

OECD Reviews of Innovation Policy

NETHERLANDS

Overall Assessment and Recommendations



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Key findings and main policy messages

Boost innovation to meet economic and societal challenges

- The Netherlands has one of the most advanced economies in the world. But it is also facing some challenges. It is still overcoming a protracted recession. Ongoing demographic change requires that economic growth increasingly depends on productivity gains. Dutch exporters have benefited less than some other EU countries from the expansion into emerging markets. Innovation is a key to future growth and competitiveness, and is also needed to address societal and environmental challenges, including energy supply and climate change.
- Dutch policies in the area of innovation recognise these challenges and reflect high aspirations, aiming to place the Netherlands among the top five knowledge economies globally. In light of the high quality of its human resources and excellent universities, the Netherlands is in a good position to fulfil this ambition. Further improvements in innovation policies and performance can help.

Enhance the benefits of the top sectors approach

- The new top sectors approach based on public-private partnerships is well suited to achieve alignment of strategies and pooling of resources. It has the potential to bring about closer cooperation between business and knowledge institutes, such as universities, and to raise the scope and ambition of business innovation (including in performing more R&D).
- The impact of the top sectors could be enhanced, however, by ensuring a strong representation of smaller and entrepreneurial companies, and by extending coverage – or at least transferring valuable experience and policy lessons – to other sectors with room for improvement in the intensity, scope and ambition of their innovation activities.
- The top sector approach would also benefit from a process to identify possible new areas of strength. This would help ensure the necessary dynamism in the top sectors in light of societal challenges, emerging technologies and changes in global demand. Care should also be taken not to align a too large share of public resources for fundamental research with the top sectors. It will be important to closely monitor its impact on the strong international performance of Dutch fundamental research.

Strengthen business capabilities for world-class innovation

- Dutch enterprises are among the world's leading innovators, with strong technological capabilities and performance. However, the business sector as a whole invests less in R&D and in knowledge-based capital than is the case in other advanced innovation systems. It would be important to broaden the base for innovation and engage more firms in innovation activities, especially in sectors that, relative to other advanced systems, collaborate little with knowledge institutes and conduct little R&D.

- The current system of R&D tax credits is well-designed, but does not serve all of the varying needs of the business sector. Rebalancing the system with a sufficient focus on competitive, well-designed direct support instruments (e.g. for joint R&D projects with knowledge institutes, including instruments used in the context of the top sector approach) would be better suited to longer-term and more ambitious innovation and would also serve the needs of SMEs subject to liquidity constraints.
- Young and entrepreneurial firms account for most of net job growth in the Netherlands and are an important source of radical innovation. However, start-ups grow only little in the Netherlands as they age and many never grow beyond one employee. Improving the environment for experimentation by young firms includes further improvement in product market regulation, e.g. as regards licensing and permits; improved labour market regulation, notably rules as regards permanent contracts; and stronger financing for innovative firms.

Maintain world-class public research, particularly in universities

- The Netherlands has strong research universities as reflected in the number and quality of scientific publications, as well as high research productivity. Most Dutch universities do very well in international rankings. Policy should continue to nurture high quality research performed in the public sector. This involves maintaining healthy funding streams for fundamental research.
- Public budgets for applied research institutes (PRIs) have remained stable over the last decade. In the coming years they are set to fall and will be increasingly tied to the Top Sectors. Universities, too, are increasingly relying on competitive funding and are moving into the types of research traditionally carried out by PRIs. While these changes in funding regime are improving links with industry, they also carry risks: universities and PRIs require core funding to maintain a healthy knowledge base and to perform their primary roles in the provision of skills and of public goods. Government will need to strike a balance and avoid cutting too much in core funding.

Improve valorisation and skills

- The Dutch government places much emphasis on the commercialisation of public research. Dutch universities have strong links with the business sector, as reflected in a comparatively high share of industry funding for university research and the high rate of co-publication. The strong focus on commercialisation is welcome, but should not detract from the other important contributions that university research makes to the economy, particularly for the development of skills that diffuse across the economy.
- The Netherlands has a strong and highly educated workforce for innovation, but has faced challenges in maintaining quality in tertiary education and responding to emerging labour market needs. The share of science and engineering graduates also remains relatively low. Existing initiatives to encourage profiling and specialisation of university teaching and research activities could enhance efficiency, though care should be taken to avoid “blank spots” in national coverage of disciplines. Coordination in the Human Capital Agendas of the Top Sectors and the Technology Pact could help improve responsiveness to labour market demand.

- The universities of applied sciences (UAS) perform relatively little and mostly applied research. They play an important role in the provision of innovation skills and have strong links to industry. Strengthening their research capabilities would be well-timed as they could bridge the divide between firms with little or no innovation experience and world-class research universities and PRIs. This will require greater levels of government investment in UAS research capabilities, and the strengthening of links between nascent research activities and existing teaching programmes.

Overall assessment and recommendations

On many accounts, the Netherlands is among Europe's most advanced economies. It is a founding member of the European Union and part of the European Economic and Monetary Union (euro zone). It is one of the most open OECD economies and ranks ninth among OECD countries in terms of GDP per capita, with a gap of 13% *vis-à-vis* the United States, which is largely accounted for by labour utilisation. The main contributing factors are low average working hours, owing in part to the prevalence of part-time work, an early effective retirement age and high numbers of disability recipients. Labour productivity, measured as GDP per hour worked, is just 2% below the level of the United States.

The Netherlands has derived much of its wealth from trade and other international transactions and is tightly integrated in the global economy through trade and foreign investment. Dutch exports have grown rapidly in recent decades as intra-EU and world trade have expanded. Openness to international trade (measured as the average of imports and exports of goods and services over GDP) is one of the highest among OECD countries and has increased over the past decade.

In the services sector, the Netherlands has traditional strengths in trade, transport and logistics – owing in part to its favourable geographical position – and acts as a gateway to continental Europe and to the United Kingdom. It is a major logistics hub. Rotterdam is Europe's main port and Schiphol is one of the largest airports in Europe and a centre of economic activity for the surrounding region. These strengths can be traced back to the country's early specialisation, which has continuously evolved with the institutional and technological changes – especially in transport and information and communication technology (ICT) – that have underpinned contemporary globalisation. Services – trade, transport and logistics, but also financial and other business services – account for nearly 40% of total Dutch value added. Dutch industry has important strengths in food processing, chemicals, petroleum refining and electrical machinery.

Achievements and challenges

In a long-term perspective, the Dutch economy has enjoyed comparatively high growth. After the Second World War the economy grew rapidly, catching up with US income levels until the mid-1970s. Economic expansion has not always been smooth, however. While its GDP per capita was well ahead of that of European comparator countries in 1970, its lead narrowed over time. A mismatch between productivity and wage increases started to appear in the 1970s, the effects of which came to be referred to as the “Dutch disease”. The situation was due in part to the negative side effects of the successful development of the gas sector, as real wage appreciation led to an erosion of competitiveness in other tradable products. In response to this situation, the Wassenaar Agreement – concluded in 1982 between business and labour unions, and later endorsed by the government – included a combination of cost cutting and institutional reforms, as well as other incentives. As a result, real wages declined and increases in unit labour costs remained below the EU15 average. An increased role for the services sector and diversification of exports also helped. The Dutch economy and productivity then rebounded and grew rapidly.

