

## **Balance in policy**

Science and innovation policy  
in outline

Advice 71

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## Summary

What should be the main lines of government policy on science and innovation in the forthcoming government's term of office? This advisory report outlines the vision of the Advisory Council of Science and Technology Policy (AWT) on the Dutch knowledge and innovation system, describes and assesses the current state of affairs and concludes with its recommendations.

## Vision

The Netherlands needs a knowledge and innovation system that creates options and seizes opportunities. Options are created by maintaining the capacity to absorb and use knowledge of all sorts. Seizing opportunities requires investing in particular areas of strength. To make this possible, the knowledge and innovation system must be well balanced, specifically with regard to the following dimensions.

- *Breadth of scope and focus:* both the knowledge infrastructure and the business community should be characterised by a broad basis with a number of strong clusters.
- *Knowledge as both capacity and product:* the research system should deliver concrete research results and contribute to the development of research competences.
- *Autonomy and guidance:* the system should provide ample room for initiative within clearly defined boundaries.
- *Stability and dynamics:* the dynamics of innovation require stability in the innovation system.

## Assessment of the current state of affairs

The following conclusions can be drawn from an analysis of developments in the knowledge and innovation system in recent years and from policy developments.

- *Scope:* more needs to be done to maintain a broad foundation in research. No gaps should open up in the academic basis.
- *Focal points:* more investment is needed in proven areas of specific strength to reinforce the competitive position of our knowledge institutes and businesses in the world.
- *Knowledge as capacity:* science policy needs to focus more on knowledge for capacity development; the current focus puts (too) much emphasis on knowledge as a product.
- *Knowledge as product:* innovation policy should put more emphasis on stimulating tangible innovations. This requires more attention for the innovation process itself: accessing, combining and applying existing knowledge, developing and launching new products, collaboration between entrepreneurs and researchers.
- *Autonomy:* the government needs to build more on trust; offering clear policy frameworks and granting autonomy within well defined boundaries should be fundamental policy principles.
- *Guidance:* for good guidance, the government needs more expertise and practical knowledge.
- *Stability:* financial arrangements for scientific research require more stability with a view to the medium and long term.
- *Dynamics:* career opportunities for researchers need to be more dynamic.

## Recommendations

Given the current state of affairs, the AWT values the policy initiatives announced in the recent coalition agreement. Besides those initiatives, the AWT makes the following recommendations, which are outlined further in this document.

## To the Minister of Education, Culture and Science:

- Invest more in the knowledge infrastructure across the entire spectrum and with a view to the long term. Increase primary funding.
- Reinforce targeted areas of scientific excellence based on a vision of the Netherlands' position in Europe.
- Use a broad definition of quality in research: maintain research for capacity development. In addition, acknowledge the value of application-driven knowledge development and reward researchers for valorisation.
- Take responsibility for the research system as a whole by formulating clear boundary conditions, objectives and tasks for knowledge institutes and conduct a "policy-rich dialogue" with them regarding their strategic agenda and their place and function within the system.

**To the Minister of Economic Affairs:**

- Continue the "key areas" approach and make more resources available for this purpose. Support the entire chain of innovation activities and do not limit this policy to co-financing research. Ask firms and knowledge institutes involved to set clear priorities based on a shared vision on the future and on international developments.
- Reinforce the infrastructure for knowledge diffusion (Syntens and SME centres) by creating more facilities for Small and Medium-sized Enterprises that innovate on the basis of combining existing knowledge and by stimulating cooperation with trade associations. Promote mobility among researchers and expand the scope of policy instruments such as the Casimir programme and the knowledge vouchers.
- Take impact on innovation into account when developing other economic policies, particularly policies regarding competition, intellectual property, education, the labour market, capital markets and government funding.

**To the members of the new Innovation Platform:**

- Ensure that regarding developing knowledge for social priorities that there is good coordination between public and private players and transparent division of responsibilities between departments. Effectively coordinate investments in research for social priorities with investments in research aimed at scientific excellence.

**To the Ministers of sector departments:**

- Encourage demand-driven innovation by setting standards and creating challenging requirements for tenders. Focus more on ensuring that government employees utilise opportunities and less on error prevention.

**To all Ministers:**

- Acknowledge the value of substantive knowledge, ensure that each Ministry has its own knowledge strategy and emphasise substantive and practical knowledge in personnel policy. Adopt innovations developed elsewhere whenever possible and try to minimise reinventing the wheel.

## **1 Introduction**

### ***When a new government takes office...***

The Advisory Council of Science and Technology Policy (AWT) advises the government and parliament on science and innovation policy. We offer both solicited and unsolicited advice. The beginning of a new term of government seems like a good time to issue an advisory report that encompasses the entire field of policy. This reveals the interconnections between science and innovation policy. Accordingly, this advisory report responds to the question:

*What should be the main lines of government policy on science and innovation in the forthcoming government's term of office?*

### ***...an advisory report on the main themes is appropriate***

This advisory report focuses on the main policy lines. We draw extensively on the advisory reports issued by the AWT over the past years, whilst taking into account recent developments and the ambitions set out in the coalition agreement.

### ***Vision on policy, the current state of affairs and recommendations***

The advisory report is structured as follows.

- First we outline the AWT's perspective on the knowledge-based society. We describe the significance of knowledge for the economy and society and the issues that the government faces in shaping science and innovation policy.
- We then offer an indication of the current state of affairs. We describe current science and innovation policy and draw conclusions about the direction in which it should develop.
- We conclude by offering recommendations, formulating advice on the policies needed for the knowledge and innovation system.

## **2 The Netherlands as a knowledge-based society**

### **2.1 Knowledge continues to be important**

#### ***Knowledge for quality of life...***

Knowledge plays a crucial role in Dutch society. Knowledge contributes to the quality of life in at least three ways.

#### ***...for prosperity, well-being and participation***

- *Prosperity.* Our economy is increasingly knowledge-intensive. The production, diffusion, exchange and application of knowledge should be fostered to facilitate the sustainable development of our economy.
- *Well-being.* We need knowledge in order to deal with collective challenges. For example, we need to learn to address cultural differences, rising sea levels, climate change, new health problems, our ageing population, congestion and social transformations.
- *Participation.* Knowledge is needed to participate in a society that is becoming steadily more complex. With increased freedom comes the need for people to take more responsibility and more initiative, both in their professional and personal lives. They need knowledge in order to evaluate information, assess risks, take choices and put plans into action. They also need knowledge and skills to contribute to public decision-making processes and democracy.

Science and innovation policy should be based on this broad perspective. The government should not focus solely on economic development; quality of life and of social development are also at stake.

#### ***Knowledge development and innovation are international***

##### **Internationalisation intensifies challenges**

Knowledge and innovation have always transcended national borders. Since the seventeenth century, the Netherlands has had a substantial share in and has always benefited from international knowledge development. The Netherlands currently produces approximately 2% of the world's total knowledge each year. That is about eight times more than our share of the world's population.

The use of ICT and progressing liberalisation of the economy increase the importance of the international dimension of knowledge and innovation. New contributors create innovations, new companies conquer world markets and new countries make their mark. The dissemination of information and the development of products are accelerating at an ever-increasing pace. Although this means that competitive advantage can be created more quickly, it can also vanish just as rapidly. The rise of China and India speaks volumes in this context.

##### ***Globalisation requires specialisation***

Internationalisation offers opportunities, but it also sets high standards. To benefit from this process, the Netherlands must focus on activities in which it has a competitive advantage. Specialisation is necessary in order to achieve economies of scale. This mainly occurs as a result of market forces. However, the government should support the specialisation pattern that emerges as a result of those influences, in part by means of the science and innovation

policy. The government must secure close connections between education, research and strong business clusters.

### ***A European vision is a necessity***

Within the framework of internationalisation, the European Union is of vital importance. On the one hand, EU countries are cooperating more and more closely in the areas of knowledge and innovation. On the other hand, competition among EU countries is intensifying, for example, in terms of the conditions for establishing a business and of focal areas for research. This compels our country to make clear choices. When do we work in concert with other countries? When do we strike off on our own?

### **Off to work!**

#### ***The Netherlands has a strong starting position...***

The Netherlands is flourishing in many areas. Dutch prosperity and productivity are among the best in the world, we enjoy high incomes and ample free time and we are comparatively satisfied with our quality of life.<sup>1</sup> These successes rely in part on the availability of a well-educated population, an effective knowledge infrastructure, competitive technology and solid social capital. Our researchers rank high in the international rankings and the Netherlands serves as a home base for a relatively large number of multinationals. We play a key role in various global markets. Consider ornamental horticulture, pension insurance and hydraulic engineering, but also commercial niche markets like wafer steppers assembly.<sup>2</sup>

#### ***...but there are weaknesses***

Despite all this, there is cause for concern. Qualitative trends in education have been the subject of intense discussion in recent years. The number of graduates in scientific and technical disciplines remains low, perhaps too low. Privately funded R&D lags behind the levels in countries around us. The availability of venture capital in the first stages of innovation processes (research, development and start-up) leaves much to be desired.<sup>3</sup>

The government must rise to these challenges. It must equip people and organisations to stand on their own feet, both economically and as part of society. Research and development, high-quality education and training are essential in achieving that self-reliance.

## **2.2 A balanced knowledge and innovation system**

### ***Towards a knowledge and innovation system...***

If the knowledge-based society is to flourish, it will require a well-functioning knowledge and innovation system. In this context, well-functioning means that the knowledge and innovation system serves two purposes: it must create options and it must seize opportunities.

### ***...that creates options and seizes opportunities...***

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<sup>1</sup> See for example Social and Cultural Planning Office of the Netherlands (2005).

<sup>2</sup> See for example Jacobs and Lankhuizen (2006).

