



Ministry of Education, Culture and
Science



Curious and committed

The value of science

“Science serves truth, goodness and beauty”

2018 academy lecture by Stevin Prize winner Beatrice de Graaf, after Plato

Curious and committed

The value of science

Foreword

Scientists are curious and committed

Curiosity drives all knowledge. In order to acquire knowledge, you have to ask questions, adopt an open attitude and move between different perspectives. Only then can you get closer to the truth. An answer to a question frequently leads to a further question, so that the quest continues and one discovery paves the way for the next. In this way, curiosity and wonder bring scientific renewal and breakthroughs, which contribute to social and economic progress. This requires a solid foundation of free and independent research. The Netherlands has a strong science system that performs well. I see the increasing investments in research that are also being made in countries around us. It is important to continue investing in science and research in order to maintain and strengthen our leading position in the world. This is only possible with the help of our scientists – the people who do research day in, day out. It is for this reason that this Cabinet is investing strongly in science and applied research, with investments rising up to € 250 million from 2020 through the Ministry of Education, Culture and Science budget, and a one-off investment of € 100 million in scientific infrastructure. I have three ambitions with this investment policy, which express the multi-faceted value of our scientists:

1. Dutch science has global impact
Being one of the world's leaders requires cooperation and a strong system
2. Science is connected to society
Everyone should be able to enjoy the fruits of our scientists' labours
3. The Netherlands is a breeding ground and a harbour for talent
Training and retaining diverse talent provides a strong foundation

With these aims, I am building on the ambitions of the Wetenschapsvisie 2025 [2025 Vision for Science], which also focused on the balance between quality, impact and talent in science. Developments within and outside science mean that a new policy agenda is needed in view of these ambitions. Therefore, I am presenting my priorities in this letter.

Scientists are always searching for answers to a question, but science does not have to lead to a result immediately. Science can increase doubt and raise new questions instead of answering them; this is simply an inherent aspect of how science works. In my view, science is always linked to society, regardless of the extent to which the research is applied or basic. This means that scientists are open to questions emanating from society and willing to commit themselves to social issues and curiosity from citizens. With this openness, we ensure that society continues to have great confidence in science. Another aspect of openness is that researchers examine an issue from all sides and question their own findings as well as those of others. This makes it possible to detect errors and eliminate uncertainty. This nuanced working method is the strength of researchers: knowing what you know but also what you do not (yet) know. I attach great value to academic freedom



Photo: Maarten Hartman, University Utrecht

and scientists should be able to express their opinion safely. That which is sometimes seen as a weakness in public debate is precisely the strength of science.

Science seeks answers to current questions, but also ensures the growth of knowledge, so that we remain prepared for future challenges. Sometimes, progress towards finding answers becomes bogged down. The old questions then no longer suffice and new questions need to be asked, because it turns out that the world looks different from the way we thought it did. It then becomes clear that new perspectives are needed in order to approach the problem from a different angle. In order to increase this diversity of viewpoints, we must do away with gender- or cultural bias. Too much talent still remains untapped due to implicit assumptions that stand in the way of diversity. The meaning of diversity also includes that there must be room for different scientific perceptions.

The interweaving of teaching and research at universities and universities of applied science is a major strength of our system. Only with this combination can the Netherlands be a breeding ground and a harbour for talent. Through the link to research, students in the Netherlands develop an inquiring attitude, learn to think creatively and are encouraged to explore new paths. Primary and secondary education also equip pupils with an inquiring attitude. To safeguard the role of science as the engine of progress, we need new generations of well-trained researchers. Inquisitive young people who want to explore boundaries and are prepared to cross them. Researchers who think and work in a multidisciplinary manner, and who can bring about cross-pollination between science and other sectors. Such people are also sorely needed outside science. A PhD is therefore also of value for a career outside of academia.

Science forms part of good national cooperation – with practice-oriented and applied research, social partners, business and government. Cooperation is in our genes and we are known internationally for the golden triangle of research, government and business. Good cooperation throughout the ecosystem is characteristic and essential for societal progress.

Science knows no bounds. There is no fence around knowledge and societal problems are not stopped by national borders. International cooperation between the best research groups is crucial for science and for society. This is why we seek strategic cooperation with partners inside and outside the European Union. In short: Dutch science has global impact. Achieving the three ambitions will ensure that the position of Dutch research on the world stage continues to be strong in the future, that the link between science and society becomes even stronger, and that the Netherlands continues to attract diverse talent. Science in the Netherlands can already boast world-class achievements. I am committed to maintaining this position and – where possible – to strengthening it.

Ingrid van Engelshoven
Minister of Education, Culture and Science

Summary

The Netherlands performs at a high level when it comes to science, among other reasons due to the good cooperation that exists between different parties in our system. At the same time, there are developments that influence science, such as geopolitical changes and big data. The Cabinet's investments contribute to achieving the ambitions that I have for science. The investments, the three ambitions that can make science even better and the key action points are summarized below.

Investments

The coalition agreement includes a stepwise increase in the budget for basic research to € 200 million from 2020. There is also an additional budget of € 200 million for applied research and innovation, of which a sum of up to € 50 million is available through the Ministry of Education, Culture and Science (OCW) budget. Finally, a budget of € 100 million in incidental funds will be made available through the OCW budget for research infrastructure.

Series G36, G37 and G38 from the coalition agreement

Education, research and innovation (in € mln.)	2018	2019	2020 e.v.
Basic research	100	150	200
Applied research and innovation	100	150	200
<i>Of which through OCW</i>	25	38	50
Research infrastructure	50	50	
Total OCW	175	238	250

With the Dutch National Research Agenda, I am investing up to € 130 million from 2020 in innovative research that focuses on a large number of challenges in society. With these funds, I encourage cooperation and a multidisciplinary approach over the whole agenda. These efforts should lead to scientific renewal and breakthroughs, and thereby contribute to societal and economic progress. With the sector plans (up to € 70 million from 2020), I am strengthening the foundations of science in a targeted fashion; in this way, I am investing in expanding research capacity and, as a result, in new and excellent research. I am also investing € 20 million annually in the digital infrastructure and up to € 25 million a year in practice-oriented research by universities of applied sciences.

Multi-annual division of funds through the OCW-budget

(x € mln)	2018	2019	2020 a.f.
Investments in science:			
1. Innovative and societally relevant research through the National Research Agenda	70 ¹	108 ¹	130 ¹
2. Strengthening the basis through:			
a) Digital infrastructure, with supercomputer as a priority	20 ²	20 ²	20 ²
b) Innovational research incentive scheme (veni, vidi, vici)	5	5	5
c) Sector plans, natural sciences and Engineering in particular	35	55	70
d) Strengthening practice-oriented research	15	20	25
e) Investing in research facilities:			
1. Increasing funds for call National Roadmap	30	0	0
2. World-class infrastructure	0	30	0
Total on cash bases	175	238	250
Cash transfer	-10	+10	
Total OCW	165	248	250

Ambition 1: Dutch science has global impact

The Netherlands wants to continue to be a part of top-class science worldwide. This requires cooperation at the national and international level, between scientific and social partners and with businesses. A strong Dutch system with good research facilities improves the position of our researchers for working on global challenges together with leading scientists from other countries.

- I am investing € 30 million in Dutch participation in the **Square Kilometre Array (SKA)** and € 1 million in the **ET pathfinder**. These investments are in addition to the extra € 30 million investment in the national roadmap for large-scale **scientific research infrastructure**. This enables our scientists access to state of the art scientific research infrastructure, attracts research talent and creates jobs.
- Excellence and impact are the key principles in negotiations for the new **Horizon Europe** framework programme and the Dutch is focused on embedding open science in all sections of the programme. This will build on the achievements and success of the current framework programme (Horizon 2020) and ensure that the EU will remain in the vanguard of worldwide research and innovation. I share the European Commission's ambition for Horizon Europe ultimately to become the most ambitious research and innovation programme yet.
- In early 2019, I will make a decision on the use of the funds for **digital research infrastructure** (€ 20 million per year) and around summer 2019, I will allocate the funds for **sector plans** based on the recommendations of the two independent committees.

Ambition 2: Science is connected to society

Scientists are rooted in society and work together with social partners and businesses in the search for answers to problems. Both the search and the answers are shared with society, because it is important to share information in order to maintain trust and confidence in science, and to ensure that everyone is involved in the importance of research. Openness in science is extremely important, regardless of how basic or applied it is, because each can strengthen the other.

- I am increasing the budget for the **National Research Agenda** from € 70 million in 2018 to € 108 million in 2019. This amount will be supplemented by research funds from ministerial departments for new, theme-based calls for proposals. The bulk of the funding – more than € 80 million – is earmarked for a new 'broad call for proposals' in early 2019, in which broad research consortia with an interdisciplinary structure will be able to submit proposals based on the routes to the Netherlands Organisation for Scientific Research (NWO). The Agenda budget for ministries for research themes and policy issues that are aligned with the routes of the National Research Agenda will rise to € 15 million in 2019. From 2020, there will be € 130 million available for the National Research Agenda. In 2022, the Agenda will be reassessed and revised with the broad-based involvement of citizens.
- To help stimulate **science communication**, I am asking NWO to develop a pilot that will reward researchers who actively engage in a dialogue with society. I am making € 1 million available for this purpose. Within the National Research Agenda, I am making € 3 million available to link the knowledge gained through the Agenda with society.
- **Open science** in scientific research is a priority for the Cabinet. I am working with stakeholders in the National Platform Open Science towards 100% open access in 2020. This is an ambitious goal and the Netherlands cannot achieve it on its own. For this reason, I am also promoting open science in Europe.

Ambition 3: The Netherlands is a breeding ground and a harbour for talent

In order to continue participating at the top levels of world science, we have to make optimal use of our talent in all its diversity. Good study programmes and a pleasant and socially secure research climate are important for this. I am aware of what the increasing pressure on the system is doing to academic personnel and I want to work to reduce this pressure, among other things by tackling funding application pressure together with NWO and the Association of Universities in the Netherlands (VSNU).

- I want to reach an agreement with the institutions in order to reduce the amount of temporary contracts. Together with stakeholders, I am working on changing the way in which scientific personnel are **valued and rewarded**. I will give financial support to experiments by stakeholders in order to achieve this change together. At the European level, I will work to modernize the manner in which research is assessed, with academic quality being considered more broadly, rather than simply looking at citation scores. I will introduce an **education prize**, alongside the Spinoza prize for top-class research and the Stevin prize for research with impact. The new prize underlines the fact that research, teaching and impact are all valued. I will work this out in more detail by the summer, in any case with VSNU, the Netherlands Association of Universities of Applied

Sciences (VH), NWO and the Royal Netherlands Academy of Arts and Sciences (KNAW).

- I want to increase **diversity** among researchers – both in people and in scientific perspectives - because this will benefit the quality of research. Therefore, in October 2019, I will organize the **European Gender Summit** in the Netherlands, together with stakeholders. Based on the results of this summit, I will draw up an action plan together with partners that will, among other things, look into new targets for the number of female professors after 2020. The additional € 5 million for the **Innovational Research Incentives Scheme** will be used to bring more women into the natural sciences and boost the number of researchers with a migration background.

Overview

The three ambitions are closely connected; policy measures can contribute to all three of these ambitions. Before I set out the ambitions in more detail, I will explain the current state of our science system and its strengths, and then describe the trends and developments that have an influence on science. This will outline the context of the ambitions.

Curious and committed

The value of science



Vision: fascination and curiosity ensure scientific renewal and breakthroughs. Committed researchers contribute to societal progress.

Connection with society

Everyone should be able to enjoy the fruits of our scientists' labours



Priorities:

The National Research Agenda for innovative research relevant for society (up to € 130 mln in 2020 and onwards)



Science communication for dialogue with society (€ 1 mln + € 3 mln NWA)



Open Science in the Netherlands and Europe

Breeding ground and harbour for talent

Training and retaining diverse talent provides a strong foundation



Priorities:

Valuing and rewarding scientific personnel for research, impact and teaching, e.g. more permanent contracts and an education prize



Increase diversity among researchers through:

- 2019 European Gender Summit in the Netherlands and 2020 national action plan diversity in science.
- More women in the natural sciences and researchers with a migration background (€ 5 mln annually)

Global impact

Being one of the world's leaders requires cooperation and a strong system



Priorities:

Ambitious new framework programme "Horizon Europe" with the principles: excellence, impact and open science



World-class research facilities: Square Kilometer Array (€ 30 mln) and Pathfinder Einstein Telescope (€ 1 mln)



New digital research infrastructure (€ 20 mln annually): supercomputer and infrastructure for open science



Sector plans for natural sciences and engineering and for social sciences and humanities (up to € 70 mln from 2020)



Strengthening practice-oriented research (up to € 25 mln from 2020)

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The science system in the Netherlands

The strength of the system

Internationally, the Netherlands plays a leading role and performs well on a budget that is modest by international standards.³ Dutch universities and universities of applied sciences are in high regard and our scientific research infrastructure is state of the art.⁴ One of the strengths of our system is the connection between education and research: students develop an inquiring mind and research can help improve education. International inspection committees assess Dutch research in its breadth as ‘internationally competitive’ to ‘excellent’ and in the international rankings of research disciplines, our universities are among the top 100 in virtually all subjects.⁵ This is unique from an international point of view and it forms a strong and fruitful base for cooperation and connections. The Netherlands is performing well in the European framework programme for research – Horizon 2020. Our researchers and other parties in the Netherlands have so far been allocated more than € 3 billion from Horizon 2020. For every euro that the Netherlands invests in Horizon 2020, Dutch researchers receive 1.5 euros.⁶

The Organisation for Economic Cooperation and Development (OECD) has lauded the Dutch approach towards public-private partnerships and the institutes where basic and applied research are carried out in tandem. The OECD also assesses positively the role played by practice-oriented research in connecting science with business.⁷ Within the framework of the HEInnovate project, the OECD concludes that the Netherlands is one of the forerunners in the field of entrepreneurship and innovation in higher education. Achieving an impact with scientific knowledge through economic or social application is a key part of the strategy of higher education institutions. Thanks in part to the Valorization Programme, staff profiles and career paths have been broadened, cooperation between higher education institutions and regional parties has been increased, and support of start-ups set up by staff and students is high on the agenda of most higher education institutions.⁸ The inflow and outflow of researchers is in equilibrium.⁹ About 8 out of 10 candidates who gain PhDs choose a career outside science and unemployment is almost non-existent.¹⁰ The universities and universities of applied sciences foster talent for their own departments and for society as a whole. In addition, Dutch citizens have for many years had great confidence in academic research and they have high expectations for the contribution of research to society.¹¹

Funding research

The coalition agreement includes a stepwise increase in the budget for basic research to € 200 million per year from 2020. From 2018, through the budget of the Ministry of Education, Culture and Science (OCW), there is also an additional budget for applied research and innovation of up to € 50 million from 2020. Finally, a budget of € 100 million in incidental funds will be made available through the OCW budget for research

infrastructure. The House of Representatives was informed by letter about the use of these funds on the 9th of March 2018.¹² This will be done in connection with the structural investments in applied research and innovation through the Ministry of EZK budget of € 150 million. The House of Representatives was informed about the use of these funds before the summer.¹³

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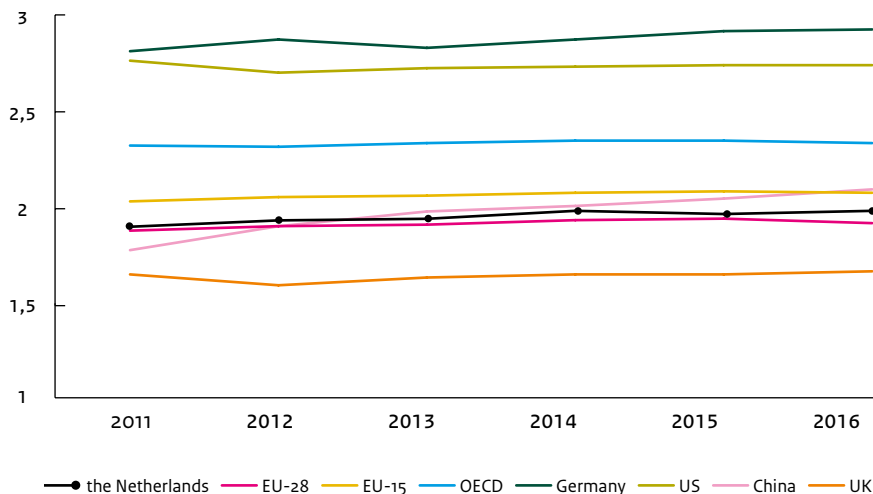
To keep up with developments in the US and Asia, European governments and companies would have to spend 3% of GDP on R&D each year (objective of Europe 2020 strategy). Due to the structure of the economy, the Netherlands has set a target of 2.5% of GDP in 2020.

