Our Vision of Applied Research

Ministry of Economic Affairs, 5 July 2013

1. Introduction

A substantial part of the applied research in the Netherlands is conducted in six institutes: the Netherlands Organization for Applied Scientific Research (TNO); the Agricultural Research Service (DLO); the National Aerospace Laboratory (NLR); the Energy Centre of the Netherlands (ECN); Deltares, which specialises in applied research in water, subsurface and infrastructure; and the Maritime Research Institute of the Netherlands (MARIN). These six institutes work together in a federation called TO2[1]. They form part of the national knowledge infrastructure and contribute to our economy, society and government. They are in a special position because they receive regular government funding to develop solutions for social problems, strengthen competitiveness (through the top sector strategy), and perform statutory tasks.
In this document I explain how the Dutch Government sees the role of these institutes and elaborate on the pledge I made on 17 December 2012 at the Wetgevingsoverleg Ondernemerschap (*consultative talks on legislation and enterprise*)[2]. I have set out the main elements of the government's vision below.

2. The main elements of the government's vision

The role of the institutes for applied research

Innovation drives economic growth and provides solutions to societal problems, such as sustainability, food security, the depletion of natural resources, and ageing populations. At the same time, it makes the implementation of government tasks more efficient and effective. The institutes for applied research form part of the knowledge and innovation system in both the Netherlands and Europe. Their job is to serve the needs of government departments, search for solutions to societal problems, and strengthen innovativeness in the business community. They also help with policy development and perform statutory tasks. All of this takes place in strategic research facilities, managed by the institutes themselves.

Ambitions

The TO2 institutes form an important part of the innovation system in the Netherlands. The Dutch government however wants to make the TO2 institutes more efficient and effective by changing their working methods and operational management. New and more cohesive working methods are required to programme and execute the research, especially research for top sectors. We also want to fine-tune the position of the institutes in order 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 spearheads which are explained in detail below. These spearheads will enable us to build on the work of the expert groups who have set the rules of behaviour for the top sectors. We sent these rules to your House on 25 June 2013.

Spearheads

1) Sharper positioning institutes in relation to commercial knowledge providers

We intend to sharpen the position of the TO2 institutes in order to set them apart from commercial providers. We consulted experts from the field and have drawn up some ground rules to prevent unfair competition. What these rules say, basically, is that government-funded institutes must perform precompetitive research and must not engage in research that is already being adequately conducted in the market.
The institutes themselves will be responsible for seeing that the rules are adhered to and will send us ideas on how they intend to do this before the end of the year.

2) Focus on multi-year public-private partnerships in top sectors

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[1] TO2 is an acronym for *Toegepast Onderzoek Organisaties*, (organisations dedicated to applied research).

[2] The same pledge was made during the handling of the budget for the Ministry of Economic Affairs, Agriculture & Innovation for 2012, on 2 November 2011

The business community and the government will have to join forces and build up a good cooperative relationship in order to deploy the institutes in the top sectors. Therefore the research will be more embedded than at present in multi-year public-private programmes with several partners. These programmes will be fleshed out in the golden triangle of government, knowledge institutes, and the business community. They will be transparent and open to anyone who wants to participate, but particularly businesses in the SME sector. The TO2 partners have three standard models for public-private partnerships (PPPs). The institutes will have to develop their competencies in such a way that they can to respond to changing demands. They will then be able to assist the transition of the Technological Top Institutes (TTIs) in the existing knowledge infrastructure.

3) Funding based more on quality and impact

The ministry aims to deploy government resources more efficiently and to respond more effectively to the changing needs and demands of business and society. We therefore intend to cut fixed government funding by an average of 20% between 2011 and 2016. Funding will be more variable and determined by societal and economic demands, private commitment, and performance. We will realise this in top sector domains with the TKI (Top Consortium for Knowledge and Innovation) supplement. Half of this supplement will probably go to programmes involving TO2 institutes. Hopefully, this will encourage the institutes to focus on domains where they can make the greatest economic and societal impact.

4) Working on quality and impact of the institutes

Every four years the effectiveness and quality of the institutes will be evaluated and compared, using the same criteria and procedure. The quality of the research, along with the impact on society and private commitments, will then play a stronger role in the funding. The results of these evaluations will determine the allocation of the funding for the next four years. The first will be held in 2015. These evaluations will increase in importance as government steering in top sector policy becomes less detailed and less determined by content upfront (unless the government is directly involved as a partner).