<sup>3</sup> See AWT Advisory Report 67 (2005), Timmer, Ypma and Van Ark (2003), MERIT and JRC (2006) respectively.

Creating options in an unpredictable world means maintaining the capacity to absorb and utilise knowledge, no matter where it is produced in the world. Taking advantage of opportunities means investing in themes we are or could be good at and benefiting from that. The AWT believes that both purposes are essential. It is a matter of both, not either/or. Choosing one to the exclusion of the other would be disastrous in the long term.

***...and is balanced across four dimensions***

For it to be possible to simultaneously create options and seize opportunities, the structure of the knowledge and innovation system has to be in balance. In the opinion of the AWT, a balance should at least be achieved in the following dimensions:

- Breath of scope and focus;
- Knowledge as both capacity and product;
- Autonomy and guidance;
- Stability and dynamics.

We discuss these dimensions in more detail below. They provide the analytical framework in which we examine the current state of affairs presented in the next chapter.

**Both scope and focus**

***To the benefit of top talent and everybody else's talent***

The knowledge and innovation system contributes to our prosperity and well-being by encouraging talent and giving it room to flourish. This is not just about the elusive talent at the top, but the talent inherent in everyone. Good science and innovation policy helps every person and every organisation to develop to the best of their abilities. That is why we argue in favour of a good balance between focal points on the one hand and support for the full scope of activities on the other.

***A high plateau with peaks***

In the knowledge infrastructure, this strategy implies development and maintenance of "a high plateau with peaks". A broad basis is needed: ample capacity in scientific research and education, spread across a broad spectrum of disciplines, easily accessible to students of various capacities who are pursuing a diversity of interests, capable of responding to a wide range of needs for knowledge arising from the business community and from society, distributed throughout the regions of the Netherlands. Focal points are also needed. Many fields require significant mass to achieve global excellence and maintain a high profile. The Netherlands is too small to achieve the necessary critical mass in all fields, but it can do so for a limited number. Focal points and peak performance in knowledge development improve the climate to establish a business in the Netherlands and the opportunities for innovation in this country, while strengthening the position that the Dutch knowledge infrastructure holds in worldwide academic networks.

***Broad basis with strong clusters***

A wide base and areas of focus can also be identified in the business community. The Netherlands has a broad base of companies that absorb and combine all sorts of knowledge and use it for innovation. The Netherlands also has a number of strong clusters comprised of world class companies. They generally organise their own learning processes and knowledge exchange, thus creating specific sustainable competitive advantages. Both parts of the

business community (i.e. the broad base and the strong clusters) are key to the Dutch economy.

### **Knowledge as both capacity and product**

#### ***Research output and competence development***

The knowledge and innovation system should give people the knowledge to generate and maintain prosperity and well-being. This concerns two types of knowledge: knowledge “as a product” and knowledge “as capacity”. Knowledge as a product consists of insights and statements as found in scientific journals and of theories and facts recorded in magazines, books and television programmes. Knowledge as capacity consists of competences to identify and absorb relevant knowledge, to combine knowledge and continue developing it, to translate and convert it and to apply it. Knowledge as capacity is embedded in people, organisations and infrastructure.

#### ***Public knowledge institutes exist for both...***

Research creates knowledge as both capacity and product. Research produces more than results published in magazines or included in patents. It also produces competent researchers and research groups which know how to bring certain issues to a sound conclusion. The AWT is of the opinion that the public research infrastructure should supply both types of knowledge. There should be room in this context for a division of labour. Universities and the institutes of the Royal Netherlands Academy of Arts and Sciences (KNAW) and the Netherlands Organisation for Scientific Research (NWO) exist primarily to produce knowledge as capacity, while the Netherlands Organisation of Applied Scientific Research (TNO) and leading technological institutes exist primarily to produce knowledge as a product.

#### ***...and businesses need both***

Businesses and civic organisations use knowledge to innovate. To do so, they must have access to knowledge as a product (tangible research results), but also to knowledge as capacity (well-educated people and a solid research infrastructure). That requires effective cooperation within the business community and with knowledge institutes. But it also requires financial institutions which are willing to share the risks of innovation. It also demands specific standards which offer assurances for interoperability and challenge users to make innovations, accurate information on the demand for innovative goods and services, and direct communication with users.

### **Both autonomy and guidance**

#### ***Competition as well as coordination***

A well-functioning knowledge and innovation system requires room to develop in a stimulating environment on the one hand and coordination and cooperation on the other. Organisations in the system perform best under a delicate balance of autonomy and guidance. There is a need for freedom and room for competition, but also for clear frameworks and guidance.

#### ***Freedom within certain conditions...***

Businesses and knowledge institutes perform best in a stimulating environment which encourages achievements and offers room for personal choices. That freedom can only

flourish given the right preconditions. A well-functioning knowledge and innovation system needs a clear, efficient allocation of responsibilities, protection of intellectual property rights, guarantees for contracts and agreements, transparency of markets and achievements. The government shapes these factors by means of policies that establish generic preconditions.

### ***...and with a view to public interests***

The government is much more than just a guard monitoring those preconditions (referee). It also represents the interests of society (player on the field). In this role, it must specify the aims of the public research infrastructure as a whole and hold institutes accountable accordingly. With regard to the private sector, the government has cause to act if competition leads to missed opportunities and intervention could lead to mutual advantage. This could be achieved by means of focused policies, targeting obstacles and opportunities in a particular field.

### **Both stability and dynamics**

#### ***Dynamics stimulate innovation...***

Science and innovation policy is geared towards change. Innovation emerges most easily in a dynamic environment. It keeps people and organisations on their toes, encourages them to achieve their best results and offers flexibility and room to develop. Conversely, knowledge development and innovation are matters for the long term. They require planning, long-term investments and perseverance. Knowledge accrues slowly and investments often yield results only after some time and often unpredictably. This requires a stable policy environment, assurances for the long term, options for experimenting and sharing risks and acceptance of failures as well as successes.

#### ***...but innovation demands perseverance***

## **2.3 The role of the government**

In a well-functioning knowledge and innovation system, the eight aspects we outlined above are all in balance. The AWT is of the opinion that the government has a special responsibility to ensure that balance is preserved.

### **What are the government's responsibilities?**

The government has three responsibilities in relation to the knowledge and innovation system.

#### ***Government tasks: maintaining the system, ...***

- The government bears responsibility for how the public knowledge infrastructure functions as a whole. Public research is a public good in that the results are non-competitive and non-excludable. This responsibility concerns the scope and quality of public research.

#### ***...guarding public interests...***

- The government is (partly) responsible for developing knowledge to serve common interests. This involves topics which are a matter of public concern and which necessitate

research and innovation, such as security, nature and the environment, public health and sustainability.

***...and promoting innovation***

- The government is partly responsible for promoting innovation. This includes creating favourable preconditions and a stimulating climate for innovation, but also offering support for private innovative efforts, promoting coordination between activities in public and private research and acting as an intermediary between private players.

The government's first two responsibilities encounter little debate. The third is open to more discussion, in particular with respect to an active role for the government. We believe that the government should not only maintain policies that establish preconditions, but also active innovation policies that go beyond simply creating favourable preconditions and employing generic instruments.

**Lending legitimacy to an active innovation policy**

***Active innovation policy: "close to the market" and "backing winners"***

In our view, an active innovation policy is characterised by two aspects: integral support for innovation processes ("close to the market") and targeted deployment of effort and resources ("backing winners"). The legitimacy of an active innovation policy is often questioned, referring to specific forms of market failure.

***Market failure calls for active innovation policy***

The AWT believes that an active innovation policy is entirely legitimate from a market failure perspective. It is important to examine all relevant forms of market failure in that context, not just knowledge spillovers from R&D. In addition, we believe it is necessary to look not only at market failures, but also at network failures and system failures. Complex innovation processes are characterised by numerous forms of lack of information, external effects and coordination failures that private agents cannot resolve properly. We refer readers to the explanatory notes added to this advisory report for a full description of how the AWT defines an active innovation policy and the underlying economic foundation.

### **3 Taking stock**

#### ***Is the knowledge and innovation system in equilibrium?***

In the previous chapter we outlined four dimensions which should be in balance in the knowledge and innovation system. This chapter looks at the actual situation in the Netherlands. Is our knowledge and innovation system in equilibrium? How does current science and innovation policy contribute to that equilibrium?

Finding answers to these questions is not a matter of mechanical measurements and calculations. The AWT bases its assessment not only on an evaluation of quantitative data, but also on qualitative information from the system, estimates of the influence from trends, internal expertise and widely accepted views on what is considered desirable for society.

#### **3.1 Areas of scope and focus**

##### ***More emphasis on focal points...***

##### **Current state of affairs**

In recent years, the knowledge and innovation system has increasingly reflected the importance of realising focal points. This concerns critical mass and excellence in the science and business community. The driving force behind this awareness is globalisation: international competition makes specialisation unavoidable.

##### ***...in the knowledge infrastructure...***

Within the research infrastructure, universities in particular have been encouraged to cooperate and divide the work among themselves. To make that possible, the development of research schools has been encouraged, top technological and social institutes have been established and mutual cooperation between the technical universities has been supported (i.e. the 3TU initiative). Indirect government funding for research is also a key instrument in this. In its strategic plan, NWO announced the National Research Initiatives (i.e. programmes investing 30 million to 50 million in the scientific disciplines in which the Netherlands ranks among the global leaders). The efforts to form focal points also received a major impetus from FES funding and the Smart Mix.

