership of inventions (measured by patent applications) from abroad (around 30%) is higher than the foreign ownership of Dutch domestic inventions (slightly above 20%) (OECD, 2013d, Figure 60). According to the 2010 Community Innovation Survey, however, the percentage of firms engaging in international collaboration on innovation is around 35% for large firms, significantly below Finland (64%), Belgium (64%) or Sweden (56.5%). It drops to 13% for SMEs only, a share that is considerably below that of most leading OECD countries.

With regard to education, the White Paper of the Ministry of Education, Culture and Science, *Quality in Diversity,* acknowledges that an education system with an "international allure" and research institutions able to attract talent from abroad are key priorities for the Dutch innovation system. Mobility and international experience during education are considered increasingly important for preparing students for the labour market. Previous documents on this topic include the internationalisation strategy, *The Borderless Good* (Ministry of Education, Culture and Science, 2008), which built on the previous strategic agenda for higher education, *The Highest Good* (Ministry of Education, Culture and Science, 2007). The main reasons for a higher education internationalisation agenda are: increasing global competition to attract knowledge workers to the domestic labour market; global challenges requiring global solutions; the increasingly international Dutch labour market; and rising competition with institutions abroad to attract the best students and researchers. More recently, the Social and Economic Council of the Netherlands (SER) has developed an action plan (*Make it in the Netherlands 2013-2016, Action Plan*) in order to attract and retain more international students, highlighting possible measures such as facilitating the learning of Dutch, strengthening the English skills of university instructors and simpler rules for the labour market transition of foreign students. A code of conduct has been developed to encourage the presence of international students in Dutch universities (Box 5.20).

### Box 5.20. The code of conduct with respect to international students in Dutch higher education

The *Code of conduct with respect to international students in Dutch higher education* guarantees the quality of the higher education provided to foreign and international students. It specifies the type of services and information that must be provided to international students by higher education institutions. Only students enrolling at educational institutions that have signed the code of conduct are eligible for study visas. The code was revised in 2013 to make it more favourable to international students and to simplify procedures for student exchanges with respect to foreign higher education cycles offered in English. To attract international students to the Netherlands, the Dutch scientific institutes abroad (NWIB) were created to share information about study opportunities in the Netherlands. These institutes act as contact points between students in foreign countries and Dutch universities. NWIB are jointly administered by six Dutch universities (University of Amsterdam, VU University of Amsterdam, Utrecht University, Leiden University, University of Groeningen, Radboud University Nijmegen).

Several national initiatives promote the international mobility of researchers, in particular the mobility grants administered by NWO, KNAW and NUFFIC (Netherlands Organisation for Co-operation in Higher Education). KNAW supports international strategic research programmes, notably between the Netherlands and emerging economies. In 2009, KNAW (in co-operation with NWO) established a joint strategic research partnership with China, resulting in a number of memoranda of understanding to promote joint projects and mobility programmes for researchers. KNAW has also launched a scientific co-operation programme with Indonesia (the Scientific Programme Indonesia-Netherlands) to promote collaborative research, sponsor student and researcher mobility scholarships, and encourage awareness and trust in science in both Dutch and Indonesian society. KNAW also promotes international science and research by participating in international networks of scientific academies at European and international level.

International collaboration is one of the priority themes of NWO, which promotes international linkages in science and research in Europe, in the framework of EU programmes, and beyond. NWO international co-operation programmes include: Rubicon, a programme offering doctoral holders post-doc experience in a top research institution outside the Netherlands; the China-Netherlands Joint Thematic Research Programme (JSTP), which promotes joint thematic research collaboration by Sino-Dutch research teams and Sino-Dutch networking seminars; the Hé Programme of Innovation Co-operation, which promotes joint research projects of Chinese and Dutch universities and business organisations; the Visitor's Travel Grant, which covers the cost of visiting foreign researchers who contribute to Dutch research projects for six months; and the New Netherlands Polar Programme, which promotes high-quality scientific research in the polar region. NWO also promotes the use of Dutch international research facilities by researchers abroad and the use of international large-scale research facilities located in foreign countries by Dutch researchers.

NUFFIC (Box 5.21) defines and manages programmes that support the international mobility of students. The Orange Tulip Scholarships offer talented students from Brazil, China, Indonesia, Korea and Mexico the opportunity to complete higher education in the Netherlands. Other programmes target the Middle East and North Africa (MENA) region. The Huygens Scholarship Programme, launched in 2006, promotes international mobility of foreign students to the Netherlands and of Dutch students abroad.

Many Dutch universities are active in international recruiting and all academic vacancies are advertised on the international portal Academic Transfer. However, current foreign workers' visa regulations create obstacles for the recruitment of non-EU citizens. In 2013, the government launched a pilot measure to address this issue. For a period of two years, employers in knowledge- and innovation-intensive sectors are not required to apply for a visa to recruit non-EU citizens. However, this pilot project only applies to large R&D companies with an annual turnover above EUR 50 million or orders above EUR 5 million (Ministry of Economic Affairs, 2013a).

**Box 5.21. NUFFIC, the Netherlands organisation for international co-operation in higher education**

NUFFIC is an independent non-profit organisation established in 1952 to support knowledge sharing and internationalisation in higher education, research and education, promote co-operation with foreign countries and improve access to higher education globally. NUFFIC operates mainly together with the Dutch Ministry of Education, Culture and Science and the Dutch Ministry of Foreign Affairs. Approximately 250 people are employed by NUFFIC, 200 in the head office in The Hague and 50 in support offices located in areas of strategic importance for higher education: Brazil, China, India, Indonesia, Mexico, Russian Federation, Korea, Thailand and Viet Nam.

NUFFIC's main operational activities include: managing international education programmes on the instructions of the Dutch government, the EU or other institutions; providing detailed information and statistics on international higher education activities of Dutch organisations; disseminating information on higher education systems and foreign legislation; strengthening the international position and raising the international profile of Dutch higher education and scientific research. NUFFIC manages a number of scholarship programmes on behalf of a number of organisations.

NUFFIC co-operates extensively with other major Dutch STI actors: the Advisory Council for Science and Technology Policy (AWT), the Social and Economic Council in the Netherlands (SER), the Confederation of Dutch Industry and Employers (VNO-NCW), the Ministry of Economic Affairs, the Netherlands Development Organisation (SNV) as well as other research institutes and think tanks.

*Source*: www.nuffic.nl.