The Netherlands managed once more to stay roughly on par with the United States in the 1990s (the “Dutch miracle”). The downturn at the beginning of the 2000s affected the country, however, and in 2003 the Dutch economy was in recession. This was attributed at least in part to a deterioration in the competitive position of the Dutch economy. Growth picked up again in the years preceding the 2008-09 crisis, with the Netherlands growing faster than many comparators. Following the downturn in 2009 the Netherlands did not rebound as quickly as other countries in northern and central Europe, and the economy double-dipped in 2012. The Netherlands is now gradually emerging from a protracted recession.

Productivity is a main driver of economic development in the long term. As labour market participation has a natural limit, higher labour productivity is the only source of sustained economic growth. This is especially relevant for developed countries such as the Netherlands, where demographic changes are expected to constrain labour market participation in the years to come. While Dutch productivity levels are high overall, the growth of multi-factor productivity (MFP), i.e. the joint efficiency of the production inputs, labour and capital, has been relatively low among comparator OECD countries over the past 25 years. The United States, Germany and Sweden have achieved higher MFP growth despite already high levels of productivity, while others have caught up to the international frontier during the last decades. Only Denmark and Switzerland had lower rates of MFP growth than the Netherlands among comparator countries. Slow productivity growth combined with disproportionately strong increases in labour costs raises unit labour costs. Over the two decades from 1991, unit labour costs in the Netherlands increased faster than in comparator countries. This has eroded competitiveness.

Dutch exports have grown rapidly in recent decades. The Netherlands is the second largest exporter among EU countries in gross terms, and its export market performance has been strong in international comparisons. Participation in the global economy now increasingly takes place through global value chains (GVCs), and, unlike other OECD countries, the Netherlands has increased its export market shares over the past decades. This is largely due to increased re-exports of goods – about 43% of total exports in 2012 – with little domestic value added compared to domestically produced goods. Most exports are accounted for by a small number of large firms, as in other small open economies with large domestic enterprises.

Even though international trade flows continue to expand, links with dynamic emerging markets are relatively weak. Only about 5% of gross exports go to the BRICs (Brazil, the Russian Federation, India and the People’s Republic of China), whereas around 10% of Germany’s or Sweden’s gross exports go to these countries. In terms of domestic value added content, the Netherlands’ share of exports to BRICs is higher than in terms of gross exports. This is due to indirect exports from the Netherlands to emerging economies through integration in value chains (e.g. intermediate inputs supplied to German assemblers which export to BRIC countries). However, the overall pattern is that the Netherlands’ share of exports to the BRICs lags that of European peers, with the exception of the United Kingdom. This suggests that it may be difficult for trade expansion to drive future growth, as the traditional Dutch export markets are likely to continue to lose weight in overall world demand. Future success in the BRICs will depend, among other things, on the qualitative characteristics of the Dutch bundle of exports. Cross-country comparisons of indicators based on export prices (unit values) suggest that “high-quality” segments are a smaller share of manufacturing exports than in peer countries. The increase in unit labour costs has also exerted downward pressure on international competitiveness, as it has been, over the longer term, stronger than in other OECD countries.

As noted, productivity is the main driver of economic development in the long term, and the major source of differences across countries in GDP per capita. For the most developed countries, innovation tends to be the main driver behind increases in productivity, and notably in multi-factor productivity. An advanced country's long-run economic performance thus relies on the level and quality of its innovation activities, i.e. the ability to generate, transfer and assimilate technological, non-technological, managerial, organisational and institutional innovations. Innovation can make an important contribution to increasing labour productivity growth and can therefore help contain unit labour costs and strengthen the international competitiveness of Dutch businesses. Innovation can also help to improve the quality of products, allow firms to move their outputs up the quality ladder, or help them introduce radically new products and services. An upgraded export bundle can also help extend the reach of Dutch exports and enhance the benefits from globalisation.

The prosperity of countries such as the Netherlands, which are at or near the technological frontier, hinges on maintaining a continuing flow of innovation, based on knowledge and technology absorbed from abroad and, to a lesser extent, developed at home. Continuously adopting existing best practices is necessary, but to preserve a top international position, the Netherlands also has to engage in new-to-the-world innovation. It is in many ways well equipped to face the challenges ahead. It not only has a great and long-standing tradition of excellence in science and technology, its science base still excels on many counts and in many areas. But there is scope for improvement. This will require stronger investment in R&D and innovation, notably by the business sector, but also excellent framework conditions and a well-functioning innovation system that ensure high returns to these knowledge-based investments.

The OECD Innovation Strategy has argued that innovation policy can contribute significantly to strong innovation performance and to an innovative, knowledge-based economy and society. Learning from best innovation policy practices in innovating countries plays an important role in that context. At the same time, Dutch policy experience is at the cutting edge in many areas and contributes to the pool of good policy practices.

Main strengths and weaknesses of the Dutch innovation system

Table 1 presents the results of a SWOT analysis of the Dutch innovation system. Overall, the Netherlands is a strong performer of innovation. It needs to remain at the top or, in areas where it is currently lagging, to move towards the top in order to sustain its high standard of living and quality of life. It faces challenges but can build on its strengths and capabilities to tackle them.

Table 1. SWOT (strengths, weaknesses, opportunities, threats) analysis of the Dutch innovation system

Strengths	Opportunities
<ul style="list-style-type: none"> • Successful long-term socioeconomic performance. • Strong export performance. • A strong human resource base. • Overall good framework conditions for innovation including solid institutions and a supportive business environment. • Tight integration in the global economy. Multinationals with global reach, including in R&D and innovation. • Specialisation in services and some manufacturing industries. • Highly developed infrastructure, including transport and ICT. A first rank European logistics hub. • A strong science base with strong research universities and public research institutes and excellent output in terms of the number and quality of scientific publications, and high productivity. • Strong technological capabilities and performance of Dutch firms. • Strong participation in European Framework Programmes and other international co-operative efforts and networks. • Innovative approaches, design, and delivery of innovation policy. • Strong evaluation culture. 	<ul style="list-style-type: none"> • Good conditions to benefit further from globalisation. • Further contributions of research institutions to social and economic development. • Creation and growth of new innovative firms. • Further development of regional knowledge hubs involving companies and the public research infrastructure with strong national and international connections. • Further internationalisation of research, including through attraction of foreign researchers and students and the attraction of foreign direct investment in R&D. • Further development of innovation in services. • Policy initiatives to address Grand Challenges, including through the use of demand-side instruments. • New approaches and practices in innovation procurement. • Comprehensive innovation strategy to strengthen core actors and long-term commitments across sectors (and levels of government). • Stronger dynamism of the top sectors to allow the growth of economic activities of increasing global importance.
Weaknesses	Threats
<ul style="list-style-type: none"> • Weak post-crisis macroeconomic performance and some longer-term issues around productivity growth. • Lagging productivity in some sectors. • Relatively low share of exports to BRICs. • Some aspects of the framework conditions for innovation, e.g. in the area of financing enterprises. • Low R&D expenditure and low propensity to collaborate with knowledge institutions in parts of the business sector. • Specialisation of parts of the economy in the lower quality range. • Frequent changes in innovation policy. • Limited public recognition of the benefits of science and technology; some weaknesses in the culture of entrepreneurship. • Low graduation success rates in tertiary education. 	<ul style="list-style-type: none"> • Failure to achieve high productivity growth, eroding competitiveness. • Stagnation of R&D intensity, notably in the business sector. • Failure to make full use of the country's rich human capital and knowledge base and loss of innovative edge in the face of global competition and sluggish domestic R&D. • Increasingly fierce competition for top international talent that compounds skills shortages due to an ageing population. • Offshoring of production and R&D activities of multinationals (corporate research centres). • Failure to diversify into sectors of growing global importance. • Cuts in public funding for fundamental and applied research.