##### ***...and in the business community***

There is also increased awareness of several focal points in the business community. The Innovation Platform has designated six key areas for the Dutch economy: "high-tech systems and materials", "water", "food & flowers", "the creative industry", "chemicals" and "pensions and insurance". These are economic clusters that have:

- Appealing and inspiring ambitions for business and society;
- Considerable organisational capacity and commitment on the part of those involved;
- Diverse economic activities that are competitive across the globe;
- Knowledge and technology enjoys an international reputation of high quality.<sup>4</sup>

##### ***The Ministry of Economic Affairs focuses on backing winners...***

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<sup>4</sup> See Innovatieplatform (2004).

In order to support these economic focal points, the Ministry of Economic Affairs has instituted a policy of backing winners. This takes shape in innovation programmes formulated on the basis of the demands of businesses and facilitated by the government. These programmes not only support R&D, but also knowledge application and marketing.<sup>5</sup> They must be distinctive in the international arena and focus on markets and technologies in which the Netherlands can excel. This demands a fairly serious financial commitment from the business community. Regional economic policy has shifted from supporting weak regions to investing in strong clusters (i.e. innovative hot spots: “areas of excellence in the delta”).

### **Toward key European areas**

Numerous initiatives have been launched to create that crucial critical mass in both the Netherlands and in the EU. Examples include the European Research Council, the Joint Technology Initiatives and the European Institute of Technology. At the end of 2006, the European Commission announced that it would be continuing to strengthen excellent clusters in order to achieve sufficient critical mass through “more and better transnational European cooperation”. To that end, the Commission will “map the strengths of national and cross-border clusters and stimulate practical cooperation between regional authorities and relevant economic actors or associations, supporting cooperation between cluster initiatives.” The aim is to set a “common cluster agenda for Europe” by the end of 2007.

### ***...and updating the generic innovation policy***

In addition, generic policy on innovation has been reinvented. Increased attention has been focused on the broad group of SMEs innovating through new applications of existing knowledge. The Ministry of Economic Affairs has developed low-threshold instruments for this group, such as knowledge vouchers. The Ministry of Education, Culture and Science (OCW) supports regional networks with universities of professional education via the Regional Attention and Action for Knowledge Circulation (*Regionale Aandacht en Actie voor Kenniscirculatie* or RAAK) scheme. The SBIR scheme was also set up for these businesses, aiming to ensure that some percentage of government projects goes to small, innovative companies.

### **Strengthening policy for SME appliers**

“Appliers” are Small and Medium-sized Enterprises that innovate by finding clever ways to combine and implement existing knowledge, rather than by doing their own R&D.<sup>6</sup> This group comprises some 200,000 companies. The Innovation Platform’s Knowledge Investment Agenda has formulated an ambitious objective for these companies. In 2016, 25% of them should be working with knowledge institutes. This is currently the case for 15%. The Innovation Alliance Foundation (*Stichting Innovatie Alliantie* or SIA) supports these companies by strengthening the regional knowledge infrastructure and by creating “short, fast connections”.<sup>7</sup> The SIA thinks that approximately 250 million more is needed to achieve the specified objective on the Knowledge Investment Agenda.

### ***The Ministry of Education, Culture and Science invests primarily in focal points***

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<sup>5</sup> See Ministry of Economic Affairs (2006).

<sup>6</sup> See AWT Advisory Report 64, *Innovation without invention. Knowledge utilisation in the SME sector* (2004).

<sup>7</sup> See Stichting Innovatie Alliantie, brief Kennisinvesteringsagenda, <http://www.hbo-raad.nl/upload/bestand/060221kennisinvesteringsagenda.pdf>. The SIA board comprises the chairmen of MKB-Nederland, the Confederation of Netherlands Industry and Employers (VNO-NCW), Syntens, TNO, the Telematica Instituut and the Netherlands Association of Universities of Applied Sciences (HBO-raad).

New initiatives in science policy focus almost exclusively on forming focal points. The amount of resources available from European funds and from the FES fund has been increased significantly and the Smart Mix was introduced. All these sources of funding go into programmes. New schemes expect universities to take more risks in PPP constructions, while the total burden of matching has increased.<sup>8</sup>

### **2007 coalition agreement: CDA - PvdA - CU**

In order to strengthen the foundation, the government will be working in the coming years to invest more in university research, improved support for innovation in SMEs and intensify the Promotion of Research and Development Act (WBSO).

- "Additional investments will be made in higher education, primarily through direct and indirect government funding."
- "The SME sector will receive more attention and emphasis in the coming government's term of office. The position of SMEs will be promoted by providing more access to innovation subsidies, innovation vouchers and government assignments."
- "Innovation will be stimulated by intensifying the WBSO scheme and expanding the innovation voucher scheme."

The government will also work to achieve economic and social focal points. It will continue to pursue the key areas approach, invest more in renewable energy and establish a new Innovation Platform to promote health care, energy and water management issues.

- "High-potential initiatives and significant sectors in the Dutch economy will receive targeted support – partly from the knowledge and innovation policy – within the framework of what is known as the key areas approach."
- "Additional investments will be made, with particular emphasis on the development of renewable energy, in unaffiliated, purely scientific research and in research financed through indirect government funding."
- "The Innovation Platform will continue to exist and will be restructured to handle the tasks that we will be facing in the coming period, paying particular attention to the areas of health care, energy and water management. The composition and involvement of the departments will undergo further review."

Renewable energy is one of the ten spearheads of the government plan for the coming four years. The aim is to take great strides in the transition towards a renewable and efficient supply of energy in 2020.

### **AWT assessment**

#### ***The Netherlands would benefit from specialisation***

In a world of continuing internationalisation, a small country like the Netherlands would benefit from a certain degree of economic and scientific specialisation. Excelling in certain areas will ensure that the Netherlands remains an interesting place for renowned scientists and multinationals. Furthermore, the presence of strong research groups and companies increases the capacity to absorb knowledge. The spillovers generated locally are more likely to base themselves locally in that case.

#### ***Scope of specific innovation policy is limited***

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<sup>8</sup> Apparent from the budget of the Ministry of Economic Affairs for 2007.

The scope of the specific innovation policy is still fairly limited compared to the resources for generic basic facilities (innovation subsidies and tax schemes for R&D, the WBSO in particular). A relatively large number of incidental resources have been added in recent years, but their continuity is not guaranteed.

### ***Coordination between areas of academic excellence and key areas is advisable***

It is good that work on developing focal points in the Dutch knowledge and innovation system is directed toward better coordination between areas of academic excellence and key areas. However, the range of instruments being used is complex, lacking transparency and coherence.

### **Backing winners under discussion**

The designation of key areas by the Innovation Platform generated intense discussion. Macro-economists in particular warned of the dangers of old-fashioned industry politics. The terms “backing winners”, “picking winners” and “backing losers” were often used in turn. Essential to the concept of “backing winners” is that the market determines the direction. The government does not make the choice (does not pick winners), but follows the choices made by the business community and knowledge institutes. The policy then focuses on strengthening the clusters rather than on individual companies. Measures targeting SMEs, start-ups and business successors in a key area should be an integral part of the policy. In principle, the policy focuses on the entire innovation process and not exclusively on R&D. Despite that fact, the Ministry of Economic Affairs – in developing the programme-based approach – seems to put primary emphasis on financial support for research and the focus on the SME sector seems very limited.

### ***Science policy is currently aimed too unilaterally at forming focal points***

The emphasis in science policy has shifted too strongly towards forming focal points. This is linked to a number of problems.

- The accumulation of research subsidies (Bsik, Smart Mix, FES funds), the growth of European research funds and the corresponding obligations which continue to be a point of friction result in excessive regulation of the system. The scope of programme-based funding is in danger of surpassing the absorption capacity of the knowledge infrastructure in some areas.
- All additional resources are used in programmes. At the same time, the corresponding problems have put pressure on the scope of the investments. As a result, there is now a danger of gaps opening up in the current academic basis.
- The incidental nature of many of the funding instruments and the short timeline are difficult to reconcile with the nature of fundamental research, which often needs a longer time to mature.
- The many different initiatives to promote the formation of focal points in science have caused widespread unrest. Different instruments were used at the same time, often for overlapping purposes. A lack of overview and the rampant growth of measures resulted in high transaction costs.

## **3.2 Knowledge as capacity and knowledge as product**

### **Current state of affairs**

#### ***Strong emphasis on economic returns on knowledge investments***

Like other investments, investments in knowledge and innovation are supposed to yield sufficient returns. The emphasis of the debate about this issue has increasingly shifted towards economic returns. Political interest in knowledge valorisation, expressed as the economic exploitation of research, has increased significantly in recent years.

### ***More attention for valorisation***

This has had consequences for public research institutes. Besides TNO (Netherlands Organisation for Applied Scientific Research) and the major technological institutes, where valorisation has been a traditional responsibility, the universities are now also being taken to task more strongly for their responsibility in valorisation. The 2004 Science Budget announced that valorisation would be incorporated in the funding system. This resulted in the introduction of the Smart Mix and a flow of incidental resources for valorisation purposes. Money was also designated for professionalisation of the patent policy at the institutes, and NWO included a valorisation task in its strategy memorandum. The Casimir scheme was instituted to improve the exchange of researchers between business and knowledge institutes.

### ***A new division of labour is needed between knowledge institutes and businesses***

In the meantime, businesses have been reducing their fundamental and central R&D in recent years in favour of development-oriented research. Their research and development efforts increasingly take place in concert, working in more or less open networks with universities and other companies. As a result, businesses are focusing more intensely on knowledge as a product and becoming more dependent on their surroundings for knowledge as capacity.

### **2007 coalition agreement: CDA - PvdA - CU**

The government identifies weaknesses in the development of our knowledge as capacity and takes steps to deal with them. Besides intensifying direct and indirect government funding for university research, the following agreements were reached.

