

SHAPING THE FUTURE

FROM OPTIMISATION TO TRANSFORMATION



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From optimisation to transformation

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Summary

The Netherlands is facing urgent challenges on a number of fronts: climate, food, energy, mobility and care, and the Dutch government's ambition is to address all these challenges. Innovative solutions are needed to make the Dutch economy and society future-proof and sustainable, in order to maintain the high levels of prosperity and welfare the Netherlands enjoys. Those solutions will not simply materialise unaided; and they will demand radical changes in Dutch society.

Transformations will be needed in many areas: fundamental changes in farming methods and food production, in mobility, in energy use and in health care, for example. All these 'societal systems' will need to be overhauled.

Science, technology and innovation will play a key role in these transformations. Scientific knowledge is needed to discover how the societal systems that we wish to change function, and to enable well-founded, evidence-based decisions to be taken. Technology and innovation are essential for the development of technological and non-technological solutions needed for the necessary changes. Transformations can be far-reaching in their impact, but also offer many new opportunities. Demand for new, sustainable products, processes, services and lifestyles will lead to new research, new forms of economic activity and more employment.

The Netherlands has many tools at its disposal to promote science, technology and innovation. It is also a world leader with its mission-driven innovation policy. This is already delivering good results, but it is not enough if we genuinely wish to change course and accelerate the necessary transformations.

Advice: Target policy more at transformation rather than optimisation of existing systems

To speed up the necessary transformations, innovation policy will need to focus more on what will be needed in the future. The present policy reinforces existing processes, structures and interests, with little attention for the fundamentally different perspectives that are necessary to address the major societal challenges we face.

The required transformations are complex and have many interactive components. This demands an approach that combines clear direction, clarity of vision, perseverance and decisiveness. Although some positive steps have been taken, for example in the National Energy System Plan for 2050 (NPE), there has been little or no progress in other areas. There is a tendency to hold on too long to the familiar and try to optimise existing systems. As a result, societal challenges – such as the nitrogen problem – quickly come to be seen as acute crises. This crisis approach gives rise to strong resistance in society,

treats the symptoms rather than the causes, reinforces the status quo and ultimately delays the necessary transformations.

Innovation policy needs to be slanted more heavily towards transformation than optimisation of existing systems. The Advisory Council for Science, Technology and Innovation (AWTI) sees a number of reasons for this.

Existing systems are resistant to radical change

The mission-driven approach to innovation in the Netherlands is the culmination of a strong tradition of the 'polder model': a consensus-based system between public and private sector actors. Established parties sit round the table to take decisions, with the principal focus on the earning capacity of the Netherlands. This approach leaves little room for new players and challengers or for non-technological knowledge input. It thus builds on earlier successes, with existing practices and principles being unquestioned. The result is incremental improvements and optimisation of the status quo. This in turn increases the risk of lock-ins: earlier decisions or investments focused on a certain direction reinforce continued progress in that same direction and impede different – and better – solutions. It also means that little attention is given to dismantling non-sustainable practices, making radical change virtually impossible.

Lack of an inspiring future vision and clear choices

Successful transformations require the development of lots of new and uncertain initiatives and the upscaling of promising solutions. It is also vital to move away from existing paths which are not sufficiently future-proof. To encourage this, and to give parties the confidence to take the necessary steps, a clear and appealing future vision is required, something that is currently lacking. Without such an overarching vision, it is impossible to gauge the impact of choices made in one domain on other, related domains. The lack of a vision for the future also has another consequence, namely undermining public support for transformations. It is high time to make choices, so that everyone can orientate themselves towards achieving them: researchers, entrepreneurs, companies, civil-society organisations, civil servants and society as a whole.

The government makes too little use of smart demand stimulation

The main thrust of the Dutch government's knowledge and innovation policy entails generic stimulation of the supply side: all innovations are welcome. The assumption is that societal challenges will naturally form a market for innovations. The reality is that markets are often absent or insufficiently developed, making it unattractive for companies and investors to invest in innovation. Stimulating adoption and demand is therefore essential for the development and dissemination of innovations. The government's actions on this point leave something to be desired. Fear of creating a worse business

climate for (large) companies causes the government to seek to stimulate adoption and demand mainly through grants and subsidies, which have a number of inherent drawbacks, for example stimulating demand for non-sustainable options (the 'green paradox' and the 'rebound effect'). They also tend to favour existing and established technologies and are not equally accessible for all companies. Subsidies and tax breaks can also undermine public support, because they are paid for by taxpayers but the (international) owners of large companies reap the benefits. Too little use is made of other instruments such as pricing (charging more for non-sustainable services or products), standardisation (introducing stricter standards and rules for services or products) and innovation-driven procurement and tendering.

Complex policy mix offers little direction and impedes cohesion

In AWTI's view, the current extensive policy mix aimed at stimulating knowledge development and innovation is not ideal for promoting transformations. There are too many parallel schemes targeting similar goals, leading to fragmentation. There is also an almost total lack of incentives aimed at the long-term, upscaling is problematic and the links between generic innovation policy and sectoral policy are weak. This leads to high transaction costs, especially for smaller, young businesses, civil-society organisations and citizens. A separate advisory report to be published by AWTI after the present report will look in more detail at the current policy mix and advise on what is needed to strengthen the focus on transformation.

The government makes too little use of the innovative strengths of society

Collaboration is crucial for finding practicable solutions to complex societal challenges: between 'theory and practice', but also across disciplinary and sectoral boundaries. To date, however, the government has paid too little attention to the many collective, 'bottom-up' initiatives aimed at finding innovative solutions to challenges in the fields of energy, food and agriculture, care, mobility and the environment. To make matters worse, these collective initiatives also face a number of obstacles, including almost no access to the innovation support system and difficulty upscaling. They lack money, are too dependent on volunteers, have difficulty professionalising and have to deal with strangling red tape.

The government makes too little use of subject knowledge

The government and politicians also need greater substantive knowledge about the various domains, technologies and innovations so that they can develop policy which exploits opportunities whilst taking into account societal aspects such as fairness, safety and ethical considerations. This will create a better understanding of the underlying problems, generate a greater insight into the relationship with other societal challenges,

standards and interests, and engender more realistic expectations about currently available and future solutions. Knowledge and expertise can moreover help them deal with pressure from lobbyists.

Four recommendations for a transformative approach to innovation

AWTI advises the government to target its innovation policy more firmly on what will be needed in the future. To translate this advice into practice, AWTI makes four recommendations.

Not all research and innovation policy needs to be focused on transformation; generic promotion of research and innovation is very helpful in strengthening the Netherlands' knowledge base and competitiveness. On the other hand, progressing and accelerating the necessary transformations requires a genuinely transformative approach to knowledge and innovation.

Recommendation 1: Offer an inspiring vision for the future based on clear choices

AWTI recommends that government and parliament build a future vision for the Netherlands. That vision will act as a compass and a magnet for researchers, entrepreneurs, companies, civil-society organisations, citizens and civil servants. It will create clarity around future markets and generate more support for innovations which align with the chosen development pathways. This in turn will give companies and investors more confidence in the development and implementation of innovations, and will give citizens confidence and greater certainty to develop initiatives themselves and switch to sustainable innovative solutions.

Radical transformation of societal systems requires government and parliament to take the initiative and display leadership in setting a course. To build this vision for the future, parliament will have to make a number of clear choices on what the Netherlands considers important, what deserves priority and how different values and interests should be weighed against each other. The government must take the lead, organise the development of the future vision in dialogue with society, integrate the different perspectives and think through the consequences.

Recommendation 2: Use pricing and standardisation to foster transformations

AWTI recommends that the government make more use of pricing mechanisms (carbon pricing, eco-taxes or true pricing) and standardisation. These are proven effective instruments for accelerating transformations and should therefore form part of a transformative approach to innovation. In the first place, they make non-sustainable trajectories less attractive or even close them off entirely. Second, pricing and standardisation stimulate demand for more sustainable alternatives. Fears that

standardisation and pricing would adversely impact the Netherlands' competitive position are unfounded. The international context is both relevant and complex, but this should not prevent the government from investigating and deploying these measures. This will require coordination at EU level.

Recommendation 3: Make better use of the knowledge and innovative strengths in society

The advocated vision for the future can only become a reality if it is approached in close collaboration with companies, researchers, civil-society organisations and citizens. The government therefore needs to create improved conditions for societal initiatives and co-creation so that better use can be made of the knowledge and innovative strengths present within society. The government itself also needs more knowledge and expertise regarding the underlying problems and challenges for transformations.

Government and parliament must ensure that politicians and civil servants possess adequate substantive and transformative knowledge and skills. To achieve this, it is vital that the government takes the steps outlined by AWTI in its earlier advisory report State of knowledge (Rijk aan kennis) (2021). AWTI also recommends that a Chief Scientific Advisor be appointed at every government ministry; under the leadership of a Government Chief Scientific Advisor, they will provide the Prime Minister and the entire cabinet with scientific advice.

Recommendation 4: Develop a transformative policy mix

Turning the vision for the future into reality and setting in motion the requisite transformations and system changes requires a clear, cohesive mix of policy measures. AWTI recommends taking a number of guiding principles as a basis, for example no longer being led solely by the future earning capacity when designing policy instruments, and judiciously deploying the policy mix at the right time over a period of several years to align with the different phases of the transformations. This allows sufficient scope for early-phase development and stimulating major upscaling and dissemination of promising innovations, with incentives for upscaling and measures for downscaling where necessary. Both the supply of and demand for innovations need to be stimulated. AWTI will set out specific advice on a transformative policy mix in a separate advisory report.

Transformations not happening quickly enough

The Netherlands is facing urgent challenges on a number of fronts: climate, food, energy, mobility and care, and the Dutch government's ambition is to address all these challenges.¹ Innovative solutions are needed to make the Dutch economy and society future-proof and sustainable, in order to maintain the high levels of prosperity and welfare the Netherlands enjoys. Those solutions will not simply materialise unaided; and they will demand radical changes in Dutch society.

Transformations will be needed in many areas: for example, fundamental changes in farming methods and food production, in mobility, in energy use and in health care. All these 'societal systems' will need to be overhauled. The achievements of the present innovation policy are impressive, but the necessary transformations are not happening well enough or – especially – quickly enough.

1.1 Transformations have an impact but also offer opportunities

The Dutch are becoming increasingly aware of the urgent need to tackle major societal challenges. The Netherlands has followed the European Commission in setting significantly more stringent climate ambitions and translating them into specific, measurable targets which are anchored in the Climate Act.² A steady stream of authoritative reports has made clear that measures which will have a deep impact on society need to be implemented rapidly in order to achieve the targets for nature and the climate.³ There are also other areas where the Netherlands is running up against the buffers; there is for example a shared recognition both in Dutch society and within the care sector that it is currently no longer possible to maintain a good standard of

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1. See e.g. the Coalition Agreement 2021-2025 'Looking out for each other, looking forward to the future' ('Omzien naar elkaar, vooruitkijken naar de toekomst'), but also the details in specific areas in e.g. the National Energy Plan for 2050 (Nationaal Plan Energiesysteem 2050) and the National Rural Area Programme (Nationaal Programma Landelijk Gebied (NPLG)).
 2. See <https://www.rijksoverheid.nl/onderwerpen/klimaatverandering/klimaatbeleid>; <https://wetten.overheid.nl/BWBR0042394/2020-01-01>
 3. See e.g. Sociaal-Economische Raad (2022); Andres et al. (2022); PBL et al. (2022); IPCC (2023); Expertteam Energiesysteem 2050 (2022 and 2023); Rijksoverheid (2023a); Wetenschappelijke Klimaatraad (2023); ESABCC (2023); Planbureau voor de Leefomgeving (2023).

universally accessible care.⁴ There is also fierce competition for the scarce land needed to build more homes, businesses, infrastructure, as well as for the transitions in relation to energy, climate adaptation and the circular economy.

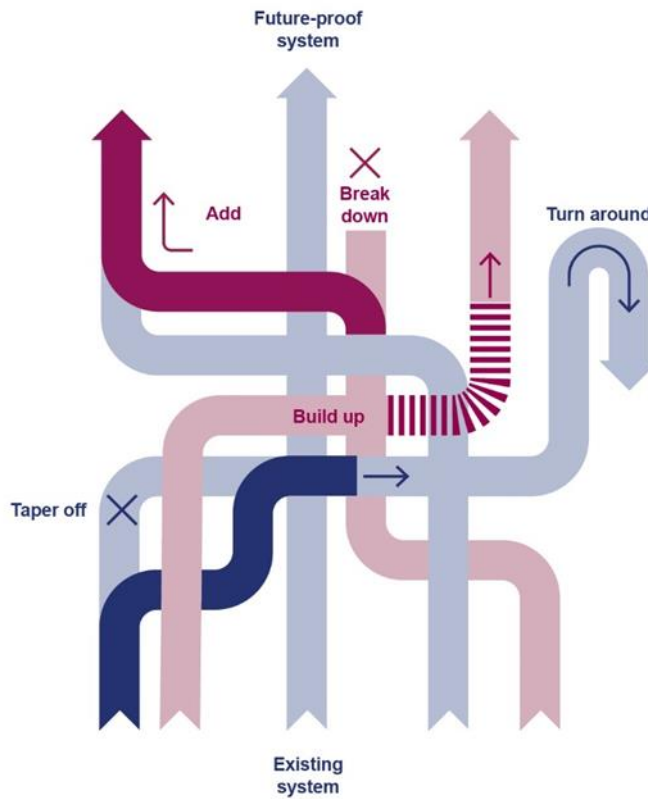
If the Netherlands is to tackle the urgent societal challenges, it is vital to progress towards targeted transformations⁵ of the societal systems. Transformations⁶ are radical fundamental changes in the structure, culture and infrastructure of those systems, which go further than 'normal' changes.⁷ They are characterised by uncertainty about what the world will look like after the transformation and also about the routes used to get there. Established, familiar paths within systems have to change; this can have a major impact and meet with resistance. Technological innovations are needed, as well as new ways of thinking, working and organising. Just as important is the need to change, phase out and discontinue existing patterns and working methods (see Figure 1). Societal systems are systems that are related to the 'needs' of society, such as food, energy, education and mobility. They consist of actors (organisations, groups, individuals), materials (products, technologies and infrastructures) and rules (regulations, values, norms and customs).