Spending on R&D						
as a percentage of GDP ¹⁴	2012	2013	2014	2015	2016	2017
Total	1,92%	1,93%	198%	1,98%	2,00%	1,99%
private sector	1,08%	1,07%	1,11%	1,11%	1,16%	1,17%
public sector	0,83%	0,86%	0,87%	0,87%	0,83%	0,82%

The Netherlands is currently at 1.99% of GDP (provisional figure for 2017). According to the Rathenau Institute, in order to reach 2.5% of GDP, public spending will have to increase by € 1.9 billion per year and private spending by € 2.9 billion per year (price level 2018).¹⁵ From 2020, the government will invest up to a total of € 400 million extra in research and innovation, and in 2018 it indicated that it would work to encourage increases in private spending and to strengthen public-private partnerships. In this way, the government wants to keep its sights on the 2.5% objective.¹⁶ In this context, I would like to refer to the response to the KNAW report ‘Wederzijdse versterking’ [*Mutual strengthening*] in subsection 2.2b. The report concludes that public investment in research and innovation attracts private investment.

The Netherlands is above the average for the EU28 but below the average for the EU15 and the OECD (see graph on next page). It is clear that the investments of countries with which we want to hold our own, such as Germany, the US and China, are higher and increase more quickly than investments by the Netherlands. Chinese investment in science is going through a strong growth phase. China has now caught up with the EU and is approaching US levels.¹⁷ In the academic field, we can compare ourselves favourably with those countries, but we want to futureproof our international position and be alert to developments. We will achieve this by means of the Balans van de Wetenschap [*Science in Figures*], which has been published every two years since 2016. In this regard, it is important to me that the parties involved in the field of research have said that they are also monitoring how future-proof the system is. This responsibility applies to all of us.

Development of total spendings on R&D as a percentage of GDP



At Dutch universities and universities of applied sciences, teaching and research are inextricably linked. All universities and universities of applied sciences are of a high standard. Research funding at universities consists of three funding flows. The research part of the primary (direct) funding flow (€ 1.96 billion in 2018) is provided directly by the government in the form of a lump sum. There is also the secondary (indirect) funding flow (€ 764 million in 2018), which is distributed via NWO and the bulk of which benefits talent programmes, large-scale infrastructure, the National Research Agenda and free, independent research. NWO contributes € 275 million to the top sectors, of which € 100 million is used within the framework of public-private partnerships. These are joint programmes in which scientists and companies set up and fund research projects together. In the funds for top sectors, there is also room for investment in free, independent research and talent, and for research under public-private programmes for which no private co-funding is needed. All the research fulfils the criteria for scientific excellence. Finally, there is tertiary funding (approx. € 1.3 billion in 2016), which involves funding from public and private sources (specifically companies, the European Framework Programme for Research and Innovation (Horizon 2020), university funds, healthcare funds and equity funds). For those universities with a university medical centre, there is an additional budget for medical education and research (€ 670 million in 2018). The universities of applied sciences receive funds for practice-oriented research through the primary (direct) funding flow allocated by the Ministry of OCW as part of the lump-sum funding (€ 80 million in 2018) and through the secondary (indirect) funding flow distributed through NWO (€ 46 million in 2018).¹⁸ This does not include the investments from the coalition agreement.



Fossil cell membrane of bacterium useful for climate research

It would be helpful if we were better at predicting future changes in the climate. And how can we do that? By looking at the past! Research by the Royal Netherlands Institute for Sea Research (NIOZ), among others, shows that it is possible to reconstruct a temperature that existed in the distant past by using the fossilized fat molecules from the cell membranes of soil bacteria. This new continental temperature indicator is a quantitative and therefore scientifically very welcome addition to the methods used up to now for reconstructing the continental climate, such as pollen and calcium deposits in caves. We are thus another step closer to finding a 'paleo-thermometer' for measuring climate fluctuations on land.



The Digital Society

Digital information technology is permeating society ever faster and with ever deeper penetration. Under the name 'The Digital Society', universities in the Netherlands have jointly set up an interdisciplinary research programme, which will pool the wealth of research on people-oriented information technology (www.thedigitalsociety.info). The aim of the programme is to find solutions to worldwide challenges and ensure that in 10 years' time, the Netherlands will be recognized around the world as a pioneer in the field of people-oriented IT. The research programme is unique in the Netherlands: the 14 universities are joining forces and freeing up extra research capacity to develop the agenda, together with other knowledge institutions, partners in society, and business. .

Structure of the Dutch research system

The research system consists of institutions for basic/academic research, practice-oriented research, applied research and private parties. The figure below gives an overview of the various actors involved in research. It is important to note that high-quality basic research is not only conducted at universities, but also at National Knowledge Institutions [Rijkskennisinstellingen], planning agencies and institutions for applied research (called TO2 institutions), for example. At the same time, universities also do application-oriented research. Furthermore, there is increasing collaboration between all the parties in the research system – something that I am proud of. There is no contradiction between academic research that is linked to society and free, independent research. Both knowledge gained from basic research and knowledge from applied and practice-oriented research can have an impact on society. Basic research is not focused on finding immediate practical applications, but the results of such research regularly find practical uses over the longer term. Basic research can be inspired and stimulated by applied and practice-oriented research, and vice versa. They reinforce each other and often progress in tandem.

Structure of the Dutch research system

NWO- (9) and KNAW- Institutions (15)	Universities (18)	University medical centres (8)	Universities of applied sciences (36)	Private parties including business
VET (63)	National Knowledge Institutions (9)	Planning agencies (3) and Statistics Netherlands	TO2-Institutions (5)	

Figuur 1: Overview of the Dutch research system. Institutions highlighted in blue are mainly funded by OCW; those highlighted in green are mainly funded by other government departments.

Trends and developments that influence science

In 2014, the ‘2025 Vision for Science: choices for the future’ was published. The report noted that Dutch science had a good starting position, but also faced major challenges, in particular increasing international competition and the need for better connections with society and business.¹⁹ Another challenge is to increase public and private investment in research. This Cabinet has made new funds available to tackle these challenges. Below, I shall examine in greater detail current trends that are responsible for the fact that challenges referred to in the 2025 Vision for Science continue to be relevant today.

Changing international relationships are having an effect on science and the international positions within science itself are also changing. For example, Brexit has consequences for science. Many Dutch scientists, for instance, cooperate with scientists from the United Kingdom in bilateral, international and European projects, in some cases using shared research facilities. KNAW points to increased international competition to recruit scientific talent. Not only China and the US, but also Germany are investing substantially in research at a rapid rate.²⁰ Asian universities are rising ever higher in the international rankings. If the Netherlands wishes to maintain its strong position, it must continue to strengthen its profile as an attractive base for academic talent. Cooperation with international partners is also needed in order to join forces, especially within the EU.

In 2018, Europe presented an ambitious new research programme – Horizon Europe. This programme continues to focus on excellence and emphasizes the impact on society. Horizon Europe offers the possibility of valuable cooperation and European funding of research. Private parties and non-governmental organizations also fund research projects.²¹ At the same time, these various potential sources of funding lead to greater pressures for matching funds and applying for grants.²²

Technological developments influence the manner in which research is conducted. The way in which data are collected, analysed, shared and disclosed (‘big data’) has undergone far-reaching changes in all disciplines and domains, and will continue to change over the years to come. In future, Artificial Intelligence will play an important role in data analysis.²³ A consequence of big data is that in the social sciences and humanities, for example, increasing use is being made of costly digital facilities. The Netherlands is in a good position in the face of these developments, but its position has to be constantly maintained.²⁴



1. Dutch science has global impact

Being one of the world's leaders requires cooperation and a strong system

The Netherlands wants to continue to be a part of top-class science worldwide. Cooperation with top-class researchers, knowledge and facilities from other countries enriches science in the Netherlands. This is important, because no single country can deal with global challenges, such as the Sustainable Development Goals, on its own and because the Netherlands wants to contribute towards meeting these challenges. For this reason, the government is committed to Horizon Europe with the aim of strengthening European cooperation. I am investing in international research facilities and digital research infrastructure. A strong base is necessary for participating at the top levels internationally. I am therefore investing in sector plans, with clear choices having to be made in view of the resources available.

1.1 International cooperation in research to address challenges

Science is by definition international. International scientific cooperation is carried out with many countries, in many different coalitions, and it takes many forms. The Dutch cabinet facilitates scientists in these cooperative efforts through the promotion of bilateral partnerships, for example with the United Kingdom, Japan, Germany and South Africa, but also multilateral partnerships such as the European Organization for Nuclear Research (CERN), the European Southern Observatory (ESO) and the Square Kilometre Array (SKA). The principal goal of this Cabinet commitment is to give our scientists access to the best knowledge available: *diplomacy for science*. Moreover, international cooperation between scientists can also contribute to diplomatic cooperation, in particular where communication is difficult due to geopolitical factors. Such cooperation keeps doors open and supports diplomatic relations: *science for diplomacy*.

The Advisory Council for Science, Technology and Innovation [*Adviesraad voor Wetenschap, Technologie en Innovatie*] (AWTI), too, strongly emphasized the importance of this type of diplomacy in its advisory report *WTI-diplomatie: offensief voor internationalisering van wetenschap, technologie en innovatie* [WTI diplomacy: offensive for the internationalization of science, technology and innovation].²⁵ AWTI refers to positive experiences using this method of working with Germany, Switzerland and the United Kingdom. I agree that stronger WTI diplomacy is essential, but my responsibility also extends to broader scientific cooperation between scientists.²⁶ KNAW and NWO will promote scientific diplomacy.²⁷

Cooperation in the European Framework Programme for Research and Innovation must provide a European basis for investment in the continuous renewal of science in all member states. Joint programmes make it possible to do research on topics that cannot be tackled by

one country alone. For the European Union to continue competing on the world stage, we must work towards a broad and high-quality European knowledge base. The Netherlands can contribute to this with very high-quality science and a willingness to cooperate internationally.



Global Biodiversity Information Facility 2019

Twenty years ago, countries became aware of the need for an international infrastructure to link different databases with biodiversity data (observations and collections) from all over the world. As a result, the Global Biodiversity Information Facility (GBIF) was created. The GBIF is an example of open data on a global scale. The open availability of biodiversity data through the GBIF is extremely important for, among other things, environmental science, climate change, big data studies and policymakers. In order to encourage international cooperation and open data, the Netherlands is organizing the 26th GBIF governing board for 21 October 2019 in the brand-new Naturalis Biodiversity Center in Leiden. During that week, some 500 experts, delegates and scientists from all over the world will come together. Participants are working in various initiatives to link biodiversity data, so that these data are openly accessible and can be used by scientists as well as non-scientists.



1.1a Dutch efforts in negotiations on Horizon Europe

In the negotiations on the new Framework Programme for Research and Innovation, Horizon Europe, the Netherlands is strongly advocating excellence, impact and open science as a basis for achieving scientific breakthroughs and making an impact on society through research. Commitment to excellence means that Europe will be able to keep up with worldwide competition and Dutch scientists will be in a position to participate optimally. The budget for the first pillar of the Framework Programme (excellent knowledge base) must stay at least at the level that the Commission has now proposed.²⁸ For the Netherlands, the proposed budget at current prices (€ 25,8 billion) for this first pillar is the absolute minimum. In percentage terms, the Netherlands would prefer it if this element received the same share of the total as in Horizon 2020 (approx. 31%). Partly because the Netherlands has highlighted the topic, the European Commission has proposed treating open science as the norm in all parts of Horizon Europe. As written in the Dutch coalition agreement, the European budget should be modernized; the EU must distribute contributions made by the European member states in a fairer, more balanced way. The Cabinet is focusing on research and innovation, among other things, as drivers of societal progress in the short and long term.

Organizing cooperation is a challenge at the national and international levels. The Horizon Europe proposal prioritizes, for example, carefully structured public-private partnerships and support for companies that do research, innovate and scale up internationally in cooperation with scientists. The European Commission names the Dutch National Research Agenda as a good example for cooperation and involving citizens in developing scientific programmes.



BabyBRAIN

For Sabine Hunnius, researcher and director of the Baby and Child Research Center in Nijmegen, it had for years been an irritation that a lot of research on baby behaviour had to take place in academic laboratories and research centres. This is not the natural environment of a baby, which means that research data may not be reliable. Sabine sees it as a challenge to change this. Thanks to funding from Horizon 2020, she can develop wireless technologies for baby research, in collaboration with an international consortium and 14 PhD candidates. This will make it possible in future to do research on babies and children while they are playing at home. This will provide reliable research data, produced in natural situations.

1.2 Access to infrastructure and research facilities

I invest in world-class infrastructure in order for high-quality research to be conducted. Cooperation within Europe and worldwide is important for scientific research facilities, for example for research on elementary particles at CERN. A large facility such as CERN is only possible through cooperation between a number of countries..



International research cooperation in the polar regions

Climate change could lead to conflict and political instability worldwide. Melting ice in sensitive areas such as the Arctic and Antarctica is raising sea levels, causing changes in biodiversity and triggering more extreme weather patterns worldwide. These developments have an influence around the globe. In consequence, we need to gain a better understanding of the polar regions and their changes. International collaboration in research is necessary to tackle this global issue. If we really want to make a difference, countries and research organizations will have to pool their strengths and resources better. For example, with the Netherlands Polar Programme (NWO), the Netherlands is active in the mobile research laboratory Dirk Gerritsz in Antarctica and at the research station on Spitsbergen. During the second Arctic Science Ministerial in Berlin in October 2018, I signed a joint ministerial declaration that calls on countries and research organizations to strengthen international cooperation in research, the shared use of research facilities, and open access to research data. By joining forces worldwide, we can be much more effective in tackling the global problems caused by changes in the polar regions.