5) Uniform working methods and management structure

Different institutes have different working methods and management structures. These have developed over time but are not always as effective and efficient as they could be, particularly when institutes serve the same clients, as in the case of top sectors. We intend to work with the institutes to harmonise the conditions and working methods. The government is also considering whether it would be better to accommodate all the institutes within one legal framework and is studying the recommendations of the De Leeuw Commission on NDPBs with this in mind. The Dutch House of Representatives will be informed of the situation before the end of the year.

Other matters

We are attending to other matters besides these five spearheads. First, the institutes must also support policy and statutory tasks and they must focus on societal issues that are separately programmed. Various government departments have set up and secured their own knowledge base at TO2 institutes. Every day, the need to find solutions to major societal problems – often international in nature – grows more critical. It is becoming ever more important to realise synergy between societal issues and top sectors, so we must make robust efforts to connect with EU programmes in Horizon 2020.
Like businesses, other knowledge partners and government bodies, the institutes will work in an international setting. Again, this will require good connections with the programming for the top sectors. Finally, the institutes will play a specific role for SMEs. They must continue to apply low-threshold working methods with transparent terms and conditions for SMEs – also in relation to intellectual property.

3. Background

Innovation is a driving force behind new economic and societal developments and an important factor in the growth of prosperity and well-being in the Netherlands. The applied research institutes that work together in TO2 contribute to this process by continuously developing new and practical knowledge, inspired by experience from the field and fed by fundamental research. They develop this knowledge in close collaboration with public and private players. Accordingly, the TO2 institutes form an integral part of the Dutch knowledge infrastructure.
They have three main tasks:

I. To develop, apply and disseminate knowledge in order to solve problems in society and to support government tasks and policy. Part of this research falls under statutory tasks;
II. To develop, apply and disseminate knowledge in order to strengthen the innovative capacity and competitiveness of the Netherlands, particularly the top sectors;
III. To manage strategic research facilities, some unique in the Netherlands and internationally.

To execute these tasks the institutes need a sound knowledge base, which can be used to address immediate questions and to anticipate future questions. In addition, the institutes engage in contracted research for public bodies and businesses. That way, they can apply the collected knowledge in practice.

Table 1: core data for TO2 institutes

Institute	Founded in	Total turnover (2012, in millions)	Government contribution to knowledge development (2012, in millions)t	Workforce (2012)
MARIN	1929	42	5	323
TNO	1932	506	186	3409
NLR	1937	79	26	618
DLO	1938	343	162	2879
ECN	1955	76	23	502
Deltares	2008	111	12	768
Total		1157	414	8499

ECN excl. Nuclear Research & Consultancy Group

The applied research at the TO2 institutes is partly funded by the government. The contribution to the development of knowledge accounts, on average, for one third of the turnover, but can vary from one institute to another. The other two thirds consist of government grants (around half), also from European programmes, and contracted research for the government and the market (the other half). The government funding for TO2 institutes makes the Netherlands an attractive location for innovative businesses – an important precondition for economic growth and prosperity. It is legitimised by three factors.
The first lies in market failure and public interest. The institutes invest in pre competitive knowledge issues which do not get enough attention from businesses. The same applies to large-scale research facilities. Secondly, the applied research focuses on the development and/or application of knowledge for the benefit of society and government. These objectives can be pursued thanks to a robust knowledge base, which is not built from one day to the next. The knowledge developed at the TO2 institutes delivers benefits in scale and synergy that would be lost if the research was scattered across many different organisations.
Finally, the independent status and reputation of the institutes is of crucial importance, particularly in societally relevant research, where the findings cannot be open to discussion and must be made directly accessible to government agencies. The institutes serve the public interest, so they are non-profit-making.

Box 1: applied research in other countries
The system in the Netherlands is similar to systems in other European countries, such as France, Germany, Finland and Sweden. The UK government privatised applied research some time ago, but is now reviewing the situation as a gap has emerged between academic research and the market. The Duitsland Instituut Amsterdam examined the innovation policy in Germany and concluded that German institutes comparable with TO2, such as Fraunhofer and the Helmoltz Gemeinschaft, are important links in the innovation chain.