- “The growing shortage of technicians and technology experts demands a targeted approach. A ‘technology, education and the labour market’ taskforce will be appointed and asked to offer advice on this issue and take action.”
- “Recalibration of standard immigration policy in accordance with the memorandum ‘Towards a modern migration policy’ will be developed in a multi-year programme for immigration on behalf of the labour market and by continuation and further improvement of the policy on ‘knowledge migrants’. A review will be conducted to determine whether the amount of legal dues presents unnecessary obstacles to these groups. If so, the amount of these dues will be adjusted.”

The government, as a customer of the business community, will promote innovation.

- “The potential promotion of new, innovative techniques will be taken into consideration in calls for tenders issued by the national government. The government will strengthen its position as a launching customer.”

### **AWT assessment**

#### ***Emphasis on economic returns is too one-sided***

To some extent, the emphasis on economic returns has resulted in one-sided science policy. The balance is threatening to tip towards (technical) knowledge as a product. For example,

a great deal of attention goes to producing knowledge which can be patented. This takes place at the expense of knowledge as capacity and of open access to scientific knowledge in the public domain. Underinvestment in knowledge as capacity is not immediately noticeable, but it undermines the capacity to absorb knowledge in the future. This development also reveals insufficient awareness of the importance of research in the humanities and social sciences.

### ***Knowledge valorisation primarily takes place through knowledge workers***

Knowledge valorisation is not the exclusive domain of knowledge as a product. A great deal of knowledge finds its way to practical application because researchers take their skills with them to their next job. This knowledge, which is generally implicit, moves along with the researchers. It is “walking knowledge”. This phenomenon has as yet received insufficient acknowledgement in policy. Extensive attention is paid to formal forms of knowledge exchange in which all the partners have their own contribution to make, but much less to personnel mobility and how the careers of knowledge workers develop.

### **Valorisation goes through various channels**

Traditionally, a great deal of the knowledge developed at universities is part of the public domain. However, in recent times, the amount of freely available knowledge they produce seems to be falling. They are increasingly generating knowledge in the framework of research contracts with third parties. Universities have set up commercial research organisations and technology transfer offices to serve that purpose. This is associated with positive aspects for knowledge valorisation.

Still, we should not overestimate the value of such initiatives. Openness in science is also an effective way to allow knowledge to flow to the users. Businesses often prefer this method to a formal transfer of knowledge through negotiations and contracts.<sup>9</sup> There have been good experiences using a people-centric approach. The continued flow of knowledge is facilitated when research focuses more on developing knowledge and skills for which there is a demand in the market, when academic degree programmes spend more time on entrepreneurship and when universities focus more on students who have an interest in enterprise. This type of people-centric approach also fits with “Open Innovation”, in which innovations are developed in open networks.<sup>10</sup>

### ***Developing competencies deserves more attention in science policy***

Knowledge as capacity enables people to navigate through an increasingly flexible and dynamic labour market. Replacing job security with work security requires people to develop more and more competences. This, too, is an argument in favour of increased attention on knowledge as capacity.

### ***Applying innovation policy to the entire process***

While science policy should be more aware of knowledge as capacity, innovation policy should look more to knowledge as a product. This policy still focuses intensely on knowledge and technology development as the “front” of the innovation process, while obstacles and opportunities throughout the process should receive attention. It is precisely in those later stages of the innovation process when it is all about moving from proof of

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<sup>9</sup> See Arundel and Bordoy (2006).

<sup>10</sup> See Allott (2005) who argues in favour of this for the English universities.

principle to proven concept that targeted support can make an important contribution to innovation. Innovation policy should focus less exclusively on stimulating the development of new knowledge and more on translating it into application within an integral approach.<sup>11</sup>

### **3.3 Autonomy and guidance**

#### ***The government is increasingly distant***

##### **Current state of affairs**

Over the past few years, the government has been increasing the autonomy of many public research institutes. They have been put at a distance whilst receiving more incentives to perform well. Many companies are also experiencing more competition due to increasingly accessible international markets and stricter anti-trust policies. Direct guidance has been replaced by indirect guidance, administrative authority by market influence. The public interest is served less by decree and more by guiding through funding.

##### ***Insufficient streamlining in indirect guidance***

In practice, an indirect approach to guiding research institutes and companies has proven less than easy. The national government aims to achieve certain goals without infringing on the autonomy of parties in the field. To date, they have primarily attempted to achieve results by deploying additional financial resources (Bsik, FES funding, Smart Mix, etc.). This has resulted in rampant growth of earmarked funds and budgets and in soaring transaction costs and administrative burdens for both the government and the institutes.

##### ***Substantive expertise in the government is eroding...***

Placing many public research institutes at a distance has also meant that the government places a different value on substantive expertise. Civil servants in contact with research institutes increasingly act as process experts. The skills needed to manage processes effectively are increasingly replacing substantive knowledge of how things work. This development is intensified by the increasing rotation of civil servants within the national government.

##### ***...while the demands placed on it are increasing***

In the meantime, the government's need to guide research institutes and companies in specific directions has only increased. They are required to take the lead in all sorts of transition processes, e.g. in the area of energy or the environment. Agreements are also made in a European context, in which the government is placed in a leading position requiring extensive expertise. This could, for example, involve creating selected lead markets by means of government tenders, standardisation and regulation.<sup>12</sup>

#### **2007 coalition agreement: CDA - PvdA - CU**

This government, more so than the previous coalition, has stated its intention "to generate widespread support for its policies [...] to enter into dialogue with public, civic organisations and other government bodies." This proposed adjustment to its methods is apparent in the plans for the economy, entrepreneurship, knowledge and innovation:

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<sup>11</sup> See AWT Advisory Reports 64, 66 and 68.

<sup>12</sup> See document on the Finnish presidency of the EU (2006).

- “Enterprises, civic organisations and institutions and the people who work there deserve the trust and the room to develop themselves to the fullest.”
- “Effective cooperation and exchange between universities, universities of professional education, knowledge centres and the business community enhance the innovative capacity of our economy. Herein lies an important social responsibility for institutes of (professional) education and for employers.”

The government aims to introduce improvements in steering and financing in higher education, but the plans in that area have not yet been finalised:

- “After consulting the education sector, a single new, integrated Bill will be introduced in the short term for funding and directing higher education and research. This Bill will address quality improvements and the position of vulnerable programmes. It will also contain uniform, simple and feasible funding rules which can combat illegitimate funding and do justice to the position of the student. The proposed legislation on learning rights will be postponed pending the introduction of this bill.”

## **AWT assessment**

### ***Trust the professionalism of the field***

### ***Increase expertise in the government***

The AWT is of the opinion that trust in the self-determining capacity of autonomous parties in the sector should be the point of departure for science and innovation policy. When needed, guidance by means of financial incentives and consultation (i.e. a “policy-rich dialogue”) would be preferable. However, a series of conditions must be met. The first condition is sufficient knowledge and expertise on the part of the government. In order to offer effective guidance and direction, you must be able to make a substantive contribution to a dialogue.

### ***Set indicative frameworks***

A second condition is the existence of indicative frameworks. Such frameworks are not yet sufficiently developed for the research system. Progress has been made in some respects (key areas, promoting focus and mass). The “policy-rich dialogue” between the government and the semi-public and private parties in the sector is beginning to emerge. However, increased clarity is urgently needed in the following areas.

### ***For scope and areas of academic excellence...***

- *The desired scope and depth in actual scientific practice.* Having concentrated its efforts in public research on promoting focus and mass, the government has (inadvertently) created the impression that it is no longer necessary to maintain the full scope of the core disciplines. It should be clear from the discussion above that the AWT has a different opinion. In any case, the government should clarify this issue. In addition, the government should work with the education sector to choose focal points that will be stimulated in the coming years.

### ***...positioning institutes...***

- *The degree to which tasks are differentiated among research institutes.* In recent years, the government has tried repeatedly to steer research institutes using financial instruments. These instruments were not infrequently open to a broad range of institutes (universities, KNAW and NOW institutes, TNO and the major technological institutes). This has led to uncertainty about their mission and profile. It would therefore be advisable to redefine the positions of the public research institutes.

***...competition and cooperation...***

- *The balance between competition and cooperation.* Research institutes are encouraged to compete more in many areas (e.g. funding), while being required to cooperate more in other areas (focus and mass). A clear vision on the balance between competition and cooperation is urgently needed, both in the Netherlands and in the context of international relations.

***...and internal systematic responsibility***

- *The role of the government itself.* Finally, the government should clarify the extent of its systematic responsibility. A lack of clarity in this area may mean that important tasks are neglected or that institutes feel abandoned.

At this time, the lack of clear frameworks and direction in the main themes leads to confusion and mistrust in the sector, to excessive regulation of some parts of the system and insufficient regulation of others, to a lack of coordination between various parties and to departments that overload the system with ad hoc measures and incidental funding.

### **3.4 Stability and dynamics**

***Research funding has become highly dynamic...***

**Current state of affairs**

***...through the growth of indirect and contract research funding and through matching***

The knowledge and innovation system has become more dynamic in recent years. Research funding and innovation subsidies are increasingly the subject of competition, awarded on a temporary basis. Indirect government and contract research funding have increased significantly faster than direct government funding. In addition, the matching obligations of these sources of funding place serious demands on direct funding. With regard to the funding of the Dutch public research institutes (TNO, DLO and the major technological institutes), the basic financing has been largely replaced by output financing. This sometimes involves contracts for which institutes compete.

***Increasing dynamics in the world of business***

In the business community, the international integration of financial markets and the stronger legal position of shareholders have intensified the dynamics. The short-term orientation of shareholders may well be at odds with the long-term perspective needed for innovation. On the other hand, the emphasis on returns may also offer incentives for more rapid innovation. This is one of the driving forces behind Open Innovation. As a result of this profit incentive and the fact that knowledge more rapidly becomes outdated, businesses tend to leave knowledge "on the shelf" as little as possible, actively marketing the knowledge at their disposal.