The Netherlands will participate in the Square Kilometre Array (SKA) and is making € 30 million available to this end. The SKA is going to be the world's largest radio telescope and it will be able to provide new answers to questions in the areas of astronomy, data science and sustainable energy. The radio telescope will be a global partnership and will be built in Australia and South Africa with help from Dutch scientific expertise and high-tech companies. Successive radio telescopes (Dwingeloo, Westerbork and LOFAR) have provided the Netherlands with broad and deep technical expertise and an active and excellent scientific community, and have taken us to the highest levels in the international field of radio astronomy. Participation in SKA will enable the Netherlands to strengthen its prominent position in the world. Participation also means that the Netherlands has a good chance of being able to host the European data centre for SKA. The scientific and economic results in terms of jobs and commercial activities are very favourable in relation to the investment of public funds made. The Science Data Center will handle large data flows that will not only produce scientific results and innovations, but will also be a pull factor for talent. The region and (northern) Dutch companies, among others, are well-placed to win contracts for the construction of the SKA telescope, partly due to the experience gained from building the LOFAR telescope near Exloo, which is seen as the precursor of the SKA.

I am also investing € 1 million in the ET Pathfinder. The ET Pathfinder is a preparation for the construction of the Einstein Telescope and the project will develop all kinds of

technologies needed for the precision technology to be used in building and operating the Einstein Telescope. With the ET Pathfinder and the strategic collaboration with Germany and Belgium, the Netherlands is strengthening its position in the run-up to a possible bid for the construction of the Einstein Telescope in South Limburg.²⁹ This is still at an early exploratory stage, among other things because the results of the soil analysis to determine the suitability of the ground are not yet available. However, there is now an impact study showing that the construction of a facility such as the Einstein Telescope could have a major economic impact on the Limburg region. According to the impact study, with its investment in the ET pathfinder, the Netherlands is gaining a strong knowledge position that will enable it to be fully involved in the research on gravitational waves, even if the Einstein Telescope does not come to the Netherlands.

Under the coalition agreement, € 20 million a year is made available for digital infrastructure. In early 2019, I will make a decision on the use of these funds, based on recommendations that I requested from NWO. With the € 20 million investment, I want among other things to keep abreast of developments in the area of high-performance computing (supercomputer) and, together with stakeholders, invest in data infrastructure for open science. For example, for the reuse of research data, one of the top priorities of open science, it is essential to strengthen the digital infrastructure. High-performance computing can carry out scientific tasks that require so much computing power that standard computers cannot cope, and it can therefore help in tackling many scientific and societal challenges.

1.3 Importance of a strong Dutch system through cooperation and profiling

In order to continue contributing to work on global challenges, it is important to have a strong Dutch system with sufficient room for all types of research and in which scientists can cooperate in the best way possible.

For the range of education programmes and research offered, it is important for universities and universities of applied sciences to strengthen their profiles more than they do now. It is important for institutions to coordinate with one another, to ensure that they do not all choose and do the same work. Defining profiles together enhances quality, as institutions can then pool their expertise. University sector plans [sectorplannen] and setting areas of focus at universities of applied sciences are useful tools for this purpose. There are opportunities to make the Netherlands a knowledge hub and a centre that competes with those elsewhere in the world. A clear profile helps attract talented researchers from abroad and, in addition, better connections are forged with other international and national research institutions, companies and civil society organizations. It is also a way of putting the Netherlands more firmly on the map as a country that develops and uses world-class knowledge.



What is a sector plan?

In a sector plan, faculties enter into a strategic cooperation agreement at sectoral level, with links being forged between education, research and societal goals. The sector plans run for six years. The sector plans consist of overviews of sectors drawn up by planners from stakeholders [kwartiermakers]: vision documents (natural sciences, Engineering and Social Sciences and Humanities (SSH)) that outline what the desired university landscape will look like in future, in order to achieve a strengthening of the research base. In addition, sector plans consist of plans by faculties, which flesh out the objectives contained in the sector overviews. The faculty plans therefore form a basis for distributing funds among the faculties. The faculty plans are assessed by independent committees. The independent committee for SSH is asked to take into account the motion Bruins in their advice.³²

Photo: Annemiek van der Kuil



1.3a Strategic cooperation through sector plans

With the funds from the coalition agreement, I am giving targeted impetus to scientific research in the Netherlands through sector plans. I am investing in the research base, for example by expanding research capacity and attracting and retaining talented research personnel. This strengthened base will improve the possibilities for participating in interdisciplinary cooperation, for example in the National Research Agenda.³⁰ In this way, I want to promote links within disciplines and strategic choices in the areas of research, education and societal goals. The approach using sector plans stimulates bottom-up coordination and cooperation. I have opted to strengthen the natural sciences and engineering sectors (up to € 60 million per year from 2020), because these sectors involve high costs.³¹ At the same time, I appreciate the value of the social sciences and the humanities, and I have asked these disciplines to draw up a sector plan as well (up to € 10 million per year from 2020). I expect advisory reports on the use of the funds for the sector plans by summer 2019 and I will then make a decision on the precise distribution of the funds over the next six years. The sector plans will then take-off in 2019. With the investments, I want to help create more permanent jobs for academic personnel. If the sector plans prove their worth in practice, this could be a reason for a future Cabinet to apply sector plans as an instrument in other areas as well, to strengthen the base.



Pooling expertise: operating without a scalpel

In five years' time, it will be one of the main methods for treating cancer: sound waves that heat the tumour so much that it is destroyed by cooking it, as it were. The University Medical Center Utrecht (UMCU) wanted to develop further this technique for eliminating cancer by means of sound waves. However, research on this method requires knowledge and technology that the UMCU alone does not have in-house. Since 2011, Eindhoven University of Technology (TU/e), Utrecht University (UU) and the UMCU have been working together in a strategic alliance. Under this arrangement, the institutions give researchers and students access to one another's science parks, the technology and application of scientific concepts (TU/e), basic research (UU) and clinical research and patient care (UMCU). The cooperation with Eindhoven University of Technology is important in particular for developing and testing this type of equipment. This involves a great deal of technical know-how, which UMCU researchers can apply in the clinic.

1.3b Multidisciplinary and interdisciplinary cooperation

The ability of researchers, fields of study and institutions to engage in multidisciplinary and interdisciplinary cooperation is already a great strength of the Netherlands. Multidisciplinary and interdisciplinary cooperation can only be successful if the base of individual disciplines is strong and healthy. By harnessing the strengths of the humanities, natural sciences, social science and medical disciplines to create links, scientific questions can be tackled together, crossing the boundaries of individual disciplines.³³ It is important to continue providing space for multidisciplinary and interdisciplinary research, and to recognize its added value. For example, the humanities can play a relevant role in new technological developments from an early stage.



Multidisciplinary cooperation: digital lifestyle coaching

Type 2 diabetes is a disease of which the symptoms can be eased if a person adopts a specific lifestyle. A change in lifestyle can even make medication unnecessary and improve the quality of life. A great deal of good, useful data is needed in order to provide personalized lifestyle interventions, but how do you give targeted personal advice to all the people with diabetes? First of all, you can ask the patients themselves, as they have access to their own data. For this reason, the Netherlands Organisation for applied scientific research (TNO), Leiden University Medical Center (LUMC), general practitioners, patients, citizens, business and others are working under the banner of the Netherlands Institute for Lifestyle Medicine on a digital diagnosis and coaching system. In this system, doctors, patients, citizens and researchers will in future have secure access to data, thus safeguarding data privacy. Artificial intelligence can subsequently be used to convert these data into usable information, with which we can improve diagnosis, lifestyle interventions and coaching in the case of type 2 diabetes. Not only is there faster access to data, but new knowledge relating to lifestyle can also be passed on faster to doctors, patients and healthy people. Artificial intelligence brings us closer to a situation in which you can find out which lifestyle works best for your personal profile.



Cooperation for better home-based care

In 2015, a change in the Healthcare Insurance Act once again gave community nurses greater responsibility for determining and organizing the necessary care. This requires not only new skills, but also more community nurses. Rotterdam University of Applied Sciences noticed that too few students were opting to study for a career in community care. The reasons were too little knowledge of the profession among lecturers and too few good internship positions. As the project manager of 'Twinning' in the Rotterdam region, Irene Baten, together with the community care research group of Rotterdam University of Applied Sciences and various partners in community care, set up a solid learning network. This gave a positive impetus to the study programme and the profession of community nurse in the region. In addition, the network offers lecturers and community nurses the possibility of exchanging knowledge and experiences, and gaining new insights. Due to the initiative's success, secondary vocational education colleges were also brought into the project in 2016.

1.3c *Effective research groups in universities of applied sciences*

Universities of applied sciences choose the orientation of their research themselves, so that with their practice-oriented research, they have an essential position in the knowledge structure of the Netherlands. Practice-oriented, basic and applied research complement one another. The connection between science and society is a quality of practice-oriented research. Research at universities of applied sciences frequently involves students and is done not just for, but also with, industry; small and medium-sized enterprises (SMEs); the city and region; partners in society; universities and institutions for applied research (TO2 institutions); and secondary vocational education. With their practice-oriented research, universities of applied sciences forge links between knowledge development and demand from professional practice, and thereby contribute to the knowledge base and to connections in the research landscape at national and regional level. This is because the unique interaction between education, practice-oriented research and professional practice is characteristic of the universities of applied sciences.³⁴

Research within universities of applied sciences has three priority areas: knowledge development, links with professional practice and society, and professionalizing of education and (teaching personnel). As announced in the sector agreement for higher professional education, in the coming period I will explore, together with the Netherlands Association of Universities of Applied Sciences (VH) and NWO's Taskforce for Applied Research SIA, possibilities for the future of practice-oriented research and priorities and policy questions in order to achieve this future structure. I will involve a large number of parties in this.³⁵ This explorative study will be concluded in June 2019. As a starting point, I am currently having an independent overview prepared of the situation in practice-oriented research. This overview will be available in early February 2019. As agreed with the House of Representatives, embedding research groups in universities of applied sciences and cooperation with SMEs form part of this exploration.³⁶ I will set out the results in the Strategic Agenda for Higher Education, which I will send to the House of Representatives at the end of 2019.

Over 10 years, the number of associate professors has more than doubled to nearly 650 (2016) and around 4300 lecturing researchers and 950 PhD candidates are working in the universities of applied sciences (2016).³⁷ As a result, the research function has been further expanded at universities of applied sciences, which has increased the impact on vocational education, knowledge development and the contribution to innovation. In order to strengthen further the contribution of practice-oriented research, I have decided to deploy € 25 million of the coalition agreement funds structurally through the primary (direct) funding flow and through NWO (Taskforce for Applied Research SIA). These funds are aimed at increasing the capacity of research groups and strengthening the position of researchers in universities of applied sciences within the research system.

As in universities, it is also important in universities of applied sciences to increase further the cooperation between institutions. The pooling of research, for example in knowledge networks [kenniskringen], field labs and Centres of Expertise, has enhanced the development

at universities of applied sciences of their own research profiles. I will continue to encourage further profiling and setting of areas of focus. In the coming years, I will also promote national alignment between universities of applied sciences. I am continuing to hold discussions with the Netherlands Association of Universities of Applied Sciences (VH) regarding research profiling and alignment between institutions, including at the national level. I am basing these discussions on the overview that VH produces every two years, setting out the Association's research profiling and the development of the Centres of Expertise.



Basic, practice-oriented and applied research

Universities of applied sciences conduct practice-oriented research. This research focuses on raising the quality of graduates of universities of applied sciences, maintaining responsiveness in education and innovating in professional practice.³⁸ In addition, there is basic research and applied research. Basic research is done primarily to acquire new knowledge of the underlying principles of phenomena and observable facts. Applied research also involves acquiring knowledge, but this is focused on a specific, practical goal.³⁹

1.3d A dynamic system of institutes

KNAW and NWO research institutes enjoy international prominence. KNAW and NWO institutes are periodically assessed by panels of independent, international experts. These experts value the innovative research, the global position and the national role of the institutes. During the most recent research assessments, academic quality, social relevance and future-proofing were assessed in virtually all cases as 'very good' or even 'excellent/world leading'. Point of attention mentioned in the assessments, in addition to the interrelationships with national and international facilities, databases and collections, are the strengthening of the connecting role of institutes and the pooling of expertise and facilities.

In the Vision for Science, it was announced that the system of institutions as a whole will be evaluated. In the assessment, it must be made clear to what extent these research institutes have added value as independent units in the total national knowledge landscape, and whether the system of institutions is responsive and dynamic enough to respond to changing scientific and societal challenges. The report from the independent committee will appear in early 2019.⁴⁰ Following the evaluation, NWO and KNAW will decide to what extent the institutes actually fulfil a national function and are essential within the system. Finally, it will be decided whether there is motivation and room within the system for newcomers, within existing budgets, and for closing institutes or embedding them elsewhere.

1.4 Agenda

- **Action:** In the European Negotiations, the Netherlands is focusing on excellence and impact. The budget for the excellent knowledge base should remain, at least, as is now being proposed. Open science – with the basic principle ‘as open as possible, as closed as necessary’ – must be the standard for the whole framework programme and must be firmly embedded in all parts of the programme. The entire research and innovation process must be supported, with ample room for cooperation and for research that can have an impact in the long term.
- **Action:** NWO and KNAW will make efforts to intensify science diplomacy.
- **Action:** The € 30 million for world-class scientific research facilities will be used to enable Dutch participation in the Square Kilometre Array (SKA).
- **Action:** In preparation for the possible construction of the Einstein Telescope, I will invest € 1 million in the ET Pathfinder. Moreover, I will intensify cooperation with Germany and Belgium for the preparation of a possible bid.
- **Action:** Based on the advisory report from NWO, I will make a decision in early 2019 on the use of the funds for digital research infrastructure (€ 20 million per year).
- **Action:** With the funds (structural, € 25 million) for practice-oriented research, I will invest in an expansion of research capacity and the further professionalization of research at universities of applied sciences.
- **Action:** Together with VH and NWO (Taskforce for Applied Research SIA), I will work on a vision for the future of practice-oriented research in universities of applied sciences and we will identify the relevant policy questions and priorities. This will serve as input for the new Strategic Agenda for Higher Education and Research.
- **Action:** Around summer 2019, I will decide, on the basis of recommendations from an independent committee, on the distribution of the sector plan funds for the next six years.
- **Action:** Based on the results of the evaluation of the system of its research institutes, NWO and KNAW will decide what actions are necessary to ensure a future-proof institute portfolio.



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2. Science is connected to society

Everyone should be able to enjoy the fruits of our researchers' labours

Science is rooted in society, while at the same time scientists have to maintain sufficient distance to be able to carry out independent research. Therefore, there has to be an optimum balance between involvement and independence. Science must be open to questions from society. Scientists pass on their knowledge from research and their research skills to students. It is important to take account of the impact of research and to communicate the results to society. People gain confidence in science if it shows or explains what is being worked on and who is involved in the research. Dutch science policy is characterized by a culture of cooperation, knowledge-sharing and trust. For this reason, I emphasize the importance of science communication and open science, so that everyone can benefit from the results of scientific research.

2.1 Culture of knowledge-sharing

2.1a *Dialogue between science and society*

Science communication runs in both directions. A dialogue between science and society lets everyone see how research contributes to social and economic progress. science communication helps society to distinguish between fact and fable, and gives people the opportunity to think about scientific developments along with the scientists. Science also holds up a mirror to society, stimulating people with new ways of looking at things. The dialogue is also of value to scientists. It can provide inspiration for new research topics and guides scientists on ethical issues. Nuance is needed in order to put across a research project clearly. For this reason, science communication also forms part of scientific study programmes.