Science, technology and innovation play a key role in transformations.⁸ Scientific knowledge is needed to understand how the societal systems we wish to change function, to underpin collective decisions about them and to find new solutions. Technology and innovation (both technological and non-technological, see Box) are essential for developing complete or partial solutions for change. In doing so, science, technology and innovation help the efforts to change course with a view to creating a society that is resilient and agile, which strengthens its prosperity and welfare (for both present and future generations) and which offers quality of life to people within and beyond the national borders. Transformations can be radical, but at the same time offer momentum and new opportunities. The demand for new, sustainable products, processes, services and lifestyles leads to new fields of research, new economic activity

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4. Raad voor Volksgezondheid & Samenleving (2023); Wetenschappelijke Raad voor het Regeringsbeleid (2021).
 5. In contrast to transformations and transitions which occur more organically and are often more gradual, such as secularisation, globalisation and digitalisation. This does not mean that they appear out of thin air: they are often interrelated and form part of more fundamental changes in society.
 6. The term 'transition' is regularly used as a synonym for 'transformation'. In this advisory report, AWTI prefers the term 'transformation' in order to stress that a number of fundamental, lasting and deep changes are needed in various societal systems, the outcome of which is not certain in advance. For an explanation and background, see Hölscher et al. (2018).
 7. For the academic basis of transformations and related concepts, see Geels (2002); Geels & Schot (2007), Geels (2020), Rotmans (2003), Loorbach (2007), Kerr et al. (undated), Schot & Steinmuller (2018), Diercks et al. (2019), Grin et al. (2010), Hebinck et al. (2022), Rip & Kemp (1998). Rotmans & Verheijden (2020); Rotmans & Verheijden (2020).
 8. AWTI (2020b).

and employment. Transformations thus constitute the engine powering a resilient and agile economy.

Figure 1. Transformations: Building up and breaking down



A broad interpretation of innovation and innovation policy

AWTI regards innovation as activities which lead to new or significantly renewed products, services, processes or methods that are available for users or have been implemented.⁹ Innovation may be technical, but can also occur in organisational processes, business models and in the social domain. Innovation is often the result of collaboration between companies, entrepreneurs, knowledge institutes, civil-society organisations, public authorities, residents and consumers (see Figure 2). Fundamental research, applied research and experimental development are important sources of innovation, but not the only ones: organisations can also buy in external knowledge and equipment to drive innovation in their processes and products.¹⁰

Innovative societies are more productive and more resilient, better able to deal with change and create general prosperity for everyone. Innovation generates economic growth and helps improve the tasks and services performed by public bodies and civil-society organisations. Innovation also helps resolve societal challenges, and it is this purpose of innovation, in particular, which is the central focus in this advisory report.

AWTI believes that promoting innovation requires an integrated policy mix for the necessary transformations, which cuts across departmental dividing lines. AWTI sees research and innovation policy as comprising all government initiatives, measures and interventions aimed at fostering knowledge development, knowledge dissemination and innovation and mitigating the problems that impede the innovation process. These are enabling, financial and organisational instruments¹¹ which fall within the remit of the Ministry of Economic Affairs and Climate Policy (business and innovation policy), the Ministry of Education, Culture and Science (science policy) and the Ministry of Finance (tax policies). There is also policy aimed at promoting knowledge and innovation to achieve a specific policy objective under the responsibility of specialist ministries such as the Ministry of Infrastructure and Water Management and the Ministry of Agriculture, Nature and Food Quality.

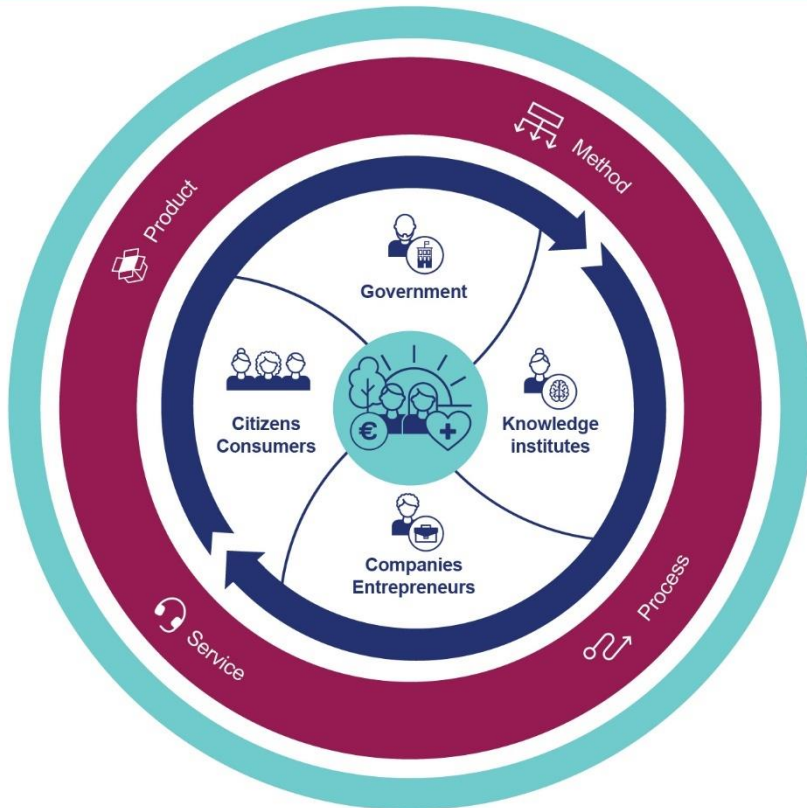
This advisory report and the recommendations in it are framed against this broad mix of policy for fostering and facilitating innovation.

9. OECD & Eurostat (2005); OECD (2015a).

10. Rathenau Instituut (2023).

11. See CPB (2016/2020).

Figure 2. A broad interpretation of innovation



1.2 Lots of promotion of innovation, but no genuinely transformative policy

The Netherlands has many instruments to promote science, technology and innovation. Much has already been achieved thanks to these instruments, accelerating the existing and exploring the new; but it is not enough to achieve a genuine change of course and to realise the necessary transformations quickly enough.

1.2.1 Innovation policy achieves impressive results

The Netherlands is one of the most competitive and innovative economies in the world¹² and Dutch science is at the forefront in many respects.¹³ Strengths include digital skills and the ability to embrace digital technologies and integrate them in a range of sectors.¹⁴ The Netherlands also has great creative and entrepreneurial capacity, with lots of start-ups and an attractive and stimulating start-up environment (though there is stagnation in the growth from start-ups to scale-ups).¹⁵ International comparative research shows that the Netherlands scores well on the UN Sustainable Development Goals (SDGs) around welfare and society.¹⁶

The Netherlands is also recognised internationally as a leader in mission-driven innovation policy.¹⁷ Since 2018, societal challenges have guided a proportion of Dutch innovation policy,¹⁸ i.e. policy aimed at achieving specific goals (missions) by mobilising relevant science, technology and innovation at knowledge institutes and companies. Examples of such missions are 'People in the Netherlands spend five years longer living in good health and there is a 30% reduction in health differentials between socio-economic groups by 2040'; or 'Dutch economy fully circular by 2050'.¹⁹ The Dutch

12. In 2023, the Netherlands is in fifth position in the IMD World Competitiveness rankings and takes fourth place on the European Innovation Scoreboard.

13. See Rathenau Instituut (2022).

14. See Global Entrepreneurship Monitor; Global Entrepreneurship Index.

15. See Global Entrepreneurship Monitor; Global Entrepreneurship Index; McKinsey (2022); AWTI (2020c).

16. CBS (2023); Rijksoverheid (2023b).

17. Larrue (2021); OESO (Larrue, 2021) defines mission-driven innovation policy as: '...a co-ordinated package of policy and regulatory measures tailored specifically to mobilise science, technology and innovation in order to address well-defined objectives related to a societal challenge, in a defined timeframe. These measures possibly span different stages of the innovation cycle from research to demonstration and market deployment, mix supply-push and demand-pull instruments, and cut across various policy fields, sectors and disciplines.' For an explanation of different types and developments in innovation policy, see chapter 3 of the preliminary study (in Dutch) 'Transformatiegericht innovatiebeleid', available from www.awti.nl.

18. Goetheer et al. (2018).

19. Minister van Economische Zaken en Klimaat (2023b).

mission-driven approach is linked to the ‘top sectors’²⁰ via the Mission-driven Top Sector and Innovation Policy (MTIB). The missions are specific, measurable and clearly defined and focus heavily on research and development for new technologies, led by research institutes and industry. The approach focuses on solutions and speeds up the quest for whole or partial solutions in the short term. This works well for ‘moonshot missions’: issues which can be readily defined and where the (technological) direction in which the solution needs to be sought is already more or less known (see Box).²¹

‘Moonshot missions’ and ‘ghetto missions’

Thinking in terms of missions has become popular following publications by authors such as the economist Mariana Mazzucato.²² She takes the ‘moonshot mission’ launched by the US president John F Kennedy in the 1960s as a source of inspiration and focus of research for a mission-driven approach to major societal challenges.²³

As well as ‘moonshot missions’ (issues with clear, achievable goals), there are also ‘ghetto missions’ (stubborn problems that are not so easy to resolve). As long ago as 1974, the scientist Richard Nelson wondered why it was possible to put a man on the moon, but not to resolve major societal problems such as poverty, illiteracy and the stubborn persistence of ghettos.²⁴ Many of society’s major challenges can be characterised as such ‘ghetto problems’. They are made up of a collection of different, closely interwoven issues, whereby it is not always clear what the underlying problems are. The proposed solutions are highly diverse and involve many different public and private actors, administrative layers, fields and policy domains. Their values, perspectives, preferences and knowledge claims are also highly divergent. This leads to a plethora of lengthy discussions about problems and potential solutions, but little by way of action or real change. Solutions for one problem can moreover have an impact on another problem in a different area of society, sometimes in the ‘here and now’, but also ‘elsewhere’ and ‘later’.²⁵

20. Top sectors are key industries in which Dutch industry and research has a global reputation for excellence, for example logistics or water management.

21. Mowery et al. (2010); Forray et al. (2012).

22. European Commission (2018); Larrue (2021).

23. Mazzucato (2022).

24. Nelson (1974); Nelson (1978); Nelson (2011).

25. Such problems are also referred to as ‘wicked problems’: persistent, resistant, unstructured and complex problems or challenges. Wanzenböck et al. (2020) give a detailed exposition on the different types of ‘wicked problems’, in which the degree of ‘wickedness’ depends on the degree of controversy, complexity and uncertainty of both the problem and the potential solution pathways.

1.2.2 Insufficient success in changing course

Researchers, companies, governments, civil-society organisations and citizens are working hard in many areas, for example to achieve climate ambitions. While progress is undoubtedly being made, the challenges are many and the issues are characteristic of 'ghetto problems'. Progress is slow and time is limited. There is little consensus about what the precise problem is and about the best solution pathways. The result is that we largely continue to follow the well-trodden paths. As things stand, the Netherlands is not succeeding well enough in changing course towards creating a future-proof society and ensuring the smooth achievement of the necessary transformations.

Despite its relatively good performance on the UN Sustainable Development Goals, the Netherlands is not improving its performance on achieving the various 'green goals'. Moreover, the negative impact of Dutch prosperity on developing countries is considerable.²⁶ Progress in making agriculture more sustainable is too slow to achieve the targets on emissions, biodiversity, water quality and nature recovery. The pressure on the environment has not diminished and biodiversity on farmland has deteriorated further.²⁷ The pace of the energy transition also needs to be stepped up significantly in order to achieve the targeted zero carbon emissions in time.²⁸

Current indications suggest that the Netherlands will find it difficult to meet its targets and ambitions for a future-proof society and economy.²⁹ It will therefore fail to meet its international agreements and be at risk of falling short in making the Netherlands an attractive country with good living conditions and a flourishing economy. To be absolutely clear: the challenges facing society are global in nature, and transformations are therefore needed on a global scale. While the impact on global targets of actions taken by the Netherlands alone may be limited, however, is certainly not nil. Moreover, the Netherlands can set an example by taking a lead; Dutch companies and knowledge institutes can remain competitive and the Netherlands can help developing countries with

26. CBS (2023); Rijksoverheid (2023b).

27. OECD (2023b). In a special report, the European Court of Auditors states that the more than 100 billion euros invested in curtailing emissions via the Common Agricultural Policy in the period 2014-2020 has not led to lower emissions in agriculture. European Court of Auditors (2021); Planbureau voor de Leefomgeving (2023).

28. Andrés et al. (2022); Rijksoverheid (2023a); Minister voor Klimaat en Energie (2023b).

29. PBL et al. (2022); Rijksoverheid (2023a); European Court of Auditors (2023); Planbureau voor de Leefomgeving (2023). The most recent Climate and Energy Survey (Klimaat- en Energieverkenning) by the Netherlands Environmental Assessment Agency (PBL) (2023) shows that the plans set out in the Spring Climate Memorandum could lead to a reduction in Dutch greenhouse gas emissions of 46-57% by 2030 compared with 1990. This brings the statutory climate target of a 55% reduction within reach for the first time, though achieving it will require everything to fall into place: timely and practical development of all plans and supporting policy to create the right framework for legislation and regulation and its enforcement, faster granting of permits and adequately trained staff.

more sustainable alternatives.³⁰ As a prosperous country, the Netherlands also bears a responsibility for a sustainable world, because our 'footprint' on other countries is considerable.³¹

1.3 Request for advice: How can Dutch innovation policy support transformations more effectively?

The Netherlands needs to change course and accelerate the necessary transformation of societal systems. Science, technology and innovation will be essential for this. Despite the wide array of policy instruments and the major efforts made by researchers, companies, civil-society organisations and citizens to deploy innovative solutions, it has so far not proved possible to speed up the requisite transformations sufficiently.

This advisory report accordingly addresses the following question:

What changes in Dutch innovation policy are needed to provide optimum support for transformations?

1.3.1 Creation of this advisory report

This advisory report was created in a number of steps (see Annex 1 for more details). The first step was a preliminary study looking at the development of innovation policy over recent decades and outlining the main dilemmas around the present innovation policy. The report (in Dutch) is available from www.awti.nl. We also carried out a literature review; to translate the insights gleaned from the literature and the preliminary study, we looked in more detail at two different transformations, in the agrifood system and the energy system. AWTI does not base any specific advice on these two transformations, but uses them as examples to help provide a simple and clear representation of the complex reality. We also compiled an inventory of national policy instruments which are relevant for research and innovation around transformations in the agrifood and energy

30. Michael Porter argued in 1991 that strict environmental legislation would not inevitably restrict the competitive advantage of companies compared with foreign competitors, but was more likely to make them more competitive. See Porter (1991) and Porter & Reinhardt (2007). Much empirical research has been carried out since then to substantiate this 'Porter hypothesis'; see Ambec et al. (2010). Anu Bradford (2020) also referred to the 'Brussels effect' to highlight that if certain countries and regions impose stringent rules on companies, those companies will adapt their products and processes to the new standards and regulations, including in their activities in other parts of the world. The size of the market and the economic importance of countries and regions mean it is less profitable or is technically unachievable for companies to adhere to different standards. The result is that a national or regional standard becomes an accepted global standard.