Scope for improving and further developing innovation policy

The Netherlands has, in many instances and in various ways, been a pioneer in the development of innovation policy. Given its willingness to experiment and its enduring strong performance, it continues to provide examples of good policy practice. Nonetheless, there is scope for changes in specific areas to improve current performance and to ensure the sustainability of the Netherlands' leading position.

Most notably, despite signs of progress in recent years, policy has yet to tackle successfully the low levels of R&D activity relative to other frontier countries, especially, but not exclusively, in the business sector. Changes in policy approaches and in the policy mix have been frequent, against a background of a fair degree of political and economic volatility. The current thrust of innovation policy rests on two pillars: providing framework conditions conducive to innovation for all businesses and the “top sectors”, a form of new industrial policy introduced in 2011 which applies to a selection of nine sectors (Box 1).

Box 1. The top sectors approach to government policy for the business sector

Motivated by concerns over international competitiveness and emerging social challenges the Dutch government announced the top sectors approach in February 2011. This new form of industrial policy focuses public resources on specific sectors and promotes co-ordination of activities in these areas by businesses, government and knowledge institutes. The nine areas chosen (which do not correspond exactly to industrial sectors in established classifications) represented strong economic sectors: agri&food, horticulture and propagation materials, high-tech systems and materials, energy, logistics, creative industry, life sciences, chemicals, and water. In 2011 these sectors accounted for over 80% of business R&D and for just under 30% of value added and of employment.

Whereas traditional approaches to industrial policy are government-centred, industry representatives are at the centre of the co-ordination process in the top sectors. For its part government undertakes to develop sector-specific policies across ministerial portfolios, including education, innovation and foreign policy, as well as regulatory burdens. The relevant policy also envisages reducing the administrative burden for businesses, uniting the henceforth disparate channels of public support to businesses with a one-stop shop for service delivery (the so-called *Ondernemersplein*).

The approach involves new forms of governance. 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 then evaluates each top team's proposed agenda, which includes a strategic plan and suggested instruments relevant to the top sector. The government's evaluation takes into account the level of ambition, the degree of commitment of stakeholders, the degree of openness, the balance between 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 the top consortia for knowledge and innovation (TKIs) of which some top sectors have more than one.

The public budget allocated to the top sectors is difficult to calculate accurately as it comprises mostly public resources committed to other purposes which have been aligned with the top sectors approach. It is subject to co-funding from the EU and also incorporates the R&D funding dispensed by thematic 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 over the 2013-16 period. 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, while EUR 700-900 million a year are foreseen for research and innovation.

The government's efforts to provide favourable framework conditions focus on streamlining the regulatory framework affecting all businesses, providing tax incentives for investments in knowledge, and instruments to improve the availability of finance, such as loans and credit guarantees.

The top sectors approach involves public-private partnerships (PPPs) along sectoral lines to facilitate co-ordination and rationalise government interventions in a way that maximises impact. Motivated by concerns over international competitiveness and emerging social challenges, the objective is to identify and address market and government failures that prevent these sectors from achieving their full potential and to prioritise R&D activities. While in principle the approach aims to concentrate government attention and resources on a few sectors, in practice the choice of nine broad sectors and the decision to use public resources committed to other purposes means that the emphasis is more on co-ordination than on targeting.

Key issues and recommendations

Taking due account of the Netherlands' innovation-related strengths, weaknesses, opportunities and threats, a number of key issues have been identified and lead to some policy recommendations.

Maintain supportive framework conditions for innovation and entrepreneurship

Conducive framework conditions are essential for a country's overall innovation performance. Framework conditions that affect innovation, in addition to basic requirements such as macroeconomic stability and openness to international trade and foreign direct investment (FDI), include competition, the regulatory regime, intellectual property rights (IPR) and the tax system. For an advanced country to retain its position as a strong performer in innovation framework conditions must be world-class.

The Netherlands' macroeconomic situation has been difficult in recent years. The crisis hit in 2009, followed by a pronounced downturn that was, however, less sharp than in other countries. Yet the Netherlands did not rebound as quickly as other countries in northern and central Europe, and the economy double-dipped in 2012. In contrast to Austria, Germany, Sweden and Switzerland, economic activity has not reached pre-crisis levels, and real GDP is 4% below its peak of the first quarter of 2008. The Netherlands is now gradually emerging from the recession. Growth is improving but remains weak as deleveraging continues, resulting in low consumer spending and weak lending to the corporate sector. A sluggish macroeconomic environment impacts on innovation activity, notably through tightened constraints on funding.

In many respects, the Netherlands has an excellent business environment, including for early-stage entrepreneurial activity. Many of the conditions relevant to business creation, experimentation and entrepreneurial activity are largely supportive. However, there seem to be some barriers to growth after the start-up phase. An important inhibiting factor seems to be the increased scarcity of bank lending since the financial crisis, especially to small and medium-sized enterprises (SMEs), combined with the limited role of venture capital in risk financing.

Overall, framework conditions for innovation and entrepreneurship in the Netherlands are supportive and have contributed to good economic performance. The Netherlands has continuously improved its business environment over time, lowering barriers to competition and easing entry and exit. There have been successive improvements in the barriers to

entrepreneurship dimension of the OECD Product Market Regulations (PMR) index and its components. The time required to open and close a business is among the shortest among OECD countries. Bankruptcy laws are sufficiently favourable towards entrepreneurs. Although many Dutch consider becoming an entrepreneur an attractive career option, attitudes towards accepting business failures and giving them a fair second chance could improve. Labour market regulations for permanent contracts are relatively restrictive, and figure just after the first-ranking “access to financing” among the most problematic factors for doing business in the World Economic Forum’s *Global Competitiveness Report 2013*.

The creation of young businesses plays an important role in innovation, including more fundamental and even “radical” innovations. The OECD’s Dynamics of Employment (DynEmp) project, which covers 18 countries from 2001 to 2011, found that: i) for the Netherlands the share of start-up companies (those with more than one employee) is relatively low, and is declining over time, as for other countries in the sample; ii) Dutch companies do not grow very dynamically as they age; and iii) the share of firms that never grow beyond one employee is among the highest in each main sector (manufacturing, business services and construction), and the highest in construction. Other data point to a large share of people who consider starting a business, but who have relatively low aspirations for job growth. Taken together these findings suggest that while it is relatively easy to start a business, there may be barriers to growth. With low transaction costs, owing to the use of ICT and important network effects, optimal size in many new and creative industries may be smaller than for traditional businesses. Nevertheless, the most productive and successful companies should still find it attractive to scale up. Therefore, lowering or removing barriers to expansion should remain an important focus of policy.

Recent initiatives (e.g. the Ambitious Entrepreneurship programme) aimed at helping new business founders achieve their growth aspirations are welcome. Easing the costs of dismissal of permanent workers should also facilitate the experimentation that is necessary for an efficient selection among start-ups and the rapid growth of successful ones. Allowing more flexible re-allocation of experienced workers could create a more dynamic labour market that would give longer-tenured employees more incentives to change jobs. Indeed, the future availability of a technically skilled workforce is critical for dynamic firm growth.

Financial conditions affect firms’ ability to obtain the resources they require. This is especially true for young and small businesses, which tend to be constrained by a lack of internal funding or collateral. Some of these businesses play an important role as a source of innovative business models and other innovations. Once successful on a small scale, they need well-functioning financial markets to help them grow and expand the scale and scope of their innovation activities. An environment in which it is easier for successful firms to scale up also creates better opportunities to experiment with new solutions and to innovate.