Besides developing knowledge, the institutes are key players in knowledge and innovation networks. They have widespread national and international connections with businesses, governments and knowledge institutes. They work with a multi-year strategy that interlocks with European roadmaps and stretches far beyond the operational timeframes of their partners. They are therefore invaluable in the development of strategies for sectoral, cross-sectoral and societal innovation. As such, they also have an important role to play when innovation contracts are being drafted for the Top Sectors.

All TO2 institutes have research facilities at their disposal. 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. In the past, investments in research infrastructure came from the Economic Structure Enhancement Fund (FES). Sometimes, as in the case of the National Aerospace Laboratory, arrangements are in place to compensate for shortfalls in funding.

Box 2: Research facilities at MARIN
MARIN is an internationally acclaimed top institute specialising in maritime research. It uses a combination of seven testing facilities, bridge simulators, and calculation and measurement technologies to make ships safer, cleaner and smarter. MARIN's latest facility is the unique 'Depressurised Wave Basin' in which air pressure is reduced to very low levels (almost vacuum) and wave generators operate along the short and the long side of the tank, thus enabling research to be conducted with scale models. The behaviour of ships and propellers can be observed and the impact of waves and wave-loads can be tested with correctly scaled air pressure.

Changing environment

As the institutes operate in a rapidly changing environment, they feel the effects of internationalisation and other societal and economic trends. Innovation patterns in the public and private sectors are also changing. Businesses are engaging less in R&D, partly because of shorter innovation cycles and open innovation. The more complex the problems become, the greater the need for multidisciplinary research and close collaboration.
Stronger interaction with fundamental research and the criss-crossing of knowledge flows have created a trend in which innovations come more from the field and less from traditional linear models. It looks as if the Wijffels Commission was right in 2004[3] when it concluded that the traditional bridging role of the TO2 institutes has become out of date. There is no one-way traffic either: knowledge and information flow just as much from the business sector to the knowledge sector as the other way around. We see knowledge-driven innovation (new knowledge generates new innovations) and innovation-driven knowledge (ideas and practical applications generate new questions).
Policy has also changed. Since the second half of the 1990s we have observed a trend towards more public-private partnerships, further boosted by the top sector policy. Findings from a current OECD project indicate that the Dutch are ahead of the rest of Europe in PPPs. Accordingly, the need for the public and the private sectors to join forces and contribute to solving national and international problems is also growing. Finally, responsibility for coordinating the institutes shifted to the Ministry of Economic Affairs in 2011 after being spread across several departments.

4. Position of applied research in the innovation system

The TO2 institutes operate in an eco-system which includes fundamental research and market players, including private knowledge institutes for specific professions such as developers and engineers. This has created a dual challenge for the institutes. They must stay in touch with cutting-edge fundamental research and with the demand for knowledge in the public and private sector. At the same time, they must prevent unnecessary overlaps. To preclude unfair competition, it is imperative for government-funded TO2 institutes to operate from a clearly defined position that distinguishes them from private knowledge providers.

A clear positioning of the institutes compared with private knowledge providers and other market players

TO2 institutes operate at the interface between the public and private sector. They work closely with end-users to maximise the relevance of the research. This interaction takes place via the top sectors and 'knowledge arenas' for societal themes.
The primary task of the TO2 institutes is to develop new knowledge and to manage the research facilities efficiently so that the market and other players can build and implement concrete applications. If knowledge or facilities already exist to a sufficient degree in the market, there is no need for the institutes to develop them. The government can make specific requests for knowledge from the TO2 institutes in their capacity as independent organisations.
This positioning is important in order to prevent unfair competition and to safeguard the efficient deployment of government resources. The Dutch government will continue to play a specific role in government-funded institutes and will not allow free competition, which would only add to obscurity and inefficiency and might even impoverish

[3] Ad hoc Commission *brugfunctie TNO en GTI's* (bridging role of TNO and GTIs) 2004, *De kracht van directe verbindingen* (the power of direct connections)

the knowledge base.