A number of international education institutions are located on Dutch territory: the UNESCO IHE Institute for Water Education; the United Nations University – Maastricht Economic and Social Research Institute on Innovation and Technology (UNU-MERIT); the Institute for Housing and Urban Development Studies (IHS); the International Institute of Social Studies in The Hague. The Netherlands is a joint funder and member of international research organisations such as the European Council for Nuclear Research (CERN), the European Molecular Biology Laboratory (EMBL), the European Molecular Biology Conference (EMBC), the International Thermonuclear Experimental Reactor (ITER), the European Organisation for Astronomy Research (ESO) and the European Space Agency (ESA).

Along with strengthening internationalisation in higher education and research, promoting international trade and investment connections of business organisations is a key priority of the government and the top sectors approach. The top sectors agenda aims to strengthen and support the international and global economic connections of Dutch firms in the top sectors in various ways. In particular, the government wishes: to strengthen Dutch economic diplomacy in foreign countries;[37] to brand and promote more effectively the Netherlands abroad; to develop a plan for strategic acquisition of foreign companies in the top sectors; and to attract foreign investments and stimulate development co-operation.

The government also plans to establish a network of top-sector representatives abroad to facilitate these tasks, with a focus on the BRICs. The government has strengthened the participation of entrepreneurs in official ministerial missions abroad, as an opportunity to meet other entrepreneurs and policy actors in foreign countries, establish contacts, engage in networking and benefit from branding opportunities. The participation of former CEOs and high-level executives can help to identify export and foreign investments

opportunities. Each top sector selects priority countries and develops marketing strategies for those countries in co-operation with the relevant foreign embassies. On the basis of the preferences expressed by each top team, a strategic travel agenda is designed at the government level. Special attention is paid to the representation of SMEs in high-level events and to the promotion of SMEs' international networks. European countries remain a priority for the exports and international activities of SMEs and smaller enterprises. Additional actions are taken in the framework of development co-operation programmes.

To attract foreign investments, the government aims to focus on high-quality strategic investments in the top sectors in co-operation with the Netherlands Foreign Investment Agency and the technical-scientific attachés. The focus on emerging markets will be expanded and foreign embassies, consulates and business support offices will help attract investors in key countries. A Steering Group for Acquisition and Business Climate, led by the Ministry of Economic Affairs (with representatives from regional and local authorities and representatives of the top sectors) was created to supervise and steer the Dutch acquisition strategy. Advisory teams of foreign CEOs will advise foreign companies interested in establishing businesses in the Netherlands and provide the relevant documentation for foreign companies and expatriates. The government also aims to reduce or eliminate unnecessary regulatory barriers to exports within EU borders and beyond. The Partners for International Business, a public-private partnership programme, was established in 2012 to position companies or groups of companies (especially in the top sectors) in promising foreign markets. The programme is managed by the newly created Netherlands Enterprise Agency. The Ministry of Economic Affairs and the Ministry of Foreign Affairs will work to co-ordinate development co-operation efforts and to promote knowledge sharing between Dutch firms and knowledge organisations and developing countries.

From the account above, it is apparent that several ministries and agencies are active in supporting international knowledge linkages in their different aspects. According to KNAW, it would be valuable for the Netherlands to develop a national internationalisation strategy in order to prevent duplication and promote co-ordination. The promotion of international co-operation among students, researchers and institutions may in fact require international agreements and legal frameworks that are typically administered and developed at the central government level. The government's active support, for instance, is essential to remove unnecessary legislative obstacles and regulations that hinder internationalisation. The German Internationalisation Strategy of the late 2000s is an example of a co-ordinated effort to develop a national internationalisation strategy for science and innovation (OECD, 2013f).

### *Maximising benefits from the participation in European programmes for science and innovation*

The participation of Dutch research and innovation organisations in the European Framework Programmes (FP) has been very successful by average European standards (Box 5.22).

### Box 5.22. Dutch participation in FP7

According to the latest FP7 monitoring report (EC, 2013b), covering the period 2007-12, the Netherlands' application success rate is significantly above the EU average (23% vs. 17%), second only to Belgium. In terms of funding attracted, the Netherlands ranks fifth, behind Germany, the United Kingdom, France and Italy, all significantly larger countries. Dutch universities perform well: among the top 50 participating universities, they are fewer in number than UK and German universities but more than Swedish ones. However, no Dutch university is listed in the top ten participating universities (which are mostly UK and Swiss). For participation by research organisations and the private sector, the leading Dutch institutions are TNO (ranked 10th) and Philips (8th). The participation of Dutch SMEs, instead, is only slightly above EU averages (EC, 2013b). Overall, SMEs account for 14.3% of the total FP7 budget (2007-June 2013). Dutch SMEs account for 15.8% of the EU budget received by Dutch organisations, less than in Austria and Belgium (21.9%), Denmark (17.3%), France (17.2%) or Germany (16.1%). The country has also been successful in terms of grants awarded by the European Research Council: since 2007, the number of Dutch funded projects is 193 for younger researchers,[38] fewer than the United Kingdom (495), Germany (326) and France (314) but more than Switzerland (145). Senior researcher grants[39] numbered 137, fewer than the United Kingdom (402), Germany (242), France (211) and Switzerland (153). The Netherlands performs above average in the Eurostars programme, an EU instrument targeting SMEs.

*Source*: EC (2013a), EC (2013b).

### Box 5.23. Horizon2020, the European Framework Programme for Research and Innovation 2014-20

Horizon2020 is the EU programme for science, research and innovation for the programming period 2014-20. The budget over the seven years is about EUR 80 billion. Horizon2020 is structured around three thematic pillars: **excellent science**, **industrial leadership** and **societal challenges** and has a number of programmes and agencies targeting specific actions or scientific domains.

i) **Excellent science.** The initiatives under this pillar aim to strengthen and extend EU scientific activities and consolidate the European Research Area. This pillar has four main objectives and programmes: the European Research Council, future and emerging technologies, the Marie Sklodowska-Curie Actions for training in science and research, and research infrastructure.

- The *European Research Council* supports frontier research and interdisciplinary activities in new and emerging disciplines through competitive funding on the basis of scientific excellence. The total budget for ERC programmes under Horizon2020 is EUR 13 095 million.

- *Future and Emerging Technologies* (FET) initiatives are expected to achieve breakthrough science and innovation through cross-disciplinary research collaboration. Under Horizon2020, FET initiatives are allocated a budget of approximately EUR 2 696 million. The FET programme is organised along three main lines of action: FET Open, to support early-stage S&T research arising from unconventional collaborations in multiple fields of science and innovation; FET Proactive, to support emerging themes and structure communities around promising exploratory research themes; FET Flagships, to support large-scale and long-term research activities to meet grand challenges. FET Flagships requires a long-term commitment from key stakeholders. FET Flagships chosen under Horizon2020 are the Graphene and Human Brain projects. …/…

**Box 5.23. Horizon2020, the European Framework Programme for Research and Innovation 2014-20 *(continued)***

- The *Marie Sklodowska-Curie Actions (MSCA)* will have a budget of EUR 6 126 million. It will support career development and training of researchers and scientists in all disciplines through cross-border and cross-sector mobility. The programme targets researchers at all stages of their careers. In addition, MSCA will be the main EU programme for doctoral training and promote the involvement of the business sector in doctoral and post-doctoral research.