31. Van Oorschot et al. (2021).

systems. Chapter 2 gives a brief outline of the insights gained. AWTI will set out a detailed analysis and recommendations in a separate advisory letter to be published after this advisory report. AWTI also collaborated with the Flemish Advisory Council for Innovation and Entrepreneurship (VARIO) to study transformative innovation policy in a number of countries. The report is available as a background study. In the final phase, all insights gained from the analyses were brought together, interpreted and incorporated into an advisory report. The draft version of the report was sent to two external readers for comment; their comments were subsequently incorporated in the final version under the responsibility of AWTI. The sources used are set out in Annex 2. The definitive text was adopted on 31 October 2023. Annex 3 contains a list of interviewees; we would like to thank all of them for their time, openness and insights.

This report was prepared by a project group consisting of Council members Sjoukje Heimovaara (chair), Ellen Moors and Vinod Subramaniam and staff members Annelieke van der Giessen, Jeffrey de Hoogen and Tara van Viegen. Government trainee (Rijkstraine) Craig Vis worked up the case study on the transformative approach in Sweden (incorporated in the background study).

1.3.2 Structure of this report

Chapter 2 sets out and substantiates the Council's advice: target innovation policy more at what is needed in the future rather than strengthening and reinforcing established processes, structures and interests. Chapter 3 describes what government and parliament can do to translate the recommendations in this advisory report into practice.

Advice: Target innovation policy more at transformation than optimisation of existing systems

To speed up the necessary transformations, innovation policy needs to focus on what is needed in the future. At present, the policy strengthens existing processes, structures and interests. Scant attention is given to the fundamentally different perspectives that are needed to address the major societal challenges we face.

At present, the Dutch government and companies are focused on finding solutions for specific (individual) problems in existing situations, in other words on optimising existing systems for agriculture, food, energy, mobility and care. Scant attention is paid to the deeper causes of the problems and potential new perspectives on them. The necessary transformations are complex and contain many interactive components. This demands a clear overview and setting a pragmatic course, both of which are largely absent at present despite steps being taken for example in the National Energy System Plan for 2050 (NPE). As a result, the present policy comes down to tackling symptoms, reinforcing the status quo and slowing down transformations. As a result, societal challenges – such as the nitrogen problem – quickly come to be seen as acute crises.

AWTI does not argue that all policy around research and innovation should focus on transformation: generic and non-specific promotion of research and innovation is essential for strengthening the Netherlands' knowledge position and competitiveness and for generating unforeseen solutions. However, in order to accelerate the necessary transformations, a proportion of the research and innovation policy does need to focus more on transformations. The Council believes this requires an integrated policy approach which crosses interdepartmental boundaries.

This chapter underlines why a different approach is needed for a proportion of Dutch research and innovation policy. Section 2.1 argues that existing systems are resistant to major change and that existing policy fails to break through this resistance. Section 2.2 describes the lack of a cohesive future vision, meaning that choices that have consequences in different domains are not adequately assessed. Section 2.3 argues that the government engages too little in smart demand stimulation for innovations. Section 2.4 explores the (overly) complex policy mix that has evolved and that does nothing to foster a cohesive approach to innovation. Finally, section 2.5 illustrates that the government makes too little use of initiatives from society and of existing knowledge.

2.1 Existing systems are resistant to radical change

The Dutch approach for using knowledge and innovation to address societal challenges mainly takes the form of mission-driven innovation policy via the Mission-driven Top Sector and Innovation Policy (MTIB), and is the culmination of a strong Dutch tradition of seeking consensus between public and private parties. The mission-driven innovation policy brings together government, the business community, knowledge institutes and other stakeholders to work on specific missions in search of solutions to urgent problems.³² The missions are linked in the MTIB to the ‘top sectors’, i.e. key industries in which the Netherlands excels. Established parties sit around the table, with the principal focus on the earning capacity of the Netherlands; there is little scope for new players or for non-technological knowledge input.³³ This approach thus builds on earlier successes, with existing practices and principles being unquestioned.³⁴ The result is incremental improvements and optimisation of the status quo.³⁵ This is an example of lock-in: earlier decisions or investments focused on a particular direction reinforce continued progress in that same direction and impede different, better solutions. As we shall see later, it also means that little attention is given to dismantling non-sustainable practices. Genuinely radical change is thus rendered virtually impossible.

2.1.1 Established parties currently hold sway way and there is little room for new players

The Dutch consensus-based ‘polder model’ tradition is characterised by mutual support and a search for synergies to capitalise on economic opportunities.³⁶ The flipside of this approach is that it leads to more or less closed circuits in which choices made in the past shape choices made in the present (high degree of path-dependency).³⁷

32. The input of the different parties is brought together in joint Knowledge and Innovation Agendas (KIAs). Government departments can also use the missions as a framework to guide their public input for knowledge and innovation. The Knowledge and Innovation Covenant (KIC) reflects the input and resources pooled by public and private partners for research and innovation based on the missions.

33. See also Wetenschappelijke Raad voor het Regeringsbeleid (2023b) and Denkwerk (2023).

34. See also Van Oers et al. (2021); Van Oers (2019).

35. The European regional ‘smart specialisation strategies’ (S3) are also based on the existing situation and aim at incremental improvements to existing systems. See Schwaag Serger et al. (2023). Building on existing innovation pathways is not by definition negative: research on the chances of success of regional breakthrough innovations show that these breakthrough innovations more commonly occur in regions where they are the result of a combination with knowledge and technology is already present within the region. See Boschma et al. (2023).

36. The OECD also sees this bottom-up strategy as one of the strengths of the Dutch approach Larrue (2021).

37. PBL (2018); AWTI (2018); Denkwerk (2023). The OECD sees this as an important caveat (see Larrue, 2021).

Under the mission-driven innovation policy (MTIB), companies, universities, universities of applied sciences and applied research institutes work closely together and jointly determine the innovation agenda. This is also the usual approach outside the MTIB context for setting joint agendas and activities.³⁸ Not surprisingly, the established participants in the ‘top sectors’ mainly come up with individual technological solutions which match their knowledge and expertise, partly because the policy separates out the missions into constituent problems, with scant attention for the interrelationship between them. The incremental improvements can be readily understood from the perspective of private logic and do deliver useful knowledge and innovations, but can increase path-dependency over the longer term (see Box). AWTI believes that promising solutions do not only lie within the existing networks such as the top sectors.³⁹ The present approach provides insufficient incentive to experiment and search for radical and creative changes; it is not in the interests of established partners to develop solutions that could undermine their position and competitiveness, whereas that is sometimes what is needed. This can delay desirable innovations, for example because established parties devise exceptions and demand customised arrangements.⁴⁰

Example of focus on individual technological solutions and optimisation: making agriculture more sustainable

The Dutch government and the farming industry are keen to use technological innovation to make agriculture more sustainable and ensure that it meets international agreements and rules, including on nitrogen and fine particle emissions. Technological innovations can help curtail specific emissions, for example low-emission stalls or different livestock, but they are nonetheless partial solutions within the existing system. They contribute almost nothing to other objectives, for example on climate, water quality and animal welfare. This leads to optimisation and treatment of symptoms focused on individual problems. Moreover, technological measures drive up the capital-intensity of the sector. This gives rise to new path-dependencies, because the investments have to be earned back. This approach does not result in a transformation of the agrifood system in which the structural problems are addressed,

38. Examples in the Netherlands include the Dutch Research Agenda (NWA), the National Growth Fund (NGF), but also the design of the Agriculture Agreement (Landbouwakkoord) or the Energy Agreement (Energieakkoord).

39. See also Janssen (2020).

40. AWTI (2018); Smink et al. (2015); Wesseling & Van der Voren (2016); Wetenschappelijke Raad voor het Regeringsbeleid (2023b).

for example developing an agriculture system which maximises production at minimum cost without taking into account the social costs.⁴¹

Citizen collectives, professionals, civil-society organisations and public executive agencies currently have little involvement in the collaboration around research and innovation. In theory, radical innovators that do not yet form part of the network of stakeholders could participate; however, if they air a proposal that does not fit in with the established innovation agenda, they will have virtually no chance of being heard. Additionally, private co-funding is a key element of the MTIB.⁴² Civil-society organisations are less likely to have or be able to raise this finance, and especially for research projects that are in an uncertain early phase – precisely where radical innovations begin.

Our societal systems (such as the agriculture system and the energy system) are moreover configured and geared to a way of working which needs to be abandoned if the necessary transformation is to succeed. These systems harbour strong path-dependencies which have produced success over many years, but which pose a problem if society or the market wishes to move in other directions. The advantage then becomes a disadvantage, because making changes become relatively expensive and risky. An example is the structure of the Dutch energy-intensive industry. This relies heavily on the continuous availability of cheap gas, something that enabled manufacturers of metals and chemicals to develop successfully, for example. It is difficult for them to make the necessary switch to different energy sources, because those sources do not as yet provide a constant flow of energy.⁴³ Stakeholders in the agriculture system (farmers, banks, suppliers, customers) also stick to the well-trodden paths, for example because investments already made in a specific method or technology make alternatives expensive and risky. The ‘system-specific path-dependency’ (the whole of material, cognitive, financial and policy choices) creates a system that is stable, but also highly resistant to change.⁴⁴

41. PBL (2018); Transitiecoalitie Voedsel (2021); Van Dijk et al. (2018); Runhaar (2021); Erisman & Strootman (2021); <https://www.uu.nl/achtergrond/landbouwtransitie-als-de-weg-naar-herstel-biodiversiteit>.

42. The co-funding requirement also often applies with other instruments, though was abandoned in early 2023 for the Dutch Research Agenda programme Research along Routes by Consortia (NWA-ORC); see: <https://www.nwo.nl/nieuws/nwo-brengt-focus-aan-nwa-programma>

43. Expertteam Energiesysteem 2050 (2022).

44. PBL (2018); Runhaar (2021); Termeer (2019).

2.1.2 Focus on earning capacity impedes socially desirable innovations

Mission-driven innovation policy incentivises researchers and companies in the top sectors to focus on innovations that also contribute to the Netherlands' competitiveness and future earning capacity.⁴⁵ This also applies with other innovation schemes (see Box). Once again, co-funding is a requirement in all cases; whilst this means that the costs and risks are not borne entirely by the taxpayer, AWTI believes it exacerbates the risk of a focus on developing solutions which serve the interests of participating established companies and top sectors. Additionally, the present earnings models do not compensate the external (societal) costs of subsidies that are frequently granted in the agriculture sector.⁴⁶ This makes it more difficult to realise socially desirable innovations which serve public interests (and parties) but do not contribute directly to earning capacity.⁴⁷

Some system changes and innovations rely mainly on the efforts of public-sector parties to drive and implement them, for example in nature protection, water management and public health. As stated, however, citizen collectives, professionals, civil-society organisations and public executive agencies almost never have a place at the table with the top sectors. It is sometimes necessary to integrate different subsystems to achieve the transformation of a larger system, for example the integration of carbon-free electricity generation and use in the built environment. This need for innovation has to be met mainly by the public sector and requires the development of civil/public-public partnerships. Private sector companies see less of a role for themselves in these arrangements.

More innovation schemes focusing on economic opportunities

MTIB is not the only scheme focused on economic opportunities. The MIT initiative (Mkb-innovatiestimulerend Regio en Topsectoren), which facilitates contributions by the SME sector to societal themes, starts more from the perspective of economic opportunities than of resolving societal challenges. The National Growth Fund is another example; its explicit objective is to support activities that contribute to 'structural and sustainable earning capacity in the longer term', in which the societal pros and cons are weighed against each other. Sustainable here means 'resilient', not green or climate-neutral. The NGF advisory committee puts together a portfolio of

45. Rathenau Instituut (2020); Transitiecoalitie Voedsel (2019); Janssen et al. (2019); Janssen et al. (2022).

46. External costs are costs or losses incurred by third parties as a result of an economic activity. See e.g. Erisman & Poppe (2020); Beers (2016); Homolová et al. (2022).

47. Janssen et al. (2019); OECD (2023b).

proposals which contribute to the sustainable earning capacity of the Netherlands and which support the missions identified by the government.⁴⁸

2.1.3 Too little room for non-technological knowledge

'Key technologies' are an important part of the mission-driven innovation policy, and there is a separate Knowledge and Innovation Agenda for them.⁴⁹ These technologies have a fundamental impact on science, society and the economy, with examples including artificial intelligence, digitalisation and life *science* technologies such as CRISPR-cas and *X-omics*. Key technologies can offer solutions to issues related to climate, energy, agriculture and care.⁵⁰ New ideas on the attitudes and behaviour of people and organisations are however essential if optimum use is to be made of technological innovation. New organisational models, business models, value chains, behaviour patterns, legal frameworks and so on are also essential for speeding up transformations.⁵¹ AWTI believes that knowledge and innovation from the social sciences and humanities are also indispensable here (see Box).⁵²

Although the contribution of that knowledge and innovation is receiving some attention,⁵³ it tends to be seen as supplementing technological innovations from the top sectors. Too little attention is currently given to the need to incorporate knowledge from the social sciences and humanities right from the start, in recognition that it can offer independent scenarios and solutions.⁵⁴

48. See <https://www.nationaalgroeifonds.nl/over-de-commissie>. In fact, the future earning capacity was not decisive in all the proposals selected.

49. Janssen et al. (2022).

50. See AWTI (2020a).

51. Lazo et al. (2023).

52. AWTI will publish an advisory report in 2024 on how the Netherlands can make optimum use of the social sciences and humanities to address a range of issues facing society now and in the future.

53. For example, there is an agenda for key methodologies (KEMs), as part of the KIA for Key Technologies and a KIA for Societal Earning Capacity: <https://maatschappelijkverdienvermogen.nl/> The KEMs are a means of using the social sciences and humanities to address societal challenges, but offer no guarantee that this will be successful in practice, for example if the knowledge deployed is inadequate.

54. Janssen et al. (2022).

Knowledge and innovation from the social sciences and humanities are indispensable

Beyond GDP / well-being

For a long time, national wealth and welfare was measured primarily using gross domestic product (GDP). The limitations of this approach were known, but there was no real alternative. After the financial crisis in 2007-2012, politicians embraced the notion of 'beyond GDP / well-being'.⁵⁵ Instead of measuring progress in terms of rising GDP, this concept more emphatically incorporates ecological and social dimensions as well. More account is also taken of welfare elsewhere, and welfare in the future. The social sciences and humanities play a crucial role in the establishment of this concept (SGW).⁵⁶ The original, criticised economic models are in fact themselves also a product of the social sciences and humanities: the *homo economicus* is a portrayal of humans driven by a rationalist economic model. However, precisely because insights from the social sciences and humanities are a key cause of the problems, they can also make a major contribution to the solution. For example, most of the dimensions and indicators used to measure and understand well-being stem from the social sciences and humanities. This model makes it possible to determine how the Netherlands is faring and thus provides information for governance and policy.