## **2007 coalition agreement: CDA - PvdA - CU**

In essential areas, the new government promotes dynamics in the economy and society. Entrepreneurship is facilitated in all sorts of ways, also receiving more attention in the education sector. Better access to risk-bearing capital is promoted.

- “Independent enterprise will be encouraged. The transition from employee to entrepreneur and back will be made easier. Starting an independent company in addition to a contracted position will be encouraged, in part through fiscal incentives. Particular attention will go to starting companies in old, disadvantaged neighbourhoods.”
- “Entrepreneurship will receive more attention in education. The inclusion of the subject of entrepreneurship in the curriculum will be promoted. Cooperation between professional education and the business community will be encouraged to facilitate a better connection between education and professional practice.”
- “Existing venture capital schemes will be combined and used more effectively, aimed at providing starting entrepreneurs and developing businesses with effective access to the capital market. The availability of micro-credit for starting entrepreneurs will also be improved.”

Furthermore, the necessary stability and long-term orientation, for example, are taken into account in research funding.

- “The natural gas revenues will dry up in 2025, but the Netherlands will continue to have ambitions in the area of FES-worthy investments even after 2025. A new system of revenue and expenditure will be formulated that is more stable (fixed feed) and has good criteria aimed at investments that strengthen the economic structure (which considerations will include: infrastructure, knowledge and innovation, renewable energy, water management, investments in spatial planning).”

## ***Research and innovation require perseverance***

### **AWT assessment**

Increased dynamics are accompanied by major advantages. Producers adapt more rapidly to user preferences and resources are distributed more efficiently. On the other hand, research and development also require stability. Research needs to mature and innovation requires perseverance. Investments do not bear fruit until years later. This demands a financing and personnel policy with a long timeline. Moreover many investments never yield results, particularly if we look exclusively at knowledge as a product. A sound distribution of returns and risks requires a portfolio approach.

## ***Increasing dynamics in research financing would destabilise the system***

The AWT is of the opinion that increasing dynamics in financing for public research would destabilise the system. Financing has already become much more dynamic over the past 20 years, including allocations from direct government funding. Matching is a burning issue for successful university research groups. It places excessive demands on the investment capacity of the institutes, thus undermining the future strength and quality of the Dutch knowledge infrastructure. Increasing dynamics in direct government funding would not be recommended. Positive results can be expected from a thematic and programme-based distribution of research funding in the innovation policy.

## ***More dynamic research careers would be preferable...***

In other respects, introducing greater dynamics in the public research system would be advisable. Young researchers often have limited career opportunities due to the lack of promotion among older staff members. The laborious growth of multidisciplinary and interdisciplinary research also indicates a lack of dynamics. After all, new developments often emerge on the cutting edge between fields of science.<sup>13</sup> Adjustments in the career policy at research institutes and in the development of research programmes would be advisable,

***...as would increased appreciation for multidisciplinary research and valorisation***

and adjustments in how the quality of research is assessed, in order to create more leeway for developing multidisciplinary and interdisciplinary research programmes. Knowledge workers in the public research system should also receive a less one-sided assessment of their contributions to creating new knowledge, no less than their contributions to knowledge diffusion and valorisation.

## **4 Conclusions and Recommendations**

### **4.1 Conclusions**

#### ***Recent policies offer perspective, but need fine-tuning***

Many new policies have been set in motion in recent years to facilitate the more effective performance of the knowledge and innovation system. The AWT can already see the initial results of these policies in various fields. However, we also see some areas in which developments are progressing too slowly, moving in the wrong direction or going too far. We have summarised the key areas for attention below.

#### **Areas of scope and focus**

##### ***Maintain absorption capacity***

- More efforts are needed to maintain a broad foundation in research. Internationalisation makes the capacity to absorb knowledge increasingly important. That is why no gaps can be allowed to open up in the current academic basis.

##### ***Work toward excellence***

- Forming focal points is a necessity. More investments need to be made in proven strengths. This is how the Netherlands will maintain its own niche in the world while ensuring a basis for competitiveness.

#### **Knowledge as capacity and knowledge as a product**

##### ***Focus on knowledge as capacity in science policy...***

- Science policy needs to focus more attention on knowledge as capacity. This is increasingly important to ensuring efficiency and self-reliance in the business community

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<sup>13</sup> See AWT, 1+1>2.

and society in general. Despite that fact, it is apparent that the policy still focuses too heavily on developing knowledge as a product.

#### ***...and on knowledge exploitation in innovation policy***

- Innovation policy requires more attention for the innovation process itself. Many companies need support in accessing, combining and applying existing knowledge, developing and launching new products and collaborating with other companies and with potential users.

#### **Autonomy and guidance**

##### ***Build on trust and offer clear frameworks***

- The government needs to build more on trust. Offering clear frameworks for the division of tasks and responsibilities in the public knowledge and innovation system and assuming autonomy within those frameworks should be the basic principles of the science and innovation policy. The government could put more trust in the intrinsic motives of professionals who run the knowledge and innovation system.

##### ***Invest in expertise in the government***

- More expertise and practical knowledge are needed within the government. Where public interests are in question or where issues require coordination at national level, the government needs to take responsibility and accept an active role. In many cases, this demands more expertise and practical knowledge than the government currently possesses.

#### **Stability and dynamics**

##### ***Stable research financing...***

- Financing for scientific work requires more stability. Research often takes a long time to mature and long-term financing generally needs to be secured in advance.

##### ***...and dynamic careers***

- The careers of university researchers need to be more dynamic. University careers are less appealing due to a lack of career prospects.

#### **4.2 Recommendations**

##### ***The coalition agreement is highly promising; our recommendations add the finishing touches***

The AWT has observed with satisfaction that the CDA, PvdA and CU parliamentary parties focus heavily on knowledge and innovation in the coalition agreement of February 2007. The new coalition has developed plans that are largely in keeping with the views of the AWT (see the previous chapter). However, there are some aspects of the intentions in the coalition agreement that could still be fine-tuned and supplemented. We address these aspects in our recommendations.

##### ***Invest in direct government funding for university research***

**1 To the Minister of Education, Culture and Science: Invest more in the knowledge infrastructure across the entire spectrum and with a view to the long term.**

***Invest in primary funding***

Ensure more stability and long-term perspective in research financing. Spend the majority of additional funding on intensifying direct government funding for university research.

**2 To the Minister of Education, Culture and Science: Develop specific focal points in science.**

***Strengthen the areas of academic excellence***

Strengthen the areas of academic excellence in the Dutch knowledge infrastructure. Ensure that this takes place based on a vision of the Netherlands' place within Europe. Encourage research institutes to work on profiling and cooperation. Promote focus and mass in scientific research where needed by provided systematic financing.

Assign systematic responsibility for forming scientific focal points to a single organisation, preferably NWO. Have NWO allocate a significant percentage of its budget to promote focus and mass. To facilitate this, participate in NWO's new strategic plan for 2007-2011 (e.g. development of National Research Initiatives).

**3 To the Minister of Education, Culture and Science: Use a broad definition of quality in research.**

***Value multidisciplinary approaches and valorisation***

Maintain the Netherlands' capacity to absorb and use knowledge developed elsewhere. This is not achieved by assessing researchers exclusively on the basis of advanced – generally monodisciplinary – scientific knowledge, which is published in leading journals. Ensure that the evaluation protocols also allow leeway for knowledge geared towards practical application. Ensure that researchers can also be rewarded for contributions they make toward valorisation, in part by appreciating the benefits of mobility. Increased attention and appreciation for multidisciplinary research would be advisable in this context.

**4 To the Minister of Education, Culture and Science: Lend more substance to systematic responsibility.**

***Clearly state what the government expects from institutes***

Start with a basis of trust that research institutes have the necessary expertise and ask them to account for their work. Set clear frameworks within which the various institutes have to operate. Avoid blending functions when it is neither functional nor productive. Clarify tasks and goals in the new Science Budget. Conduct a "policy-rich dialogue" with each of the institutes regarding their place and function within the system and regarding their strategic agenda.

**5 To the Minister of Economic Affairs: Maintain the key areas approach.**

***Ensure that the key areas policy is sustainable***

Strengthen the key areas policy by making more resources available for this purpose. Make sure that this policy does not become restricted solely to research co-financing. Maintain an overview of the entire innovation chain and be prepared to intervene as needed. Ask the businesses and knowledge institutes that are directly involved to work in consultation with the government to set priorities based on a shared vision for the future and for the European and global context.

Ensure an open and transparent approach, incorporating input from all the relevant parties. This should include an exploratory study of each key area. Transparency is served by streamlining the current model. It would be best to put responsibility for a single overall assessment in the hands of a single, independent committee.

**6 To the Minister of Economic Affairs: Focus attention on the infrastructure for knowledge diffusion.**

***Encourage knowledge diffusion among SMEs***

Do not gear innovation policy only towards the development and initial application of knowledge, but also on the diffusion of innovations and the absorption of knowledge. To that end, intensify the “knowledge diffusion infrastructure” for SME appliers (Syntens, SME centres) and cooperation with branch organisations. Promote the mobility of researchers between various knowledge institutes and between the knowledge infrastructure and the business community. Expand the scope of measures such as the Casimir grant for personnel mobility and the knowledge vouchers. In this context, focus more attention on the users of innovations and on non-technical knowledge, such as innovations in services.