- The *European Strategy Forum on Research Infrastructure (ESFRI) roadmap* seeks to develop, open and integrate national research facilities and e-infrastructure in the European Research Area. Its main goals are to avoid duplication and to co-ordinate efforts of member states. The roadmap encourages exchanges of researchers and scientists in different facilities and closer industry-academia co-operation.

**ii)** **Industrial leadership.** The Industrial Leadership pillar is organised around three main objectives and programmes: *Leadership in enabling and industrial technologies,* to support R&D in ICT, nanotechnology, advanced materials, biotechnology, advanced manufacturing and processing, and space, by emphasising possible interactions and convergences across and between different technologies and fields and societal challenges; *Access to risk finance,* to support the development of venture capital at EU level (together with the Competitiveness of Enterprises and SMEs) at all stages of companies' development; *Innovation in SMEs*, to provide support to promote innovation, growth and internationalisation of SMEs.

**iii)** **Societal challenges.** Under this pillar, resources from different fields are brought together to focus on grand challenges for EU societies. Funding instruments will focus on: health, demographics and wellbeing; food security, sustainable agriculture, water research and the bio-economy; clean and efficient energy; smart, green and integrated transport; climate action, environment, resource efficiency and raw materials; inclusiveness; secure societies.

**iv)** Other key institutes and programmes include *the European Institute of Innovation and Technology (EIT)* and the *Joint Technology Initiatives (JTIs).* The goal of EIT is to reinforce the innovation capacity of the EU and its member states in order to address the grand challenges facing European society. Over 2014-20 EIT will receive EUR 2 711 million to promote innovation in Europe. EIT was created to integrate education and entrepreneurship with research and innovation at the EU level. It works via the knowledge and innovation communities (KICs) to develop and test new models for approaching, managing, financing and delivering innovation. In 2010 three KICs were established to address innovation in climate change, sustainable energy, and ICT. From 2014 new KICs will be established in the following fields: innovation for healthy living and active ageing; raw materials (in 2014); added-value manufacturing and food4future (in 2016); urban mobility (in 2018).

**v)** JTIs are the EU instruments for public-private partnerships and were introduced in FP7. JTIs allow the EU and the business sector to fund and implement jointly some FP7 initiatives. Five JTIs were implemented under FP7: aeronautics, pharmaceutical research, fuel cells and hydrogen, embedded systems, and nano-electronics. Under Horizon2020, JTIs will focus on strong or emerging sectors of the EU knowledge-based economy. The priority areas for JTIs are: innovative medicines; fuel cells and hydrogen; clean sky; bio-based industries; electronic components and systems. These five JTIs are estimated to mobilise total investments of over EUR 17 billion (EUR 6.4 billion in EU funding).

***Source:*** http://ec.europa.eu/programmes/horizon2020/.

The 2014-20 European Framework Programme for Research and Innovation, Horizon2020 (Box 5.23), will combine different sources of European research and innovation funding under a single programme.[40] Its priorities are scientific excellence, industrial leadership and societal grand challenges (climate change, sustainable transport and mobility, affordability of renewable energies, food safety and security, ageing population). Access to credit and promoting innovation in SMEs will be two of the main priorities of the industrial leadership pillar. Horizon2020 aims to simplify the administrative procedures of previous FPs, in particular to strengthen the participation of SMEs, which often lack the resources to undertake time-consuming administrative procedures.

The Ministry of Economic Affairs and Ministry of Education, Culture and Science (2014) have recently acknowledged the opportunities arising from the Horizon2020 agenda for Dutch science and innovation actors. In particular, there are promising avenues for strengthening the links between the European STI agenda and the top sectors approach. Many of the EU grand challenges are directly related to some of the top sectors (energy, water and climate change; agri&food and food safety and security). The importance of these links was recently noted by the Dutch Council for Science and Technology Policy, which recommended closer connections between the top sectors approach and grand societal challenges. According to the Council, these links have been insufficiently developed or exploited and can be reinforced through a cross-theme approach (AWT, 2013). Further alignment of the top sectors agenda and Horizon2020 represents an opportunity not only to facilitate top-sector participation in EU programmes, but also to encourage further cross-sectoral exchanges, with great innovation potential. In addition, the shift towards less administrative burden and easier access to credit, especially for SMEs, is a main concern not only at the European level but also for the top sectors. National innovation policies may therefore benefit from co-ordinating efforts with the European agenda, especially on topics of importance for the Dutch innovation system. Moreover, given the attention that top sectors devote to internationalisation, synergies between the top sectors and the European agenda are important to strengthen international collaboration by firms and research institutions in the top sectors and beyond.

In order to better capture the possibilities for co-operation with EU programmes, the Ministry of Economic Affairs recently developed measures to encourage the participation of Dutch organisations in European programmes: an annual budget of EUR 100 million has been allocated to European programme from 2015 onwards, of which EUR 13 million is earmarked (over the full Horizon2020 period, 2014-20) to strengthen the participation of Dutch SMEs. Initiatives to better inform and advise SMEs about possibilities for participating in European programmes and finding international partners for co-operation have been established. In addition, EUR 36 million has been allocated for 2014-17 to co-fund participation in European research projects focused explicitly on grand challenges.

# Notes

1. Technologies of this kind include ICT, biotechnology or nanotechnology. They are distinguished by their wide scope of applicability throughout the economy and across industrial sectors. Practically all OECD countries, in one way or another, have supported the development or adoption of these technologies. To focus on enabling technologies with an impact throughout the economy is another attempt to foster technological progress while avoiding the pitfalls of the old, more narrowly oriented, sectoral industrial policy approaches.

2. Subsequently the agency expanded and its name was changed to Senter, SenterNovem and AgentschapNL in the wake of several mergers.

3. This section draws extensively on de Heide et al. (2013).

4. The extent to which the concept of "focus and mass" was actually applied has been questioned: "in many ways, the government did not apply this strategy of focus and mass to its research and innovation policy. E.g. a large part of the policy was based on ad-hoc budgetary decisions to increase the FES funds, and there is no focus or strategy in the large and very diverse mix of investment projects. Another example of the lack of focus and strategic policy-making is the observation made by the AWT that three of the largest institutions in the Dutch research structure, namely TNO, NWO, and KNAW, all have their own, different research themes" (Wintjes, 2007).