Energy cooperatives

The number of energy cooperatives (which began back in the early 20th century) has increased sharply in recent years, with around 700 currently active in the Netherlands.⁵⁷ They are initiatives by local residents who meet their own energy needs, for example by installing sustainable energy technologies. Energy cooperatives are also organisationally innovative, creating new relationships both between producers and consumers and between citizens and municipalities. The relationship between residents also changes when they work together in an energy cooperative.

55. Since 2018, Statistics Netherlands has published the Monitor of Wellbeing and the Sustainable Development Goals (Monitor Brede Welvaart en de Sustainable Development Goals at the request of the government on Accountability Day (the third Wednesday in May) and the subsequent Accountability debate in parliament. See <https://www.cbs.nl/nl-nl/dossier/dossier-brede-welvaart-en-de-sustainable-development-goals>. Since the 2023 Annual Budget (Miljoenennota), wellbeing has formed part of the budgeting system; see Minister van Financiën (2022).

56. The Wellbeing Index (Brede Welvaart Index -BWI) is an initiative by Utrecht University in collaboration with the RaboResearch research department of Rabobank. See Van Bavel et al. (2019).

57. Klimaatstichting HIER & Energie Samen (2023).

ETS

The Emissions Trading System (ETS) was developed by the European Union, the first and still the largest carbon trading system in the world.⁵⁸ When the system was developed in 2005, it drew on and integrated knowledge from both economics and public administration, and went on to become perhaps the most successful instrument for reducing carbon emissions. The system was improved steadily in successive phases based on reflection and evaluation studies by the social sciences and humanities.

2.1.4 Little attention for phasing out practices which hinder transformations

Promoting the building of new systems and innovations are not enough to ensure that transformations succeed: phasing out and abandoning of existing practices and structures is also essential.⁵⁹ This 'exnovation' breaks down inhibiting structures, interests and path-dependencies and involves a deliberate stepping away from non-sustainable practices and solutions. This creates scope for transformative innovation and opens the way for bottom-up initiatives.⁶⁰

AWTI believes that too little attention is currently paid to phasing out practices which hinder transformations. In fact, a large proportion of the current innovation policy actually sustains research into non-sustainable solutions, for example through tax breaks for research and development (WBSO) and the 'Innovation Box'. Neither scheme by definition contributes to transformative innovations, also promoting for example technologies and innovations based on fossil fuels.⁶¹

National and international analyses show that fossil technologies, products and companies also receive other forms of substantial tax and financial support.⁶² These are

58. See https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/development-eu-ets-2005-2020_en

59. David (2017); David & Gross (2019); Davidson (2019); Van Oers (2019); Heyen et al. (2017); Ongerling (2022). Phasing out is part of the x-curve as used in transition management. See Diercks et al. (2020).

60. Van Oers et al. (2021).

61. Rusu et al. (2021); AWTI (2016); Velzing (2021); Wetenschappelijke Raad voor het Regeringsbeleid (2023b). Innovations can also be promoted by ensuring that products and processes based on fossil fuels are more energy-efficient and produce fewer emissions. This can help in the phase when abandoning fossil fuels completely is not yet possible. The flipside is that it sustains existing path-dependencies.

62. Estimates range from 600 billion to 7,000 billion dollars per year worldwide, and between 4.5 and 46.4 billion euros for the Netherlands. See: Van der Meijden & Withagen (2022);

not mainstream subsidies, but measures such as exemptions, tax deduction possibilities, discounts and compensations. This support can drive up the production and consumption of fossil fuels and the search for new fossil fuels. It can thus lead to higher carbon emissions, but can also make it less attractive to invest in finding sustainable alternatives.

Countering these incentives – as agreed at international level – is complex,⁶³ partly because this form of support for fossil technologies is not readily visible because tax revenues not received do not show up in the budget. There is also debate about what should be regarded as undesirable or helpful support,⁶⁴ there is no uniform framework and not everything is registered, making it impossible to form a complete picture of the extent of the support. Fears that industrial companies would relocate their activities (and therefore the jobs they provide) if the support was removed mean that efforts to phase out this support are half-hearted, despite growing societal pressure.

There are also a number of schemes in the agriculture sector which support and promote non-sustainable practices and therefore have a negative impact on nature and biodiversity. Throughout the world, these kinds of subsidies outnumber subsidies which contribute to sustaining biodiversity. This prompted the United Nations to make agreements during the Conventions on Biological Diversity in 2011 and 2022 on making subsidies that are harmful for nature and biodiversity greener, adapting them or phasing them out. The Netherlands committed to these agreements; however, a recent analysis of 34 different instruments used by the Dutch Ministry of Agriculture, Nature and Food Quality revealed that more than a third of the instruments for agriculture have a potentially harmful effect on nature and biodiversity. Instruments can also have both harmful and positive effects, because they are aimed at several goals, but offer no guarantee that one application or project will contribute to all of them. Harmful effects can arise for example because the instruments encourage intensification and upscaling of agriculture, or because they require heavy investments by the farmer, which can in turn lead to upscaling or intensification in order to earn back the investments. Although some steps have been taken to prevent the harmful effects, there is room for improvement so that

International Monetary Fund (2023); Leefmans et al. (2022); Metten (2021) and (2023); SOMO et al. (2023); Staatssecretaris van Financiën. Fiscaliteit en Belastingdienst (2023).

63. The Dutch government has already announced plans to abolish the degressive tariffs, but this has not yet happened. Despite earlier promises, the Netherlands also still provides export credit insurance to projects in the fossil industry. See Hensen & Lonkhuyzen (2023). There are also some international agreements and guidelines which make it difficult for the Netherlands to withdraw support for the fossil industry; changes can then only be made at international level. See also (in Dutch) Annex 25 'Fossiele Subsidies' ('Fossil Subsidies') to the 2024 Annual Budget.

64. See e.g. Bouman (2023); Brink et al. (2023); Mulder et al. (2023); Van Wijnbergen et al. (2023).

agricultural policy instruments can also have a positive impact on nature and biodiversity.⁶⁵

2.2 Lack of an inspiring future vision and clear choices

Successful transformations require the development of many new, uncertain initiatives and the upscaling of promising solutions, and existing pathways need to be partially dismantled. To promote and steer this, and to give people the confidence to take these steps, an inspiring and clear vision of the future is needed.

AWTI believes that there is currently no inspiring and overarching future vision for the necessary transformations. Whilst recognising that it is difficult to formulate a broadly supported future vision against the backdrop of diverse perspectives and a lack of consensus, the Council believes it is high time to make choices and set radical changes in motion. It is up to parliament and the government to set this ball rolling. Everyone can then focus on the vision for the future: researchers, entrepreneurs, civil-society organisations, civil servants and society as a whole. Without such a vision, the consequences that choices made in one domain have in another domain are not apparent. The absence of a future vision also undermines public support for transformations, as we shall argue below.

2.2.1 Lots of visions in individual domains, but scant attention for interconnections and dependencies

AWTI observes that there are lots of visions, future projections and roadmaps in individual domains, sectors and transitions. However, there is often a lack of an overarching vision which embraces the cross-cutting interconnections and dependencies. Often also lacking is the international dimension and a link to local dimensions. Finally, the focus is mainly on the short rather than the long term.⁶⁶ The Council believes that currently preferred solutions could be rendered ineffective or lead to unintended consequences, and that opportunities for synergy are being missed.

One example is the transformation of the energy system. This concerns not just the production of renewable energy, but also energy use for mobility, in the built environment, in industry and in agriculture. Energy is also closely connected to circularity, entailing more efficient use and distribution of scarce commodities, materials and products. These

65. Rijksdienst voor Ondernemend Nederland (2023b).

66. See Nationaal Klimaat Platform (2023) and Wojtynia et al. (2021) for illustrations relating to energy and agrofood.

connections are insufficiently recognised at present.⁶⁷ Plans are moreover insufficiently based on long-term scenarios for the development of supply and demand for energy in the different sectors.⁶⁸ The focus on short-term goals means that small, relatively easy steps can be taken, but the risk is that attaining these short-term goals makes it harder to achieve the ultimate goal and that investments can turn out to be disinvestments.⁶⁹ On a positive note, the government is taking some meaningful steps in this regard, for example in the new (draft) National Energy System Plan and in the outline for the Climate Plan 2024 and the Environment and Planning Memorandum 2024 (see Box).

The agricultural and food system provides a second example. Here too there is a lack of a coherent vision.⁷⁰ The result is that the sector and the government stumble from crisis to crisis. The problems in this system not only concern issues such as nitrogen, but also greenhouse gas emissions, climate, water, biodiversity, land use, landscape, nature, food safety, health and the earning capacity of an economic sector.⁷¹ The various issues facing agrifood are mostly addressed individually, however; for example, the discussions on the Agriculture Agreement (Landbouwakkoord) focused only on farming, and ignored the relationship with food.⁷² The Ministry of Agriculture, Nature and Food Quality concentrates on agriculture and the Ministry of Health, Welfare and Sport on healthy food; despite recommendations from organisations such as the Netherlands Scientific Council for Government Policy (WRR) (2014), there is a complete lack of joint initiatives for food policy.⁷³

Positive exceptions

The new National Energy System Plan

The National Plan marks the first time the government has set out a cohesive vision for the energy system up to 2050. It makes five targeted choices for the development of the future energy system. Instead of looking at the energy system sector by sector, the Plan also advocates an integrated approach involving four energy chains

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67. Sociaal-Economische Raad (2022); Expertteam Energiesysteem 2050 (2023); Ministerie van Infrastructuur en Waterstaat (2020). In the new climate plans published by the Minister for Climate and Energy Policy, the view on the role of raw materials is also limited to recycled plastic or bio-based plastic. See Minister voor Klimaat en Energie (2023a).
68. Raad voor leefomgeving en infrastructuur (2019); Nederlandse Vereniging Duurzame Energie (2023); Expertteam Energiesysteem 2050 (2023).
69. Raad voor leefomgeving en infrastructuur (2019); Nederlandse Vereniging Duurzame Energie (2023).
70. See e.g. Sociaal-Economische Raad (2021); Vermunt et al. (2022); Klimaat Platform Nederland (2023); Rijksoverheid (2020); Wetenschappelijke Raad voor het Regeringsbeleid (2014).
71. Runhaar (2023); Raad voor leefomgeving en infrastructuur (2023).
72. Kalden (2023).
73. Rijksoverheid (2020).

(electricity, hydrogen, carbon and heat). In working up and implementing the choices made, the government will take into account circularity and commodity use, climate adaptation, the labour market and digitalisation.⁷⁴

Outline Climate Plan 2024

In the outline proposals for the Climate Plan 2024, the government announced that the Plan would focus emphatically on the long-term climate strategy for the period to 2050; it begins with a perspective for the Netherlands in 2050. That perspective not only concerns the question of how the Netherlands can achieve climate-neutrality, but also how this challenge relates to other challenges within Dutch society and the economy. The Climate Plan will also reflect on the relationship between the energy, commodities and food transitions and explore the relationship between Dutch and international policy aimed at reducing emissions within and beyond the Netherlands.⁷⁵

Outline Environment and Planning Memorandum

In the outline memorandum for the Environment and Planning Memorandum (Nota Ruimte), the government sets out a vision on the planning challenges for the Netherlands as a whole, including directions and choices affecting the environment. The vision brings together three guiding principles:

1. Striking a future-proof balance between agriculture and nature throughout the Netherlands;
2. Achieving a climate-neutral and circular society;
3. Creating socially and economically strong regions, towns and villages throughout the Netherlands.

The Memorandum will focus on the short (2030), medium (2050) and long term (2100), recognising that developing and implementing spatial plans takes a long time.⁷⁶

2.2.2 No clear choices that remove systemic barriers and go beyond individual interests

In the Council's view, the many different visions do not lead to clear choices. Worse, they build further on existing situations and systems, whereas the radical changes that are

74. Minister voor Klimaat en Energie (2023b).

75. Minister voor Klimaat en Energie (2023d).

76. Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2023).

needed for transformations require clear choices and fundamentally different perspectives, which offer guidance, direction and inspiration.⁷⁷

Several reports and studies have shown that choices need to be made to achieve the climate targets for 2030 and 2050, for example.⁷⁸ What will a climate-neutral Netherlands in 2050 look like? How does this influence our use of land? What does it mean for the energy system and for the role division between government, industry and citizens? As an example of the dilemmas, citizens have few opportunities to set up their own local energy systems; they are still in the dark about the arrival of heat networks, while traditional central heating boilers are being phased out. The Dutch face enormous investments, but have little opportunity to set priorities for strengthening the energy network. There are too many uncertainties, for example regarding the installation of energy infrastructure, but also the distribution of the advantages, disadvantages, costs and benefits of the transformation. More clarity and clear frameworks would help stakeholders make choices. If that clarity is absent, people will invest less.⁷⁹ The (draft) National Energy System Plan which was launched in July 2023 presents five principal choices for the development of the energy system. This is a good step forward and offers pointers for stakeholders.

The government has waited too long in providing clarity around the transformation of the agriculture and food system. Although the Ministry of Agriculture, Nature and Food Quality has outlined a number of scenarios (conventional, nature-inclusive, circular, organic, short chains), it has not made any choices for the long term and virtually ignores the European and global interrelationships. The established parties in the system have proved unable to reach a consensus on a future agrifood system, what it will look like and what its economic characteristics will be. As a result, most of the choices made favour technological solutions within the existing paradigms of a highly efficient agrifood system focused on economic growth and exports.⁸⁰ That is not because the stakeholders are unwilling to take measures, but because systemic barriers are not demolished in the absence of clear choices that go beyond individual interests.⁸¹ AWTI believes that clear, non-optional choices need to be made which make absolutely clear what is and is not permitted, and where. More important than focusing on process and resources is a focus on goals and cohesion, including in relation to other parts of the food system (such as waste, food safety, short chains). That will provide a space within which stakeholders can

77. Van Dijk et al. (2018); Expertteam Energiesysteem 2050 (2023); Loorbach (2022).

78. PBL et al. (2022); Rijksoverheid (2023a); Andrès et al. (2022); Expertteam Energiesysteem 2050 (2023).

79. Expertteam Energiesysteem 2050 (2023); Duijnmayr (2023).

80. Wojtynia et al. (2021).

81. Runhaar (2019); PBL (2018); Runhaar (2017); Raad voor leefomgeving en infrastructuur (2021); Runhaar et al. (20178).

act.⁸² The Agriculture Agreement (Landbouwakkoord), the Rural Area and Nature Transition Fund (Transitiefonds Landelijk Gebied en Natuur) and the National Rural Area Programme (Nationaal Programma Landelijk Gebied) must offer those frameworks, but without an inspiring future vision and a number of fundamental choices, it will be difficult to develop future-focused rural programmes.