**7 To the Minister of Economic Affairs: Highlight innovation in other economic policies.**

***Evaluate the effects of innovation policy measures***

Systematically evaluate the effects that policies for competition, intellectual property, education, the labour market (employment protection), the capital market and government financing have on innovation and innovative capacity. Explicitly state these effects as assessment criteria in the existing Business Impact Report.

**8 To the members of the new Innovation Platform to be established: Concentrate knowledge development on social priorities.**

***Have the Innovation Platform concentrate on social priorities***

Take systematic and significant steps to ensure knowledge development and application on behalf of renewable energy, health care and water management. Improve coordination between public and private players and ensure a clearer, more transparent process of coordination between public bodies in allocating resources. Ensure better coordination in investments aimed at scientific excellence and pay more attention to what is happening in the European context.

**9 To the Ministers of sector departments: Encourage innovation on the demand side.**

***Inspire innovation using tenders***

Challenge market parties and knowledge institutes to innovate by setting standards and creating challenging requirements for tenders on government assignments or, for example,

environmental policy. Induce a shift in cultural paradigm: focus less on ensuring that government employees prevent errors and more on ensuring that they utilise opportunities. Share best practices for innovative procurement and expand the scope of calls for tenders.

**10 To all Ministers: Value substantive knowledge and ensure that best practices are applied in the government.**

***Invest in expertise and encourage innovation among the ranks***

Ensure that each Ministry has its own explicit knowledge strategy, headed by a top official of the Ministry. Emphasise substantive and practical knowledge more in the personnel policy. Compete with the private sector for the most qualified personnel. Use a special procedure in high-priority areas to take a flexible approach – involving competitive terms of employment – to attract the right people.

Also ensure identification and dissemination of best practices. Government organisations can achieve a great deal by implementing innovations available from elsewhere. This could include using ICT applications to increase transparency, improving interaction with the public, processing information more efficiently and effectively and supporting decision-making processes.

Accordingly, the AWT recommends that in the forthcoming government's term of office a balance be achieved in policy to enable our knowledge and innovation system to overcome the challenges it encounters.

Drawn up in The Hague, March 2007

J.F. Sistermans, chairman

Dr. P. Baggen, acting secretary

## **Elaboration: the economic rationale for active innovation policy**

### **1 Introduction**

*“Providing a ‘road map’ with which the policy-maker can ultimately make the only and accurate choice is an impossible request. Economics is both a science and an art. The trick will always be to apply the fruits of science satisfactorily.” (C.N. Teulings, A.L. Bovenberg and H.P. van Dalen, De Calculus van het Publieke Belang [The Calculus of Public Interest], June 2003)*

The AWT believes that the government should have an active innovation policy that goes beyond simply creating favourable conditions and using generic instruments. Two components are characteristic of this active innovation policy:

- Offering integral support for innovation processes (and therefore also “staying closer to the market”);
- Concentrating efforts and resources on strong economic clusters (“backing winners”).

A plea from the AWT in favour of an active innovation policy is nothing new. It can be seen in nearly all the advisory reports that the Council has published in recent years and is a guiding theme underlying this report as well. These notes to the advisory report, prepared by council employees Paul Diederer and Rens van Tilburg, indicate in economic terms why the AWT believes that active innovation policy would be advisable.

In these notes, we first describe how the AWT uses the terms “integral support” and “backing winners”. This latter definition may deviate in some areas from the programme-based approach used by the Ministry of Economic Affairs and the key areas approach used by the Innovation Platform. Then there is the question of whether the Dutch government should maintain such a policy based solely on a market failure perspective. We indicate which forms of market failure occur and how an active innovation policy responds to those forms. We then take a look at the legitimacy of the government’s role in this from a somewhat broader perspective. This leads to the qualification of market failure as the sole reason legitimising government intervention. A less rigid application of the market failure criterion shifts the perspective on government policy from “no, unless market failure can be demonstrated” to “yes, as long as the policy is effective and efficient”. The AWT supports this latter perspective.

### **2 What is an “active innovation policy”?**

According to the AWT, an active innovation policy contains two elements: integral support for innovation processes and concentrated deployment of effort and resources in the strongest areas of the economy. The AWT sees this active policy as a supplement to generic policy that creates the necessary conditions, which should of course lie at the foundation of the innovation policy. Good innovation policy starts with clear, constructive conditions and requires ample support for scientific research and pre-competitive R&D.

#### **What does it mean to have “integral support” for innovation processes?**

The AWT considers innovation policy that offers integral support to innovation process to be policy that not only takes action in relation to pre-competitive research, but also supports processes that take place “closer to the market”. This could include government policy that:

- Not only focuses on the development of knowledge, but also on the diffusion and application of knowledge, e.g. via demonstration projects.

- Is not only supply-driven by targeting R&D, but also supports the connection to demand and facilitates interaction with potential users.
- Not only supports technological research and technological development, but also offers support in other areas, such as developing and organising innovative networks and mobilising commercial, legal and other expertise.
- Not only subsidises, but also responds to the demand for information, knowledge transfer and advice, regulation (e.g. in the form of standards), coordination, mediation and direction.
- Not only facilitates, but also plays an active role in bringing parties together and providing support in developing plans, finding partners, making agreements, developing trust, building cooperation or arranging commitment, for example.
- Supports not only pre-commercial research (“proof of principle”), but also high-risk development, which cannot generally get commercial financing (through to “proven concept”).

The Netherlands does have an active and integral innovation policy to some extent, but is too cautious, too reserved. The gap between the point where government guidance and support ends and normal entrepreneurial risk starts is still too great.

#### **What is meant by “backing winners”?**

In the backing winners strategy, the government deploys its resources by concentrating on those areas in which the country excels in the international arena, both scientifically and economically. In essence, backing winners is about innovation policy that builds on proven strengths, facilitating areas in which private parties have proven in the past that they can innovate successfully. In practice, it has become apparent that there are a fair number of misconceptions about the policy line proposed by the AWT. It is therefore important to emphasise the following points:

- *The market determines who the “winners” are; the government follows that selection.*  
The AWT does not propose a policy in which the government makes the choice, but one in which the government follows the choices made by the business community and knowledge institutes by investing part of its innovation resources. Businesses and knowledge institutes which can rely on a certain track record are invited to make that tangible and to work in concert to develop a strategic plan in order to strengthen their position in global markets. The government decides to offer its support on the basis of criteria which are related to proven innovative capacity, cooperation and future prospects.
- *The challengers in a strong area will also receive extra support.*  
It is not our intention that the backing winners strategy should result in cutting out innovative challengers who present unexpected alternatives or are operating in other fields. The challengers and market entrants should also have access to programmes or be able to use incubator facilities and knowledge diffusion instruments, for example. A policy of backing winners should not evolve into supporting dominant companies which have more or less acquired a monopoly.<sup>14</sup>

### **3 Why have an active innovation policy?**

One of the principles often put into practice is that the government should not intervene and set policy unless three conditions have been met:

- It involves a public interest (legitimacy);
- The implementation of policy serves that public interest (effectiveness);
- The benefits of this policy outweigh the costs (efficiency).

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<sup>14</sup> As argued by Aghion and Howitt (2006) (see section 3.4).

We will discuss below whether the first of these conditions has been met: is an active innovation policy legitimate? This discussion will not consider the effectiveness or efficiency of the policy instruments that have been used.<sup>15</sup>

One question that this principle raises is: What is a public interest? Many economists are inclined to search for the answer to this question in market failure: a public interest is involved if the market fails.<sup>16</sup> "The reasoning is then as follows. The Dutch economy is organised as a market economy. To the extent that the market economy operates effectively, it makes a positive contribution to the prosperity of the people. In that case, the market serves the public interest. There is then no reason for the government to intervene. However, markets do not always work perfectly. Markets fail."<sup>17</sup>

### **Market failure**

Although market failure is a term that has gained widespread popularity in the world of policy, the literature is not entirely unanimous on what the term actually means. Markets are considered to have failed if their coordination mechanism does not lead to a Pareto optimal result, if the total potential of society is not maximised.<sup>18,19</sup> Various lists of forms of market failure are circulating in the literature. The following categories of market failure are often defined:

- *Imperfect competition* leads to market power (the formation of monopolies and cartels as a result of access inhibitors or collusion);
- *Externality* occurs when private parties take action or enter into transactions that have negative or positive consequences for other players who are not involved in the decisions about these actions and transactions. In the case of negative externality, these uninvolved players experience a "burden" and there is room to improve prosperity by offering them some degree of protection. In the case of positive externality, they benefit (as free-riders) and there is room to improve prosperity by forcing them to make contributions;
- *Imperfect information and uncertainty*, when combined with the possibility that others will behave opportunistically, leads to high transaction costs or the failure to agree on mutually beneficial transactions. Transaction costs in this context could include the costs of gathering information (searching, monitoring, quality assessment, etc.), taking decisions (negotiating, considering the factors) and ensuring guarantees (effectuating contracts and agreements, enforcing property rights). In addition, transactions could fail to take place due to hold-up (relationship-specific investments) or due to inappreciable characteristics beforehand (adverse selection) or the threat of reckless behaviour afterwards (moral hazard).<sup>20, 21</sup>

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<sup>15</sup> We acknowledge the concerns regarding the effectiveness and efficiency of the available instruments and of the approach used in practice, but we also see that a learning process is still taking place.

<sup>16</sup> And keeps failing. In many cases, the market itself presents solutions for forms of market failure. Or, as some Americans state enterprisingly: "Every market failure is a business opportunity."

<sup>17</sup> The phrasing here comes from Theeuwes (2004).

<sup>18</sup> Market failure occurs when the total social capital is not maximised. The concept does not say anything about how that capital is distributed in society. *De Calculus van het Publieke Belang* [The Calculus of Public Interest] recognises that the acceptability of the resulting distribution of income (and therefore of capital) may constitute separate grounds for legitimising government intervention. We support this view.