5. Quoted from de Heide et al. (2013).

6. The FES complemented the research budgets of the relevant ministries. Wintjes (2007) argues that co-ordination and control was difficult and the objectives too broad and diverse to be called priorities. Moreover, the funding was *ad hoc* and covered a very diverse set of activities and projects for which funding through normal procedures was not available. Arguably, the procedures to assess the financed projects improved over time and compared rather well to those of other measures.

7. In the 1990s, there was a shift away from support for individual companies, and increased focus on generic R&D support.

8. The other tax-based instrument, the innovation box, is implemented by the Netherlands Tax Office.

9. The polder model (sometimes referred to more generally as the "consultative economy") involves wide-ranging consultation for decision making in a tripartite co-ordination process involving employers, employees and government. According to some, it dates back to the time when broad cross-sections of the diverse Dutch population had to co-operate to reach agreement on maintaining the costly system of water defences (SER, 2013).

10. There is, however, a Standard Evaluation Protocol which has been recently updated (VSNU, KNAW, NWO, 2014)

11. It should be noted that there is disagreement about the coverage of Top Sectors. According to not much older Statistics Netherlands publication (Statistics

Netherlands, 2012) the Top Sectors account for a much higher 96% of total BERD. The share of export value includes re-exports and would be much higher if they were excluded.

12. One example cited in the original top sectors proposal (Ministry of Economic Affairs, 2011) is Wageningen University and Research Centre's testing sites, where university scientists and researchers from applied research institutes are brought together to exchange knowledge. Firms can learn about research results at these testing sites and can contribute to their funding through their product boards.

13. The top sectors approach also envisages reducing the administrative burden for businesses, uniting the disparate channels of public support to businesses with a one-stop shop for service delivery (*Ondernemersplein*).

14. On 3 March 2014 the Cabinet announced additional funding from 2015: EUR 50 million EU co-financing (for EU public-private programmes and public to public programmes) and EUR 50 million matching (a top up for public R&D institutes to cover indirect costs at EU project level). www.rijksoverheid.nl/documenten-en-publicaties/kamerstukken/2014/03/03/kamerbrief-met-uitwerking-begrotingsafspraken-2014.html

15. According to some, the economic rationale for the Top Sectors is (similar to other forms of innovation-minded government intervention) based on the presence of strong positive externalities due to knowledge spillovers and of benefits from co-ordination (sometimes referred to, under a different framework, as 'systems failures'). In both of these cases the same question applies: It is unclear that sectors of existing strength have (as much) room for further growth in either R&D intensity or exports as, e.g. sectors at an intermediate stage of their development.

16. Progress in aligning the Top Sectors with global societal challenges is documented in Ministry of Economic Affairs and Ministry of Education Culture and Science (2014).

17. The SBIR budget of central government was reduced after 2010, to EUR 6.2 million in 2013. Partly reflecting the evaluation in 2010, it was decided that regional and local governments as well as dedicated agencies (such as Rijkswaterstaat) should contribute more. The magnitude of this instrument can thus not be judged on its central government budget. No data on the uptake of this instrument throughout the country was available at the time of the review.

18. It should be emphasised however that this is conditional on resolving some of the coordination problems identified by Hessels and Deuten (2013). Lack of trust and conflicts of interest may prevent companies from sharing their future plans or signals of opportunities. This is one of the mechanisms that can make stakeholder-led programming inductive to short-termism.

19. The Finnish SHOKs are, like the top sectors, large-scale PPPs built around strong industrial sectors. The 2013 evaluation of this scheme indicated that, in contrast to the original objectives, some of the SHOKs had focused on fairly short-term and unambitious research projects (Lahteenmaki-Smith et al., 2013).

20. Lagging innovation performance may of course be also a symptom of deeper issues in parts of the business sector that go beyond the scope of this review. For example, according to some studies (e.g. Kox, 2012) the lagging productivity of certain types of sectors is due to competition and regulatory issues. As regulatory issues are resolved and markets become more competitive innovation would become more important for these firms.

21. The performance agreements also include commitments on research profiling and valorisation, which are discussed further below.

22. In Denmark, the development contracts of universities were first introduced by the revision of the *University Act* in 1999 as part of a reform of university governance that provided universities with greater scope and flexibility to meet their challenges (Benneworth et al, 2011). In Austria, performance agreements were adopted for university general funds in 2004 based on the *Universities Act 2002*. In Finland, performance agreements with individual universities have gradually been adopted since 1994 (Ministry of Education and Culture, Finland).

23. Sweden and Finland have made a direct link between the outcomes of quality evaluations and funding, but only for stimulating excellence. The Ministry of Education, Culture and Science claims the Dutch system to be innovative because it uses a nuanced indicator set in combination with funding and agreements with the individual institutions.

24. However, a university's strategic development does not only depend on the formal governance system. It can be influenced as much or more by the initiative of key persons with vision and determination. For example, reforms at the University of Twente started long before the introduction of the 1997 reform and were implemented on the initiative of the then rector and administrative director. Together they set out to transform the university from a marginal position into an innovative and entrepreneurial university by changing the budgetary system (lump-sum, cost-centre, responsibility-centre budgeting) (Clark, 1998, p. 45).

25. Specifically, AWT suggests that the committee should also ensure strategic coherence with EU strategies, pay attention to the present and future costs of existing research facilities, focus on the quality of research facilities, explore the possibility of public-private partnerships for the development and the use of the infrastructure. The committee should also be aware of the degree of alignment between research infrastructure and specialisation and development strategies of universities, research institutes and regions.

26. The term "valorisation" is commonly used in the Netherlands but rarely used elsewhere. According to the Dutch National Valorisation Commission (cited in Rathenau Institute and STW, 2011), valorisation refers to "the process of creating value from knowledge by making knowledge suitable and/or available for economic and/or societal use and translating that knowledge into competitive products, services, processes and entrepreneurial activity".

27. Following this recommendation, the General Board of NWO decided that from 2014, valorisation should be part of the assessment of applications in all of NWO's funding instruments, including the talent and curiosity-driven research programmes. NWO explicitly asks researchers to state how their research might be of interest to other scientific disciplines, society or industry. The assessment procedure for the talent and curiosity-driven research programmes has been set up so as not to disadvantage researchers who can clearly present the reasons for the lack of any prospect of knowledge utilisation in the foreseeable future. Valorisation will be assessed during the monitoring and evaluation of funded projects and programmes.

28. To recall, the contribution of public research is evident not only in strong performance in the various available indicators of commercialisation, but especially in supporting the production of very high quality human resources, raising the

visibility of the Netherlands as a knowledge-intensive economy and attracting international talent.