2.2.3 Lack of a broadly shared future vision undermines public support

Transformations are not technocratic processes, but social changes in which people and organisations not only feel the consequences, but are also able and willing to actively contribute. The absence of an inspiring future vision leads to fundamental lack of consensus regarding the ultimate goal of transformations and the choices that need to be made. AWTI believes this undermines public support and certainly slows down the transformation process.

Public support for energy and climate policy cannot be taken for granted. Several studies have shown that the vast majority of Dutch citizens are worried about climate change and recognise that intervention is necessary.⁸³ At the same time, at least half are concerned about the impact of climate policy, for example affordability, and fair distribution of the costs between citizens and businesses and between people with different income levels. There are also concerns about the effectiveness of the measures and the practical constraints. The level of support for climate and energy policy is related to the degree to which the policy is seen as fair, especially as regards the distribution of costs. Half of citizens do not trust the government to take their interests into account. They would like a more reliable government, more information about the policy and more practical support.⁸⁴ This requires consistent policy, as well as policy that is not implemented so quickly that it bypasses a proper weighing of interests and engagement of citizens.⁸⁵ For companies, uncertainty about the government's long-term intentions can lead to a reticence to invest in sustainable innovations.⁸⁶

The same arguments arise in the agriculture debate. Farmers point to the arbitrariness and inconsistency of government policy. They feel they are having to deal with more and more rules and are reluctant to invest. They also feel they are treated unfairly by the

82. See also Remkes (2022); Raad voor leefomgeving en infrastructuur (2021); Runhaar (2019); Sociaal-Economische Raad (2021); Runhaar (2023); Ros et al. (2023).

83. Klösters et al (2022); Dreijerink & Peuchen (2020); Dreijerink & Klösters (2021); Kloosterman et al. (2021); Vringer & Carabain (2019); Wetenschappelijke Raad voor het Regeringsbeleid (2023a); Inwonerraad Energie (2023).

84. Klösters et al. (2022).

85. Jongsma & De Lange (2023); Expertteam Energiesysteem 2050 (2023).

86. Noailly et al. (2022); Kalantzis (2021); Wetenschappelijke Raad voor het Regeringsbeleid (2023b).

government compared with other sectors such as aviation and industry. Farmers also feel that the government and society as a whole trust and value farmers too little.⁸⁷

2.3 The government makes too little use of smart demand stimulation

A substantial proportion of the present policy for promoting innovation is focused on the supply side: all innovations are welcome. The assumption is that societal challenges will naturally form a market for innovations. The reality is that markets are often absent or insufficiently developed (see Box), making it unattractive for companies and investors to invest in innovation. Stimulating adoption and demand is therefore essential for the development and dissemination of innovations.⁸⁸

Example of lack of a market for innovation and transformation: agriculture

There are too few attractive business models to persuade farmers to go green.⁸⁹ The sector's prevailing business model is largely based on the production of large quantities of safe, good and affordable food at the lowest possible costs for an international market. In the present market-based system, innovations focus mainly on further reducing production costs and food prices. The changes that are needed to create a green agriculture and food system generate a value that is currently not being paid for. The sector is therefore unable to earn back the investments, thus holding back the necessary changes.

The government can help here with smart demand stimulation, for example through innovation-driven procurement and tendering, pricing (charging customers more for non-sustainable services or products) or standardisation (implementing stricter rules for services or products). The Council believes that the government currently makes too little use of these tools for stimulating demand. Fear of creating a worse business climate for (large) companies leads the government to stimulate demand mainly using subsidies (see Box) – an approach which carries a number of drawbacks.

87. Raad voor leefomgeving en infrastructuur (2021); Bos et al. (2023).

88. AWTI (2018).

89. Beers (2016).

Examples of adoption subsidies to stimulate demand

One of the biggest energy subsidies is the Stimulation of Sustainable Energy Production and Climate Transition (SDE++), which amounted to 3.5 billion euros in 2023. This subsidy has made many sustainable energy projects possible. Since 2020 it has also been available for measures to reduce carbon emissions in industry. SDE++⁹⁰ subsidises the 'unprofitable component' in the operation of installations: the difference between the cost price of the technology and the average market reimbursement paid for the generated energy or reduced CO₂ emissions.

Other, much smaller instruments include the Energy Investment Allowance and the Environmental Investment Allowance, the Sustainable Energy and Energy Saving subsidy (ISDE) and the Accelerated Climate Investments in Industry scheme (VEKI). All these instruments use subsidies and tax reductions to make investing in sustainable technologies more attractive.

2.3.1 Major drawbacks to widely used government subsidies

Demand stimulation using subsidies and tax breaks can work, but also has a number of serious disadvantages.

Economists point to the risk of the 'green paradox': because subsidies lower the price of sustainable alternatives, the prices of non-sustainable products also ultimately fall. Providers of non-sustainable products will step up their attempts to sell the products, only exacerbating the negative impact on the climate.⁹¹ Subsidies and tax breaks can also lead to a 'rebound effect', whereby innovations improve the greenhouse gas-efficiency of non-sustainable products. These efficiency improvements also depress the price, which can then increase demand, as well as increasing the total greenhouse gas emissions.⁹²

Another problem is that subsidies such as SDE++ give priority to technologies which are already more mature and established, because these proven technologies deliver the biggest reduction in tonnes of CO₂ at the lowest price. This makes it easier to take meaningful steps. However, this arrangement also acts as a barrier to technologies that are not yet mature and are therefore more expensive. Yet these technologies, such as hydrogen electrolysis, could ultimately make a bigger contribution to the reduction targets

90. The scheme began life as SDE, but successive amendments led to a change in the name to SDE+ and then SDE++.

91. See Van der Meijden & Withagen (2022).

92. Oosterhuis et al. (20213); Europese Rekenkamer (2021).

(see also Box).⁹³ On a positive note, since 2023 SDE++ does advocate a solution to this issue.⁹⁴

Only stimulating adoption of proven technologies is not enough: an example

Investments are being made worldwide in Carbon Capture and Utilisation (CCU)⁹⁵ as one of the strategies for achieving the climate goals in the Paris Agreement by 2030 and 2050. Research by De Kleijne et al (2022) suggests that several CCU technologies that have been developed will help achieve the 50 percent reduction target by 2030, but are insufficient to achieve the goal of climate-neutrality by 2050.⁹⁶ That will require different solutions, which are still in an early phase of development. More support is needed for accelerating the development of these early-phase technologies in order to avoid lock-ins and achieve the 2050 climate targets.

Another problem is that subsidies are not equally accessible for all companies. Large, established players have the capacity, know-how and contacts needed to take advantage of the various subsidy schemes. However, the application procedures are much more complex and time-consuming for smaller companies and civil-society organisations, which are virtually unable to free up the necessary capacity.⁹⁷ It is relatively easy for large corporations to make use of subsidy programmes such as SDE++, whereas until recently this subsidy programme was funded by small-scale consumers such as private households and small businesses via the degressive Sustainable Energy Surcharge.⁹⁸ The Innovation Box, offering a reduction in corporation tax for companies with profitable innovative practices, ends up being used in practice mainly by a limited number of large corporations. These large companies are better able to take the risk of investing in R&D and innovation, whereas smaller companies benefit more from schemes which lower the costs of those investments. There is also some doubt as to whether the support ends up

93. OECD (2021); Expertteam Energiesysteem 2050 (2023); PBL et al. (2023); <https://www.rvo.nl/subsidies-financiering/sde>; Ministerie van Economische Zaken en Klimaat (2022).

94. From 2023, a system of ring-fencing will be introduced in the SDE++. This will improve the opportunities for technologies that are currently more expensive but which will eventually have a bigger impact. The Minister for Climate and Energy Policy is also considering whether the public system costs, such as expanding the electricity network, could also be priced in since they influence the cost-effectiveness. Minister voor Klimaat en Energie (2023c).

95. As well as CCU, there is CCS, Carbon Capture and Storage, in which captured CO₂ is stored permanently.

96. De Kleijne et al. (2022).

97. Rijksdienst voor Ondernemend Nederland (2023b); Wetenschappelijke Raad voor het Regeringsbeleid (2023b).

98. Expertteam Energiesysteem 2050 (2023); Wetenschappelijke Raad voor het Regeringsbeleid (2023a).

with the companies whose innovations actually contribute to the desired transformations.⁹⁹

Large-scale use of subsidies and tax breaks can also undermine public support for a transformation.¹⁰⁰ With subsidies, the costs are borne by society (taxpayers) whilst the benefits are enjoyed by (often international) business owners.¹⁰¹ Subsidies benefit large, energy-intensive corporations more than smaller companies and consumers.¹⁰² In principle, companies do not have to pay anything back if the subsidised investments generate unusually high profits (surplus profits or unusually high windfall profits), for example due to a sharp rise in energy prices. The large funding schemes introduced by the government in recent years (such as the Nitrogen Fund and the Climate Fund) also follow this subsidy logic rather than an investment logic (see Box).

An investment logic for a fairer distribution of costs and benefits

One way of achieving a fairer distribution of costs and benefits is through a 'two-sided contract for difference', whereby companies and investors not only agree a minimum price with the government, but also a maximum price. This means they are assured of that minimum price, but will repay if the market price exceeds the agreed maximum. The government can then use the income for example to mitigate the negative impact of high prices for citizens and companies. The United Kingdom has been using this system for a number of years, and the European Commission has proposed introducing it across Europe. The Netherlands is not yet enthusiastic.¹⁰³

Another option for large funds is to make more use of hybrid funding, in which subsidies and public investments are combined.¹⁰⁴ Public investments are then (partially) revolving funds, aimed at securing social and economic returns in the longer term.¹⁰⁵ This option ensures that funders look beyond the here and now and open up

99. Van Rijn & van Dijk (2023); Velzing (2021).

100. The 17th Budgetary Policy Study Group (Studiegroep Begrotingsruimte) (Rijksoverheid, 2023c) also points out that the government has recently opted to set aside a lot of extra money to tackle societal challenges. However, the Study Group argues that the additional resources cannot be spent because of an overheated economy and tight labour market. Targets are not being achieved and promises are not being met. This too undermines public support.

101. Raad voor leefomgeving en infrastructuur (2022).

102. Raad voor leefomgeving en infrastructuur (2022); Wetenschappelijke Raad voor het Regeringsbeleid (2023a en b).

103. It is argued that these contracts would remove the incentive for system integration and flexibility, would require an expensive and radical restructuring of the SDE and could lead to an increase in the amount of subsidy. De Ronde (2023).

104. See AWTI (2021b).

105. According to the *shared value* principle, where investments contribute to both competitiveness and to the achievement of societal objectives. See Porter & Kramer (2011).

the way for new practices which are still uncertain but have the potential to contribute to the desired transformations. It also helps create leverage between different public and private funding sources at regional, national and European level.

2.3.2 Subsidies driven by unfounded fears of harming business climate

In the latest climate policy package, with supplementary measures to achieve the climate targets in 2030, the government again opts for a system of subsidies and allowances.¹⁰⁶ A major reason put forward for this is that introducing stricter standards and more levies would create less attractive business climate. To help prevent the assumed potential relocation of economic activities away from the Netherlands, the government is opting for exemptions, degressive taxes and customised arrangements involving subsidies and compensation schemes for the biggest established players – which are often also the most energy-intensive companies, with the highest emissions.

The Council acknowledges the importance of an attractive business climate, but there is little evidence that companies actually leave the country because of more stringent climate policy. A climate policy that is stricter than in other countries can undoubtedly have a negative impact on the profitability of specific industrial companies, and this can increase the risk that those companies will relocate their activities.¹⁰⁷ However, a recent study by the Netherlands Bureau for Economic Policy Analysis (CPB) showed that climate policy had in the past led to adaptation rather than relocation of production processes. The study on the impact of carbon costs for around three million companies in 15 different sectors in 32 countries found little or no evidence that climate policy has negatively impacted the profits, productivity or turnover of the average industrial company. Companies are more likely to adapt their business operations than to relocate to countries with no or less stringent climate policy.¹⁰⁸

The argument also loses validity if there is more coordination at European level and beyond on this policy and if similar goals are pursued using similar levies. That is also the thrust of European climate policy and the Carbon Border Adjustment Mechanism

106. See Rijksoverheid (2023d). This is despite the advice of the Interdepartmental Policy Review (IBO) working group (Rijksoverheid 2023a; Rijksoverheid 2021) and several economists and scientists. They advise using subsidies mainly for the development of new technologies, but that standardisation and pricing should be the main mechanisms to stimulate adoption. McDonald (2023).

107. Strategy& (2023). Results based on case studies at five companies (Dow, Yara, Smurfit Kappa, Nyrstar and Vreugdenhil Dairy Foods) and one sector study (refinery).

108. Trinks & Hille (2023). See also the discussion of the leakage and pull effects of CO₂ levies in the report 'Goede Zaken' by the Wetenschappelijke Raad voor het Regeringsbeleid (2023b).

(CBAM).¹⁰⁹ There may also be a ‘Brussels effect’, where the size of the market and the economic importance of the European Union persuades companies to adapt all their products and processes to the stricter European standards, including in their operations in other parts of the world. It is often not profitable or technically feasible to maintain different production lines and production processes for differing standards.¹¹⁰

Competitive advantages can also change. The competitiveness of the Dutch energy-intensive industry was for example long based on the availability of cheap gas. That advantage is now disappearing, but could be replaced by other benefits, such as the high potential for offshore wind and underground gas storage.¹¹¹ There are also companies which actually benefit from stricter standards and pricing, which can make the business cases for more sustainable alternatives more attractive compared with non-sustainable products.¹¹²

2.3.3 Untapped potential of innovation driven procurement and tendering

There is ample potential for innovation-driven procurement, but in the Council’s view that potential is not currently being well utilised.¹¹³ It is a form of procurement in which a government agency asks companies and researchers to develop innovations for a public task to enable the government to implement it more effectively and more efficiently. Innovation-driven procurement creates a market for innovative entrepreneurs, with examples including Small Business Innovation Research (SBIR), Innovation Partnership (IPS) or competitions. Government agencies can also use competition-focused dialogue, trials, challenges (such as Startup in Residence), market consultations, ‘hackathons’ or functional specification. The Dutch government’s procurement budget for 2022 is estimated at 100 billion euros per annum.¹¹⁴ Research by the European Commission shows that the Netherlands spends almost 12 percent of its public procurement funds on purchasing innovative solutions. The Netherlands does not score badly compared with

109. CBAM is a European Regulation which imposes a price correction on goods imported into the EU based on the CO₂ emissions in the production process outside the EU. This removes the competitive disadvantage faced by European producers in the face of imports from third countries where the costs for carbon emissions are lower.