We have noticed in recent years that, despite the guarantees, TO2 institutes are sometimes operating in the same areas as private knowledge providers and market players. These practices could easily cause disruption in the market. The top sector approach is actually adding to this risk in some sectors rather than reducing it. The institutes must engage in research that will benefit the top sectors, but if the programming for the top sector research brings the institutes into the territory of private knowledge providers and market players , the risk of unfair competition will increase. We must therefore demarcate more clearly the playing field in which the institutes may operate.

The government has set some rules with the TO2 institutes and market players – including private knowledge providers – which clearly state where the role of government-funded 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 Appendix 1).
The institutes will apply these rules when they formulate and implement their strategic plans. At the same time, the market players and public bodies will engage in ongoing dialogue. The institutes themselves will be primarily responsible for ensuring that the rules are adhered to and will report to me before the end of the year on how they intend to do this. To prevent unfair competition we shall also re-examine the tax arrangements for contracted research.

We have no intention of watering down the collaboration between the institutes and the market – particularly between TO2 institutes and private knowledge providers, who have common interests. Private knowledge providers can contribute to the valorisation of knowledge alongside all the other channels used by the institutes for this purpose. Conversely, the private knowledge providers can benefit from new knowledge and insights from TO2 institutes which they cannot develop themselves. Collaboration can therefore bring about a win-win situation for both sides. Where useful, we will encourage the TO2 institutes to outsource parts of research projects to private knowledge providers. It might also prove productive to shift researchers around TO2 institutes, private knowledge centres, universities and market players.
Deltares is a good example. It works closely with engineering agencies, despite concerns when it was first established that a government-funded competitor was entering the market. Deltares and the engineering agencies reached a deal in which they clearly defined the methods of cooperation.

Good connections with fundamental research

Good connections between applied and fundamental research are necessary, first of all, to ensure that knowledge is continuously renewed and updated through the application of the very latest fundamental research. Secondly, good connections are instrumental in passing on the knowledge from fundamental research to end-users in the market, society and government. At the same time, the fundamental research must be fuelled by problems and practical experience, gathered largely via applied research.
The TO2 institutes and universities have always worked well together. There are part-time university professors who also work at TO2 institutes, internships carried out at the institutes, shared facilities, etc. The agricultural research institute, DLO, is in a unique position as it is accommodated together with Wageningen University in one organisation, Wageningen UR.

Box 3: Collaboration between the National Aerospace Laboratory and universities
The National Aerospace Laboratory (NLR) engages in fundamental research in close collaboration with Dutch universities. In addition to providing internships and opportunities for graduation projects, the Laboratory has PhD students on its payroll who conduct fundamental research with the universities. It also works with various universities on projects in fundamental and applied research and often acts as an intermediary between academe and industry. External PhD students have regular access to its facilities. The Laboratory enjoys a special relationship with TU Delft as co-owner of a research plane. The two organisations share the maintenance and management of the plane, thus significantly increasing its cost-effectiveness. TU Delft uses it for teaching purposes and fundamental research and the Laboratory uses it for applied research and operational services. TU Delft and the National Aerospace Laboratory work together intensively with this plane on the interface between fundamental and applied research.

The top sector policy has boosted cooperation between fundamental and applied research. The innovation contracts, translated into roadmaps and programmes, are bearing fruit. Take, for example, the maritime sector,

where until recently it seemed that fundamental research was at risk of drying up completely. MARIN came into action and an agreement was reached with the Technology Foundation STW, via the Water top sector, to set up a programme for fundamental research in the domains relevant to the maritime sector. However, there are still obstacles in the organisation and funding of both fundamental and applied research that must be removed as they are compromising optimal cooperation and knowledge-sharing. The expert groups have drafted ways in which the different forms of PPPs for fundamental and applied research can be coherently programmed. The Ministries of Economic Affairs and Education, Culture & Science, the Netherlands Organisation for Scientific Research (NWO) and the association of Dutch universities, VSNU, will come together to explore opportunities for strengthening the collaboration between applied and fundamental research still further. They will consider the recommendations of the Advisory Council for Science and Technology Policy (AWT) with regard to facilities (see Section 6).[4]
We must not fall into the trap of thinking in terms of fundamental versus applied research, as if a sharp division existed between the two. There is an eco-system, which asks not only whether the research is fundamental but also whether it is driven by curiosity or inspired by practice (see Figure 2). The latter category is, of course, vitally important for the contribution that academic research makes to the innovative capacity in the Netherlands. In the past this kind of research was conducted by the Technological Top Institutes (TTIs) and consortia established with money from the Economic Structure Enhancement Fund (FES). But, according to the Meijerink Report[5], amongst others, there was no transparency in the way the Fund allocated resources. In addition, the funding for these initiatives was uncertain and led to extra coordination and red tape. Eventually, we decided to stop funding these programmes and institutes separately and to give them a place in the existing knowledge infrastructure.