29. In this respect, success rates in some of NWO's first top-sector-related calls could be a cause for concern: for example, in the STW HTSM call 2012, out of 73 project proposals, 32 were funded (44% success rate); even higher levels are reported for other top-sector-related calls. These levels are somewhat higher than the average success rate of 35% for NWO thematic programmes (Table 5.10) and reflect relatively low submission rates for some of the top-sector-related calls. This may be due to a number of factors: the relevant industry-academic networks may not yet be well established in many areas; in-kind or in-cash contributions from private partners may be difficult to secure; and in some research areas there is little experience (on both sides) with such kinds of collaboration. These factors could change over time as relationships in the top sectors develop further. In the meantime, there is a risk that under-subscribed calls could compromise research quality.

30. KNAW (2013) makes a related, though broader point: "not all research that is vital to society can be described in terms of economic utility. In a society that functions effectively, including a properly functioning knowledge economy, security, social trust, good governance and similar matters are vitally important . . . It is at least as important for research to derive its value and meaning from more than its direct relevance to society. A high-value knowledge society requires high-value, broadly educated people who are capable of acting independently and creatively when tackling new challenges. Any random academic programme might contribute to meeting that general aim."

31. In this regard, it is essential to recall the rationales for direct government funding of the TO2 institutes (see Box 4.6), which include the need to offset market failures.

32. Evaluation results are expected to be just one input that will be combined with a balanced vision of the interests and research needs in the fields of economic competitiveness, societal themes, and policy and statutory tasks in determining the allocation of funding for subsequent periods.

33. Territorial Level (TL) 2 regions represent the first administrative tier of subnational government, such as regions in many European countries or States in the United States; Territorial Level (TL) 3 regions are smaller administrative areas contained in TL2 regions. They refer for example to provinces in many European countries.

34. Some peaks in the delta projects were continued until 2011.

35. These findings are confirmed by studies on the Netherlands (Frenken et al., 2007), Italy (Boschma and Iammarino, 2009) and Spain (Boschma et al., 2012). In addition, studies in economic geography suggest that the type of agglomeration externalities varies according to the level of maturity of industries: Jacobs externalities (knowledge spillovers emerging from the agglomeration of firms in different industries) are more beneficial to new industries, whereas Marshall-Arrow-Romer (MAR) externalities (knowledge spillovers emerging from spatial agglomeration of firms in the same industry) are more beneficial to mature industries (Potter and Watts, 2011; Henderson et al., 1995; Neffke at al., 2011; Boschma and Frenken, 2011).

36. For a list of regional initiatives see: www.antwoordvoorbedrijven.nl/subsidies/innovatie/provincie.

37. Letter to the Dutch House of Representatives: "Modernising Dutch Diplomacy", available at:

http://www.minbuza.nl/en/appendices/the-ministry/about-the-ministry/missions-abroad/reforming-diplomacy-clear-choices-new-emphases/letter-to-the-house-of-representatives-modernising-dutch-diplomacy.html.

38. Starting grants for researchers with 2-7 years of experience, grant budget of EUR 1.2-2 million.

39. Advanced grants for leading researchers, grant budget between EUR 2.5-3.5 million.

40. The sources are the Framework Programmes for Research and Technical Development, the Competitiveness and Innovation Framework Programme (CIP) activities related to innovation and the European Institute of Innovation and Technology.

# *References*

Acemoglu, D., P. Aghion and F. Zilibotti, (2006), "Distance to Frontier, Selection, and Economic Growth", Journal of the European Economic Association, MIT Press, Vol. 4(1), pp. 37-74, 03.

AWT (2003), Backing Winners. Van generiek technologiebeleid naar actief innovatiebeleid, Advisory Council for Science, Technology and Innovation.

AWT (2013a), Advisory Letter: Initial Observation from the Top Sector Results, Advisory Council for Science, Technology and Innovation.

AWT (2013b), Size and Suitability, Investing Strategically in Large-Scale Research Facilities, Advisory Council for Science, Technology and Innovation.

Benneworth, P.S., H.F. de Boer, L. Cremonini, B.W.A. Jongbloed, L. Leisyte, J.J. Vossensteyn and E. de Weert (2011), "Quality-related funding, performance agreements and profiling in higher education, an international comparative study", CHEPS report, University of Twente, Enschede.

Boekholt, P. and P. den Hertog (2005), "Shaking up the Dutch Innovation System: How to Overcome Inertia in Governance", Chapter 7 in OECD, Governance of Innovation Systems, Vol. 2: Case Studies in Innovation Policy, OECD Publishing.

Boschma R. and K. Frenken (2011), "The Emerging Empirics of Evolutionary Economic Geography", Journal of Economic Geography, Vol. 11, pp. 295-307.

Boschma, R. and S. Iammarino (2009), "Related Variety, Trade Linkages, and Regional Growth in Italy", Economic Geography, Vol. 85, Issue 3, pp. 289–311.

Boschma, R., A. Minondo, M. Navarro (2012), "Related Variety and Regional Growth in Spain", Papers in Regional Science, Vol. 91, Issue 2, pp. 241–256.

Brouwer, E., P. den Hertog, A.P. Poot and J. Segers (2002), WBSO nader beschouwd. Onderzoek naar de effectiviteit van de WBSO, Amsterdam, PriceWaterhouseCoopers, Dialogic and TU Delft.

Clark, B. R. (1998), Creating Entrepreneurial Universities: Organisational Pathways of Transformation, Pergamon, Elsevier Science Ltd, Kidlington, Oxford.

de Boer, H. and L. Goedegebuure (2001), "On limitations and consequences of change: Dutch university governance in transition", Tertiary Education and Management, Vol. 7, No. 2, pp. 163-180.

de Boer, H., J. Huisman, and C. Meister-Scheytt (2010), "Supervision in 'modern' university governance: boards under scrutiny", Studies in Higher Education, Vol. 35, No. 3, pp. 317-333.

de Heide, M., W. Manshanden, E. Poliakov and J. Ypma (2013), Background report – OECD review of the Netherlands, [Background Report for the OECD Review of the Netherland's Innovation Policy], TNO, Delft.

de Jong, P. and R. van Winden (2011), "Nederland en de BRIC's: oorzaken van de beperkte aansluiting van Nederlandse bedrijven", Onderzoek voor het Ministerie van Economische Zaken, Landbouw en Innovatie, Aarts De Jong Wilms Goudriaan Public Economics bv (APE), The Hague.

de Jong, P., M. Gielen and M. van Praag (2013), "Evaluation of the Dutch Innovation Credit Facility", Study Commissioned by the Dutch Ministry of Economic Affairs.

den Hertog, P., B. Kaashoek, L. Korlaar, B. Minne S. Smeets and R. te Velde (2011), Eindevaluatie Vraagsturing TNO en GTI's, Evaluation commissioned by the Ministry of Education, Culture and Science, Dialogic, Utrecht.

den Hertog, P., F. Bongers, B. Minne, J. Veldkamp, L. Korlaar and M. Janssen (2012a), Evaluatie van de programmatische aanpak, Evaluation commissioned by the Ministry of Economic Affairs, Agriculture and Innovation, Dialogic, Utrecht.

den Hertog, P., C.-J. Jager, R. te Velde, J. Veldkamp, D.W. Aksnes, G. Sivertsen, T. van Leeuwen, E. van Wijk (2012b), "Science, Technology and Innovation Indicators 2012", www.sti2.nl/.