<sup>19</sup> Another question that is relevant here concerns the possibility of assessing the extent of the market failure – that is necessary in order to determine how strong the policy response should be in order to compensate for the failure. It will come as no surprise that quantifying and assessing market failure in relation to innovation processes is impossible in practice (and is wisely never actually attempted, despite the fact that demonstrating market failure is valued so greatly).

<sup>20</sup> A full exposition of this dogma would require much more text and explanation than is available here.

<sup>21</sup> One well-known coordination shortage for many transactions is adverse selection: the salesman is more capable of assessing the value of his goods than the buyers (as in the market for second-hand cars). Because the buyer lacks the ability to appraise the goods, he takes into account that he might be buying a lemon (e.g. a bad car) and is only willing to

There are also other categories of market failure. Some consider the existence of public goods (goods characterised by non-competitive and non-excludable use) to be a separate form of market failure.<sup>22</sup> The most important problem for public goods (as for common-pool goods) lies in their non-excludability. This is an external factor. Others distinguish specificity (the hold-up problem) and uncertainty (adverse selection, moral hazard) as separate forms of market failure, but do indicate that they are also specific forms of externality (missing markets).<sup>23</sup> *De Calculus van het Publieke Belang* [The Calculus of Public Interest] reduces all market failures to forms of externality:

*"The representation of public interest is thus not much different from the internalisation of externalities by restricting free-rider behaviour using the force of public law." and "To safeguard a public interest, a society 'chooses' between coordination via the market or via political decision-making, in which the institution that has the lowest transaction costs is preferred." (ibid.)*

### **Market failure and innovation policy "closer to the market"**

The fact that stimulating R&D is part of innovation policy is hardly subject to debate. The consensus is that a certain amount of support is justified due to the positive externalities arising from private R&D (knowledge spillovers). These positive external effects will cause private players to invest less in R&D on their own initiative than would be preferred from society's point of view.

An integral innovation policy that is also closer to the market provides support that benefits specific individual entrepreneurs more. Opponents of this policy claim that the results of activities closer to the market are less likely to enter the public domain. If the benefits all go to the individual entrepreneur, there is no reason to provide support from public funding. In that case, it would be up to the company to make the investments itself in advance. Support should go to where the external impact will be greatest. Support close to the market only disrupts market influences.

### **External effects close to the market**

We believe that knowledge spillovers do not occur exclusively in the pre-competitive stage of the research and development process, nor are they limited to the technical aspects of the innovation process. In that context, we note the following aspects:

- Innovation processes that are close to the market, where it concerns combining and applying existing knowledge or achieving innovations in organisation and design, are accompanied by external effects. Competitors learn from pioneers in the sector. Innovations that enter the market reveal knowledge that had been only tacitly implied before that point. It is unsurprising that second movers and early adopters often profit more from an innovation than the pioneers.
- Where the technical aspects of innovations can still often be protected using patents, changes in organisation and logistics, new business concepts, innovations in style and design and new ideas for software applications can generally be copied without any problems. The protection of intellectual property is difficult here. This type of innovations accordingly generates a great deal of spillover.<sup>24</sup>

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pay a small amount. The salesman is not willing to sell his best quality for that low amount, so he does in fact pass off a lemon. This makes it impossible to negotiate for good quality.

<sup>22</sup> According to Theeuwes, op. cit., referring to textbooks by Lipsey and Courant (1996) and Pindyck and Rubinfeld (1998).

<sup>23</sup> For example, the Netherlands Bureau for Economic Policy Analysis (CPB) distinguishes between these two in *Challenging Neighbours* (1997) as separate forms of market failure.

<sup>24</sup> There is a trade-off between the scope of intellectual property and the scope of knowledge spillovers: as intellectual property can be established on more aspects, fewer spillovers take place. However, a broader application of intellectual

Looking at it from the other side: while the results of pre-commercial research may be available to everyone, the group of players that can actually use it profitably is generally very limited. Why should pre-commercial research receive public funding if the number of people who could potentially profit from it is limited? Those capable of absorbing the results of pre-commercial research often constitute a very small group. The question here should be: what is the public interest?

### **Information problems**

An additional factor is the fact that externalities are not the only reason why the market fails. Innovation often demands a complex process of interaction between diverse players. This process is characterised by all sorts of information problems. Innovation is naturally accompanied by tremendous uncertainty: not only is there a lack of insight into future developments (technical options for implementing an innovation, practical options for production and distribution, commercial prospects, as determined by cost and market developments, learning curves and opportunities for improvement), but also the efforts of others (the quality of the input, openings for opportunistic behaviour). In joint innovation efforts, considering the necessity of making relationship-specific investments, incomplete property rights, the potential for moral hazard and the risk of a failure to generate profitable actions and transactions, these latter factors lead to market failure.

One practical example of market failure as a result of information problems is the phenomenon that entrepreneurs have difficulty convincing banks to finance innovation processes. It is well known that the capital market fails at providing financial resources to bring the innovation process from proof of principle to proven concept. This is particularly true in the case of SMEs and large innovation projects. This is a result of incomplete and asymmetric information, combined with a lack of sureties that an entrepreneur can put up for a line of credit.

### **Market failure and backing winners**

Backing winners is a form of specific innovation policy. It makes a distinction between players that operate in a field acknowledged as strong and those that do not. In the discussion on the legitimacy of this policy, the question arises as to the market failure that justifies making this distinction between players.

### **External effects: strong areas absorb more knowledge spillovers**

If the legitimacy of government support rests on the argument of externalities (i.e. the results of innovation also go to parties that did not contribute – potential free-riders – with the result that companies will invest too little in R&D and innovation on their own initiative), then a policy of backing winners could be legitimised by the fact that innovation processes in some areas of business generate more knowledge spillovers than in others. However, we have no indications that knowledge spillovers (on the margin) differ between areas of business, technology or geography.

We do not believe that the Netherlands should give more public funding to some sectors than to others simply because there are systematically more spillovers there than in other sectors. We think that the Dutch government should provide the funding because there is greater domestic absorption capacity for those spillovers in some areas in the Netherlands than in others. In sectors where the Netherlands is strong and has a broad spectrum of strong players, it profits disproportionately from knowledge spillovers generated in the

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property rights also involves costs for registration and enforcement and delays the diffusion process. The US has chosen a different balance than Europe: it is possible to claim intellectual property rights for more immaterial innovations there.

Netherlands and internationally.<sup>25</sup> This is partly due to the expertise (knowledge as capacity), which determines the extent to which knowledge can be understood, assessed, assimilated and processed. It is also partly due to the available production and distribution capacity, which determines the options for rapid economic exploitation of the knowledge absorbed. Profiting from knowledge spillovers is intensified where agglomeration effects are involved.

### **Agglomeration effects**

An agglomeration effect is involved when similar companies or companies in the same sector base their activities in close geographic proximity to each other. The phenomenon of agglomeration has been known since the Middle Ages, when tradesmen practising the same craft and belonging to the same guild chose to settle in the same areas of the cities. These effects are still relevant today. A comparative study by Spanish economist Ciccione (CREI) on agglomeration effects in the US and EU showed that they occur equally in both parts of the world and are also highly significant: "a large part of regional productivity differences can be explained by agglomeration effects. In fact, agglomeration effects appear to be more important for explaining regional productivity differences than, for example, education."<sup>26</sup>

Companies often specialise within agglomerations. A market emerges offering a diversity of specialised service providers, who in turn boost the productivity of the cluster. The higher density of related businesses and knowledge institutes increases competition between those involved, thus enhancing the selection of successful companies and innovations.

The emergence of business agglomerations is stimulated by knowledge spillovers, which are often highly localised. The transfer of tacit knowledge between people takes place via personal contacts. The dissemination of skills and the transfer of tacit knowledge between organisations often depend on job mobility. Contacts are more intensive and job mobility is higher within agglomerations in which people encounter each other face to face. The growth of an agglomeration or cluster is a self-propagating effect (snowballing). Every subsequent addition of a new player to an established network increased the number of potential contacts and profitable interactions. The development of agglomerations and clusters contributes to the development of sustainable comparative advantages in an economy.

### **Information problems**

External effects are not the only factor involved. Information problems also give reason to provide more support for companies in large, strong clusters than those in other areas. The information problems are greater in these areas, precisely due to the size and diversity of the clusters. Innovative clusters are areas of business that are, almost by definition, characterised by a range of complementary players that are all present in the Netherlands: businesses in different links of the supply chain, research institutes and universities, knowledge brokers, financiers and service providers. They face the challenge of shaping innovation processes in a network context. The interaction between all these parties is rife with information problems that complicate cooperation. This is to a large extent the reason for market failures in these sectors.<sup>27</sup>

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<sup>25</sup> In technical terms: If the national contribution of companies' R&D efforts to the supply of knowledge in the international public domain increases proportionately to the number of domestic companies, then the national absorption of knowledge from this international domain increases quadratically in relation to the number of domestic companies.

<sup>26</sup> See <http://www.crei.cat/research/opuscles/op9ang.pdf>.

<sup>27</sup> Some prefer to characterise system failure as faulty interaction between players in the system. Where the interaction between parties does not resemble market interaction, as is sometimes the case in the interaction between knowledge institutes and companies, there is something to be said for this.

In the case of innovative clusters, we see two forms of market failure that occur more frequently here than elsewhere: knowledge spillovers and information problems related to cooperation. These issues demand extra consideration in policy. The extra consideration when setting policy could include not only granting R&D subsidies, but also generating information (e.g. by means of regulation, by promoting standardisation, by safeguarding contract assurance), promoting transparency, facilitating cooperation or acting as an independent mediator. However, in this area, as in so many others: businesses have to make it happen on their own first. The government should impose the requirement that sectors must demonstrate sufficient self-organising capacity to deal with information and coordination problems before it acknowledges those sectors as strong areas and offers extra support.