Figure 1: types of research

	Inspired by possible applications?		
		No	Yes
Fundamental concept central	Yes	Purely fundamental research (Bohr)	Fundamental research inspired by applications (Pasteur)
	No		Purely applied research (Edison)

Source: Stokes 1997

We have found two ways to secure the strengths of the TTIs and the consortia funded by the FES and to guarantee sufficient attention for fundamental research inspired by applications in the field. First, the Netherlands Organisation for Scientific Research (NWO) reserves some of the resources designated for the top sector for this kind of research. Secondly, where feasible and desirable, the TTIs are being embedded in the TO2 institutes, which can then grow into institutes that also conduct or programme fundamental research inspired by applications in the field. A classic example is the Holst Centre founded in 2005.
The embedment of the Embedded System Institute in TNO is now complete. The government will decide together with the top teams, TTIs, the NWO, and the TO2 institutes whether and how further embedment is realisable for each top sector. This will take place on a voluntary basis, whereby the strengths of the TTIs will be secured and safeguarded.

Operating in an international context

Innovation networks are becoming more international. The importance of internationalisation is expressed in different ways. The problems facing society have taken on a global dimension and businesses are operating far more on an international scale. Knowledge is becoming more of an international commodity. Countries with emerging markets are no longer focusing only on the production of goods but are developing them as well. In this new scheme of things the institutes sometimes form a bridge between businesses and the rest of the world. Outstanding knowledge institutes and research groups also enhance the attractiveness of the Netherlands as a base for foreign companies and knowledge workers. It is therefore essential that the institutes continue to align their activities with the interests of the Dutch economy and Dutch society. We will be launching an investigation to

[4] AWT 2102, *Maatwerk in onderzoeksstructuur* (Customisation in Research Infrastructure)
[5] Meijerink Report, 2010, *Evaluatie procedure Fonds Economische Structuurversterking, domein Kennis, Innovatie en Onderwijs* (evaluation procedure of the Economic Structure Enhancement Fund for the domain of Knowledge, Innovation and Education)

ascertain the most opportune role for the TO2 institutes abroad.

The research policy is playing out more and more at European level. This is reflected in, for example, the development of the European Research Area and Horizon 2020. Accordingly, Europe is becoming increasingly important as a source of funding for research and innovation. The TO2 institutes are key players in European programmes which the Netherlands can easily connect with. The institutes are an excellent channel for making knowledge from Europe available in the Netherlands. Between 2007 and 2010 the institutes were allocated 211 million euros in projects within the framework programme. The success rate of the TO2 organisations was 30% – higher than the national and international average. Besides retaining these good results in Europe, we have two other important aims. First, the national and European programmes must be in line with each other. Participation in Europe is not an aim in itself. These considerations must be taken on board when selecting research themes and allocating budgets in the top sectors and when societal issues are being programmed. We also expect the institutes to make maximum efforts to include the Dutch business community – particularly the SME sector – in European projects. This is happening right now but there is room for improvement.

Box 4: international position of Wageningen University and Research Centre (WUR)/DLO
With nine DLO research institutes, Wageningen University and Research Centre is an internationally acclaimed leader in the field of green research. DLO owes its strength to the connection between the natural and social sciences and the bundling and interaction of academic teaching and research. With the demand for food expected to double in the future, WUR has grabbed the initiative and is forming an alliance with leading universities and applied research institutes in the world's main food-producing countries and regions (Brazil, California, China, France and New Zealand). The aim is to coordinate priorities, tap into collective sources of funding, and bundle the strengths in the execution. The alliance will be bolstered by contacts with developing countries (in Africa), where food, water and bio-based are high on the agenda. International visitation committees have rated the research at DLO as excellent or outstanding.