Credit conditions have been tight for SMEs since the beginning of the financial crisis. The SME lending survey of the European Central Bank shows that Dutch SMEs, anticipating possible rejection, are less likely to apply for credit than firms in comparable countries. If they do apply, they are less likely to get what they want. Credit standards for SMEs tightened in 2013 after easing in the previous two years. Moreover, interest rate differentials between SME loans and other loans have increased substantially since the crisis and barely lessened up to 2012. To compensate for the current reticence of the banking sector to provide funds, especially to SMEs, the government has set up various schemes to help them obtain credit. These instruments help to fill the gap due to the weak levels of lending by financial institutions, but they may be insufficient fully to offset them.

Evidence of the availability of early-stage risk finance in the Netherlands is mixed. Venture capital investment as a percentage of GDP – including early-stage – is roughly on par with some comparator countries in the EU but is far behind the leading countries. Banks, pension funds and insurance companies face obstacles for investing in private equity funds. This may negatively affect the pool of financial resources and may be at least partially responsible for the relatively small size of the venture capital market, especially for the seed and early stages. To address this shortcoming, the government has put in place several targeted financing facilities (fund of funds, regional development agencies, the growth facility), and is planning additional ones, such as an early-stage instrument and the business angels co-investment facility. The fund of funds and co-investment approaches are considered good practice owing to their reliance on private investors' expertise, incentives and resources. Involving business angels is also a welcome step, and taken together, these facilities have the potential to improve substantially the venture capital investment climate.

The Netherlands owes much of its economic success to its highly developed water, rail and air transport infrastructure. It also has a highly developed ICT infrastructure. Nearly all businesses, irrespective of size, have access to a broadband connection, either fixed line or mobile. More recent wireless technologies are, however, less pervasive than on average in OECD countries. Subscription prices tend to be rather high, generally in the middle or in the upper ranking of OECD countries. This mainly concerns the mobile and wireless market, but also the broadband segment for bundles with high data volume and the fastest connection speeds.

Recommendations

- *Maintain sustainable public finances as an important requirement for dynamic private and public investment in innovation. In undertaking the required fiscal consolidation, fully take into account the potential negative long-run effects of reducing investments in human capital and in basic and applied research.*
- *Improve the environment for experimentation by young firms by further improvements in product market regulation, e.g. as regards licensing and permits.*
- *Pay due attention to the role of a flexible and well-functioning labour market as a precondition for a competitive and entrepreneurial environment, especially for allowing successful young businesses to scale up and find the required set of skills and quality in the workforce.*
- *Furthermore, contain the cost of dismissals by an appropriate easing of employment protection of open-ended, permanent contracts; this would help facilitate experimentation with business models and foster the reallocation of employment towards the most productive companies.*
- *Encourage risk financing by continuing to improve the regulatory and legal environment. In particular, consider alleviating restrictions on banks, insurance companies and pension funds for investments in alternative assets such as venture capital.*

Improve public governance – steering and co-ordination

Overall governance

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 are today considered to have roles to play in supporting innovation; the private sector's role in formulating and implementing policy, for example through PPPs, has increased; and the research-performance landscape is increasingly fragmented, with more public research centres (and re-organisation of existing ones) and more firms performing R&D. The innovation policy landscape has been further complicated by the growing number of policy instruments deployed (and frequently changed) and by the increasing number of objectives pursued. The growing role of regions and the European Union in innovation policy adds an additional “multi-level” governance dimension.

Policy coherence is a major concern and raises various issues in terms of co-ordination. From a vertical, principal-agent perspective, agencies are accountable to ministries but many operate with significant autonomy, particularly if they have a research funding function. Horizontal co-ordination of ministries, particularly of the two ministries most active in innovation policy – the Ministry of Economic Affairs and the Ministry of Education, Culture and Science – is mediated through a range of fora, some internal to government but many involving several other actors. The Netherlands has a rich array of intermediary organisations that together provide space for consensus to emerge in a more “bottom-up” style (through the so-called Dutch “*polder*” process) than is typical in other OECD countries. As such, they moderate “top-down” steering efforts and provide for “negotiated changes” in innovation policy and its governance. At the same time, their influence can mean that necessary changes can be hard to achieve.

That said, there has been a great deal of change in Dutch innovation policy, in part as a result of the political and economic volatility of the last decade. Some of the policy changes are at the instrument level, such as the shift in the balance between the use of direct and indirect support measures for business R&D. Others are more institutional, such as the funding and governance of applied research institutes. The frequency of these changes has created some uncertainty and a certain yearning for greater policy stability. At the same time, there does appear to be some continuity in the objectives pursued and in the sectors singled out for special attention. For example, the sectors chosen for the top sectors approach, have clear antecedents in sectors prioritised during the Innovation Platforms and the Peaks in the Delta programmes.

Top sectors: rationale, trade-offs and vision

The top sectors approach (Box 1) was motivated by concerns over international competitiveness, particularly the difficulties faced by Dutch exporters for expanding into BRICs' markets. 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. The approach also involves agenda setting in education, the use of foreign policy, and a focus on deregulation to facilitate new firm creation and on streamlining the business environment.

The approach has many of the characteristics of modern approaches to industrial policy, especially its focus on co-ordination and alignment, the principal role attributed to stakeholder demand (particularly the business sector), and the commitment to monitoring and evaluation. Monitoring and evaluation practices in the Netherlands are in fact extensive and relatively sophisticated by international standards. As an approach to innovation policy, too, the top sectors approach reflects current thinking to a considerable extent. Its 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. At the same time, the policy differs from other modern approaches in its emphasis on economic sectors (as opposed to tasks or activities) and the absence of a search process for new niches, which make it somewhat less dynamic than other forms of modern industrial policy.

It is fair to say that the approach has been the subject of some debate. Many of the concerns raised are familiar to almost any debate about selective industrial policy: the government does not have enough information to pick future winners, the process runs the risk of capture by well-organised interests, and co-ordination can be bureaucratic and inefficient. Some arguments take issue with specific aspects of the top sectors approach. Among them feature claims that a sectoral approach does not take account of global value chains, that it risks diverting resources from horizontal policies such as education, fundamental research and the provision of public goods, and that gains from co-operation by 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 the specific sectors, the alleged lack of “critical mass” in the top sectors 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 science. Policy makers are also called on to remain vigilant with respect to possible regulatory capture and increased heterogeneity of regulation across sectors.

It would seem that at least part of the debate stems from issues related to its rationale and to the vision projected for the future. Focusing on sectors of strength is not always compatible with increasing overall competitiveness. As such sectors are unlikely to be sub-critical compared to other domestic sectors, the argument appears to be that they need strengthening compared to the corresponding sectors of international competitors. It will be important to incorporate the needed international comparisons into mechanisms that 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. It would therefore be desirable to strengthen the rationale for the approach and inject further nuance and clarity, including in the specification of links between the overall strategic vision and its intermediate objectives.

Progress in the top sectors

It is too early to assess the impact of the top sectors approach, as it has existed for only two years. The policy – notwithstanding a healthy debate – appears to enjoy broad acceptance, in part because of a general understanding of the need for long-term stability in innovation policy. The co-ordination of top sectors and the attention paid to this dimension at the outset stand out as positive features of the approach. There are high levels of awareness, engagement and enthusiasm from businesses in some top sectors and

considerable progress has been made in embedding the approach into policy making and research planning. Some of those involved in the drafting of roadmaps report that the approach has created a new and positive dynamic in public-private co-operation. There are tentative indications that the public research system is becoming aligned with industry in the top sectors.