110. Bradford (2020).

111. Expertteam Energiesysteem 2050 (2023); Expertteam Energiesysteem 2050 (2022a); The Sustainable Industry Lab (2023). The Porter Hypothesis (Porter, 1991) already suggested as much: strict environmental legislation does not inevitably constrain the competitive advantage of companies relative to foreign competitors, but makes companies *more* competitive because they develop and utilise different competitive advantages.

112. Wetenschappelijke Raad voor het Regeringsbeleid (2023b).

113. See also AWTI (2018) and AWTI (2021b).

114. Schotanus (2022).

other European countries (above the average of 9.3 percent, and in third place), but comes nowhere near the European ambition of 17 percent.¹¹⁵

There are several factors which impede innovation-driven procurement, for example unclear commissioning or a lack of internal engagement and responsibility on the part of the tendering departments. There are also financial obstacles, because the process takes longer than regular procurement. There are no multi-annual budgets, the risks are higher and the costs are incurred before the benefits are received. There is also a cultural component: the public sector is more conservative than the business community and does not always operate in an innovation-friendly climate. Different government agencies also have different views on this point. Finally, there is unfamiliarity and inexperience on the part of both government and businesses with the innovation-driven procurement infrastructure.¹¹⁶

2.3.4 Limited use of pricing to stimulate demand

The use of pricing (and taxation) mechanisms is still limited in the Netherlands and is not used intelligently enough, despite the fact that many economists argue that pricing is a proven effective and efficient instrument for persuading the market to switch to more sustainable alternatives.¹¹⁷

An example is the introduction of carbon pricing or an emissions trading system. This provides a financial incentive for fossil energy producers to reduce their emissions and incentivises consumers to save energy. This in turn leads to more demand for innovations which help achieve this, without defining what those innovations are.¹¹⁸ Another option is to integrate the actual costs, including the external costs,¹¹⁹ into the price of a product (true pricing). The big advantage of pricing is that it follows the principle of 'the polluter¹²⁰ pays' (as opposed to 'everyone pays'). The costs for citizens and companies are clear, the instrument can be implemented at minimal cost and incentivises innovation without prescribing particular technologies, thus avoiding lock-ins.¹²¹

The Netherlands does use carbon pricing and an emissions trading system (ETS) for industry and a number of sectors. The OECD accordingly takes a positive view of the Dutch approach, which since 2021 has applied a carbon pricing escalator mechanism on

115. European Commission (2021).

116. Werkgroep Innovatiegericht Inkopen / Pianoo (2022).

117. Van der Meijden & Withagen (2022); Fischer & Newell (2008); Hart (2019); Nordhaus (2015); Rijksoverheid (2023a).

118. Krohn (2023).

119. External costs are costs or losses incurred by third parties as a result of an economic activity.

120. More precisely, the party that can influence the external costs pays.

121. Rijksoverheid (2023a).

top of the European ETS price. Fixed emission levies and certainty about future carbon prices make investing in carbon-saving technologies attractive. According to the OECD, combined with subsidies for technology development, the pricing approach helps companies to develop a sound business case.¹²²

Notwithstanding the OECD praise, there are also a number of caveats; the impact of pricing is less smart and effective than it could be.¹²³ To avoid overtaxing companies in times of economic difficulty (during the pandemic), the Dutch government introduced a series of exemptions for the energy-intensive industry. These companies are exempted from energy taxes, or pay a reduced rate for higher consumption, and receive free emission rights and dispensation rights. In granting these exemptions, the legislation does not look at the vulnerability of these major consumers for international competition. This mainly benefits the large, energy-intensive users at the expense of smaller companies and private households. Another issue is that the present energy tax makes no distinction regarding the energy source and therefore offers no incentive to switch to more sustainable sources.

Pricing is also used much less to address issues other than making industry more sustainable.¹²⁴ For example, the Netherlands does not operate a specific car pricing scheme with differentiation based on the sustainability of the vehicle. There is no emissions trading system in the agricultural sector, and exemptions have been granted in the glasshouse horticulture industry (see Box for an illustration of the complexity of introducing emission levies in agriculture).

Denmark and New Zealand are seeking to introduce emission levies in agriculture, but this is not straightforward

The Danish government has announced the introduction of a CO₂ levy for the farming industry.¹²⁵ The Danish parliament had earlier decided that the greenhouse gas emissions from this sector must be reduced by a third. The government stated that the levy must not jeopardise the food supply and must not lead to farmers leaving the industry. The revenue from the levy must be reinvested in agriculture in new technology and in the 'green agriculture transition'. A committee is working out the details of the levy. There is broad political support for the levy, but the sector itself has great difficulty with it. Charging on the cost to the consumer is difficult because, as in

122. OECD (2021).

123. OECD (2021). Expertteam Energiesysteem 2050 (2023); Rijksoverheid (2021); Brink & Vollebergh (2021); Rijksoverheid (2023a).

124. Rijksoverheid (2023a).

125. Janssen (2022).

the Netherlands, the Danish agriculture sector produces mainly for export. Farmers and scientists argue that Danish farmers already have the lowest carbon footprint of all meat and dairy producers worldwide.

The New Zealand government has also proposed that livestock farmers should pay for emissions of greenhouse gases such as methane and nitrous oxide.¹²⁶ As in Denmark, the intention is that the money raised should go back into the sector through investment in research and development and premium payments. New Zealand stock farmers are critical of the proposal and fear that if farmers are forced to reduce their production, that production will relocate to other countries with lower environmental standards. In the face of protests by farmers and agricultural organisations, the government has decided to defer the introduction of the levy until the end of 2025.¹²⁷

2.3.5 Standardisation is mainly voluntary and therefore insufficiently effective

In addition to pricing, standardisation is a proven effective instrument for stimulating demand for sustainable innovations and phasing out non-sustainable activities and products. Although the Netherlands does use this instrument, in a striking number of cases it is not very stringent and the standards and norms applied are non-obligatory. The system mainly consists of agreements and covenants, agreed between the government and companies on a voluntary basis.¹²⁸ For example, there are agreements on reducing emissions, using more biofuels, recycling more raw materials and pursuing circular production, and on ceasing polluting activities. In another example, the government is seeking to reduce nitrogen levels in nature areas by offering an attractive, voluntary scheme to buy up neighbouring stock farms.¹²⁹ The advantage of voluntary covenants, agreements and schemes is that everyone can be mobilised to maximise the support for the intervention. The drawback is that it is time-consuming and its non-obligatory nature means it is not effective enough: achievement of the climate objectives is currently not on the horizon.¹³⁰ The Netherlands Scientific Council for Government Policy (WRR) highlights a further disadvantage of voluntary standardisation and self-regulation: established parties can also exert an influence; their interests can then stand

126. Mons (2022).

127. AgriHolland (2023).

128. Rijksoverheid (2023a).

129. NOS (2022).

130. See also Rijksoverheid (2023a).

in the way of public interests, and it is harder for other actors such as new companies, consumers or environmental organisations to exert influence.¹³¹

International research shows that stringent and mandatory standards are extremely effective in fostering the transition to sustainable innovations. Unlike pricing, standardisation does not draw a distinction between the financial capacity of companies and consumers: with pricing schemes, it is possible to opt for non-sustainable alternatives by simply paying. Standardisation leads to the development and use of genuinely sustainable alternatives.¹³² This is confirmed by research on the impact of carbon emission standards in the automotive industry in the US and Europe.¹³³

2.4 Complex policy mix gives little direction and impedes cohesion

The Council believes that the extensive policy mix currently used to stimulate research and innovation does not function optimally for transformations. The (mainly) generic funding means existing policy offers little directional guidance. Numerous policies operating in parallel, each aimed at similar goals, leading to fragmentation. There is also a lack of incentives for the long term, upscaling is problematic and there is little connection between (generic) innovation policy in a strict sense and sectoral policy focusing on specific policy domains such as energy, agriculture or care. This leads to high transaction costs, especially for smaller and young companies, civil-society organisations and citizens.

In a separate advisory letter to be published by AWTI after this advisory report, the Council will look in more detail at the policy mix for knowledge development and innovation and advise on what is needed to focus that policy mix more on transformations.

2.4.1 High proportion of generic funding gives little direction

Dutch research and innovation policy is largely generic; all companies, technologies and scientific disciplines can make use of it provided they meet the conditions. Whilst it offers scope for innovation, international organisations,¹³⁴ but also the Netherlands Bureau for Economic Policy Analysis (CPB)¹³⁵ and AWTI¹³⁶ itself, have already stated that more

131. Wetenschappelijke Raad voor het Regeringsbeleid (2023b).

132. Kraan (2023); Rozendaal & Vollebergh (2022).

133. Rozendaal & Vollebergh (2021).

134. International Monetary Fund (2019); European Commission (2019); OECD (2019).

135. Rusu et al. (2021); Mot & Trinks (2022).

136. AWTI (2020a).

targeted and specific investments in research and innovation are needed alongside this generic funding for pure research. That would facilitate greater focus and critical mass within specific domains. There have been some attempts in recent years to introduce specific policy (see Box).

Increase in specific investments as a share of total investments

In 2023 around 68 percent of government funding for research, development and innovation is generic funding; policy instruments targeting a specific theme, mission or assignment account for roughly 29 percent of the total; in 2022 the figure was 16 percent.¹³⁷ The share of specific investments is thus increasing substantially, mainly because of the allocation of funding from the National Growth Fund to specific proposals.¹³⁸ The Mission-Driven Top Sector and Innovation Policy (MTIB) is also a key instrument in the specific policy mix. In financial terms, the biggest categories in the generic policy for research and innovation are the first flow of funds for research allocated mainly to universities, as well as fiscal support, in particular the tax reduction for research and development (WBSO).¹³⁹

In theory, the MTIB gives direction to innovation through 25 adopted missions.¹⁴⁰ Line ministries and the companies and knowledge institutes in the top sectors formulate the missions jointly. Initial analyses of the MTIB and discussions held by AWTI show that line ministries play a mainly facilitating role and organise the process in which companies and knowledge institutes work together to find a direction. Not starting from an integrated and clear future vision leads to broadly defined missions. This means that many different directions – and therefore projects – are possible, whereas there are indications that some directions are more promising than others. The risk of such an open approach is that none of the promising directions will be able to genuinely flourish and that the necessary investments will not be made.¹⁴¹ The five central missions presented by the

137. Calculations based on the figures for Total Investment in Research and Innovation (TWIN) by the Rathenau Instituut (2023). See Annex 4 for an explanation of the method.

138. Rathenau Instituut (2023): In 2023 the government budgeted 9.1 billion euros for R&D expenditure and 1.8 billion euros for spending on non-R&D innovation. The government also provided tax support for R&D and innovation totalling 1.5 billion euros.

139. The Innovation Box is by far the biggest tax support measure, amounting to 1.847 billion in 2021. The Innovation Box is not included in the calculations owing to international agreements to exclude measures of this type ('patent boxes') as reported by the Rathenau Instituut. For details, see OECD (2015b), p. 346.

140. The missions were updated in May 2023 relative to 2019. The government defined five central missions, worked up into 21 specific missions which were set out in a Covenant covering the period 2024-2027. See Minister van Economische Zaken en Klimaat (2023b).

141. Janssen (2020); Janssen et al. (2023).

Minister of Economic Affairs and Climate Policy in May 2023 are a step forward in channelling the joint efforts in a more focused direction.¹⁴²

The National Growth Fund is a large policy instrument, established by the government to fund major projects involving knowledge development and innovation to support the future earning capacity of the Netherlands. The NGF is not focused on transformations, but does offer the opportunity to achieve transformation goals linked to strengthening future earning capacity. Government departments determine which proposals consortia can submit; the proposals must fit in with the policy strategies and objectives of that department. Consortia can also submit proposals independently via a different route. Ultimately, the NGF advisory committee assesses all proposals; it makes its own judgements here, but in its portfolio development also considers the missions and themes set by the government.

2.4.2 Large, fragmented policy mix

The policy infrastructure for knowledge development and innovation is very large and complex. Examples can be found in the transformation of energy and agrifood. The policy inventory by AWTI and other policy analyses¹⁴³ show that different ministries deploy a wide array of policy instruments (more details of the AWTI policy inventory are set out in a separate advisory letter). They include subsidies, tax instruments, standards, public campaigns, guarantees, investments in infrastructure and tenders. Different instruments often have different objectives and different conditions. In addition to central government, provincial authorities, local authorities and the European Commission also have their own schemes. The consequence is that small companies (and citizens), in particular, find it difficult to navigate the subsidy landscape and therefore make less use of these instruments than larger companies.¹⁴⁴

The administration of the MTIB is relatively complex. A ‘mission structure’ has been overlaid over the original top sectors structure; each mission has both its own and joint teams and involves (many) consultations. Several top sectors and Top consortia for Knowledge and Innovation (TKI) contribute to different missions. Stakeholders find this

142. Minister van Economische Zaken en Klimaat (2023b).

143. See e.g. Janssen (2020); OECD (2021); Rusu et al (2021); Larrue (2021); Rijksdienst voor Ondernemend Nederland (2022).

144. Conijn & Smit (2023a); Conijn & Smit (2023b); Rijksdienst voor Ondernemend Nederland (2022). This is also a factor in large European instruments such as the IPCEIs and projects deriving from the European Chips Act; see Kleimann et al. (2023).

confusing and say it does not help to work in a focused way. It also makes it difficult for new actors to gain entry.¹⁴⁵

Policy for specific sectors and systems also often focuses on particular components or chains, without considering the interdependencies and without obtaining clarity on whether the different plans and programmes add up to the desired result. A good example is the policy for making industry more sustainable. This has prompted the government to set up a National Programme for Sustainable Industry, with the aim of taking more control and introducing greater cohesion.¹⁴⁶

2.4.3 No focus on the long term; linking instruments is not easy

Different policy instruments do not always dovetail perfectly. Researchers and entrepreneurs who spend years working on a new technology have to jump from one policy instrument to another, clearing hurdles on the way, such as complex application procedures and uncertainty about follow-up funding in competitive tenders.¹⁴⁷ For example, the government is actively promoting hydrogen innovation, but provides no support for scaling up its production from biomass, a route which is closed off in the SDE++, for example.¹⁴⁸ Whilst the Council recognises that continually having to qualify for follow-up funding helps prevent projects ending up in a cul-de-sac, the disadvantage is that it slows down the development of genuinely promising projects.¹⁴⁹

In addition, each scheme has its own criteria.¹⁵⁰ This is a common issue across the policy instruments and even within programmes. For example, the National Growth Fund is intended to support research and development on technologies and innovation over a longer period and throughout different phases, but in practice the programmes are sometimes broken down into segments, each with its own criteria and arrangements. This means it can take a long time before parties are able to get started on the projects, and makes cohesive programming more complex. AWTI believes it is not so much the convenience of the researcher or innovator that should predominate, but rather the

145. OECD (2023a); Janssen (2020); Minister van Economische Zaken en Klimaat (2022). The Minister of Economic Affairs and Climate Policy sets out the ambition of simplifying the governance of the MTIB in a letter to parliament.