I am proud of the broad range of activities relating to science that take place every day in the Netherlands. From lectures and debating events to new formats such as online 'talks'. Science museums and science centres throughout the country play a key role in this context. The NEMO science centre in Amsterdam is especially important as the catalyst of activities such as the national festival 'Weekend van de Wetenschap' [*Weekend of Science*].

Researchers often do not receive sufficient appreciation and support for these research activities. That is a great shame, as connections between science and society start with the public communication of science. For this reason, I am giving impetus to facilitating and rewarding researchers who enter into a dialogue about their specialist field. I have asked NWO to develop a pilot project to reward researchers who make efforts in science

communication. I am making € 1 million available for this pilot project. As part of the National Research Agenda, I am asking researchers to be active in sharing their knowledge and the research process with society. Every cooperative partnership should earmark 10% of the allocated research budget for this purpose and within the Agenda, I am making € 3 million available each year for science communication and sharing knowledge obtained through the Agenda with society.

2.1b Citizen science

As well as entering into conversation with researchers, people can also be active participants in research. We use the term citizen science when citizens are actively involved in various phases of a research project, from its design to implementation and the distribution of results.⁴¹ Involving citizens in research strengthens the connection between science and society, making the importance of science visible.

The National Research Agenda shows how individuals and civil society organizations can play an important role in drawing up a research agenda. There are also other examples of cooperation between science and public institutions. In one initiative, visitors to the University Museum in Utrecht sent soil samples from their own gardens to researchers at the Westerdijk Institute, who discovered new fungus species in the samples and named them after those who had sent them in. Another example is cooperation between festivals and science: as part of the Lowlands Science programme, for instance, researchers from universities and universities of applied sciences invite festivalgoers to take part in experiments. Due to the increasing interest in citizen science, the National Platform Open Science recently decided to promote this further through a separate unit within the Platform. In addition, NWO has decided to encourage citizen science from the bottom up. NWO offers scientists the opportunity, when they think it is useful, to involve volunteers in carrying out research projects. For this purpose NWO has made a funding module available for the participation of volunteers in research projects, for the funding instruments that are part of its 'Research and cooperation for excellence and renewal' aims.



Navigation can be learned

Many people have difficulties in finding their way. They become confused in an unfamiliar environment, they do not know which turn to take, or they quickly lose their way. Ineke van der Ham, neuroscientist at Leiden University and a specialist in our powers of navigation, wants to help people with such navigation problems. With the aim of developing a treatment for people who get lost, she was keen to hear from as many people as possible who do not have that problem of how to find their way. The annual public survey, which is launched during the Weekend of Science each year, offered the ideal opportunity to do this. Ineke developed an online game with navigation tasks and looked at the influence of age and gender on performance. Through the public survey, within one year Ineke had data from more than 12,000 participants of all ages. “Very valuable data that brings us one more step closer to developing a treatment.”⁴²

2.1c Culture of knowledge transfer

It is important to have a culture in which it is worthwhile for scientists to remain inquisitive and to seek collaboration with other parties. This strengthens the impact of science. We therefore need to provide sufficient opportunities for knowledge transfer. Alongside education, this can be done through start-ups, existing organizations and sharing knowledge with society as a whole.⁴³ Knowledge Transfer Offices (KTOs) can play an important role in this.

The Van Meenen motion requested that the government investigate the ways in which universities and research institutes can be supported and facilitated as much as possible in obtaining, maintaining and exploiting patents.⁴⁴ It is to be expected that with the additional public investment, there will be new findings and innovations, and that patents can be a source of private funding for universities and research institutes. Although the costs precede the benefits and the benefits will not always outweigh the costs, I think this is an important topic. Patents fulfil an important function in the pursuit of impact by science, because they make it attractive for investors to provide the finance that is often so essential on the high-risk journey towards innovation.

A number of recent studies have provided useful recommendations for stronger, more professional management of intellectual property rights at knowledge institutions,⁴⁵ with stronger links between and outside the knowledge institutions.⁴⁶

I have asked NWO about ways in which it is possible, within the National Research Agenda, to give the knowledge institutions more encouragement and support in obtaining, maintaining and using intellectual property rights (patents and copyrights). NWO sees possibilities for ensuring that a consortium can focus more strongly on knowledge transfer, network-building (including social networks) and intellectual property rights. I therefore anticipate that there will be increasing opportunities for new inventions and innovations. In monitoring knowledge use within the National Research Agenda, NWO will also look at

all these aspects of impact. This could provide us with valuable lessons. In addition, the future Thematic Tech (Knowledge) Transfer scheme will increase the chances of new inventions and innovations, support in managing intellectual property rights and income from licences. This is one of the measures for promoting impact that are referred to in the policy response to the evaluation of the Valorization Programme.⁴⁷



Tailor-made parenting advice via an app

Development psychologist Loes Keijsers of Tilburg University is doing research on the mental health and wellbeing of teenagers, for example how parents can contribute through their parenting methods [NWO-VIDI]. She saw parents and teenagers wrestling with issues and she was keen to help them with tailor-made advice. But this was very difficult, because research always produces answers involving averages. As a result, Keijsers could not translate the scientific findings to the individual, to determine what works best for a specific person. For this reason, she brought together excellent basic research from various disciplines in the Tilburg Experience Sampling Center. There, researchers are now collecting large amounts of data by having people complete a short questionnaire on their smartphone several times a day. By applying smart algorithms to this data, Keijsers and her colleagues will be able to support people better in future with evidence-based e-health apps that make personal advice possible.

2.1d Charting the impact of research

At the request of the Ministry of OCW, KNAW has studied how the impact of scientific research can best be charted. On 2 November 2018, the KNAW advisory report ‘Maatschappelijke Impact in Kaart’ [*Charting the Impact on Society*] was published. In the report, KNAW underscores the great importance of creating a clear picture of the impact on society, but warns at the same time that showing the effects of scientific research on society is a complex matter: impact can often be determined only long after the event, is often impossible to evaluate objectively, and can rarely be linked to individual researchers or projects in a linear process.

I share KNAW’s observation that a great deal of data is already available about the societal influence of research in the Netherlands. Narratives are compiled as part of evaluations of the knowledge institutions themselves. These narrative descriptions set out in a clear and gripping fashion the impact on society of a knowledge institution’s research.⁴⁸ KNAW advocates making these narratives more accessible, including for a wider public, and to use them in the self-evaluations of institutions. I embrace this recommendation and will work to ensure that as of 2019, the knowledge institutions will make their impact narratives available in a manner that is more accessible for the general public.

In talks with knowledge institutions and research funding bodies such as NWO, I want to ensure that when they receive research proposals, they consider impact more as a regular procedure, in particular factors and processes that increase the likelihood of impact. Impact pathways and the presence of a productive, interactive network are crucial to this. This fits

in with NWO's new strategy, in which user committees play a key role in promoting productive networks for research in all academic areas. I will discuss with VSNU, VH and NWO, among others, how concrete steps can be taken in this matter in 2019.

KNAW notes that the National Research Agenda offers a possibility of further shaping the mission-driven approach. This can be achieved, for example, by linking a number of research agendas, such as those of other departments, by means of a theme-oriented approach and by connecting with the knowledge and innovation agendas of the top sectors. At my request, NWO has arranged investment in the National Research Agenda in such a way that 'Action Line 2' provides room for theme-based programming. With a financial contribution, ministerial departments can develop the mission-driven approach (see also subsection 2.2) and thus preselect with a view to the missions of Horizon Europe. In the longer term, this can also provide useful information about success factors in building productive networks and achieving a better and more rapid impact on society.



CHILL

In order to achieve innovation and smart solutions, it is important to combine the knowledge and resources of various parties. Modern chemistry also faces this challenge. To this end, the Centre of Expertise Chemelot Innovation and Learning Labs (CHILL) was set up. CHILL connects start-up entrepreneurs, established SMEs, large companies and knowledge institutions, creating new possibilities for innovation. This cooperation offers students, from secondary vocational education to universities, as well as researchers and companies, the possibility of working together in an inspiring environment with professional equipment and technologically advanced facilities. This allows companies to innovate and students to have closer contact with business by learning in the professional field.

2.1e *Open science ensures connection with society*

Science is undergoing a change in which values such as openness and interconnectedness are becoming increasingly important. Openness to, and interconnectedness with, society requires communicating and publishing in an open manner. Paywalls for results of academic research that has been paid for with public money, such as academic papers and data, are in conflict with this approach. This worldwide change towards open science requires an ambitious national approach with a global vision and shared responsibility. In the Netherlands, Europe and beyond where possible, I am committed to promoting open science and open access. The key principle is that all publicly funded research should be freely accessible.⁴⁹ This makes knowledge-sharing faster and better, within science but also between science and society.⁵⁰

The importance that the Dutch scientific community attaches to open science is reflected in the cooperation of knowledge institutions in the National Platform Open Science. The appointment of a National Coordinator for Open Science has reconfirmed our country's leading role and a number of countries have now followed this approach. The parties work together on ambitious objectives such as 100% open access in 2020; making optimum use

of research data for reuse; recognizing and valuing achievements in the area of open science; and citizen science. The National Platform Open Science strives to involve researchers in the initiatives in the best way possible and support them in developing open science.

With the objective of 100% open access of papers in Europe in 2020, we have set the bar extremely high. The latest figures from VSNU show that 50% of the peer-reviewed papers of 2017 from 14 Dutch universities are openly accessible. This is an increase from the previous year and the Netherlands is the leader worldwide, so things are moving in the right direction.⁵¹ Further action is needed to achieve 100% open access in 2020. Therefore, the parties in the National Platform Open Science, spearheaded by VSNU, will vigorously pursue negotiations with the scientific publishers. The negotiations focus on various aspects, such as extending open access policy to books. In addition, the Taverne amendment sets down that, after a reasonable period, any Dutch author has the right to make his or her academic work available to the public through open access. A pilot project will investigate how the amendment can be used in practice to support open access.⁵² The National Platform Open Science will discuss the possibilities for supporting new initiatives for publication platforms. The possibilities for an open access publication platform will be discussed with universities of applied sciences, the SURF programme (Smart Urban Regions of the Future) and the Taskforce for Applied Research SIA. This platform will include not only papers but also other results that are evidence of the impact of research, such as designs and presentations.



Sustainable access to data on the history of books project: students work on making research data FAIR

The digital academic archive of Leiden-based book historian Prof. Paul Hoftijzer contains the results of an exhaustive study of book history, in which detailed descriptions are drawn up of individuals, organizations and events connected with the Leiden book industry in the early modern period. However, in its current form, this archive is difficult for other researchers to access. For this reason, in this project the raw data from the digital documents is converted into structured data and an online environment is developed in which these data are made available in an easily accessible way for reuse. The data are also archived in a recognized data archive according to the FAIR principles and students use the material in their studies. Through a series of assignments, students are encouraged to explore a number of academic applications for the archive and to visualize the information. As a result, the online environment of the archive is improved with the help of insights from the students.

The reuse of data is an important part of science that involves sharing research data, so that other researchers can build on them or do research to replicate the results. We base this on the principle ‘as open as possible, as closed as necessary’. Based on this viewpoint, a few exceptions to openness have been formulated, because there are sometimes risks associated with making all data public. With open data, there is tension between openness and intellectual property, and the following exceptions have been formulated at European level:

intellectual property rights, protection of privacy, reasons of safety and competition, and other legitimate interests.⁵³ I consider the reuse of data to be a priority and therefore support the FAIR principles (findable, accessible, interoperable and reusable), agreed at European level.⁵⁴ The European Open Science Cloud, launched on 23 November 2018, is a very important development for encouraging the reuse of research data. The Netherlands is playing a pioneering role by investing in the GO FAIR initiative, together with Germany and France, as a step towards the European Open Science Cloud. And the Netherlands will also be actively involved in further shaping the European Open Science Cloud, among other things by participating in the governing board, in order to create the best possible infrastructure for the reuse of research data. To make the reuse of research data a success, it is necessary to reinforce the infrastructure and to work together to bring the knowledge and skills required in the area of research data management up to date. For example, Delft University of Technology and Utrecht University are investing in training data stewards, who ensure that research data are disclosed and made accessible.

As indicated, this does not involve just a Dutch initiative or changes in the Netherlands. The academic world, its culture and researchers' careers are international. The Netherlands wants to maintain its pioneering role at the EU level by forming coalitions with like-minded countries. Moreover, it is important for open science to be firmly embedded in Horizon Europe. For this reason, in the negotiations on Horizon Europe, I will be active in promoting open science as the standard for Horizon Europe and in calling for all facets of open science, including new ways of valuing and rewarding researchers, to be included.



cOAlition S: international cooperation for open access

Nowadays, you can look up everything on the Internet. But when patients, companies and researchers, for example, want to read an academic paper, they run up against a paywall. It is a thorn in the side of those who fund research that academic papers made possible through public research funding are not available to the public. This has to change through open access. To this end, on 4 September 2018, NWO, the funding body of the Netherlands, together with research funding bodies from 12 EU countries, joined 'cOAlition S' for accelerating progress towards open access. The most important aim is for all these academic papers to be fully accessible from 1 January 2020. This will give everyone access to science. COAlition S works on the basis of some 10 principles to achieve the European objective of complete open access in 2020. There is resistance from publishers to the change to open access publications, because they earn money from the paywall for publications. Academics are generally enthusiastic about the aim of cOAlition S, but they are concerned about possible consequences and whether these are desirable. On Monday 26 November, cOAlition S published implementation guidelines for Plan S. These provide greater clarity regarding the requirements and conditions of Plan S and answer a number of questions that have been raised since the launch of Plan S. There is also an online public consultation round and in January 2019, NWO is organizing a consultation meeting for academics.

Photo: ANP



2.2 Academic cooperation

2.2a *The National Research Agenda*

The National Research Agenda is a research agenda for the Netherlands. The idea of the Agenda arose out of the Interdepartmental Policy Review on Science Policy⁵⁵ and was included in the 2025 *Vision for Science*.⁵⁶ This Cabinet has ensured financial investment in the Agenda. This research agenda is based on a very large number of questions for science from citizens, public authorities and civil society organizations. These knowledge questions – which number approximately 12,000 – are collected in 25 routes covering the entire breadth of academic research.

The Agenda's goal is to achieve scientific breakthroughs and to solve problems in society across the full breadth of academic research and to give the answers back to society. The Agenda is distinguished by its bottom-up nature in setting up and carrying out academic research. This is expressed in the wide-ranging involvement of society and a multidisciplinary approach. The Agenda encourages broad-based cooperation within the public knowledge chain of universities of applied sciences, universities, university medical centres, institutions for applied research (TO2 institutions), planning agencies and National Knowledge Institutions, with social partners from public and semi-public sectors and from business. This is expressed in programme rounds focusing on long-term research projects running for six to eight years.