At the same time, there are indications of variable awareness, development and commitment in the top sectors. As the nature of co-ordination problems tend to vary among sectors (according, for example, to the composition of stakeholders), it would be profitable to use evidence collected in the course of monitoring and evaluation to facilitate learning and consolidate experience into actionable lessons. While the participation of SMEs has increased over the past year, their representation remains a challenge, especially for SME-rich top sectors such as creative industries and logistics. Merely having SME representatives on the top teams may not be sufficient, given the enormous diversity of this constituency; additional ways to solicit their views and shape agendas (such as open consultations and surveys) may be required.

Co-ordination of the kind that takes place in the top sectors seems useful for bringing about lasting changes in behaviour, such as facilitating co-operation with knowledge institutes and raising the scope and ambition of business innovation, including by performing more R&D. However, current indications are that the need to increase the intensity, scope and ambition of innovation may be a particular challenge in parts of the business sector that are not covered by the top sectors approach. Extending the approach – or at least the lessons that can be drawn from it – to other parts of the economy could strengthen its impact. This would be important to help safeguard the long-term dynamism of the Dutch economy and innovation system.

The government appears well aware of these limitations and is taking steps to adapt the approach. For instance, in view of the limitations of the sectoral focus, three cross-cutting themes (ICT, bio-based economy, nanotechnology) were introduced. To encourage the participation of SMEs, special co-funding regimes are available and dedicated efforts are made to increase awareness. There is also an increasing awareness of the need to reflect emerging social challenges – particularly through alignment with the EU's Horizon2020 programme – and to develop the regional planning dimension.

Looking to the future, efforts are needed to clarify the rationale of the top sectors, to find a more compelling vision, and to link public support to measureable progress.

Recommendations

- *Systematise learning from past experience and tailor governance arrangements to the specific co-ordination problems of each sector.* Some of these problems are not new but were present in previous innovation-oriented public-private partnerships (PPPs). It is important not to miss opportunities to accumulate valuable lessons and to tailor governance arrangements to the specific needs of each sector.
- *Refine the strategic vision for the top sectors approach and make a compelling, evidence-based case for sector selection and for the merits of government support.* To this end the link between the high aspirations of the approach and existing monitoring tools could be improved by introducing intermediate-level objectives. The continuation of government support could be linked to success in meeting these objectives within specific timeframes.

- *Consider extending coverage – or at least transferring valuable experience – to other sectors, in particular those with greater scope to improve the intensity, scope and ambition of their innovation activities.* A recent self-organised initiative by the construction sector to emulate the top sectors approach could be instructive in this regard, providing pointers to how the approach can be extended to other parts of the economy.
- *Extend the monitoring and evaluation framework to take due account of effects outside the top sectors (i.e. a full social cost-benefit analyses).* In particular, closely monitor its impact on the strong international performance of Dutch fundamental research.
- *Institute mechanisms to strengthen the dynamism of the approach in light of societal challenges, emerging technologies and changes in global demand. Among others this may include:*
 - Strong representation of smaller and entrepreneurial companies;
 - Use of part of top-sector funding for competitive identification of innovation activities that cut across the top sectors, e.g. multidisciplinary PPPs that could lead to new and valuable combinations of knowledge.

Maintain a world-class human resource base for science, technology and innovation

The Netherlands has a highly educated workforce overall. A moderately large share of the population has engaged in higher education, and various pieces of evidence, including the OECD's PISA and PIAAC assessments, attest to the high quality of education and skills. The Netherlands also enjoys moderately high shares of knowledge-intensive employment. Around 22% of its workers contribute to R&D, design, software, database and other knowledge-intensive activities. In this it is similar to Belgium and Sweden and not far from the leading country, the United States. Moreover, the share of employment in industries classified as knowledge-intensive (on the basis of their average propensity to employ tertiary graduates) is in keeping with the levels of Finland, Norway and Germany. A particular strength is the expansion of professional education in the universities of applied sciences (UAS), a level and type of education that is important for innovation and an area in which many OECD countries face difficulties.

While these strengths are considerable, there is also room for improvement in the availability of skills relevant to innovation. In line with the low levels of R&D expenditure and the importance of non-R&D-based innovation in the Netherlands compared to other advanced systems, the workforce has a low share of researchers and R&D personnel, behind most countries in the comparator group with advanced innovation systems. The Netherlands is also at the lower end of the comparator group for doctoral graduation rates. Technicians and associated professionals account for a somewhat smaller share of total employment than in most countries with strong innovation systems. Whether these lower levels represent shortages or are appropriate to the economy's current needs is a subject of debate, though it was estimated recently that an additional 30 000 technicians will be needed every year until at least 2016.

Tertiary education has expanded substantially over the last two decades but there are concerns over teaching quality, particularly in the UAS, where teachers' qualifications are considered low and dropout rates are high. Furthermore, universities will need to adapt to

new types of students and their changing needs. An ageing population underscores the importance of increasing lifelong learning, improving female representation in science and engineering careers, and attracting global talent. In this regard, around 17% of 25-64 year olds in the Netherlands participated in education and training in 2012, a level above the EU28 average of 9%, but considerably lower than the 30% in Denmark and Switzerland. To increase participation rates, the government intends to liberalise student grants and is considering the introduction of loans for part-time students. The Netherlands has relatively few female researchers, though progress has been made over the past decade. The main research funding agency, NWO, has a number of programmes to improve gender balance at all levels of the academic career. Dutch universities are increasingly internationalised: around one-third of research staff are foreign-born. However, more international students would be welcome. The government has developed an action plan to attract and retain such students, which includes measures such as simpler rules for foreign students to enter the Dutch labour market on graduation.

The government has introduced multi-year performance agreements with each university covering actions to improve their teaching. These actions include elevating the educational level of UAS teachers, concentrating on fewer courses for which an institution has existing strengths (profiling), and implementing teaching programme accreditation systems in the UAS. Implementation of these performance agreements is linked to changes in the university funding model, with 7% of the block grant allocation now tied to achieving performance targets. Though not overly generous, these funds can be used to allow universities to take action to improve their teaching activities. It is too early to assess the impacts of these agreements, but the 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 government intends to monitor and evaluate the performance agreements and performance-based funding over the next few years, which is welcome.

As part of the top-sector policy, the government has established Human Capital Agendas to identify skills needs for individual top sectors, and has set up Centres of Expertise to strengthen technical education in the UAS and Centres for Innovative Craftsmanship in secondary vocational education colleges. These measures were followed by a “Technology Pact” for increasing the number of technically trained people in areas in which there appear to be shortfalls. Co-operation between higher education institutions and the private sector is one of the main aspects of this pact, which includes measures to promote science and technology in primary and secondary education, a fund to promote co-operation between business and education, 1 000 scholarships a year for engineering students offered by companies in the top sectors, and EUR 300 million a year for on-the-job technological training.

In sum, the Netherlands’ substantial knowledge-intensive workforce and related economic activities suggest that comparatively low levels of R&D activity and, more generally, somewhat less new-to-the-world innovation than in other countries with advanced systems are not inevitable. Even if the country’s lower scope and ambition in terms of innovation is a reflection of its current industrial structure, it is well placed to upgrade its human resources further and to diversify into economic activities that generate new-to-the-world innovation.