146. Minister van Economische Zaken en Klimaat (2023a); Venema et al. (2022).

147. Expertteam Energiesysteem 2050 (2023); Hers et al. (2021).

148. See Rijksdienst voor Ondernemend Nederland (2023a).

149. Janssen et al. (2023), A stage-gate model or cascade process could mitigate this problem (see Cooper, 1990).

150. Taskforce Versnelling Innovatieproces Stalsystemen (2020).

question of how an innovation can be progressed through the different development phases as smoothly as possible.¹⁵¹

Positive exception: Mission-driven Research, Development and Innovation (MOOI)¹⁵²

MOOI, introduced in 2020, is an initiative which does stimulate a more cohesive approach. It enables multidisciplinary consortia to work on the integrated development of technological and non-technological solutions for societal challenges whilst taking into account social/societal factors. Consortia can focus their efforts on three themes related to the Energy Top Sector: electricity (offshore wind farms and onshore renewable energy; the built environment; and industry). MOOI applications are opened every two years, with the next round scheduled for 2024.

2.4.4 Not enough support for scaling up innovations

Upscaling of promising innovations is essential for accelerating transformations. It means innovations can be effective and have a large-scale impact, not just locally, in a pilot or trial setting. Scale equals efficiency and thus lower production costs: essential to make innovations competitive against existing practices. When upscaling, it is important that the (technological) performance and reliability of innovations can also be demonstrated on a larger scale. This can be a time-consuming and expensive step, which not only requires technological developments, but also things such as amendment to regulations, investment in infrastructure or new standards.

Upscaling is a major challenge in accelerating the transformation of the energy system.¹⁵³ There are various instruments in relation to energy which incentivise the demonstration, market introduction and adoption of technologies and innovations.¹⁵⁴ An array of subsidies, tax breaks and loans is used for this, but also regulations, investments in infrastructure, such as a charging infrastructure for electric vehicles, and (albeit on a limited scale) innovation-driven procurement. There are fewer instruments available for

151. Different phases in the innovation cycle require different competences, which are mostly not possessed by the same actors; see also Janssen (2020).

152. See <https://www.rijksfinancien.nl/memorie-van-toelichting/2024/OWB/XIII/onderdeel/2142637>

153. Andrés et al. (2022); Ministerie van Economische Zaken en Klimaat (2023a); discussions held by AWTI confirm this picture.

154. Analyses by the Netherlands Enterprise Agency (RVO) of the policy instruments for energy innovation reveal a shift from subsidies for experimental development and industrial research to subsidies for demonstrations, feasibility studies and investments in mature technologies. See Rijksdienst voor Ondernemend Nederland (2023a).

stimulating fundamental and experimental research, though those which do exist are bigger. As the development of technologies and innovations advances, the financial instruments become more targeted, but also smaller. Their limited size means that most schemes are rapidly exhausted, limiting their impact. Furthermore, the smaller instruments fit in less well with the latter phases of demonstrations and upscaling, which generally require larger investments.¹⁵⁵ The OECD confirms this in an analysis of Dutch policy aimed at achieving a climate-neutral industry (see Box).

OECD on stimulating Dutch climate-neutral industry

The OECD notes that the Netherlands has numerous instruments aimed at stimulating demonstrations and upscaling, but observes that the programmes are relatively small, with annual budgets of less than 10 million euros per project, whereas the average financial scale of a demonstration project in industry is closer to 50-75 million euros.¹⁵⁶ The Netherlands Bureau for Economic Policy Analysis (CPB) reaches similar conclusions.¹⁵⁷ The OECD advises the Netherlands to make more use of the leverage offered by the European Innovation Fund and the Important Projects of Common European Interest (IPCEI) programme, for example for hydrogen projects. It also argues that the National Growth Fund could provide more support for developing and upscaling breakthrough technologies.¹⁵⁸

All kinds of small-scale initiatives and experiments are taking place with a view to developing new knowledge and innovations. These innovations can be part of the necessary transformations. They receive some support from subsidies, for example in agrifood, but it remains difficult to scale up these initiatives and share the knowledge gained broadly.¹⁵⁹

Legislation and regulations can be an obstacle to experimentation. The legislation is based on existing systems, with strict divisions between agriculture and nature, for example, and between individual segments within the agricultural sector. Farmers who opt for an innovative approach find it difficult to obtain unambiguous information aimed at the average farm. They need specific information on agronomy and results, tailored to their individual farm, and easy to find and access. This knowledge-sharing infrastructure is not yet sufficiently accessible. There is also a lack of financial resources for further

155. Expertteam Energiesysteem 2050 (2023); Hers et al. (2021).

156. OECD (2021).

157. Rusu et al (2021); OECD (2021).

158. OECD (2021).

159. Rathenau Instituut (2020).

development and upscaling.¹⁶⁰ The OECD also advises the Dutch government to provide better support to farmers wishing to experiment or implement innovations. That can be achieved with advice, training and knowledge-sharing.¹⁶¹

The Netherlands has traditionally had a strong agricultural knowledge and information network (via research stations), but this network needs to be enlarged and reinforced in a cohesive manner. The Ministry of Agriculture, Nature and Food Quality is currently developing a network of between 12 and 18 field labs for area-specific development of innovations, aimed at ensuring a smoother and faster transition to sustainable and profitable farms. However, affected farmers report that they are thus far making little use of the insights developed; the research is of limited practical use for many farmers, and some of them prefer to acquire knowledge from study clubs, other local farmers, pioneer companies, producer organisations, etc. All kinds of initiatives are being developed within the sector itself aimed at marshalling demand articulation, knowledge-sharing and development between farmers, researchers, funders and nature organisations (e.g. Plaatsen, Wij.land, BoerenNatuur, Duinboeren). Several organisations have joined forces to develop a long-term plan for farming (Plan BoerenPerspectief), which is intended to provide long-term support via regional hubs and support individual farmers and regions with knowledge and experience as well as access to all kinds of supporting parties, services and networks. Here, too, systemic obstacles need to be identified and addressed.¹⁶²

2.4.5 Little connection between innovation policy and sectoral policy

Stimulating the development of new knowledge, technologies and innovations is not enough on its own to ensure successful transformations. As stated, above all there needs to be a vision for the future and a large number of (supplementary) technical, economic, social and institutional changes. This requires cooperation and coordination between different government ministries and public bodies.¹⁶³ AWTI observes that there are too few connections between innovation policy in a strict sense and sectoral policy. Insufficient linkage and coordination between different policy domains can lead to incoherence and even conflicts, thus hindering the progress of transformations.

The Ministry of Economic Affairs and Climate Change focuses mainly on stimulating economic activity and the supply of new technologies and innovations in line with its societal missions. The introduction of the MTIB has changed the role of the line

160. Van Dijk et al. (2020); Nationaal Klimaat Platform (2023).

161. OECD (2023).

162. Wij.land et al. (2023).

163. Hynes et al. (2020); Janssen (2020).

ministries, which now formulate the missions and are responsible for setting the parameters for the dissemination of innovations and the necessary system changes.¹⁶⁴ The linkage between innovation policy and sectoral policy is not good for all missions; by no means all missions are included in the policy strategies of the line ministries or has funding been set aside for the missions.¹⁶⁵ One sticking point in the linkage between innovation policy and sectoral policy is that government ministries each have their own objectives and accountability procedures.¹⁶⁶

The government is taking steps to address specific transformations in a coordinated way, for example with the National Energy System Plan for 2050. This Plan is intended to deliver an overarching, multi-year vision and coordination of the cohesion between the different policy instruments and programmes for the energy system.¹⁶⁷ The National Programme for Sustainable Industry is another example, which the government hopes will enable it to guide the move towards a sustainable industry. Under the motto 'better green here than grey elsewhere', the government is looking to exercise control over the whole sustainability chain, with a view to identifying and resolving coordination problems more rapidly, for example regarding the timeliness of the supply of green energy and permits, spatial integration, nitrogen allowances and sufficient qualified staff.¹⁶⁸ In the areas of nature, water, soil, nitrogen and climate, the government is developing a National Rural Area Programme (NPLG), which addresses the challenges in relation to nature, nitrogen, water and climate and the agricultural transition in an integrated and region-specific way. The NPLG is intended to provide frameworks to enable the provincial authorities to set up regional programmes.¹⁶⁹ However, it contains no clear choices and no long-term vision.

2.5 The government makes too little use of knowledge and innovative strengths in society

Cooperation is crucial for finding usable solutions to complex societal challenges: cooperation between 'theory and practice', but also across disciplinary and sectoral boundaries.¹⁷⁰ The government currently makes too little use of the many collective 'bottom-up' initiatives to find innovative solutions to challenges in relation to energy, food

164. Janssen et al. (2022); Janssen et al (2023).

165. Frenken et al. (2021); Raad voor Volksgezondheid en Samenleving (2022); Janssen (2020); Janssen et al. (2023).

166. Janssen et al. (2023).

167. Minister voor Klimaat en Energie (2022); Minister voor Klimaat en Energie (2023b).

168. Minister van Economische Zaken en Klimaat (2023a).

169. See <https://www.rijksoverheid.nl/onderwerpen/aanpak-stikstof-natuur-water-en-klimaat>

170. AWTI has underlined this in earlier advisory reports; see e.g. AWTI (2022 a,b and c).

and agriculture, care, mobility and the living environment. To make matters worse, these initiatives face numerous barriers. Government and politicians also need more substantive knowledge about domains, technology and innovation.

2.5.1 Bottom-up initiatives offer opportunities for innovation and resilience

Examples of bottom-up initiatives include the more than 700 energy cooperatives in the Netherlands,¹⁷¹ or local food cooperatives (e.g. Herenboerderijen) and Community Supported Agriculture farms (CSAs). Enterprising officials, social entrepreneurs, activists, researchers, inventors, creatives and residents come together to develop new ideas and working methods. They try out alternative approaches, learn 'on the job' and demonstrate that change is possible. They are developing new forms of organisation which operate at the interface between community, market and government.¹⁷² This gives rise to a different potential for innovation, enrichment of the knowledge and genuinely new, creative and workable solutions.¹⁷³ They are often initiatives which society perceives as acceptable and justified. Moreover, government policy is then more closely aligned with the needs, wishes and ideas of society. The process of shared learning, researching, innovating and experimenting also generates greater problem-solving ability and resilience in society.¹⁷⁴

Current policy instruments to support transformations are not well aligned with these collective initiatives, mainly targeting research and innovation by companies and knowledge institutes. The 'collectives' fall outside the traditional definition of the 'triple helix': the public-private partnership between public authorities, companies and knowledge institutes.¹⁷⁵ Even the Dutch Research Agenda (NWA) fails to fully achieve genuine transdisciplinary collaboration in practice, in which parties from civil society form part of the research team.¹⁷⁶ Those parties often run up against the buffers of the funding criteria; co-funding is often mandatory, but that is too high a hurdle for these parties to clear because they often lack the necessary resources.¹⁷⁷ Companies and knowledge institutes, for example those in the top sectors, are also looking for commercial striking power, and that is not something that civil-society parties can automatically offer. The collectives also have difficulty in growing or scaling up: they lack the money, are heavily dependent on volunteers, have insufficient knowledge and expertise to professionalise

171. Klimaatstichting HIER & Energie Samen (2023).

172. Nationaal Klimaat Platform (2023b); Diercks & Avelino (2022); De Moor (2023).

173. Soete & Stierna (2023); Schwaag Serger et al. (2023).

174. AWTI (2022c); Den Boer et al. (2021).

175. Transitiecoalitie Voedsel (2019); Diercks & Avelino (2022).

176. AWTI (2022b).

177. AWTI (2022a); Nationaal Klimaat Platform (2023b); Diercks & Avelino (2022); De Moor et al. (2020).

and are hamstrung by regulatory strictures.¹⁷⁸ The Physical Environment Consultative Council (Overlegorgaan Fysieke Leefomgeving - OFL) refers to empowerment in this context: a society which feels equipped and empowered to make a contribution.

2.5.2 The government makes too little use of substantive knowledge

Working towards transformations requires that the government make better use of knowledge and development of the skills needed to achieve them (see Box). The government needs substantive knowledge about domains, technology and innovation in order to develop policy which exploits opportunities whilst taking into account social aspects such as fairness, safety and ethical considerations.¹⁷⁹ If the government and politicians make better use of this knowledge, they will gain a better understanding of the underlying problems and a better insight into the relationship with other societal challenges, standards and interests. Expertise is also needed to formulate realistic expectations about current and future solutions and their impact. Knowledge and expertise also help counter 'regulatory capture': the tendency to succumb to strong lobbying and focus mainly on the interests of a few established players at the expense of the broader interests of society.¹⁸⁰

Transformation tasks and skills

Working towards transformations requires that civil servants develop the skills needed to carry out tasks focused on transformation, for example giving direction, creating a new governance structure, stimulating innovations, phasing out dysfunctional systems and developing new capacities and structures.¹⁸¹ They will need to acquire new skills for this (e.g. combining different targets and the ability to reflect), but will also have to adopt a new governance tradition which facilitates and legitimises these tasks. That is by no means always the case today, for example because the governance tradition prescribes that civil servants are bound by strict rules and procedures (whereas there are no blueprints for transformations), or must always choose efficient solutions (whereas transformations often incur speculative costs before the benefits emerge).¹⁸² Research among officials at the Dutch Ministry of Infrastructure and Water Management shows that all kinds of rules and assumptions can impede the

178. AWTI (2022c); Overlegorgaan Fysieke Leefomgeving (2022); De Moor et al. (2020). The co-funding rules were abandoned in the Dutch Research Agenda programme Research along Routes by Consortia (NWA-ORC) in early 2023; see: <https://www.nwo.nl/nieuws/nwo-brengt-focus-aan-nwa-programma>

179. AWTI underlined the importance of knowledge for the government in AWTI (2021a).

180. Stigler (1971).

181. Braams et al. (2021).

182. Braams (2021).

implementation of transformative tasks, for example an aversion to the potential chaos if the government starts involving all kinds of stakeholders, or not being accustomed to ignoring established interests. There is also often a preference for encouraging the new over abandoning the old, and process specialists are valued more than subject specialists.¹⁸³ If the government wishes to make best effort to achieve transformations, the rules and assumptions need to change and a new legitimacy for government action needs to be found.¹⁸⁴

Despite their obvious importance, there is a lack of sufficient knowledge, expertise and learning capacity among politicians and civil servants.¹⁸⁵ There is a widening gulf between policy and knowledge; more and more time and energy are devoted to short-term issues and incidents, and a lack of insight into the underlying problems and potential solutions means that policy is insufficiently adaptive (see Box). Ministries and executive agencies have to develop and implement policy too quickly, which pushes the more strategic policy tasks and skills to the background. Despite the many highly trained people who work there, they have too little long-term substantive expertise and ability to challenge; job rotation means there is too little time and scope to develop those skills, and substantive knowledge is undervalued in the civil service hierarchy. Moreover, substantive debate and weighing of knowledge is inadequately organised; too little attention is given to design knowledge and the government makes little use of government-wide policy experiments.¹⁸⁶ Parliament also develops too little substantive knowledge. The steps taken by the government and parliament to make better use of knowledge in policy are valuable, but in the Council's view also insufficiently structured and methodical.¹⁸⁷

Lack of insight hinders adaptive policy

Transformations involve continuous changes in what people consider important, normal and desirable. They generate new technological possibilities, innovative ideas and geopolitical realities. Insufficiently allowance is currently made for these learning effects in future visions and policy plans. As a result the government and politicians, as well as the business community and society, can be taken by surprise by the

183. Braams et al. (2022).

184. Braams (2021) introduced the term 'transformative government', as an administrative tradition alongside the high-performing, legitimate, responsive and collaborative government (see perspectives on governance by Van der Steen et al. 2014).