European Commission (EC) (2011), A Composite Indicator for Knowledge Transfer, Report from the European Commission's Expert Group on Knowledge Transfer Indicators", Brussels.

European Commission (2012), Regional Innovation Scoreboard 2012, Brussels.

European Commission (2013a), Sixth FP7 Monitoring Report.

European Commission (2013b), SME Participation in FP7, June 2013 Report.

EIM (2012), "Evaluatie WBSO 2006-2010. Effecten, doelgroepbereik en uitvoering", Zoetermeer, www.rijksoverheid.nl/bestanden/documenten-en-publicaties/rapporten/2012/04/02/hoofdrapport-evaluatie-wbso-2006-2010/hoofdrapport-evaluatie-wbso-2006-2010.pdf.

Ferlie, E., C. Muselin, and G. Andresani (2008), "The steering of higher education systems: a public management perspective", Higher Education, Vol. 56, pp. 325-348.

File, J.M. and B. Stensaker (eds.) (2006), "The extent and impact of higher education governance reform across Europe", final report to the Directorate-General for Education and Culture of the European Commission", Vol.3, CHEPS, University of Twente, Enschede.

Frenken, K., F. Van Oort and T, Verburg (2007), "Related Variety, Unrelated Variety and Regional Economic Growth", Regional Studies, Vol. 41, 685-697.

Geerdink, M., P. Krauss, J. Krebbekx, R. van der Mark, M. Soentken and M. van der Wilt (2010), Pieken in de delta: evaluatie subsidieregeling, Berenschot Consultants, The Hague.

Griffith R., H. Miller and M. O'Connell (2012), "Corporate tax and the location of intellectual property", CEPR Discussion Paper, No. 8424)

Guellec, D. and B. van Pottelsberghe de la Potterie (2003), "The Impact of Public R&D Expenditure on Business R&D", Economics of Innovation and New Technology, Vol. 12(3), pp. 225-243.

Hassink, W., B. van der Klaauw, M. van Maasacker, W. Schaasberg, B. Straathof, J. Theeuwes, T. Dirkmaat, T. Gelissen, J. Heijs, L. Klomp, (2013), "Dare to measure: Evaluation designs for industrial policy in The Netherlands". Final report of the Impact Evaluation Expert Working Group, November 2012, www.cpb.nl/en/article/dare-measure-evaluation-designs-industrial-policy-netherlands.

Henderson, J.V., A. Kuncoro and M. Turner (1995), "Industrial Development in Cities", Journal of Political Economy. Vol. 103, 1067-1090

Hessels, L. and J. Deuten (2013), "Coordination of research in public-private partnerships: lessons from the Netherlands", Rathenau Institute Working Paper 1302.

Hicks, D. (2010), Overview of models of performance-based research funding systems, in: Performance-based Funding for Public Research in Tertiary Education Institutions, Workshop Proceedings, OECD 2010, pp. 23-52.

HMRC (2010), "An Evaluation of Research and Development Tax Credits", Research Report 107, www.hmrc.gov.uk/research/report107.pdf

HTSM Top Team (2013), Innovation contract 2014-2015, High Tech Systems and Materials Top Team Secretariat, Eindhoven.

IBO (2002), Samenwerken en Stroomlijnen: Opties voor een effectief innovatiebeleid [Co-operation and Streamlining: Options for an Effective Innovation Policy], Final Report.

KNAW (2013), Effecten van universitaire profilering en topsectorenbeleid op de wetenschap in Nederland: Een eerste kritische reflectie, Royal Netherlands Academy of Arts and Sciences, Amsterdam (in Dutch).

Kox, H. (2012), "Unleasing competition in EU business services", CPB Policy Brief, 2012/04, www.cpb.nl/en/publication/unleashing-competition-eu-business-services.

Lahteenmaki-Smith, K., K. Halme, T. Lemola, D. Piirainen, K. Viljamaa K. Haila, A. Kotiranta. M. Hjelt, T. Raivio, W. Polt, M. Dinges, M. Ploder, S. Meyer, T. Luukkonen and L. Georghiou (2013), "A Licence to SHOK?"- External Evaluation of the Strategic Centres for Science, Technology and Innovation, Publications of the Ministry of Employment and the Economy, Innovation, 1/2013, Edita Publishing, Helsinki. www.tem.fi/julkaisut?C=98033&xmid=4981.

Leisyte, L. (2011), "University commercialization policies and their implementation in the Netherlands and the United States", Science and Public Policy, Vol. 38 (6), pp. 437-448.

Lokshin, B. and P. Mohnen (2009). "How effective are level-based R&D tax credits? Evidence from the Netherlands", Updated UNU-MERIT Working Paper No. 29, University of Maastricht.

Ministry of Economic Affairs (EZ) (2010), "Kamerbrief Evaluatie SBIR", Interdepartementale Programmadirectie Kennis en Innovatie.

Ministry of Economic Affairs (2011), To the Top. The Enterprise Policy in Action(s), The Hague.

Ministry of Economic Affairs (2013a), "Enteprise Policy at Full Speed: Progress Report on Enterprise Policy 2013", Ministry of Economic Affairs, The Hague.

Ministry of Economic Affairs (2013b), "Monitor Bedrijvenbeleid: Bedrijvenbeleid in Beeld 2013", Bijlage bij Voortgangsrapportage Bedrijvenbeleid 2013 Bedrijvenbeleid in Volle Gang.

Ministry of Economic Affairs (2013c), "Summary chart enterprise policies", unpublished communication.

Ministry of Economic Affairs (2013d), "Our Vision for Applied Research", (in Dutch), The Hague.

Ministry of Economic Affairs and Ministry of Education, Culture and Science (2013), "Strength-weakness-analysis of the Netherlands' innovation system and points of interest for the OECD innovation review 2013-2014", Staff Paper, unpublished.

Ministry of Economic Affairs and Ministry of Education, Culture and Science (2014), Global Challenges, Dutch Solutions, The Hague.