Recommendations

- *Extend the human capital agenda initiative to parts of the economy not covered by the top sectors.* Particular attention should be paid to other knowledge-intensive sectors, notably in services. This will be important for sustaining dynamism in non-technological innovation.
- *Strengthen the alignment between top-sector-related skills initiatives and the broader education policy agenda.* A close monitoring of the effectiveness of co-ordination in the skills agendas and other measures should enable systematic learning. A key policy task will be to draw broader lessons for national education policy from the top-sector-related initiatives.
- *Consider tying a larger portion of block grant allocations to multi-year performance targets.* If evaluations show that performance agreements meet their objectives in terms of improving teaching quality, consideration should be given to raising the performance-related component of the block grant allocation, perhaps to as much as 20% of the total.
- *Continue efforts to improve teaching quality in higher education institutions, particularly in the UAS.* These efforts should ensure the continuing relevance of teaching programmes to the needs of industry, particularly in the profession-oriented UAS, while strengthening generic skills such as innovation management and entrepreneurship. These institution-level efforts should be complemented by a national overview on the provision of teaching programmes so as to avoid “blank spots” in the national coverage of disciplines.
- *Further improve the availability of STI skills by stepping up efforts to facilitate lifelong learning, improve female representation in science and engineering careers, and attract international talent.* The Netherlands is already making good progress in each of these areas, but efforts need to continue to offset expected skills shortages caused by an ageing population.

Foster innovation in the business sector

The Netherlands has an innovative business sector. Large Dutch multinationals are among the world’s leading innovators, with impressive technological capabilities and performance. A majority of Dutch firms reported innovation activity in the 2008-10 EU Community Innovation Survey (CIS) that was similar to that of other countries with advanced innovation systems.

The Netherlands has very high rates of patenting activity and is typically among the world’s leaders, owing to the presence of some large, globally networked and probably highly efficient R&D spenders. It performs moderately well – even if not always among the leaders – in other measures of intellectual property that can be used as proxies of innovation, such as trademarks. OECD estimates suggest that, relative to other advanced innovation systems, R&D resources and patenting are strongly concentrated in the top ten firms. It is likely because of this that Dutch patenting productivity (number of patents per amount spent on R&D) leads the comparator group in terms of Patent Cooperation Treaty or triadic patent families applications by considerably more than Germany, the second most productive country in this regard. These observations appear to suggest that, despite its small size, the Netherlands has been well positioned to exploit scale economies in R&D.

However, knowledge capital investments and business R&D expenditure (BERD) as a share of GDP (commonly referred to as BERD intensity) are low compared to other countries with advanced innovation systems. While the reasons for the low business R&D are the subject of some debate, the prevalence of sectors that typically invest little in R&D certainly plays an important role. Indeed, OECD analysis suggests that, once sectoral structure is taken into account, BERD intensity is just above the OECD average. Nevertheless, even the corrected BERD intensity is behind most other countries with advanced innovation systems, with the exception of the United Kingdom and Norway.

There are some indications that, despite the high innovative propensity of Dutch firms overall, a smaller share of innovating firms than in other frontier countries engage in new-to-the-world innovation. Besides low R&D intensity, these include the relatively low share of researchers in total R&D personnel, the relatively low share of firms that report co-operation with universities and public research institutes (PRIs) and the relatively low share of firms that report international collaboration on innovation activities. These low levels appear to be more prevalent in certain parts of the Dutch business sector. The deficits in terms of R&D and university-PRI collaboration relative to other advanced innovation systems seem to be greater for firms larger than SMEs and in certain sectors, including some services sectors.

These observations suggest a contrast between generally large, R&D-driven and highly internationalised firms and parts of the business sector whose innovation activities tend not to look much beyond national borders or established markets. Even if this reflects the current strategic positioning of Dutch firms in specific economic activities, the country's long-term economic sustainability might be better served by efforts to extend the scope and ambition of a greater share of business innovators, as is the case in other countries with advanced systems.

The current policy mix of support to business innovation is dominated by R&D tax incentives. Additional support is available, particularly for smaller firms, through a range of loan and credit-guarantee instruments for innovation projects. Firms that belong to one of the top sectors can also count on support in the form of the TKI allowance and relatively easier access to public research.

Over the past two decades, OECD countries have increasingly implemented tax incentives for R&D, and in the Netherlands, tax incentives play a dominant role in the current mix of instruments to support business R&D and innovation. Like direct support for business R&D, tax incentives can be justified as a response to the tendency of the market to devote fewer resources to R&D than would be socially desirable. They can be advantageous over direct funding in that they allow firms to decide which R&D projects to finance. At the same time, there is growing evidence that direct support, if well designed, has strong impacts on R&D spending and productivity. Direct funding can be better targeted at parts of the business sector that need support, at a wider range of firms' 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).

The Netherlands places more emphasis on tax incentives, as opposed to direct funding instruments, than most other OECD countries, with the exception of Canada and Australia. Relief for inputs to innovation is channelled through the WBSO (Research and Development Promotion Act) and the RDA (Research and Development Allowance); the Innovation Box provides relief for licensing and commercialisation revenues. The budget for the WBSO and RDA for 2013 was EUR 698 million and EUR 375 million, and budget depletion in 2012 EUR 731 million and EUR 130 million, respectively. The

WBSO is particularly beneficial to SMEs. This is due to its design, notably the ceiling and the fact that the first bracket is more generous. Evaluations of the WBSO have been generally positive and policy design has been responsive to their findings. A potential drawback to this reliance on tax incentives is that they do not distinguish among types of R&D and innovation and leave little room for influencing the scope and ambition of firms' innovation an apparent need for parts of the Dutch business sector. More generally, they may be less suited to support the longer-term and riskier innovation activities that markets typically fail to provide and that cannot be fully covered by public research but hold great promise in terms of future social and economic impact.

The availability of finance for SMEs has been of particular concern. SMEs receive considerable support in the form of R&D tax credits and generally seem well served by the current policy mix. They receive the majority of WBSO funding. In light of the difficult financial conditions of recent years, a number of other instruments supply innovation-related finance in the form of loans and loan guarantees. The schemes have been fine-tuned, usually through information gained from evaluations, to cater to different types of firms at various stages of their development. However, the take-up rate of loans and loan guarantees is not very high, as suggested by the amount of uncommitted funds. Moreover, the re-introduction of the innovation voucher scheme in some top sectors, at the request of entrepreneurs, signals a need for other types of innovation funding. Co-ordination within the top sectors and potentially beyond represents an opportunity to find out more about specific bottlenecks in firm finance and to take remedial action.

The current imbalance in favour of tax credits may constrain first-time innovators, which often require upfront, small-scale funding. Their needs are on the whole more likely to focus on design and engineering activities than on R&D. Given their strong links with industry, the UASs seem well placed to support the development of capabilities in firms that innovate for the first time. Current efforts to strengthen the research and innovation activities of UASs appear well timed and could be explicitly linked to this effort.

Considerable support is available to firms that participate to the top sectors. The top sectors approach seeks to encourage R&D, innovation and other knowledge-intensive activities in the business sector, to provide the requisite human resources and to lift sector-specific regulatory barriers. In addition to generic instruments, the top sectors have the SME innovation support top sectors (MIT), which gives the top-sector leadership a choice over the mix of instruments to support SMEs' participation in the top sectors: technical feasibility studies, knowledge vouchers, support for hiring highly skilled personnel, R&D co-operation projects, support for participation in innovation performance contracts (IPCs), networking activities and innovation brokers. Entrepreneurs in the top sectors welcome the MIT as an opportunity to tailor interventions to demand. However, as its current budget is small (typically EUR 2 million per top sector and per cross-cutting theme), it is unlikely to redress the imbalance between direct and indirect measures.