The Dutch Cabinet is investing generously in this broad research agenda. A total of € 70 million was made available for the National Research Agenda programme in 2018. There has been considerable enthusiasm for participation in the Agenda, both for the large open call and for the call focused on ministerial departments, for joint investment in knowledge. For the large open call of 2018, a large number of high-quality initial proposals were submitted, covering all 25 routes. The call for ministerial departments has resulted in extra investment of € 11.6 million by ministerial departments in research through the National Research Agenda, which will be matched by funds out of the Agenda's € 70 million. In May 2019, NWO will decide which of the proposals submitted will be able to start. I will inform your House about the results in mid-2019 and will then go into detail regarding the contribution that this research can be expected to make, along the various routes of the National Research Agenda, towards meeting the societal challenges faced by society and this government.

The budget for the National Research Agenda will be increased to € 108 million for 2019. This amount will be supplemented by research funds from ministerial departments for new, theme-based calls for proposals. The bulk of the funding – more than € 80 million – is earmarked for a new 'broad-based call' in early 2019, in which broad research consortia will be able to submit to NWO proposals based on the routes. The Agenda budget for ministries for research themes and policy issues that are aligned with the routes will rise to € 15 million in 2019. The remaining funds are intended for science communication related to the National Research Agenda, giving results back to society and to future end-users, and for creating future consortia for the 25 Agenda routes. From 2020, the budget will be increased

structurally to € 130 million per year. Given its characteristics, the National Research Agenda complements the mission-driven innovation policy. For the Agenda, the emphasis is on long-term knowledge development; it is a bottom-up and broad agenda. The mission-driven innovation policy⁵⁷ is focused on the four themes (energy transition and sustainability; agriculture, water and food; health and care; and safety) and also on those key technologies that help to achieve technological breakthroughs in order to tackle successfully the societal challenges that the Netherlands faces. Where there is synergy between the National Research Agenda's bottom-up approach and the mission-driven innovation policy, this will be used to achieve optimum results and further strengthen the entire ecosystem with the help of this broad approach. In the case of synergy, cooperation is needed between the National Research Agenda and the Knowledge and Innovation Agendas of the top sectors. I consider myself to be responsible for this cooperation, together with the State Secretary of Economic Affairs and Climate Policy.

I attach great value to sharing knowledge. Therefore, the experiences and results of the studies will be shared with society. To this end, a number of activities are being organized, including the knowledge festival in 2019.

Partly on the basis of the answers obtained, scientific questions and societal challenges will change, and the questions and routes of the National Research Agenda will therefore also be dynamic. For this reason, in 2022, the professional parties will consider together with society whether the routes need to be revised and, if so, what issues then have to be tackled by academic research?



Bottom-up research at NeuroLabNL

Why am I me and not you? This question from Lisa* was one of nearly 12,000 queries for the National Research Agenda. A recognizable but difficult question for NeuroLabNL.⁵⁸ This is the workplace where researchers look for answers to questions about the best conditions for the learning ability, safety and resilience of young people. It is a workplace because professionals from universities, universities of applied sciences, knowledge institutions and civil society organizations work together on research and knowledge distribution relating to the brain, cognition and behaviour. During the Weekend of Science, the NeuroLabNL researchers offered a glimpse behind the scenes to make their activities accessible to the general public.⁵⁹ Among other things, they have launched the website *Kijk in je Brein*⁶⁰ [Look into your Brain], where Lisa can now find the answer to her question.

**The question was sent in anonymously and Lisa is therefore a fictitious name.*

2.2b Public-private cooperation

KNAW has done research on the relationship between public and private investment in research and development, prompted by the motion by Paternotte.⁶¹ The research looked closely at, among other things, trends in R&D spending in the Netherlands and other countries; the nature and scope of government support; development in various sectors; and the strategic relationship between public and private research.

KNAW concluded in the report ‘Wederzijdse versterking’ [*Mutual reinforcement*], which was presented on 6 December 2018, that public investment in R&D attracts private investment, both in the short and long term.⁶² It is thus not the case – as was presumed in the motion – that companies invest less if the government invests more. However, R&D does disappear from the Netherlands if public investment in other countries is significantly higher than in the Netherlands. For development, we have long observed the trend that companies want to be close to big markets such as China and India. In the case of research, the Netherlands is an attractive country because of strong regional hotspots, such as Brainport in Eindhoven. However, in research, too, it was shown that countries with significantly higher public spending (in absolute terms but also as a percentage of GDP), such as Germany and emerging economies, are gaining ground in attracting private research.

The report describes a worldwide trend in which companies are leaving basic and other research more to universities, while cooperation between companies and universities is growing. The Rathenau Institute also notes that large companies worldwide are engaging in increasingly close cooperation with carefully selected universities, for example in joint laboratories and research centres.⁶³ Dutch universities are responding to this development and are succeeding in forging links with companies that operate worldwide. This leads to fruitful cross-pollination, enabling researchers to shift the boundaries of science and allowing knowledge to circulate faster, which results in greater impact. The increasing cooperation between public knowledge institutions and private parties ensures good connections between academic research and business. Long-running research partnerships increase the chances of scientific breakthroughs and innovation. For a university, this is also a way of attracting and retaining talent, and conducting research at a high level for which there would otherwise be no funding.⁶⁴ On this subject, I do think it is important that researchers allow themselves to be led by questions that are scientifically relevant, because scientific advances will then be accompanied by innovation and economic growth.

Based on the KNAW report, I note that public investment in R&D has the effect of attracting private investment in R&D. The use of government funding for research and innovation is therefore expected to have a positive effect on private investment. Additional investment is needed in order to spend 2.5% of GDP on R&D.

At the universities of applied sciences, public-private cooperation is implemented among other things in Centres of Expertise. Centres of Expertise are sustainable, action-oriented partnerships in which universities of applied sciences, companies, public authorities and other public and civil society organizations do research, innovate, experiment and invest

together for the benefit of future-proof higher professional education and professional practice, and to accelerate desirable economic and societal transitions. In the sector agreement for higher professional education (April 2018), I reached agreements with the universities of applied sciences on supporting existing Centres and setting up new ones, which will also focus on societal challenges. In October 2018, the Netherlands Association of Universities of Applied Sciences established a framework with the objectives and characteristics of the Centres, which provides a guide for the further development of this form of public-private cooperation.



Shoe-TIMEs

Ten per cent of the world's population suffers from a form of diabetes. This is a disease that, as a consequence of reduced feeling in the feet, can lead to serious health problems. In the most serious cases, it can even necessitate full or partial amputation of the foot. Fred Holtkamp of Fontys Paramedical University of Applied Sciences and his colleagues would like to gain a greater understanding of how these foot problems arise and try to prevent them with the use of an intelligent sole. This would be a sole that would use dynamic measurements to provide information on friction and pinch and pressure points. To develop this sole, they launched an ambitious project – Shoe-TIMEs – in cooperation with students and lecturing researchers of Fontys Universities of Applied Sciences; the Industrial Design programme of Eindhoven University of Technology; several SMEs; the Nederlandse Vereniging van Orthopedische Schoentechniek [Netherlands Association of Orthopaedic Footwear Technology] (NVOS); and the Dutch Diabetes Association. It is to be hoped that in future, amputation of the foot will be a thing of the past!

2.2c *The advisory system for science*

If science wants to have a central place in society, there is a need for good science policy and a good understanding of how the science system operates. AWTI, KNAW and the Rathenau Institute each has its own role to play. AWTI advises on science, technology and innovation policy. KNAW creates connections between science and society. The KNAW recommendations focus on 'policy for science' as well as 'science for policy'. The Rathenau Institute is involved in research and debate about the impact of science, innovation and technology on society, and provides information about how the science system operates. It is desirable for AWTI, KNAW and the Rathenau Institute to be well-coordinated and to cooperate effectively. In the response to the evaluation of the Rathenau Institute, I indicated that I would look at the position of the Rathenau Institute as an independent institute within KNAW.⁶⁵ KNAW and the Rathenau Institute agree that the Rathenau Institute will remain associated with KNAW as an institute. The two institutes will define their relationship and responsibilities more precisely. KNAW will be put in a position to carry out its management responsibility and the substantive independence of the Rathenau Institute will continue to be safeguarded.

2.3 Confidence in science

Society has long had great confidence in science. For example, there is a lot of trust in sources of scientific information about climate change and vaccination.⁶⁶ I give all credit to researchers and their institutes for this. It is wonderful that there is such a positive opinion of science, and that nearly four out of five people in the Netherlands think that scientists work carefully and are expert and trustworthy in their fields. This also indicates that support from Dutch society for science is strong. I am concerned to read that it appears confidence in scientists declines when they work under contract to the government or to companies. Scientists deserve society's trust. They work hard to earn this trust and are strict in holding one another to high standards for quality, independence and reliability. Cooperation between researchers and the government provides valuable insights for policy in areas such as the climate and vaccination. Without cooperation between researchers and companies, no sustainable energy sources or new vaccines will be developed.

The government and companies must constantly work to increase confidence in research funded by them. Transparency is important here: why was the research commissioned? What will be done with the results? And how certain are the results of the research? In addition, the government is increasingly active in providing information tailored to specific target groups, such as young people. We hope that this information will help increase confidence. I take reports of possible improper influence seriously and take action against such practices. The article 'Government curbs science' in the NRC newspaper reports that the General Government Terms and Conditions contain provisions that are in conflict with the code for scientific independence.⁶⁷ At the request of the Minister of the Interior and Kingdom Relations (BZK), members of the committee that has drawn up the Dutch code of conduct for research integrity are now assessing the General Government Terms and Conditions against the new code. On the basis of this assessment, it can be determined whether changes are necessary. Before summer 2019, the Minister of BZK and I will inform the House of Representatives about the results.

2.3a Research integrity

Research integrity is a responsibility of the institutes and their researchers, and they take it extremely seriously. The new Dutch code of conduct for research integrity came into force on 1 October 2018. VSNU, KNAW, NWO, NFI, VRI, WOTC and the Federation of institutions for applied research (TO2 institutions) have signed up to this code. A number of National Knowledge Institutions, such as the Royal Netherlands Meteorological Institute (KNMI) and the National Institute for Public Health and the Environment (RIVM), will probably join later.⁶⁸

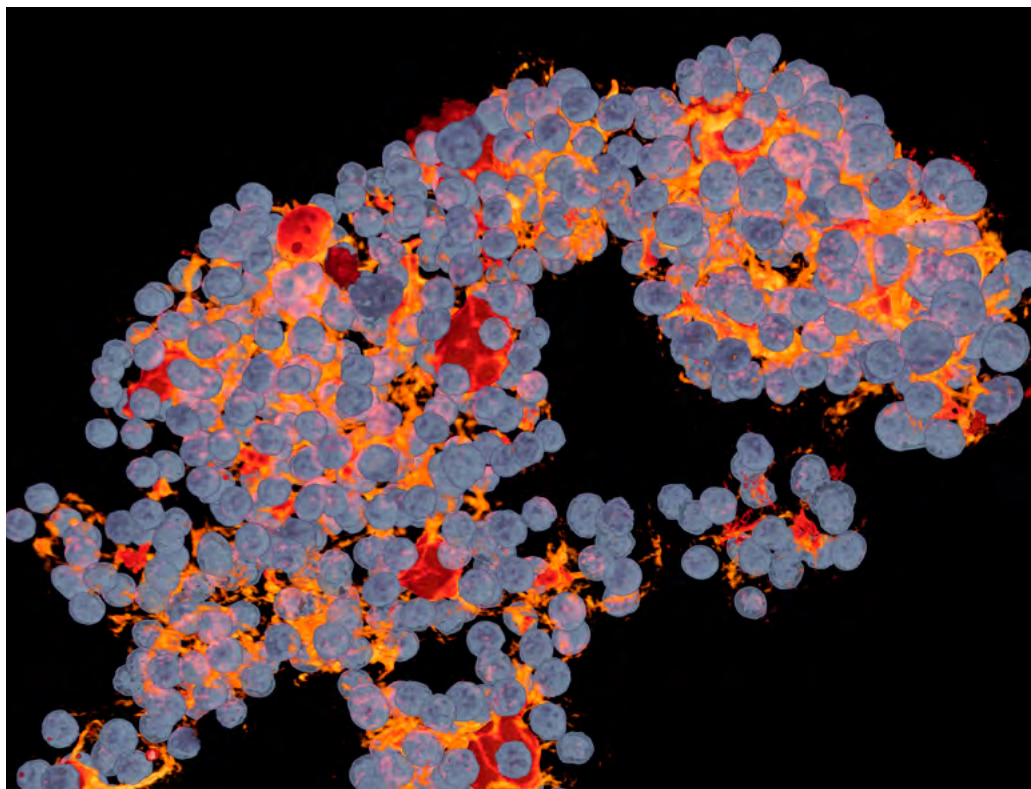
The National Board for Research Integrity (LOWI) is the highest body to advise the boards of its member institutions regarding suspected violations of research integrity. LOWI was set up by KNAW, VSNU and NWO, and its membership is growing steadily. LOWI is currently based at the KNAW premises. The Board's independence will be strengthened in 2019 by making it autonomous and organizing it into a foundation.



The code of conduct for research integrity

The new code of conduct has several unique elements that make it a pioneering code worldwide. It is written in such a way that it can apply to both public and public-private scientific research in the Netherlands. The code explicitly makes room for cooperation and multidisciplinary, and takes account of the differences between research institutes. It also refers to the responsibility of researchers to take into account, within reason, the interests of stakeholders and other people and organizations for which the research is relevant.⁶⁹ It is also unique that the code imposes duties of care on the institutions. In this way, the research institutes show that they are responsible for creating a work environment in which sound research practices are promoted and safeguarded. Furthermore, the new code of conduct distinguishes between violations of research integrity, questionable behaviour and minor shortcomings.

Photo: Florijn Dekkers and Anne Rios, Princess Máxima Center and Hubrecht Institute



2.4 Agenda

- **Action:** I am increasing the budget for the National Research Agenda from € 70 million in 2018 to € 108 million in 2019 and from 2020 it will be structurally € 130 million. This amount will be supplemented by research funds from ministerial departments for new, theme-based calls for proposals. The bulk of the funding – more than € 80 million – is earmarked for a new ‘broad-based call’ in early 2019, in which broad research consortia will be able to submit to NWO proposals based on the routes. The Agenda budget for ministries for research themes and policy issues that are aligned with the routes of the National Research Agenda will rise to € 15 million in 2019. The remaining funds are intended for science communication related to the National Research Agenda, giving results back to society and to future end-users, and for creating future consortia for the 25 Agenda routes. In 2022, the National Research Agenda will be reassessed and revised with the broad-based involvement of society.
- **Action:** Together with the State Secretary of Economic Affairs and Climate Policy, I am responsible for synergy, where it exists, between the National Research Agenda and the mission-driven Knowledge and Innovation Agendas.
- **Action:** I am asking NWO to develop a pilot project that will reward researchers who actively engage in a dialogue with society and I am making € 1 million available for this.
- **Action:** Knowledge institutions will make their impact narratives publicly accessible from 2019.
- **Action:** The knowledge institutions in the National Platform Open Science are working together strategically and joining forces to work towards ambitions mentioned above. I support the National Platform Open Science, among other things by providing a secretary. In addition, the Ministry of OCW is the technical chair of the Platform and the Steering Group.
- **Action:** Open Science will ultimately become the norm; this change will not take place automatically and will cost money. The parties in the National Platform Open Science will identify the transition costs and where extra investment is required.
- **Action:** At the EU level, the pioneering role of the Netherlands in the area of Open Science remains a priority. In this context, I am committed to the European Open Science Cloud and the GO FAIR initiative. Open science must be the standard for the whole framework programme and it must be firmly embedded in all sections. In international consultations, I am taking a strong stand in support of a joint approach to the open science aims.
- **Action:** In 2019, universities of applied sciences will launch new Centres of Expertise. There will also be room for Centres that only cooperate with the public domain. This is because I think that public-public cooperation is of great importance in addition to public-private cooperation.
- **Action:** At the request of the Minister of the Interior and Kingdom Relations (BZK), the General Government Terms and Conditions will be assessed against the new Dutch code of conduct for research integrity. On this basis, it will be decided whether the terms and conditions need to be amended. Before summer 2019, the Minister of the Interior and Kingdom Relations and I will inform the House of Representatives about the results.