Ministry of Education, Culture and Science (OCW) (2007), The Highest Good, The Hague.

Ministry of Education, Culture and Science (2008), The Borderless Good, The Hague.

Ministry of Education, Culture and Science (2011), Quality in Diversity, Strategic Agenda for Higher Education, Research and Science, The Hague.

Ministry of Education, Culture and Science (2013a), Key Figures 2008-2012, The Hague.

Ministry of Education, Culture and Science (2013b), Uncharted Frontiers: the Netherlands' Roadmap for Large-Scale Research Facilities, The Hague.

Neffke, F., H.M. Svensson, R.A. Boschma, K.-J. Lundquist and L.-O. Olander (2011), "The Dynamics of Agglomeration Externalities along the Life Cycle of Industries", Regional Studies, Vol. 45, No. 1, pp. 49-65.

NOI (2009), Van voornemens naar voorsprong: Kennis moet circuleren. Voorstel voor een Nederlandse valorisatieagenda, Nederland Ondernemend Innovatieland, Innovatieplatform (in Dutch).

NUFFIC (2012), Mapping Mobility 2012: International Mobility in Dutch Higher Education, Netherlands Organisation for International Co-operation in Higher Education, The Hague.

NWO (2013), NWO bijdrage aan de topsectoren 2014-2015, Netherlands Organisation for Scientific Research, The Hague (in Dutch).

OECD (2005), "Assessing Innovation Policy and Performance in the Netherlands", in OECD, Assessing Innovation Policy and Performance – A Cross-country Comparison, OECD Publishing.

OECD (2011), *Regions and Innovation Policy*, OECD Reviews of Regional Innovation, OECD Publishing, doi: 10.1787/9789264097803-en.

OECD (2012), *OECD Economic Surveys: Netherlands 2012*, OECD Publishing, doi: 10.1787/eco_surveys-nld-2012-en.

OECD (2013a), *Science, Technology and Industry Scoreboard 2013: Innovation for Growth*, OECD Publishing, doi: 10.1787/sti_scoreboard-2013-en.

OECD (2013b), "Measuring Tax Incentives", www.oecd.org/sti/rd-tax-stats.htm.

OECD (2013c), "Maximising the Benefits of R&D Tax Incentives for Innovation", www.oecd.org/sti/rd-tax-incentives-for-innovation.pdf.

OECD (2013d), *Regions at a Glance 2013*, OECD Publishing, doi: 10.1787/reg_glance-2013-en.

OECD (2013e), *Regions and Innovation: Collaborating across Borders*, OECD Publishing, doi: 10.1787/9789264205307-en.

OECD (2013f), *OECD Reviews of Innovation Policy: Sweden 2012*, OECD Publishing, doi: 10.1787/9789264184893-en.

OECD (2014a), *Main Science and Technology Indicatiors*, Volume 2013, Issue 2, OECD, Publishing, 10.1787/msti-v2013-2-en.

OECD (2014b), *OECD Economic Surveys: Netherlands 2014*, OECD Publishing, doi: 10.1787/eco_surveys-nld-2014-en.

OECD (2014c), *OECD Territorial Reviews: Netherlands 2014*, OECD Publishing, doi: 10.1787/9789264209527-en

PBL (2013), The Rationale of Spatial Economic Top Sector Policy, Statistics Netherlands and PBL Netherlands Environmental Assessment Agency, The Hague, www.pbl.nl/sites/default/files/cms/publicaties/PBL_2013_The-rationale-of-spatial-economic-top-sector-policy.pdf.

Poot, A.P., P. den Hertog, T. Grosfeld and E. Brouwer (2003), "Evaluation of a Major Dutch Tax Credit Scheme WBSO Aimed at Promoting R&D", Amsterdam, www.pbl.nl/sites/default/files/cms/publicaties/PBL_2013_The-rationale-of-spatial-economic-top-sector-policy.pdf.

Potter A. and H.D. Watts (2011), "Evolutionary Agglomeration Theory: Increasing Returns, Diminishing Returns, and the Industry Life Cycle", Journal of Economic Geography. Vol. 11, 417-455

Rathenau Institute and STW (2011), Valuable – Indicators for valorisation, Rathenau Institute and STW, The Hague / Utrecht.

RVO (2014), "MKB-innovatiestimulering Topsectoren (MIT)", www.rvo.nl/subsidies-regelingen/mkb-innovatiestimulering-topsectoren-mit.

Scherer, F.M. and D. Harhoff (2000), "Technology policy for a world of skew-distributed outcomes", Research Policy, Vol. 29, No. 4-5, pp. 559-566.

Sealy, T., H. de Poot and R. Slotman (2013), Research collaboration between Universities of Applied Sciences and SMEs, presentation to RAAK Monitoring and Policy Research, Enschede / The Hague, June 2013.

Silverberg, G. and B. Verspagen (2007), "The size distribution of innovations revisited: An application of extreme value statistics to citation and value measures of patent significance", Journal of Econometrics, Vol. 139, No. 2, pp. 318-339.

Sociaal-Economische Raad (SER) (2013), "The Power of Consultation: The Dutch Consultative Economy Explained", Social and Economic Council, The Hague.

Statistics Netherlands (2012), "Monitor topsectoren, Uitkomsten eerste meting", http://www.cbs.nl/NR/rdonlyres/FA8F2205-3054-41D9-A206-BC9D13F7ECBF/0/monitorentopsectorenresultatenweb.pdf

Statistics Netherlands (2013), Internationalisation Monitor 2013, The Hague/ Herleen.

Technopolis (2010), "Eerste evaluatie Small Business Innovation Research (SBIR) programma's in Nederland".

TNO (2010), Innovate with Impact: TNO Strategic Plan 2011-2014, TNO, Delft.

van Drooge, L., S. de Jong, M. Faber, D. Westerheijden (2013), "Twenty Years of Research Evaluation", Rathenau Instituut, http://depot.knaw.nl/13919/1/13_0520_FeitenCijfers_EN_Pr2a_LD.pdf

van Drooge, L. and R.L.J. Vandeberg (2013), "Valuable – understanding valorisation", Proceedings of the 2013 EU-SPRI Forum Conference, Madrid, 10-12 April 2013.

Velzing, J.-E. (2013), Innovatiepolitiek. Een reconstructie van het innovatiebeleid van het ministerie van Economische Zaken van 1976 tot en met 2010 [Innovation Politics. A Reconstruction of Innovation Policy of the Ministry of Economic Affairs from 1976 to 2010], PhD Thesis, University of Amsterdam, Eburon Academic Publishers, Delft.