The top sectors also support collaboration on innovation between public research and businesses. The focus on world-class research and the involvement of the Royal Netherlands Academy of Arts and Sciences (KNAW) and the Netherlands Organisation for Scientific Research (NWO) can help to ensure scientific rigour and high impact. Their involvement may also encourage firms with experience in new-to-the-firm and new-to-the-market innovation to extend the scope and ambition of their activities to the global level. However, care should be taken when aligning a large share of public resources for

fundamental research on the top sectors. It will be important to monitor closely the impact on the international performance of Dutch fundamental research.

Over the longer term, raising the scope and ambition of a greater share of business innovators should be a key policy goal. It could improve the economic impact of their efforts, achieve a more balanced portfolio of strong innovators and thus strengthen resilience. It could encourage diversification into new economic activities and strengthen companies' in-house capabilities for innovation. It could also improve the responsiveness of the broader innovation ecosystem to the emergence of new activities, for instance in the supply of relevant skills and in government regulation. Strengthening the dynamism of top-sector policy will be an important part of this effort.

Recommendations

- *Raise the intensity, scope and ambition of business innovation.* Pay particular attention to the needs of firms that are already innovative (or otherwise knowledge-intensive) but collaborate little with knowledge institutes and conduct little R&D.
- *Rebalance the policy mix by complementing the current focus on R&D tax credits with competitive, well-designed direct support instruments,* e.g. for joint R&D projects with knowledge institutes, and instruments used in the top sectors approach, such as the MIT.
- *Foster stability and minimise the burden imposed on businesses by frequent changes in the policy mix.* Predictability could be improved by linking major policy changes to system evaluation cycles agreed upon in advance (e.g. over five-year periods).

Foster critical mass, excellence and relevance in public research

The Dutch public research system consists of universities and a range of public research institutes. Universities accounted for around one-third of all research expenditures in the Netherlands in 2012. The PRIs performed around 10%. The Netherlands' binary university system is composed of academic universities (WO) and universities of applied sciences (UAS). The academic universities conduct scientific research, provide science- and research-based teaching, and promote the utilisation of research findings in society and the economy (so-called "valorisation"). The UAS are mainly oriented towards teaching that draws on professional practice.

Academic universities

The quality of research in academic universities is very high in international terms. For example, the citation rate of Dutch academic publications is the third highest after Switzerland and Denmark in a ranking of 18 countries. This research involves a high degree of international collaboration, which can be attributed both to the scientific excellence of the academic universities and to the Netherlands' relatively small size. Around one-half of Dutch scientific articles are published with an international co-author, somewhat higher than the OECD average.

External experts have evaluated the research of the academic universities since the 1980s. Evaluations occur at regular six-year intervals and address individual research units and the university as a whole. The results are used predominantly by university

administrators for planning; they are not used by the government in funding allocation decisions, as in some other OECD countries. The research units also make use of the evaluation results to enhance their reputations, although grade inflation now means virtually all are rated good or excellent. Recent changes in the 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 (i.e. number of publications) has been dropped, a clear signal that quantity is no substitute for research quality.

The source of research funding varies but is typically made up of three parts: a government block grant, indirect funding from research councils (NWO and KNAW), and contract research primarily from government organisations, the European Union and the private sector. As in many other OECD countries, the historical trend has been towards a smaller share of funding from block grants and a growing share of indirect funding and contract research. Indirect funding, particularly from NWO, is especially important for supporting fundamental research in the academic universities. However, grant proposal success rates in open curiosity-driven research calls have fallen markedly in recent years, to 17% in 2012, which is slightly on the low side by international standards.

Part of this decline can probably be attributed to a diversion of funds towards top-sector-related research calls, which also fund fundamental research on the condition that it is aligned with the knowledge needs of the top sectors. Top-sector-related investment is distributed across NWO's entire budget and is an integral part of NWO policy. 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). Some of this top-sector-related funding is directed through public-private partnerships, and businesses are expected to make in-cash and/or in-kind contributions to research projects performed in the universities. However, the present requirements for business-sector commitments appear to be light as a whole.

Joint programming in the top sectors seems a promising way to encourage complementarity of public and business innovation investments and is in line with the Dutch government's view that more needs to be done to promote research "valorisation". However, several pieces of evidence suggest that Dutch universities are already well aligned with the needs of industry and have been for some time. In international comparisons, universities appear to attract a higher share of their funding from industry than in most other countries with advanced systems. Moreover, the Netherlands occupies a leading position among OECD countries in terms of international patent citations to national non-patent literature. The level of university-industry co-publications is also high, albeit below the levels attained in Sweden and Denmark. With this in mind, the policy drive for even greater valorisation of public research risks diverting the attention of top research universities away from the research frontier, which could jeopardise their strong international positions and capabilities. It may also approach the limit to what can be achieved in this area, unless it is accompanied by policies to institute lasting changes in the capacities and behaviour of parts of the business sector, too.

Universities of applied sciences

The UAS have limited research capacity, as conducting research was not among their original tasks and the teachers' educational level did not provide them with sufficient capabilities. The situation is gradually changing in both respects. In recent years, there have been efforts specifically to promote the research capabilities of the UAS and to utilise the

knowledge generated for the benefit of SMEs. For example, the Regional Attention and Action for Knowledge circulation (RAAK) programme, a competitive flow of funds for practice-oriented research, has strongly stimulated co-operation between the UAS and employers; the Centres of Excellence programme has seen the establishment of several centres to promote research, teaching and knowledge transfer oriented to SMEs; and the appointment of more than 500 part-time research-performing lecturers has provided an anchor for research and valorisation practices.

The results of these programmes seem positive and complement other public schemes to support knowledge utilisation in the economy and society. The measures are consistent with the aim of catering to the innovation needs of firms that may not be fully served by the more established academic universities. However, research activities still remain small-scale and, as such, benefit only a small part of the teaching and outreach activities of the UAS. They are also relatively new and will take time to develop their full research potential.

Public research institutes

There are three categories of PRIs in the Netherlands: scientific research institutes that fall under NWO and KNAW, government laboratories, and applied research (TO2) institutes, notably TNO (the Netherlands Organisation for Applied Scientific Research). From a policy perspective, the TO2 institutes are the more significant, with expenditures in excess of EUR 1 billion per year. The government's policy towards the TO2 institutes was recently rearticulated in a government position paper, "Our Vision of Applied Research", which proposes to make them more efficient and effective by changing their working methods and operational management. Wholesale reorganisation of the TO2 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. However, they face significant cuts in direct government funding over the coming years and are expected to align large parts of their research with the top sectors. By 2016, the TO2 institutes will receive on average only about one-quarter of their income through direct public funding (compared to around one-third in 2008), a rather low level by international standards.

It is worth recalling the purpose of this 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. Furthermore, independence is an important aspect of TO2 institutes' research as they support the public interest or implement public tasks. Cutbacks in block grant funding could compromise the long-term knowledge base of the TO2 institutes and their independence. Whether business will fund the core knowledge base of the TO2 institutes is doubtful and in some instances, where independence is required, may be undesirable.

Nevertheless, business is now expected to play a leading role in articulating demand for TO2 institutes' research through the top sectors, a role previously largely played by the government. The new arrangements somewhat restrict the institutes' autonomy, and there are concerns that they will lead to shorter time horizons and insufficient investment in infrastructure and development of competences. 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. However, the extent to which such arrangements can compensate for reductions in dedicated public investments in the TO2 institutes' knowledge base is unclear.