3. The Netherlands is a breeding ground and a harbour for talent

Training and retaining diverse top-class talent provides a strong foundation

The Netherlands is an attractive country for academic researchers, as KNAW noted in 2018.⁷⁰ Diversity in the broadest sense of the term is essential to ensure that no talent is unused and that research can benefit from different perspectives. This improves the quality of research. We see the Netherlands not only as a haven in the sense of an arrival place, but also as a safe base with an agreeable work atmosphere, so that we can retain talented personnel. This is important in order to maintain and strengthen our international position.

3.1 Measures to relieve pressure on the system

I am aware of what the increasing pressure on the system is doing to academic personnel. Academic personnel are experiencing pressure as a result of many factors, including having to provide teaching in the face of growing student numbers, combined with the feeling that they have to publish and submit proposals in order to have a career.⁷¹ Institutions experience the additional money from NWO and the European Union as pressure, because they have to match it rather than just receive it as extra funds. The factors that contribute to this pressure have to be clearly identified, so that we can better manage the phenomenon. Nowadays, it seems as if academic personnel are expected to be able to do everything, but it is not possible to pay the same amount of attention to research, teaching and impact, and to do everything equally well. And we do not want to demand this of people. Below are various actions, each of which can help relieve the pressure on the system, while a joint approach is also needed. There is an interplay between valuing and rewarding teaching and impact alongside research, reducing the pressure to match funds and increasing acceptance rates. I note that the rising pressure is being taken seriously within VSNU, NWO and KNAW. I have asked these parties to work together and come up with a proposal this year for relieving pressure on the system and on the people involved.

3.1a *The role of funding*

I have asked the Advisory Committee on the Funding of Higher Education and Research (Van Rijn committee) to produce an advisory report on the distribution of research funding in the primary funding flow. In this report, the committee will indicate how the distribution of the research part of the primary (direct) funding flow can be linked more firmly to research efforts, academic quality and efforts to have an impact on society. With this report, I am implementing the coalition agreement. In view of the task entrusted to the Van Rijn committee, the relationship between the primary and secondary funding flows falls outside the scope of the advisory report requested. However, the committee has been asked to look at fund-matching obligations connected with the secondary funding flow (NWO subsidies)

and tertiary funding (EU subsidies, among others). The committee will also consider the space available for free, independent research.

According to the Rathenau Institute, matching is at the expense of the education and research part of the lump sum.⁷² According to KNAW, scope for research is under pressure due to rising student numbers, which means that an increasingly large share of the direct funding flow and academic personnel is required for education. This is shifting the balance between research and education, according to KNAW. These various approaches show that the problem is complex and a nuanced approach is needed. In view of the above, I want to encourage researchers and institutes to be more selective when submitting applications. Universities and universities of applied sciences are free to decide which subsidies from NWO and the EU (Framework Programme for Research and Innovation) they want to obtain, knowing that this involves a contribution in kind from them. I expect universities and universities of applied sciences to look carefully at their profile and their research priorities. The Encouraging European Research scheme (SEO scheme) at NWO meets the direct and indirect costs of publicly funded knowledge institutions when they take part in an EU-funded project under the Framework Programme.



Small words with a great effect

‘Hmm’, ‘Oh!’, ‘Huh?’ — everyone uses these words when they talk, but where do they actually come from? And are they used all over the world? Mark Dingemans of Radboud University will use his Vidi grant to seek the answer. In earlier research, his team discovered that ‘Huh?’ might be a universal word. For this discovery, they won the Ig Nobel Prize, for research that first makes you laugh and then makes you think. The new research focuses on the question of which elementary particles hold our conversations together. This will give us a better understanding of the way in which small words make complex language use possible and how we can ensure that our communication with computers goes just as smoothly as our everyday conversations.

3.1b Measures relating to application pressure and permanent contracts

I am aware of the pressure on researchers resulting from the uncertainty of temporary contracts of employment. The application pressure is increasing because obtaining grants and subsidies helps in maintaining an employment position. I want to reach an agreement with institutions to increase the number of permanent contracts of employment and I will urge institutions to make funds available for this, with the aim of reducing the number of temporary contracts.⁷³ The pressure to make applications has increased in recent years and acceptance rates have declined. At NWO, this happens above all with the talent instruments and the open competition. NWO has done a lot to find out the reasons why the pressure for applications has increased over recent decades. NWO has decided to give the institutes more detailed information each year on the assessment of the proposals submitted by them and the acceptance rates. In addition, NWO and VSNU are engaged in extensive discussions about what data the institutes need and how it can best be provided.

NWO has decided to include the security of a researcher's position ('inbeddingsgarantie' or fixed position guarantee) as a criterion in assessing the research proposals in the Innovational Research Incentives Scheme. By offering a fixed position that is appropriate to a researcher's career stage, a university shows confidence in the researcher.⁷⁴ This measure will lead to a reduction in the number of applications under the Innovational Research Incentives Scheme; in the most recent round, 25% fewer Vidi applications were submitted. The measure could also ensure that the number of permanent contracts of employment at universities increases. Academic freedom will not be compromised by this measure.⁷⁵ This is because researchers can always opt to do their research at a different institute from the one where they are currently working and obtain a fixed position there. NWO is conducting an ongoing evaluation of the process relating to the fixed position guarantee, in which it is obtaining responses from researchers and universities. I expect to have the results of the evaluation in the course of 2019. In addition, at my request NWO is investigating whether it can take any more measures to make permanent positions at universities more attractive.

3.1c Relationship between open competition and talent instruments

The motion by Member of Parliament Bruins et al. calls for a re-evaluation of open competition and a study of the optimum ratio between the open competition and the talent instruments (Innovational Research Incentives Scheme).⁷⁶ The key point is that both the open competition and the talent instruments concern funds that are used for free and independent research that is driven by curiosity. For both instruments, this research is open to all disciplines. There is also little difference in the amount of funding available for the different instruments. I have asked KNAW to carry out a study of the funds that are obtained in competition and to look at the difference between talent, free research (open/free competition) and theme-based research. For this study, I asked KNAW to compare the situation in the Netherlands with that in other countries. I expect the results of the study at the end of 2019.

3.2 The importance of diversity in the broad sense

The increasing complexity and multidisciplinary of societal problems requires research teams that are larger and more diverse in their composition. This means that in personnel recruitment, research organizations should strive for diverse teams, but also for a culture that makes the most of the differences between perspectives and attitudes. There is still limited diversity among academics, especially at the top level. There are already a great many initiatives to ensure better career progress for diverse talent, but this needs to remain a priority concern in order to achieve real change.

Photo: Marc de Haan



3.2a *Female researchers and researchers with a migration background*

In recent years, demands have been made to increase the share of female professors. In order to arrive at their own target figures, the universities are taking a critical look at, for example, their appointment procedures and they have developed mentoring programmes.⁷⁷ However, the figures do not lie: there are still only 20.9% of professors who are women.⁷⁸ Although this represents an increase of 1.7 percentage points compared with the previous year, the Netherlands still lags far behind at the EU level, as only three countries score lower.⁷⁹ Universities of applied sciences are doing better than universities, with female professors making up 31% of the total.⁸⁰ The Rathenau Institute indicates that with natural professional development figures, we should be able to reach 450 female professors in 2020. This number is higher than the target figures (excluding the Westerdijk Talent Scheme). This prompts the question whether, after meeting the current targets, we cannot be even more ambitious.

However, we will not achieve our aims simply with numbers of people. Research shows that women devote on average 4% more time per week on teaching than was contractually agreed, while men devote on average 4% more time on research.⁸¹ This represents 70 hours – thus nearly two working weeks – per year. These kinds of facts reinforce implicit bias and there is therefore still no equal distribution of individuals and tasks, but work is being done on this issue. I am happy with the work of the national network of university Diversity Officers, which has been in existence for two years. The aim of the network is the exchange of knowledge in relation to the creation and implementation of diversity and inclusivity policies. Members of the network exchange experiences on subjects such as gender bias in official texts and giving training courses in the area of implicit bias.

We can see that it is necessary to widen our definition of diversity. In the Netherlands, there are many people from abroad working as researchers and they bring with them their own experiences and viewpoints. We see that the share of total academic personnel originating from other countries rose sharply between 2003 and 2016, from 19% to 37% (and the share of foreign PhD candidates actually rose from 29% to 47%).⁸² Although we do not have any exact figures on the number of researchers with a migration background, there are indications that this group is currently very underrepresented in academia. Thanks to the extra funds from the coalition agreement for basic research, € 5 million will be used structurally for the Innovational Research Incentives Scheme.⁸³ This money will be used for researchers with a migration background, among other things.⁸⁴ The precise details of the instruments that will be employed to encourage talent from minority groups depends on the results of research in this area. NWO has asked the Expertise Centre for Diversity in Higher Education (ECHO) to survey the diversity landscape and provide recommendations for effective measures to increase the share of researchers with a migration background. As part of its study, NWO will also evaluate the Mozaïekprogramma [*Mosaic Programme*], which has nearly concluded, and the experiences will be used in the ongoing programme 'Refugees in academic research'.⁸⁵ As the inflow of Dutch researchers with a migration background is particularly low, it is expected that the instruments will mainly focus on young researchers.



If I can do it, so can you...

Janne-Mieke Meijer is a young and talented research star in soft matter: a research area that brings together physics and chemistry. Sometimes she falls prey to doubt. 'How should I carry on with my research; am I on the right track?', but also 'Do I really want to go into an academic career, with all that pressure to publish and make applications?'. She wonders whether she would not be better off going into industry. And that would be a loss to science. Luckily, Janne-Mieke is able to take her doubts and questions to Daniela Kraft, who also does research in the field of soft matter. In her still short career, Daniela has been awarded a Rubicon grant, a Veni and an ERC starting grant. Now she heads a research group at Leiden University. She is a researcher who knows what she wants and she is also happy to lend an ear to the concerns of other researchers. In conversations with Janne-Mieke, she is able to ease her doubts and, based on her own experience, she can offer a different view of an academic career. Furthermore, Daniela is a role model for Janne-Mieke in the way in which she leads her group and has successfully established her line of research. This gives Janne-Mieke the confidence to continue to pursue an academic path. This shows that in academia, too, role models are worth their weight in gold.

The motion by Members of Parliament Van der Molen and Tielen asked about the possibility of taking diversity into account when granting funds for academic research.⁸⁶ NWO has set itself the goal of ensuring that the limited funds are allocated to the best researchers with the best research proposals. In this process, acceptance rates for female applicants, on average and on a multi-year basis, should be at least as high as for male applicants. For years, NWO has been committed to giving equal opportunities to women and men in obtaining subsidies for academic research. In 2015, NWO commissioned research on the differences in acceptance rates between women and men in the NWO competition.⁸⁷ Based on the recommendations from this research, NWO launched a pilot project with training for assessors in the Veni round, to make them aware of implicit gender bias. In addition, a follow-up study has been set up to look at gender-neutral words for describing quality. The results of the research and the pilot projects will be translated into specific structural measures, of which more will be made known in early 2019.

In addition to the € 5 million from the coalition agreement, NWO and the Ministry of OCW are each making € 0.7 million available out of their own funds for measures to promote diversity by means of various NWO procedures for the 2019-2021 period. Specifically, but not exhaustively, these involve countering implicit associations relating to women and minorities in assessments of academic research by training committee members and secretaries; amending and broadening assessment criteria in NWO calls for proposals and making them neutral in tone; improving texts and word use to remove barriers to various target groups; and further promotion of expertise.



Having the real conversation about #MeTooAcademia

Susanne de Jong, a talented PhD candidate, is happy when her supervisor returns from a sabbatical. Internationally renowned professor Loek Dekker is charismatic, approachable and inspirational. But during a conference in Berlin, Susanne encounters a dark side of the well-known academic. When the professor makes advances to her but is rebuffed, the consequences for Susanne are catastrophic. Where can she go for help? Over recent years, sexual harassment has become an issue within universities. However, it is still difficult to talk about it. On 12 October 2018, the play 'The Learning Curve' was performed at Erasmus University. Based on anonymous stories – such as Susanne's – the play shows that the 'real conversation' about behaviour and culture at universities is possible, and how you should approach it.

**Susanne's story is one of those in the play, which is based on anonymous stories..*

3.2b Diversity in viewpoints at the university

In broadening our definition of diversity in academia, we also need to look at diversity in viewpoints, theories and ideas. It is not only the person who addresses the lecture room or leads the research group who makes the difference here, but also which theories are passed on and which ideas dominate. A recent study in the field of economics showed that this can also have negative consequences for the quality of research.⁸⁸ The stereotypical masculine qualities that appear to lead to success in economic research have the effect of limiting alternative viewpoints. It is not necessary for every faculty or even university to offer a diverse range of possibilities, but in the Netherlands as a whole, there should be options available. To respond more thoroughly to the motion by Members of Parliament Tielen and Van der Molen on preventing self-censorship and the limiting of diversity, I call on the universities to be aware of this issue and to devote time and effort to dealing with it.⁸⁹

3.2c The importance of an inclusive culture in academia

The academic world is an environment in which many relationships of dependency naturally occur. If these are not dealt with carefully, it can create an unpleasant working atmosphere. Compared with reference countries, the Netherlands does not score highly on experienced inclusivity.⁹⁰ According to KNAW, we therefore run the risk that our poor performance as regards inclusivity will negatively impact both the attractiveness of our country as a country of research and its research performance.⁹¹

Within universities there are complex power relations. PhD candidates in particular are vulnerable, because they are dependent on their supervisors. For this reason, an attractive and socially safe work environment is important. The Dutch Network of Women Professors [*Landelijk Netwerk Vrouwelijke Hoogleraren*] (LNVH) receives reports from the field about careers of academics being obstructed. LNVH defines this sort of obstruction of people conducting academic research as scientific harassment.⁹² VSNU also condemns these kinds of practices and is working on a statement. Among other things, VSNU shares best practices of various universities for preventing scientific harassment and calls on confidential counsellors to join the national network of confidential counsellors for universities in order to promote

expertise and peer-to-peer counselling. To find out more about scientific harassment, Prof. Marieke van den Brink, Prof. Yvonne Benschop and Marijke Naezer have been commissioned by LNVH to carry out an exploratory study.⁹³ The results are expected in spring 2019. Based on the results, I want to take further action together with the institutions.