VSNU, KNAW, NWO (2014), "Standard Evaluation Protocol 2015-2021. Protocol for Research Assessments in the Netherlands", https://www.knaw.nl/en/news/publications/standard-evaluation-protocol-2015-2013-2021

Westmore, B. (2013), "R&D, Patenting and Growth: The Role of Public Policy", OECD Economics Department Working Papers, No. 1047, OECD Publishing. doi: 10.1787/5k46h2rfb4f3-en.

Wintjes, R. (2007), Country Review: The Netherlands, Monitoring and Analysis of Policy and Public Financing Instruments Conducive to Higher Levels of R&D Investments – The "Policy Mix" Project, UNU-MERIT, Maastricht University.

WRR (2013), Towards the Knowledge Economy, Scientific Council for Government Policy, Amsterdam University Press.

Zanden, J.L. van (1998), The Economic History of the Netherlands 1914-1995, Routledge, London-New York.

Zomer, A.H., B.W.A Jongbloed and J. Enders (2010), "Do spin-offs make the academics' heads spin? The impacts of spin-off companies on their parent research organisation", Minerva, Vol. 48, pp. 331-353.

# Annex 5.A1

# The evolution of Dutch innovation policy since 2002: An overview

This annex is derived from the background report for this review provided by TNO (de Heide et al., 2013).

Five governments took office in the period from 2002 to present, each with their own view on how the innovation system should be fostered. In the following, the evolution of Dutch STI with links to Higher Education policy is outlined based on the coalition agreements between the political parties participating in the respective governments.

## Balkenende I[1] (2002)

The Strategic Agreement (*Strategisch Akkoord*) of the first Cabinet Balkenende identifies increasing labour productivity as a primary objective in response to a decreasing labour supply owing to demographic change. Proposed interventions refer to improving the entrepreneurial climate and further wage moderation. R&D and innovation are not mentioned in the Agreement.

## Balkenende II[2] (2003)

R&D and innovation play a prominent role in the Outline Agreement (*Hoofdlijnenakkoord*) of the Balkenende II Cabinet. The objective is to position the Dutch innovation system "… in the frontline in the fields of education, research and innovation". This ambition is later defined as achieving a "top-5 position" in these specific policy areas. Specific measures include:

- Set-up of an Innovation Platform (i.e. Innovatieplatform I, following the successful example of the Finnish Research and Innovation Council) with stakeholders from the Dutch innovation system ("Triple Helix" approach).
- Increasing of the budget for fiscal measures for industry-oriented R&D (WBSO).
- Changing in the structure of funding of R&D performed by the public research infrastructure (i.e. Research Institutes and Higher Education) from direct / base funding (first flow of funds) to project funding (second flow of funds via NWO) in order to increase competition and improve quality (applicability) of output.
- Promoting / encouraging enrolment and completion of studies in S&T disciplines at Higher Education Institutions.

1 Cabinets are named after the Prime Minister in the Netherlands. Balkenende I took office on 03/06/2002, and was constituted by CDA (Christian-democrats), LPF (populists), VVD (liberals).

2 Constituted by CDA (Christian-democrats), VVD (liberals), and D66 (left-liberals) on 16/05/2003.

## Balkendende IV[3] (2007)

The Coalition Agreement (*Coalitieakkoord*) of Balkenende IV, too, identifies R&D and innovation as an important element for strengthening the competitiveness of the Dutch economy. Important decisions concerning policy and instruments are:

- Continuation of the Innovation Platform (i.e. *Innovatieplatform II*). [Note: It was discontinued in 2010].
- Intensification of thematic scope in research and innovation policy (initiated also by the AWT advisory letter "Backing Winners", and consultation / advice from the first Innovation Platform) by continuation / further implementation of the "Key Areas Approach" (Sleutelgebiedenaanpak).
- Strengthening / further intensifying the WBSO and innovation vouchers (especially for SMEs).
- Additional investments in the Higher Education sector (first as well as second stream funding), especially project funding for basic scientific research on renewable energy;
- Additional resources to strengthen the role of the government as "launching customer" for new innovative technologies.

## Rutte I[4] (2010)

The Cabinet Rutte I in its Government Agreement acknowledges the necessity of strengthening the competitiveness of the business enterprise sector by a "… specific and targeted policy for the advancement of innovation". In contrast to previous Cabinets, Rutte I links this policy focus to "policy aimed at supporting and strengthening entrepreneurship". The Cabinet also adopts the ambition that the Dutch innovation system should belong to the "top-5 of knowledge economies in the world". The "3% objective" however is abandoned; the new target is the allocation of 2.5% of GDP to GERD. Major initiatives include the following:

- Further shift towards a thematic policy approach: from "Key Areas" (focusing on (industrial) R&D and innovation) to "Top Sectors" (focusing on (industrial) R&D and innovation, and entrepreneurship).
- Further embedding (industrial) R&D and innovation policy into industrial policy, as part of a dedicated economic growth strategy. This is also reflected in the establishment of a new Ministry of Economic Affairs, Agriculture and Innovation that coordinates / governs all innovation-related measures.
- Redesigning of the mix of support instruments for R&D and innovation, with a reduction of the financial contribution through direct support measures and an increase in fiscal support.

3 Constituted by CDA (Christian-democrats), PvdA (Socialists), Christen Unie (Christian-right) on 07/02/2007. After the fall of Balkenende II, the existing Coalition minus D66 briefly continued as Balkenende III in order to bridge the gap towards the next elections. Existing policy (concerning R&D and innovation) was continued by this interim Coalition.

4 Constituted by VVD (Liberals), and CDA (Christian-democrats) on 07/10/2010.

- Creation of "Focus and Mass" in subsidies by simplification and combination of existing tools (allowing only for subsidies with proven effectiveness).
- Set-up of a revolving fund of subsidies addressing the innovation process.
- Intensified corporate tax reduction and extension/increase of WBSO.
- Emphasis on support of exploitation/valorisation of knowledge, especially by SMEs.
- The central government abandons regional economic policy (e.g. regional R&D and innovation policy). A (more) prominent role in advancing regional economic development is foreseen for Regional Development Agencies.
- The Government Agreement does not contain a financial overview addressing the main interventions as described above. During the period of office of the Cabinet however, it was decided that budget constraints were required to address the upcoming financial and economic crisis. A prominent decision involved the termination in time of support from the FES, which ultimately will result in a cut of EUR 400 million of R&D funding.

## Rutte II[5] (2012)

The current Cabinet Rutte II has adopted the basic stance of the previous Cabinet concerning support of the Dutch innovation system in order to strengthen competitiveness, and provide a basis for innovation-driven economic growth.

5 Constituted by VVD (Liberals), and PvdA (Socialists) on 29 October 2012.