### **Why an active innovation policy at this particular time?**

The discussion about the necessity of a (more) active innovation policy is nothing new. However, several dominant developments have increased the relevance of an active innovation policy:

- *Increasing Open Innovation.* Innovations are increasingly developed in more or less open networks. In more and more cases, innovation is a complex process involving various parties, posing challenges and obstacles of a technical nature but also of an organisational nature. Innovation is often simply a matter of creating clever combinations. This makes developing and maintaining networks that have sufficient size, diversity and openness an important condition for innovation. Many of the obstacles in the innovation process lie in coordinating many different parties with diverse interests, each contributing its own expertise and services. An integral innovation policy helps to overcome these obstacles.
- *Internationalisation makes specialisation unavoidable.* An approach of backing winners focuses policy on those areas that will produce the highest yield from a national perspective. As a small country, we cannot do everything. Besides promoting a generally favourable economic climate and setting generic innovation policy, it is therefore advisable to make an extra effort for the areas in the Netherlands with the highest potential. Given the scarce resources, choices on where to invest will have to be made regardless, on the basis of limited information. A policy of backing winners does mean that the information about past successes bears some weight, besides the value of convincing plans for the future.

## **4 A broader perspective on legitimacy**

We started this discussion based on the statement that market failure involves a public interest. We looked at our society as a market economy, an economy in which the market mechanism ensures coordination of economic behaviour and allocation of production factors, goods and services. Economic relationships are trading relationships between free players. The guiding principle is the concept that the government should abstain from interfering as long as the market functions properly. In this section, we question this view. Society is more than just a market economy and relationships between people are not restricted to market relations.

### **Network failures and system failures**

Coordination, motivation and allocation in the private sector are not only regulated and directed by the market mechanism. Other institutional mechanisms also play a role: hierarchies and social networks.<sup>28</sup> Hierarchy (coordination through power relationships) is

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<sup>28</sup> Institutions are often broadly defined as: "sets of common habits, routines, established practices, formal and informal rules, laws that regulate relations and interactions between individuals and groups of actors". In *Challenging Neighbours*, the Netherlands Bureau for Policy Analysis (CPB) distinguishes between four institutional mechanisms: competition,

the primary coordination mechanism used in organisations. Social networks coordinate behaviour by using social standards (mutual trust, reciprocity, loyalty) and sanctions (exclusion). They not only play a role between individuals within organisations, but also between organisations. Economic relationships between players are not solely a matter of market relations; they also involve social and hierarchical relationships. The failure of the social network or the hierarchy may well offer grounds for public intervention, just as the failure of the market mechanism to generate a Pareto optimal level of prosperity does.

Although there is no broadly accepted theory of network failure, a number of possible elements of such failure would seem obvious. Social networks are vulnerable coordination mechanisms. Relationships are engaged on the basis of reciprocity and trust. In a world of uncertainty, social networks offer a sort of insurance policy for the future. However, they always operate under threat of opportunistic behaviour. Social networks are stable if partners trust each other, if they expect to need each other more often in future and if it is uncertain who might be able to do something for whom in future. Trust is built up over time and is the result of investments: accepting postponement of short-term profits by not being opportunistic. Networks fail due to a lack of trust; in that case, mutually profitable initiatives and activities never get off the drawing board. The government can intervene in this situation by creating certainties: establishing rights, safeguarding agreements, demanding transparency, bringing players into contact with each other, creating a positive atmosphere, propagating values and enforcing standards, or helping to develop social capital.<sup>29</sup> Besides network failures, there are also other types of system failure that may legitimise government intervention, such as lock-in and path dependency.<sup>30</sup>

### **The definition of a public interest is a political choice**

Our first step was to argue that having an active innovation policy is legitimate from a perspective of market failure. Our second step was to state that the perspective of market failure is too restricted: our economy is more than just a market economy. Social mechanisms that do not have the same characteristics as markets are also important to ensuring that the economy works in the way it should. Those social mechanisms can also fail, thus legitimising government intervention.

For our last step, we return to the beginning of this section, to the concept that government intervention is only expedient if three conditions have been met:

- It involves a public interest (legitimacy);
- The implementation of policy serves that public interest (effectiveness);
- The benefits of this policy outweigh the costs (efficiency).

Let us consider the first condition: policy intervention is only permitted if a public interest can be demonstrated. Many economists state that a public interest is only involved if the market fails. The underlying concept here is that the government should not interfere with something that is essentially a private matter. Players (people, organisations, companies) are

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control, common values and norms, and cooperative exchange (in which the latter occupies an intermediary position in relation to the other three).

<sup>29</sup> Example: in the recent change to the Dutch Civil Code, the liability of the seller was extended in an important way, even after the transaction has been completed. The change in the Civil Code reduces the problem of adverse selection (consider the example of hidden defects in the market for used cars in footnote 21) by offering the buyer recourse to retrieval. This reduces the transaction costs for good-quality products in the market (from Teulings et al. (2003)).

<sup>30</sup> Human behaviour is not only characterised by bounded rationality (caused by our incapacity to take in and process all the relevant information during decision-making processes), but also by irrationality (systematic deviations from rational behaviour – examples include time inconsistency and framing effects). Innovation processes are by nature complex and uncertain and involve a long timeline. Irrationality in decision-making processes concerning innovation may lead to a systematic imbalance between the actual social capital and the potential capital – this is also a form of failure that may offer grounds for government intervention.

in principle free to do whatever they want. Governments should not get involved in their actions unless private behaviour has consequences for third parties.<sup>31</sup> If one is to argue that government intervention is legitimate, then the first step is to demonstrate the existence of a public interest, because the market has failed.

The question is whether it would not be possible to do without that first condition. Why shouldn't the second and third conditions be sufficient? If policy is effective and efficient, then it is expedient to implement the policy. If it is effective, then it works; if it is efficient, its benefits outweigh its costs. Is policy not automatically legitimate and warranted if those two conditions are met? In that case, not implementing the policy would mean ignoring the chance to achieve Pareto efficiency for prosperity.

Why add the separate requirement that market failure must be demonstrated? This would seem to arise from putting individual freedom at the forefront: government interference is only permitted if it is possible to demonstrate unequivocally that free interaction between players does not lead to optimal prosperity. There is something to be said for that position, but assigning absolute value to individual freedom is a political choice. Equating public interest to market failure is not an objective basis. What is considered legitimate is normative. This puts legitimacy on an entirely different order than effectiveness.

In that sense, the Scientific Council for Government Policy (WRR) is much more open in *Borging van het publieke belang* [Safeguarding the public interest] in its definition of a public interest: a public interest is what the politicians designate as such – it is a political decision. With regard to the legitimacy of science and innovation policy, the AWT follows the WRR in this line. Since strengthening the innovative capacity of our economy is a political desire that has been formulated clearly, any policy that attempts to achieve this objective is legitimate.

This leaves only the second and third conditions: if active innovation policy is effective and efficient, then it is expedient to implement the policy. Given the complex nature of the policy, it is not possible to ascertain this in advance. Effectiveness and efficiency can only be determined by trial and error, in part because the development and implementation of this policy involves a learning process. Both effectiveness and efficiency will change over time.

### **Conclusion**

This leads the AWT to the conclusion that active innovation policy is expedient. It is legitimised because it deals with market failure. It is also legitimised because it offers an answer to network failure and system failure. Finally, it is legitimised because we have decided democratically to take the political choice to promote innovation in private companies. On these grounds, the AWT believes that the guiding principle for active innovation policy should not be: “no, unless market failure exists” to “yes, as long as it proves to be effective and efficient”. The latter principle can only be ascertained by trial and experimentation for a sufficient time period.

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<sup>31</sup> This is clearest where it concerns the external effects of actions and transactions. With some leeway, it is possible to see how this can also be the case if favourable actions and transactions fail to be created due to information problems. However, in that case the consequences of the problem are much more likely to fall on private parties that miss out on all sorts of benefits, while the collective only encounters indirect effects.

## **annex 1**

### **Dialogue partners and project staff**

#### **The Netherlands:**

Wijzen Committee Mr A. van der Hek  
Wijzen Committee Mr W. Zegveld  
Ministry of Economic Affairs Mr J. Broerse  
Ministry of Economic Affairs Mr H. de Groene  
Ministry of Economic Affairs Mr I.B. Ostendorf  
Ministry of Economic Affairs Mr T. Roelandt  
Ministry of Economic Affairs Ms C.C.H.M. van de Werk  
Ministry of Education, Culture and Science Mr J. Bartelse  
Ministry of Education, Culture and Science Ms F. Heijs  
Ministry of Education, Culture and Science Mr R. Roborgh  
Ministry of Education, Culture and Science Ms G.R. Valenti  
SenterNovem Mr J.B.M. Heijs  
Scientific Council for Government Policy (WRR) Mr W. van den Donk  
Scientific Council for Government Policy Mr A.C. Hemerijck  
Scientific Council for Government Policy Mr B. Nooteboom

#### **Finland:**

Gaia consulting, Helsinki Ms M. Hjelt  
Kitewing, Espoo Mr J.E. Luther  
Nexstim Ltd. Helsinki Mr J.P. Särkkä  
Science and Technology Policy Council Mr K. Husso  
Science and Technology Policy Council Mr E. Seppälä  
Tekes Ms P. Kyläkoski  
Tekes Mr J. Romanainen  
Tekes Mr P. Peltonen

#### **AWT project staff involved:**

Peter Baggen, Paul Diederer and Rens van Tilburg

## annex 2

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