5. Research Programming and Funding

Programming in the top sectors

The TO2 institutes are operating at full throttle in the top sectors. They play a key role in executing research and compiling programmes and roadmaps. The top sector approach will continue to build on demand-driven steering as recommended by the Wijffels Report but collaboration in the Golden Triangle will also be stepped up.
We need clear ground rules for the contribution by the institutes in order to achieve effective collaboration in top sectors. The government asked three expert groups for advice on fundamental research, applied research and intellectual property rights. It then presented the ground rules to the Chamber on 25 June. The institutes used these rules to draw up three distinct models for PPPs.

Collective programming
The starting point of top sector policy is that the programming will be drawn up collectively by businesses, knowledge institutes and the government, working together on an equal footing.
The institutes are expected to organise themselves in a way that enables them to meet the needs of the top sectors. To do this, they may have to build up new fields of knowledge and ditch old ones. Any mismatches between the required and available competencies and knowledge for a top sector will be redressed by agreeing on a clear transition path, which may involve quantity as well as quality.

Multi-year approach
The top sector policy is based on collaboration over several years. This begins with innovation contracts followed by roadmaps. The aim is also to work more in multi-year programmes or in the form of an institute, like the Holst Centre. This will enhance synergy in the activities, show businesses how to give direction and join in, and prevent institutes from being drawn away from the market by incidental projects. In this multi-year approach both businesses and institutes must be prepared to commit financially for the longer term. The results of the agreements will dispense with the need for a separate TNO co-funding programme.

Box 5: Van 't Hoff programme (TNO)
The Van 't Hoff Programme at TNO is a prime example of a 'shared research programme'. These programmes, which are based on the working method at the Holst Centre, are multi-year public-private collaborations for measuring light technology (optical spectroscopy), as an alternative to taking blood samples, for example. This

programme is special for a number of reasons: it is cross-sectoral (Life Science & Health and High Tech Systems & Materials top sectors), it aims to solve societal problems while making bus inesses more competitive, and, besides businesses, it involves patient organisations and charities such as the Parkinson's' Association and the Diabetes Fund.

Transparency and accessibility
The top sector policy supports businesses across the entire sector. In principle, all businesses should be able to participate in PPP programmes and projects. Obviously, many will be unable to do so for practical reasons, but interested businesses will get a chance. The roadmaps and invitations to participate in programmes and projects should therefore be low-threshold. The process must also be transparent and include clear explanations of the roadmaps and research programmes and how businesses can participate in them.

Cross-sectoral activities
The institutes must gear their programming to interfaces between sectors and themes – the areas where interesting developments happen. Cross-sectoral programmes must not be impeded by the distribution of budgets across themes and top sectors. The institutes, the government departments, and the businesses must prevent this by pursuing a proactive and cooperative role.

Support for SME
The institutes are an important partner for SMEs. Even more than large companies, the innovative SME sector depends on the knowledge developed at TO2 institutes because they cannot support adequate levels of R&D in-house, are less capable of keeping pace with the latest technology, and have difficulties beating a path to academic research. TNO has more than 12,000 co-financiers and clients a year and reaches more than 10,000 SMEs (2500 directly and the rest through sectoral channels). This is why the institutes need to be alert to the specific needs of SMEs and incorporate them in their organisation and their terms and conditions of collaboration. The conditions for intellectual property and the protection of background knowledge in businesses should also be transparent.

The institutes organise special activities for SME collaborations, including events, Small Business Innovation Research (SBIR) programmes and research and knowledge dissemination for trade associations. It is important to connect well to the SME entry point for the top sectors and to work with companies such as Syntens.

Box 6: Energy Centre of the Netherlands and SME
Tempress Systems, an SME based in Vaassen (Gelderland), develops and produces thermal production equipment for the semi-conductor, MEMS (Microelectromechanical systems) and solar energy industries. Tempress is working with ECN on the development of new production technology that will lower the costs of solar cells through economies of scale and efficiency improvements. A large part of this research is being carried out within the TKI solar programme. The partnership has led to the construction of a 300-megawatt production capacity for n-type monocrystalline silicon ('Panda') solar cells and modules, the biggest order in the history of the company so far. Another notable achievement is a large production facility scheduled to be built in Texas (US) and based on technology, largely delivered by Tempress. The consortium, including Tempress and ECN, had the best proposal in the global tender.