3.3 Attracting and retaining academic talent

Although research shows that the 'brain drain' and the 'brain gain' are in equilibrium in the Netherlands, we sometimes see talent abandoning vulnerable and newly emerging scientific fields such as artificial intelligence. It is important to take particular care in attracting and retaining academic talent in these areas of science in which there is fierce international competition and our researchers sometimes receive offers from a number of countries. We will have to make strategic choices in order to maintain our standing. The recently established International Strategic Board Nederland (ISB-NL) for international positioning may be able to play a role in this.⁹⁴ To do their research, it appears that companies mainly choose places with good access to distinctive knowledge sources, talented researchers and possibilities for cooperation in research. The Netherlands can improve its position in the international competition for knowledge investment by making sure that it has an attractive knowledge infrastructure.⁹⁵ At EU level, the Netherlands supports the European Commission in ERC's role of promoting ground-breaking research that is not tied to a specific theme, with excellence as the single leading criterion, to ensure that top researchers do not leave Europe.



Turned out nice again?! Solar cells respond to Dutch weather conditions

It is increasingly common to see solar cells in the landscape. However, current solar cells based on silicon have nearly reached the limits of their efficiency. Around the world, scientists are looking for alternative technologies to improve solar cell efficiency still further. Physicists from AMOLF (the FOM Institute for Atomic and Molecular Physics) and the University of Cambridge have made a comparison using theoretical models. The research shows that a specific type of solar cell is more stable when there are variations in weather conditions and therefore better suited to Dutch weather. The great thing is that this technology can even be used to improve existing solar cells.⁹⁶

3.3a Broader job prospects for PhD candidates and postdocs

By also valuing career paths outside academic research and seeing a PhD as a preparation for a wide range of professions, we can prepare talent for the labour market in the best way possible. In 2017, the Ministry of OCW made € 3.4 million available for a pilot project with industrial doctorates.⁹⁷ This is intended for PhD candidates who work partly in knowledge institutions and partly in industry, with the underlying idea that cooperation between companies and universities enhances opportunities for actually implementing knowledge. NWO, together with VSNU and VNO/NCW, has developed a successful pilot programme. NWO has announced that it wants to continue the programme and extend it to 'societal doctorates'.⁹⁸ Opportunities for internships serve the same purpose. Through the 'Professional PhD Program' set up by the Promovendi Netwerk Nederland, which represents the interests

of PhD researchers in the Netherlands, PhD candidates can do a three to six-month internship in industry or government.⁹⁹ In addition, PhD candidates who want to do research that is more strongly focused on the relevant professional practice opt to obtain their PhDs from a university of applied sciences, so that they have the connection to a university.

In practice, we find that holders of PhDs can be deployed in a multitude of positions, including outside the academic world; 8 out of 10 PhD candidates leave the field of academic research and contribute to society with their broad-based research skills in a wide variety of places.¹⁰⁰ Nevertheless, guiding PhD candidates towards their next job is still a neglected part of HR policy at many universities. Many candidates begin their PhD programme with the idea that they have made a definitive choice to stay in academic research. The fear of losing the chance of a job in academic research due to a broader labour market orientation ensures that PhD candidates have eyes only for the academic prospects. I think it is important for universities and research institutes, as good employers, to pay more attention during the PhD phase to the period that follows and the possibilities for the postdoc inside and outside academia. The collective labour agreement now offers PhD candidates the possibility of doing an internship during their doctoral studies, so that during this period, a PhD candidate can also prepare for a possible career outside academic research. The university can help in this by using its contacts with industry, education or government to find internships for candidates, and by viewing an internship as very useful work experience for potential employees of the university. PhD candidates acquire skills which make them better prepared for a career outside research and attractive for business and other employers.

The importance of career development for postdocs is still too often ignored. One organization that is working on this is the Postdoc Career Development Initiative (PCDI). Postdocs must also have the right guidance, courses and work experience in order to acquire the skills that will enable them to choose from various career paths. As for PhD candidates, the links between academia and other sectors (private, public and others) are not being properly used for the benefit of postdocs.¹⁰¹ Universities as well as other sectors and stakeholders share the responsibility to create a culture in which mobility from academic research to other sectors (and vice versa) is valued.

At universities of applied sciences, the added value of gaining a PhD is increasingly seen as a way of enhancing the quality of education and further strengthening practice-oriented research. The universities of applied sciences are aiming to have 20% of lecturers with PhDs. I think it is important that there is also a route open for students of universities of applied sciences who ultimately want to do a PhD. I would encourage universities of applied sciences and universities to intensify their cooperation in the area of PhD programmes. In addition, the universities of applied sciences are starting an art study programme in early 2019, with a vision that includes the development of a third cycle in the creative sector. I am following these developments with interest and will give them my attention in the coming Strategic Agenda for Higher Education and Research.



Helping robots find their way

How can a robot find its way properly in a hospital, agricultural environment or if it is vacuuming your house automatically? Robots actually have a hard time finding the way if there are glass doors, for example, or if there is mud on the path. Henk Kortier, who is a lecturer in mechatronics and a researcher at Saxion University of Applied Sciences, saw in this a challenge to be tackled. In his postdoc research at the university of applied sciences, he is therefore looking at the possibility of using advanced sensor fusion techniques for precise navigation. To this end, he is doing research at companies, together with students. This gives him a greater understanding of how robots could work better in practice and the students are enthused by this specialist area and by research in general. A real win-win situation.

3.4 Academic research is teamwork: valuing and rewarding researchers more broadly

Academic research and researchers are currently assessed within knowledge institutions far too much according to the number of their publications, how high their impact factor is and the number of grants they have obtained. This emphasis in relation to valuing and rewarding researchers is seen by the academic world as too narrow. Recently, VSNU, NWO, NFO and the Netherlands Organisation for Health Research and Development (ZonMw) announced that they are going to encourage change in the way academics are valued and rewarded.¹⁰² KNAW has informed me that it also supports this movement. I support this aim and want to cooperate with the knowledge field on making this change. This is because it is very important that the manner of appreciating and rewarding researchers be more closely aligned with the societal tasks of the knowledge field: conducting outstanding academic research, ensuring high-quality academic education and transferring knowledge for the benefit of society.

3.4a Differentiation in valuation

The aim of the universities is for a variety of career paths to be possible. As well as valuing academic research, there should also be appreciation for teaching, having an impact on society and demonstrating academic leadership. This does not mean that one person has to be equally good at all these tasks, as that would increase the pressure of work still further. Arranging a differentiated distribution of tasks within teams should reduce the pressure for individual excellence and place more emphasis on the achievements of the team as a whole. A good example is that of the professors with an education profile, who are present at increasing numbers of universities. Another example is the tenure track policy at various universities, in which explicit efforts are being made to consider more than just research performance. I support these developments and am in talks with the profession field about how I can strengthen this movement. One step in the right direction is to create an education prize alongside the Comenius grants, as was asked for in the Tielen motion.¹⁰³ This prize will be developed further before the summer, in cooperation with at least VSNU, VU, NWO and KNAW.

3.4b Valuing education, research, impact and leadership

The current criteria for assessing research and researchers reflect a limited conception of academic quality. These are the criteria that are generally accepted internationally, such as the number of publications, the impact factor and the number of grants obtained. Such criteria often say little about the actual quality and relevance of the research. Moreover, they are not appropriate for all areas of academic research. Neither are cooperation and open science activities, such as sharing data and open access publishing, encouraged under these criteria. I also support the aim of VSNU, NWO, NFI and ZonMw, which have announced their intention of developing new criteria that say more about the quality and societal impact of research.¹⁰⁴ In addition, no generally accepted assessment methods have been developed as yet for teaching, impact and leadership. VSNU has stated that it wants to develop a toolkit with sound and clear criteria for creating greater equality in valuing and rewarding the core tasks. These are criteria that can be rolled out nationally and, over the longer term, internationally as well.

I am going to support diverse initiatives aimed at bringing about change in methods of valuing and rewarding researchers. In 2019 and 2020, I will make a total of € 500,000 available to match an amount provided by VSNU, to develop pilot projects and experiments in this area. I am also providing room to do research on the effects of team science, in which research, education and impact are covered by different people.



An academic teaching career

The University of Twente is keen to appoint professors who put the emphasis on teaching. This is despite the fact that in the current situation at universities, academics are principally valued for their research skills. For this reason, in the coming years the University of Twente, together with other technical universities, will take part in an international study by Ruth Graham (www.evaluatingteaching.com) on the way in which the teaching performance of academics is valued within universities. The study covers the whole world, because there are increasing numbers of universities that want to place greater emphasis on the quality of academic teaching. The advantage of this working method is that a talent for teaching in the academic sector stimulates students and ensures a better quality of education.

3.4c International context

The Dutch knowledge field is inextricably linked with the European and international science system. As long as this system attaches great value to individual research output, there is a risk that the above change will have negative consequences for the development, reputation and funding of Dutch academic research and individual academics. The movement that is now gaining momentum in the Netherlands needs to be followed at European and global level. This means that VSNU, NWO, KNAW and other parties will join forces with their international partners. I will work to get things moving together with like-minded countries in Europe and beyond.



San Francisco Declaration

The San Francisco Declaration on Research Assessment (December 2012)¹⁰⁵ is an initiative of a number of editors and academic publishers. They concluded that too much value is attached to the primary parameter – the journal impact factor – in spite of the many objections to its use. The Declaration notes that many bodies and institutions are already applying improved methods for assessing research. There is a clear movement in favour of more refined and meaningful approaches to research assessment. The Declaration recommends assessing research according to its own qualities and merits and to involve other forms of research output when assessing the effectiveness of research. It is important to be explicit about the criteria that are used in evaluating academic productivity and in the recruitment and tenure tracking of academics. In the Netherlands, VSNU has signed the Declaration. NWO has said that it will do this soon and will work together with sister organizations in other countries to implement the Declaration.

Photo: Alamy



3.5 Agenda

- **Action:** I have asked VSNU, NWO and KNAW to work together and come up with a proposal this year for relieving pressure on the system and on the people involved. I expect that this process will in any case consider the interplay between 1) valuing and rewarding teaching and impact besides research, 2) reducing the pressure to match funds and 3) increasing acceptance rates.
- **Action:** I want to reach an agreement with institutions to increase the number of permanent contracts of employment and I will urge institutions to make funds available for this, with the aim of reducing the number of temporary contracts.
- **Action:** The additional € 5 million from the coalition agreement for the Innovative Research Incentives Scheme (VI) will be used to bring more women into the natural sciences and boost the number of researchers with a migration background. In addition, the Ministry of OCW and NWO are each making € 0.7 million available from their own funds for the 2019-2021 period, to promote additional measures in support of diversity.
- **Action:** I will host the European Gender Summit in the Netherlands in 2019. At this two-day event, international policymakers, administrators, academics and experts will exchange knowledge about all aspects of gender diversity in academia. Based on the results, I will draw up an action plan before 2020, together with the parties in the field, which will consider a follow-up to the current target figures.
- **Action:** The results of the LNVH study of scientific harassment are expected in spring 2019. During the LNVH Spring Symposium in May 2018, it was apparent that action is needed and some universities began to work on taking action immediately after the symposium. Based on the results of the study, I want to take further action together with the institutions.
- **Action:** I will support initiatives of institutions aimed at bringing about a change in the methods for valuing and rewarding researchers. In 2019 and 2020, I will make a contribution of € 500,000 available, with institutions matching that contribution.
- **Action:** At the European level, I will work to modernize the manner in which research is assessed. In this way, I will strengthen actions taken by NWO and its sister organizations.
- **Action:** Together with the knowledge field (VSNU, NWO, NFWO, and ZonMw), I will take a stand in international consultations in support of the change that the Dutch knowledge field wants to achieve in the area of valuing and rewarding academics. We want to create a movement at the international level that supports the desired development.
- **Action:** In order to value and reward all three elements of research, education and impact, an education prize will be established in addition to the Spinoza and Stevin prizes. Together with VSNU, NFWO, NWO and KNAW at least, I will elaborate this further before the summer.

Endnotes

- ¹ In 2018 and 2019, the funds for digital infrastructure come from the incidental funding for research infrastructure and from 2020, they will come from funding for basic research.
- ² The funds for practice-oriented research are from the Ministry of Education, Culture and Science's funds for applied research.
- ³ For the investments, see OECD (2018). *OECD Reviews of Innovation Policy: Netherlands*. OECD Publishing, for the achievements of science in the Netherlands, see: Koens, L., Vennekens, A., Hofman, R., van den Broek-Honingh, N. & de Jonge, J. (2018). *Balans van de wetenschap 2018*. The Hague: Rathenau Institute.
- ⁴ KNAW (2018). *De aantrekkelijkheid van Nederland als onderzoeksland*, Amsterdam, KNAW.
- ⁵ Van Dijk en Van Saarloos (2017). *Wetenschap in Nederland: waar een klein land groot in is en moet blijven*, Amsterdam, KNAW.
- ⁶ Koens, L., Vennekens, A., Hofman, R., van den Broek-Honingh, N. & de Jonge, J. (2018). *Balans van de wetenschap 2018*. The Hague: Rathenau Institute.
- ⁷ OECD (2014). *OECD Reviews of Innovation Policy: Netherlands*. OECD Publishing.
- ⁸ <http://www.oecd.org/publications/supporting-entrepreneurship-and-innovation-in-higher-education-in-the-netherlands-9789264292048-en.htm>
- ⁹ KNAW (2018). *De aantrekkelijkheid van Nederland als onderzoeksland*, Amsterdam, KNAW.
- ¹⁰ Koier, E. & J. de Jonge (2018). *De zin van promoveren – Loopbanen en arbeidsmarktperspectieven van gepromoveerden*. The Hague: Rathenau Institute.
- ¹¹ Van den Broek-Honingh, N. & de Jonge, J. (2018). *Vertrouwen in de wetenschap – Monitor 2018*. The Hague: Rathenau Institute.
- ¹² Letter of 9 March 2018 from the Minister of Education, Culture and Science, *Uitwerking investeringen wetenschap en onderzoek*, Parliamentary papers II, 2017–2018, 29 338, no. 158.
- ¹³ Letter of 13 July 2018 from the Minister and State Secretary of Economic Affairs and Climate Policy, *Naar missiegedreven innovatiebeleid met impact*, Parliamentary papers II, 2017–2018, 33 009, no. 63.
- ¹⁴ OECD, Statistics Netherlands Statline.
- ¹⁵ Vennekens, A. & de Jonge, J. (2018). *Overzicht Totale investeringen in Wetenschap en Innovatie (TWIN) 2016-2022*. The Hague: Rathenau Institute.
- ¹⁶ Letter of 13 July 2018 from the Minister and State Secretary of Economic Affairs and Climate Policy, *Naar missiegedreven innovatiebeleid met impact*, Parliamentary papers II, 2017–2018, 33 009, no. 63.
- ¹⁷ Xie, Q. & Freeman, R.B. (2018). *Bigger Than You Thought: China's Contribution to Scientific Publications*. NBER Working paper 24829 (July 2018).
- ¹⁸ In the General Consultation on Science Policy of 6 June 2018, I agreed to follow up on recommendations from the Rathenau Institute regarding the definitions of primary and secondary funding flows. In its report entitled 'Chinese borden' [*Chinese plates*], the Rathenau Institute looks at the effects of funding flows on the policy of a university. I use the generally accepted definition of the primary and secondary funding flows. This definition is based on the funds as they are included in the state budget and as the money is made available to the universities.
- ¹⁹ Ministry of Education, Culture and Science (2014). *2025 Vision for Science: choices for the future*.
- ²⁰ KNAW (2018). *De aantrekkelijkheid van Nederland als onderzoeksland*. Amsterdam, KNAW.
- ²¹ See also OECD (2018). *OECD Reviews of Innovation Policy: Netherlands*. OECD Publishing.
- ²² Koens, L., Vennekens, A., Hofman, R., van den Broek-Honingh, N. & de Jonge, J. (2018). *Balans van de wetenschap 2018*. The Hague: Rathenau Institute.
- ²³ See also OECD (2018). *OECD Reviews of Innovation Policy: Netherlands*. OECD Publishing.
- ²⁴ One of the Dutch initiatives focusing on data science is JADS, the Jheronimus Academy of Data Science. JADS was set up by Tilburg University, Eindhoven University of Technology, the Province of Noord-Brabant and the municipality of Den Bosch.