At the same time, the lack of uniform evaluation arrangements, similar to those that apply to the universities, makes it difficult for the government to understand the outputs of the institutes and their quality and impacts. To this end, the government 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 procedures. Evaluation results will then be used as an input in determining the allocation of funding for the next four years. 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.

Recommendations

- *Continue to nurture the high-quality research performed in the public sector.* This means maintaining healthy funding streams for fundamental research, particularly in NWO and KNAW. Avoid an overly strong focus on the top sectors, as this will limit the funds available for new topics and important research areas that are not directly relevant, with the risk that insufficient means are available for new areas and the pursuit of unexpected or risky topics.
- *Increase the contribution that business is expected to make to public-private partnerships.* The present requirements for business appear to be light, perhaps necessarily so while relationships and arrangements for PPPs still need time to develop. But the rules should be kept under scrutiny, with a view to increasing business commitments. It will be important to ensure that complementarity effects dominate possible crowding out.
- *Ensure that valorisation agendas are realistic and take sufficient account of the demand for public research from the business sector.* Insofar as the apparent shortcomings in collaboration are due to insufficiently ambitious forms of innovation in parts of the Dutch business sector, there is a danger of too much emphasis on supply-side measures when real bottlenecks persist in the absorptive capacity and behaviour of parts of the business sector. At the same time, it is important for policy to broaden its concept of valorisation, for example by acknowledging the multiple channels through which public research contributes to the economy and society, and to improve its measurement and evaluation accordingly.
- *Consider accelerating the development of research capabilities in the UAS,* ensuring their close alignment with the main teaching programmes.
- *Closely monitor the impacts of funding cuts and 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, for investment in core competences and infrastructure.
- *Ensure that the new uniform evaluation arrangements for the TO2 institutes respect the full range of their activities and outputs, as well as the considerable diversity of the institutes.* In particular, it will be important to avoid over-reliance on crude indicators, a particular risk when aiming for measurement standardisation across institutes.

Supporting international knowledge linkages

The Netherlands' long tradition of international economic and commercial linkages is reflected in the openness of the Dutch economy today. At the heart of western Europe, it benefits from close proximity to major markets and knowledge centres. It also has a highly internationalised science system, as attested by the high share of internationally co-authored publications.

The Ministry of Education, Culture and Science and the Ministry of Economic Affairs have recently developed national strategies to promote the international dimension of STI policies and programmes. The funding bodies KNAW and NWO play a role in defining strategic orientations and programming to support the internationalisation of STI. Individual universities and research organisations are also responsible for developing internationalisation strategies independently of national agendas.

Participation of Dutch science and innovation organisations in European Framework Programmes (FPs) is high compared to European averages. According to the latest FP7 monitoring report, the success rate of Dutch applications is significantly above EU averages (23% vs. 17%), although SMEs perform only slightly above the EU average. The government has acknowledged the opportunities arising from the Horizon2020 agenda, through the strengthening of linkages with the top sectors approach. Many of the EU grand societal challenges in the Horizon2020 agenda are directly related to some of the top sectors (energy, water and climate change; agri&food and food safety and security). A 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 cross-sectoral exchanges with a greater potential for innovation.

Recommendations

- *Consider developing a co-ordinated national strategy on the international aspects of STI policy.* This could be jointly led by the Ministry of Economic Affairs and the Ministry of Education, Culture and Science and would promote co-ordinated action vis-à-vis internationalisation agendas more generally.
- *Continue to strengthen measures to increase the participation of Dutch SMEs in European programmes for science and innovation.* The focus on SMEs and the simplification of rules both in Horizon2020 and the top sectors approach offer an opportunity to target them specifically.
- *Continue to promote synergies between the top sectors and the Horizon2020 agenda while using European programmes to promote science and innovation more broadly, including for sectors and challenges not covered by the top sectors.* Establishing a stronger link between top sectors and societal challenges could make an important contribution in this regard. European programmes can also be an opportunity to connect internationally leading research teams active in non-top-sector research fields.

Strengthen regional innovation policy and co-ordination between different levels of government

Income inequalities between Dutch regions are relatively low owing in part to the polycentricity of the Dutch economy. No single province contributes more than 20% to aggregate national growth, a proportion much lower than generally observed in OECD countries. The regions have good levels of innovation intensity compared to OECD averages. The southern area of the country, in particular, hosts global innovation hubs.

Since the mid-2000s, regional development policy in the Netherlands has moved away from transfer mechanisms targeting lagging regions to investments in local strengths and assets. This shift coincided with the launch of the Peaks in the Delta programme, a national strategy with a territorial focus based on six local development strategies. These strategies identified opportunities and challenges in each regional innovation system, on the basis of existing strengths and clusters of activities. Despite the overall positive evaluation of the effectiveness and the efficiency of this policy, it was replaced by the top sectors approach, which marks a shift of policy focus from regions (regional and territorial development) to sectors (support for nationally selected sectors irrespective of location).

Regional and local authorities play an active role in the top sectors approach, however, especially in the support and promotion of leading regional clusters, SMEs, human capital and lifelong learning programmes. Furthermore, the south-east and the northern wing of the Randstad have been identified as key contributors to the top sectors agenda, owing to the concentration of top-sector-related activities in these areas. Several instruments associated with the top sectors approach – the SME+Innovation Fund, the centres of expertise, innovation-oriented procurement and the human capital agenda (each region has a technology pact that contributes to the national one) – have a clear regional dimension.

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. The top sectors approach increasingly acknowledges the importance of a constant dialogue between sub-national actors and the central government. Some of the risks related to national-regional programme misalignment are unnecessary overlap, omissions, fragmentation, and conflicting rules in programme design and implementation. The involvement of regional representatives in formal or informal steering groups associated with the top sectors could help to ensure that co-ordination is effective and that the needs of local actors are sufficiently taken into account. However, while such alignment is suitable for regions that specialise in the top sectors it is less so for areas specialised in other industries. The latter can develop smart specialisation strategies tailored to their respective strengths and assets and programme innovation activities using funding from the EU Structural Funds.

In addition to vertical co-ordination, top-sector policy may be an opportunity to strengthen inter-regional co-ordination in selected sectors, as well as cross-sectoral co-ordination at the local level to promote synergies and innovation at the intersection of different sectors. Between the top sectors and regional actors, dialogue and synergies can be promoted across firms located in contiguous areas and operating in different top sectors to identify opportunities for innovations that bridge thematic areas. In addition, inter-regional co-ordination may prevent the risk of disconnecting peripheral innovative clusters or firms from the core areas of activity in related industrial or technological fields.

Recommendations

- *Continue to engage regional and local authorities in the implementation and definition of regional aspects of top-sector policy (notably support for SMEs and the human capital agenda).* This will require the promotion of more active bottom-up consultations between multiple levels of government with the participation of regional and local representatives in steering groups and consultation teams.
- *Actively promote links between peripheral but innovative top-sector firms and leading clusters of activities.* It is important to ensure that innovative but isolated firms do not lack the opportunity to tap into national and international innovation networks.
- *Manage expectations regarding the alignment of the top sectors and regional innovation policy agendas appropriately.* Depending on the different regional specialisations, the alignment of top sectors and regional innovation agendas may be more or less appropriate. In addition, the non-alignment of some aspects of regional and local programmes to the top sectors may allow bottom-up initiatives to emerge.