Societal themes and public tasks

The research programming for government departments is guided by policy issues, national and international regulations, and the public tasks and obligations of the departments themselves. Independence is an important aspect of the research. The aim is to organise recognisable programmes at the institutes – if they have not been realised already. One of the challenges is to involve the business community without compromising the public interest or the implementation of public tasks.

Societal problems play an equally important role in the top sectors. Often, solutions come from the business community. What is more, societal problems form an interesting growth market for businesses. The challenge is to realise synergy between societal and economic aims. The institutes for applied research can play a meaningful role in this process as they have historically engaged in research in both domains and are adept in making connections.

Box 7: Deltares and societal problems
Deltares researches the safety of flood barriers in the Netherlands, along lakes and rivers as well as the coast. It collects and develops knowledge on normative water levels and waves, on the strength of dykes, dunes and other barriers, and the potential consequences of flooding. It is also conducting research on optimal safety levels. In recent years a consortium of Dutch public and private parties, led by Deltares, developed a new method for calculating the economically optimal height of dykes. This method, which can be applied worldwide, is opening up new horizons and may deliver substantial savings in dyke reinforcement. The project was the recipient of the prestigious Franz Edelman Award in the US.

Long-term research to build a strong knowledge base

The TO2 institutes must also develop knowledge that will help to answer questions posed in the future, so the knowledge base is built for the long term. Though the research is inspired by questions from the field, the immediate aim is not to find solutions to today's questions. We need to see good cohesion between the strategic research at the TO2 institutes and fundamental research and more effective top sector involvement in the research for the knowledge base. We therefore intend to create scope in the overall government funding to enable all institutes to engage in this long-term research.

Funding: robust and versatile

The government is working towards a situation in which institutes receive less of a fixed subsidy upfront and, instead, are granted additional funding on the basis of quality, output and impact. The quality and the economic and societal impact of the institutes will be systematically assessed through visitations and evaluations (see Section 6 for details). The results of these assessments combined with a balanced vision of the interests and research needs in the fields of economic competitiveness, societal themes, and policy and statutory tasks will help us to make responsible decisions on the allocation of funding for subsequent periods. The evaluation criteria will take account of the different research needs for top sectors, societal issues, and policy and legislation.

We have already introduced impact-led steering to some extent in the funding for TO2 – top sectors in particular – via the TKI supplement. The acquisition of private commitment is key.

Figure 2: Budget breakdown

<table>
<tr><td>EU and national and regional grants</td><td rowspan="2">PPP private contribution

<</td><td rowspan="4">Contracted research (for businesses and government bodies)</td></tr>
<tr><td>TKI supplement</td></tr>
<tr><td colspan="2">Government contribution to TO2 for top sectors ^</td></tr>
<tr><td colspan="2">Government contribution to TO2 for societal issues, knowledge base and statutory tasks</td></tr>
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It would be wrong to assume that the government commitment is fixed for four-year periods on the basis of visitations and evaluations. There must be space for interim adjustments so that the institutes (with government approval) can respond to new developments and needs in the public sector, society and industry, and to the willingness of other players to co-fund. We must strike and maintain a good balance between research for the top sectors, for societal issues, and for the long-term knowledge base. We will also take account of differences between institutes.
Given the heavy remit of the TO2 institutes, we will not move budgets between institutes or between societal issues and top sectors before the end of 2015. Efforts will, however, be made to build more synergy between top sectors and societal themes, also with a view to making a maximum contribution to the top sector policy.

6. Organisation, steering and preconditions

Collaboration between TO2 institutes

The institutes are united in a federation and often work together in practice. There is, however, scope for more cooperation, certainly at strategic level. Programming in top sectors has already significantly improved coordination between projects. Having noted this trend and given due consideration to the significant amount of time and energy we would have to invest in institutional redeployment, we have asked the institutes to step up their collaboration and to draw up a collective strategic plan stating how they could work better together, where they could coordinate and share activities more effectively, how they could approach the target groups together (including the top sectors), where they could realise efficiency gains, and how they could learn from one another's strengths.

Government steering

The government plays a number of roles with regard to the TO2 institutes: it is responsible for the system, it is the financier, and it is the purchaser or requisitioner. The government takes on a different role in each of the research types.