- ²⁵ AWTI (2017). *WTI-diplomatie, offensief voor internationalisering van wetenschap, technologie en innovatie*, The Hague: AWTI.
- ²⁶ Letter to the House of Representatives of 19 April 2018, *kabinetsreactie AWTI-advies WTI-diplomatie*, Parliamentary papers II, 2017–2018, 33 009, no. 62.
- ²⁷ NWO (2018). *NWO strategy 2019–2022. Verbinden van wetenschap en samenleving*.
- ²⁸ BNC Fiche – *Verordening en Besluit Horizon Europa 2021–2027 het Europese kaderprogramma voor onderzoek en innovatie*, Parliamentary papers II, 2017–2018, 22 112, no. 2648.
- ²⁹ With this, I am implementing the motion by Members of Parliament Van Meenen and Van der Molen regarding the Einstein Telescope Field Lab (35000–VIII–69).
- ³⁰ Motion by the Members of Parliament Van der Molen and Tielen, *diversiteit bij de toekenning van wetenschapsmiddelen*, Parliamentary papers II, 2017–2018, 29338–172.
- ³¹ Coalition agreement ‘Vertrouwen in de toekomst’.
- ³² Motion by Member of Parliament Bruins, *voldoende aandacht voor geesteswetenschappen binnen het sectorplan SSH*, Parliamentary Papers II 2017–2018, 293338–166.
- ³³ NWO (2018). *NWO strategy 2019–2022. Verbinden van wetenschap en samenleving*.
- ³⁴ Koens, L., Vennekens, A., Hofman, R., van den Broek-Honingh, N. & de Jonge, J. (2018). *Balans van de wetenschap 2018*. The Hague: Rathenau Institute.
- ³⁵ such as, among others, students, associate professors, lecturers, administrators in higher professional education, but also the MBO Council and VSNU, the Ministry of Economic Affairs and Climate Policy, NWO and MKB Nederland.
- ³⁶ Motion by Member of Parliament Van der Molen et al., *kennisdeling met het mkb*. Parliamentary papers II, 2017–2018, 29338, no. 171.
- ³⁷ Netherlands Association of Universities of Applied Sciences (2018). *Atlas onderzoek met impact*, The Hague: VH.
- ³⁸ <https://www.vereniginghogescholen.nl/themas/praktijk-en-onderzoek>.
- ³⁹ The definitions of basic research and applied research are from: OECD (2015). *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development*, Paris: OECD Publishing.
- ⁴⁰ The House of Representatives received a baseline measurement for the system in early 2017. This measurement contained factual information on the institutes’ performance within the overall science system. The evaluation of the system of institutes is currently in progress. At the request of the House of Representatives, there will be an explicit examination of the institutes’ contribution to impact and the effect on the rankings of institutes in case of embedding institutes in universities.
- ⁴¹ For an explanation and examples of citizen science, see: Koens, L., Vennekens, A., Hofman, R., van den Broek-Honingh, N. & de Jonge, J. (2018). *Balans van de wetenschap 2018*. The Hague: Rathenau Institute, p. 37.
- ⁴² See <https://www.universiteitleiden.nl/nieuws/2018/09/resultaten-publieksonderzoek-weekend-van-de-wetenschap>.
- ⁴³ Letter to the House of Representatives of 21 December 2018, *stand van zaken startup en scale-up beleid*, Parliamentary papers II, 2018–2019, 32637, nr. 343.
- ⁴⁴ Motion by Member of Parliament Van Meenen, *ondersteunen van universiteiten bij verwerven van patenten*, Parliamentary papers II, 2017–2018, 29338, no. 175.
- ⁴⁵ Such as patents on inventions and copyrights on software.
- ⁴⁶ The recommendations also set out how the Ministry of OCW and the Ministry of EZK can contribute to this. I refer specifically to the recommendations in the report by KNAW, VSNU, the Netherlands Federation of University Medical Centres (NFU) and NWO on ‘Benutting van octrooiën op wetenschappelijk onderzoek’ [*Use of patents for scientific research*] (2014); the report by Technopolis on ‘De knelpunten voor doorgroeende academische start-ups in Nederland’ [*Obstacles facing growing start-ups in the Netherlands*] (2015); and the recent evaluation by Dialogic of the Valorization Programme EZK/OCW 2010–2018 (2018); as well as the responses to this from my ministry and the Ministry of Economic Affairs and Climate Policy.
- ⁴⁷ Letter to the House of Representatives of 11 December 2018, policy response to the evaluation of the Valorization Programme 2010–2018, Parliamentary papers II, 2018–2019, 2018Z23415.
- ⁴⁸ Evaluations such as: SEP: Standard Evaluation Protocol for university research evaluations; BKO:

Brancheprotocol Kwaliteitszorg Onderzoek [Sector Protocol for Quality Assurance in Research] for universities of applied sciences and the evaluations of institutions for applied research (TO2 institutions).

- 49 This can be deviated from in exceptional cases (see Article 12b of the new Dutch code of conduct on research integrity).
- 50 This makes scientific knowledge more accessible for everyone and therefore also for the SME sector, as agreed during the General Consultation on Science Policy of 6 June 2018 on the elaboration of the motion on open science by the Member of Parliament Rog. Talks with SMEs made it clear that no supplementary action needs to be taken at present.
- 51 Vennekens, A. & Koens, L. (2018). *Factsheet: Open access van wetenschappelijke publicaties*, The Hague: Rathenau Institute.
- 52 Section 25fa Copyright Act [Auteurswet] and Neighbouring Rights Act [Wet op de naburige rechten].
- 53 Council conclusions on Open Science 2016: <http://data.consilium.europa.eu/doc/document/ST-9526-2016-INIT/en/pdf>
- 54 The FAIR principles arose from a workshop in Leiden in January 2014. In March 2016, they were published in the journal Scientific Data of the Nature Publishing Group. They have now been adopted worldwide, among others by the EU, G7 and G20.
- 55 Administrative Committee Review (2014). *Interdepartmental Policy Review on Scientific research*, Ministry of Finance.
- 56 Ministry of Education, Culture and Science (2014). *2025 Vision for Science: choices for the future*.
- 57 Letter of 13 July 2018 from the Minister of Economic Affairs and Climate Policy, *Naar missiegedreven innovatiebeleid met impact*, Parliamentary papers II, 2017–2018, 33009, no. 63.
- 58 NeuroLabNL is one of the routes of the National Research Agenda that began its research with the initial impetus it received in 2017.
- 59 <https://neurolab.nl/wetenschap-voor-de-schermen/>
- 60 <https://kijkinjebrein.nl/>
- 61 Motion by the Member of Parliament Paternotte et al., *onderzoek naar de relatie met bedrijfsinvesteringen in R&D*, Parliamentary papers II, 2016–2017, 31288, no. 600.
- 62 KNAW (2018). *Wederzijdse versterking - Hoe publieke en private investeringen in onderzoek en ontwikkeling samenhangen*. Amsterdam: KNAW.
- 63 Tjong Tjin Tai, S.Y., van den Broek, J., Maas, T., Rep, T., & Deuten, J. (2018). *Bedrijf zoekt universiteit – De opkomst van strategische publiek-private partnerships in onderzoek*. The Hague: Rathenau Institute.
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- 65 As agreed, to come back to the results of an examination of the position of the Rathenau Institute at KNAW in the letter of 17 April 2018 from the Minister of Education, Culture and Science, Parliamentary papers II, 2017–2018, 34 775 VIII, no. 132.
- 66 Van den Broek-Hoeningh, N & de Jonge, J. (2018). *Vertrouwen in de wetenschap - Monitor 2018*, The Hague: Rathenau Institute.
- 67 *Overheid breidelt wetenschap*. (2018, 3 September). NRC.
- 68 Diercks, G., Faasse, P., van der Meulen, B., & Diederens P. (2018). *Met gepaste afstand – Onafhankelijkheid en integriteit bij onderzoek door rijkskennisinstellingen*. The Hague: Rathenau Institute.
- 69 The Netherlands is also a leader in responsible research in Europe; at the EU level, there is currently the Responsible Research and Innovation concept which focuses, among other things, on gender, inclusion, sustainability and open science.
- 70 KNAW (2018). *De aantrekkelijkheid van Nederland als onderzoeksland*. Amsterdam: KNAW.
- 71 The growing pressure on academic staff, particularly at universities, is also shown in the report by the Rathenau Institute. (Koens, L., Hofman, R. & de Jonge, J. (2018). *Drijfveren van onderzoekers – Goed onderzoek staat nog steeds voorop*. The Hague: Rathenau Institute.
- 72 Vennekens, A., de Jonge, J. & Hofman, R. (2018). *Factsheet: Het onderzoek aan universiteiten en umc's*, The Hague: Rathenau Institute.
- 73 Letter of 24 September 2018 from the Minister of Education, Culture and Science, *reactie op verzoek commissie over het rapport “ruimte voor investeringen en talent” van de Vereniging van Samenwerkende Nederlandse Universiteiten (VSNU)*, Parliamentary papers II, 2018–2019, 31288, no. 656.

- ⁷⁴ For example, for a Veni grant it is a requirement that if the application is successful, the researcher must be given access to all the expertise and facilities of the institute. For a Vidi application, the institute has to make a tenure-track position available beforehand if the application is approved.
- ⁷⁵ Motion by the Member of Parliament Özdil, *de inrichting van de inbeddingsgarantie*, Parliamentary papers II, 2017-2018, 29338 no. 169.
- ⁷⁶ Motion by Member of Parliament Bruins et al., *onderzoek naar herwaardering van vrije competitie*, Parliamentary papers II, 2017-2018, 29338 no. 167.
- ⁷⁷ The target figures exclusively include the professors appointed under the Westerdijk Talent Scheme.
- ⁷⁸ LNVH (2018). *Monitor vrouwelijke hoogleraren 2018*.
- ⁷⁹ European Commission (2013). *She Figures 2012: gender in research and innovation*. Brussels: European Commission.
- ⁸⁰ See also <https://www.vereniginghogescholen.nl/actueel/actualiteiten/vrouwen-doen-het-goed-bij-hogescholen>.
- ⁸¹ LNVH (2018). *Monitor vrouwelijke hoogleraren 2018*.
- ⁸² Koens, L., Vennekens, A., Hofman, R., van den Broek-Honingh, N. & de Jonge, J. (2018). *Balans van de wetenschap 2018*. The Hague: Rathenau Institute, p. 82-84.
- ⁸³ The NWO Innovational Research Incentives Scheme is using three person-related forms of subsidy to focus on the various stages in the academic career of researchers: Veni (recent PhD), Vidi (experienced researcher) and Vici (potential professor).
- ⁸⁴ The money is also used for attracting more women into science and engineering.
- ⁸⁵ See also <https://www.nwo.nl/onderzoek-en-resultaten/programmas/vluchtelingen+in+de+wetenschap>.
- ⁸⁶ Motion by Members of Parliament Van der Molen and Tielen, *diversiteit bij de toekenning van wetenschapsmiddelen*, Parliamentary papers II, 2017-2018, 29338, no. 172.
- ⁸⁷ Van der Lee, R & Ellemers, N. (2015). *Honoreringskansen voor mannen en vrouwen in de NWO-competitie*. NWO research report.
- ⁸⁸ Derks, B., van Veelen, R., Handgraaf, M. (2018). *Successful economists are highly masculine* ESB 47675 016-019.
- ⁸⁹ Amended motion by Members of Parliament Tielen and Van der Molen on preventing self-censorship and the limiting of diversity (29338-179).
- ⁹⁰ KNAW (2018). *De aantrekkelijkheid van Nederland als onderzoeksland*, Amsterdam: KNAW.
- ⁹¹ KNAW (2018). *De aantrekkelijkheid van Nederland als onderzoeksland*, Amsterdam: KNAW.
- ⁹² This involves matters such as stealing data; unjustified authorship of publications; overlooking a person when allocating management and research tasks; deliberately speaking badly of people or ignoring them, for example in the case of committees; having a negative influence on the work environment and obstructing research processes.
- ⁹³ See also <https://www.lnvh.nl/scientific-harassment>.
- ⁹⁴ ISB-NL is a platform for public-private cooperation between government, including regional government, knowledge institutions and companies. As described in the Letter to the House of Representatives 'Investeren in perspectief' [*Investing in perspective*] (Parliamentary paper 34 952, no. 1), the goal of ISB-NL is to embed cooperation between ministerial departments, knowledge institutions and companies, thus strengthening the knowledge base, innovative ability and international position of the Netherlands, and contributing to achieving the SDGs in the Netherlands and worldwide.
- ⁹⁵ Deuten, J. (2015). *R&D goes global: policy implications for the Netherlands as a knowledge region in a global perspective*. The Hague: Rathenau Institute.
- ⁹⁶ See also <https://amolf.nl/news/licht-splitsen-voor-stabiele-verbetering-van-zonnecellen>.
- ⁹⁷ Letter of 19 January 2017 from the State Secretary for Education, Culture and Science, *Wetenschap met Impact*, Parliamentary papers II, 2016-2017, 31288, no. 574.
- ⁹⁸ NWO (2018). *NWO strategy 2019-2022. Verbinden van wetenschap en samenleving*.
- ⁹⁹ See also <https://www.hetpnn.nl/2013/05/06/ppp/>
- ¹⁰⁰ Koier, E. & de Jonge, J. (2018). *De zin van promoveren – Loopbanen en arbeidsmarktperspectieven van gepromoveerden*. The Hague: Rathenau Institute.
- ¹⁰¹ Van der Weijden, I.C.M., Teelken, C., De Boer, M., & Drost, M. (2015). *Career satisfaction of postdoctoral researchers in the relation to their expectations for the future*. Higher Education, 1-16.

- ¹⁰² VSNU, NWO, NFU and ZonMw give impetus to change in valuing and rewarding researchers, 26-11-2018, <https://www.nwo.nl/actueel/nieuws/2018/11/vernieuwing-in-het-waarderen-en-belonen-van-wetenschappers.html>
- ¹⁰³ Motion by Member of Parliament Tielen, *een onderwijsprijs voor academici*, Parliamentary papers II, 2018–2019, 35 000 VIII, no. 41.
- ¹⁰⁴ VSNU, NWO, NFU and ZonMw give impetus to change in valuing and rewarding researchers, 26-11-2018, <https://www.nwo.nl/actueel/nieuws/2018/11/vernieuwing-in-het-waarderen-en-belonen-van-wetenschappers.html>
- ¹⁰⁵ <https://sfdora.org/read/>

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