Responsible for the system

Responsibility for the system rests with the Ministry of Economic Affairs. More specifically, the ministry is responsible for the framework in which the institutes operate: it maintains it and monitors the robustness of the knowledge base. It steers the institutes with a view to certain preconditions and the effectiveness and efficiency of the system as a whole.

The institutes operate in different ways at present. These differences have evolved over time and are a legacy of the days when the institutes were run by different government bodies. To raise efficiency and to clarify matters for organisations that work together with different institutes, we are developing more uniform steering and working methods. We have already taken a major step in this direction by calling in expert groups to draw up rules of behaviour – also for the top sectors. The institutes will follow this up and thus provide us with clearer insight into fees, supervision, publication practices, and the treatment of intellectual property.

The institutes were 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 person with a statutory remit. The rest are private foundations. The government will look into the desirability of incorporating all the institutes within one legal framework while giving due consideration to the specific interests of government bodies. It will study the recommendations of the De Leeuw Report on independent public bodies in the process. The Dutch House of Representatives will be informed of this before the end of the year.

Financier

The government also plays a major role as the financier of the research. Most of the government's contribution to the development of knowledge is on the budget of the Ministry of Economic Affairs. This 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. 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 2: direct government funding for TO2 institutes**

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.

Purchaser or requisitioner
The government also needs knowledge to execute its own tasks. It steers the institutes on the basis of concrete needs via different ministries with special remits such as the Ministries of Defence and Economic Affairs.
The government can also participate in the substantive management of institutes without encroaching on ministerial responsibilities. This may occur when a ministry is broadly responsible for a policy domain but the user of the knowledge or the implementing agency is another party. This can also apply to local government. Ministries play a coordinating role to ensure that the needs of solution seekers resonate in the programming of the research institutes.

Steering led by quality and impact

In the future, quality and impact will figure more strongly in the assessment of the institutes. The institutes are actively embracing quality measurement but with very different methods. The same applies to the way different government bodies treat these measurements.
We need to get a tighter grip on quality and output and use these as a basis for steering and accountability. To achieve this, we must invest in more uniform monitoring, effect measurement, and evaluation. This will give us 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. This approach also fits in with the evaluation of the demand-driven management of 2011.[6] Every four years the institutes will undergo a standardised evaluation combined with visitations. The evaluation will be conducted for the first time in 2015 and will include the quality of the research, the impact on policy and society, and the impact on the economy. Tried and tested methods are already being used. The results of these evaluations will determine the funding for the next four years.

Intellectual property and the dissemination of knowledge

The overriding mission of the institutes is to develop and disseminate knowledge. This calls for a policy on intellectual property and the publication of research that contributes to the dissemination of knowledge. Government-funded knowledge must be in the public domain and generally accessible. In some cases – but certainly not all – it is useful to have this knowledge temporarily patented. When patents are being built, they must be accessible at the lowest possible threshold. The different approaches to this issue at the institutes have prompted us to take a closer look at the intellectual property policy and streamline it. We also take account of the ground rules proposed by the expert group in doing so.
The knowledge that is collected and developed by the institutes must be accessible to a wide audience. Only under exceptional circumstances can it be kept temporarily or permanently under wraps.

Large-scale research facilities

The Advisory Council for Science and Technology Policy (AWT) recently published recommendations for large-scale research facilities. The council stresses that funding should be used only for the intended purpose. Public resources are invested in TO2 institutes with a view to supporting innovation or facilitating government policy and therefore serve a different public purpose than the resources of the Netherlands Organisation for Scientific Research and the universities, which primarily serve science. This situation does not, however, change the fact that a more integrated approach to investment in and the exploitation of large-scale facilities for both fundamental and applied research would lead to more efficient deployment of public resources. Clearer insight is also needed into the current facilities and in funding more attention should be paid to the facilities' exploitation phase.
These recommendations offer good openings for a more coherent and systematic approach to the facilities in fundamental research and the TO2 institutes without losing sight of the differences between fundamental and applied research. The government will respond to the Council's recommendations after the summer recess.

[6] Dialogic, 2011, final evaluation demand-driven management TNO and GTIs

Appendix 1: Ground rules and rules of behaviour

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 which 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 the relationship with the institute where it originated.

Preconditions

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