185. AWTI (2021a); ABDTOPConsult (2023), Teeuw (2023).

186. AWTI (2021a) and AWTI (2018).

187. AWTI (2021a).

speed of developments, leaving them unprepared, for example, for the number of people and training profiles needed, or the need to increase the capacity of technical infrastructures.

The energy scenarios are an example of this: they mainly take into account economic and technological factors, with less attention for the impact of societal processes in practice. Models are based on hard commitments for new wind and solar energy, but take no account of learning effects and social feedback.¹⁸⁸ There is also a failure to allow for unexpected developments, such as the war in Ukraine and the resultant sharp rise in energy prices. Those prices lead to energy-saving on the one hand and on the other speed up the switch to renewable sources. This in turn leads to an accelerated increase in the capacity of wind and solar energy, for example, but also in the development of energy storage systems.¹⁸⁹ However, the electricity networks are unable to keep pace, leading to congestion on the network and delaying new projects. The consequences of a war are difficult to assess in advance, but some agility is needed to anticipate possible but unforeseen circumstances, otherwise we will continually be surprised by the speed of developments. A comprehensive long-term vision which is regularly updated can mitigate the impact of these unforeseen events.

188. Alkemade & De Coninck (2021); Alkemade et al. (2023); Eppinga (2022).

189. Gerlagh & Vollebergh (2023).

Four recommendations for a transformative approach to innovation

AWTI advises the government to focus innovation policy more on what will be needed in the future. This transformative policy needs to be based on an attractive perspective which stimulates and gives direction rather than – as at present – on strengthening and reinforcing established processes, structures and interests.

AWTI does not argue that all research and innovation policy must be focused on transformation. Generic stimulation of research and innovation remains essential for strengthening the knowledge position and competitiveness of the Netherlands and for generating unforeseen solutions, but speeding up the necessary transformations also requires a genuinely transformative approach to knowledge and innovation.

AWTI makes four recommendations for translating this advice into practice:

- ▶ Set a course with an inspiring future vision based on clear choices;
- ▶ Make more use of pricing and standardisation;
- ▶ Make better use of the innovative strengths of society and give knowledge and expertise in the civil service and politics top priority;
- ▶ Finally, develop a transformative policy mix which both stimulates new innovation pathways and breaks down well-trodden and unhelpful paths. AWTI will give more detailed advice on the latter in a separate advisory report on the elements of a comprehensive and cohesive transformative policy mix.

3.1 Recommendation 1: Offer an inspiring future vision based on clear choices

AWTI advises the government and parliament to organise an inspiring future vision for the Netherlands.¹⁹⁰ At present, the government is focused mainly on facilitating such a vision and encouraging others to choose a direction; this carries the risk of a lack of cohesion and clinging to existing interests and frameworks. To achieve radical transformations of societal systems, government and parliament must work together to take the initiative, give leadership and chart a course.

190. AWTI gave this advice in its earlier report 'Strengthen the role of science, technology and innovation in transitions', and explained how such a vision could be formulated. The advice to give more direction with an inspiring future vision was also recommended by the Council in AWTI (2021b) and AWTI (2020d).

The future vision will act as a compass and a magnet for researchers, entrepreneurs, companies, civil-society organisations, citizens and civil servants and enable them to mobilise.¹⁹¹ It will create clarity on future markets and generate more support for innovations which fit in with the chosen development pathways. The future vision will give companies and investors more confidence in the development and implementation of innovative technologies and solutions, and will offer citizens a framework to enable them to develop initiatives with confidence or to switch with greater certainty to sustainable innovative solutions.

The future vision is built around a series of interconnected 'windows' each dealing with specific transformations (in energy, agriculture, care, etc.) within the international context. It makes clear how specific transformations are related to each other, sets out basic values for a future-proof Netherlands and thus answers the question of how we would like things to be. It also outlines expectations and ideals and answers the question of how it could be achieved. These societal values form the basis for policy and decisions by government, but also by companies and citizens.

Establishing such a future vision requires a number of clear choices about what we consider important, what we prioritise, how we weigh different values and interests against each other. How will the Netherlands contribute to the world food problems in the future? What role will livestock farming play in that future? Should we separate nature and farming or intertwine them? How do we wish to shape consumer behaviour?¹⁹² What constitutes a sustainable energy system that is also fair and robust? Which industrial activities fit in with a sustainable economy, and which no longer do so? How do we distribute scarce space, talent, raw materials and resources across all functions of the economy and society? How do we weigh the pros and cons of these choices against each other?

To establish the future vision, AWTI recommends that government and parliament take the following steps.

Parliament: make choices in values and principles

Discuss and decide which values should play a central role in the future vision and also what the Netherlands does not want. Parliament has the democratic mandate to create a supported future vision. It is the appropriate body to determine which values and principles should be front and centre in a future-proof Netherlands and to make choices and set goals on that basis.

191. In AWTI (2020b), AWTI discussed the function of a future vision.

192. See e.g. <https://www.wur.nl/nl/nieuws/zeven-knoppen-doorhakken-voor-een-nieuwe-landbouwvisie.htm> for a number of dilemmas that are at play in agriculture.

Government: take the lead and seek input from society

Take the initiative and organise the establishment of the future vision in dialogue with society. Allow parties that are used to considering societal issues in the long term to make proposals in consultation with stakeholders, for example government advisory agencies, public knowledge organisations, think tanks and advisory councils which are experienced in performing forward studies. Place ultimate responsibility for the future vision with a subcommittee reporting to the Cabinet. This subcommittee should be coordinated by the Minister for Home Affairs and Kingdom Relations in order to safeguard the interdepartmental nature of the approach and establish a relationship with citizen participation.¹⁹³

Subcommittee: integrate different perspectives and think through the consequences

Explicitly integrate the perspective of future generations. Take into account the advice from the Future Council and introduce a generational test¹⁹⁴ to make visible the potential impact of new policy on present and future generations. Also take into account the exploratory studies carried out in connection with the National Growth Fund and climate policy.¹⁹⁵

Additionally, carry out a test of the international dimension. Integrate the role of the Netherlands in addressing the challenges in Europe and other parts of the world into the future vision.¹⁹⁶ Introduce an EU test as recommended in the AWTI advisory reports 'Strategic interplay' (2023) and 'Grasp the challenge' (2016). Look at which choices are made elsewhere, which measures are being taken in other countries and how the Netherlands can align with this, either by making parallel choices to reinforce, or by opting for a complementary approach. Also consider factors in areas such as economic safety,

193. See also AWTI (2020a).

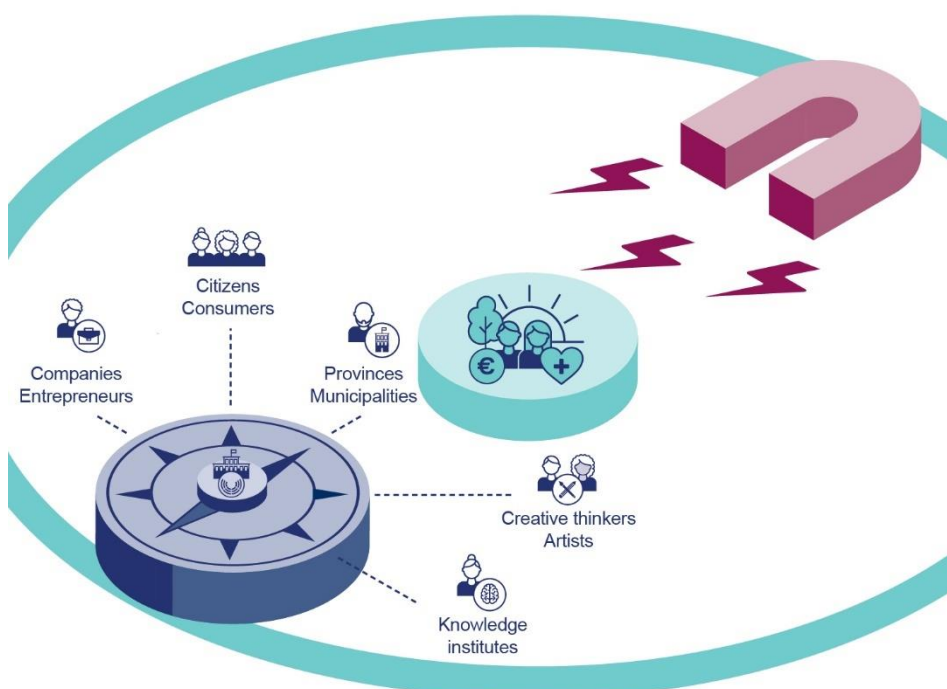
194. Raad voor de Toekomst (2023).

195. The generational test was proposed by the Social and Economic Council (SER) Youth Platform (Sociaal-Economische Raad 2019). The Dutch parliament called on the government to introduce this generational test (Tweede Kamer, 2019). Coalition-Y and the SER Youth Platform repeated this call when the fourth government led by Prime Minister Mark Rutte took office. Studies have since been carried out on how the generational test could be used in climate policy and the National Growth Fund; SIRA consulting (2022) and SIRA consulting (2023).

196. See e.g. the calls by NGOs, farming organisations, scientists and companies for the government to include in the future perspective for agriculture the role and influence of the Netherlands in agricultural issues in other parts of the world. See Manifest (2023).

technological leadership, open strategic autonomy, as well as the degree to which people can participate and profit from general welfare.¹⁹⁷

Figure 3. A future vision as a compass and magnet



3.2 Recommendation 2: Use pricing and standardisation for transformations

AWTI advises the government make more use of pricing (e.g. carbon pricing, eco-taxes or true pricing) and standardisation, in combination with subsidies to stimulate research and development. Pricing and standardisation are proven effective instruments for

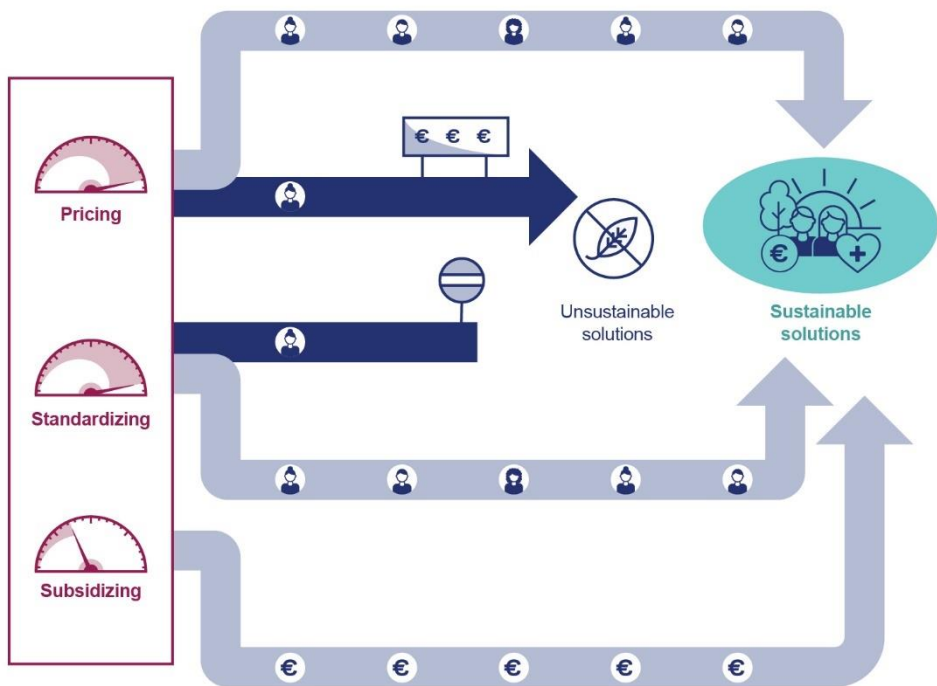
197. See Ministerie van Economische Zaken en Klimaat (2023b) for the central ambitions of the government for the Dutch economy in the future.

accelerating transformations, and should therefore form part of a transformative approach to innovation. Pricing and standardisation fulfil two key roles in transformations: they make non-sustainable trajectories less attractive or even close them off altogether; and they stimulate demand for more sustainable alternatives. If the polluter has to pay some of the societal costs of its emissions, that provides an incentive to switch to sustainable and future-proof alternatives. If non-sustainable activities, products and processes are banned, this creates a need and demand for sustainable alternatives. Fears that standardisation and pricing will have a negative impact on the Netherlands' competitive position are unfounded.

Pricing and standardisation are relevant and complex in the international context, but this should not hold the government back from investigating and deploying these measures. It is important to seek coordination at EU level, partly because the size of the European market and the economic importance of the European Union can force companies to adapt to stricter EU legislation, including in their activities outside the European Union.¹⁹⁸

Figure 4. Combine pricing, standardisation and subsidies

198. See Bradford (2020) for a substantiation of this 'Brussels effect'.



Government: combine pricing, standardisation and subsidies in the following way

- ▶ Extend pricing to other sectors of the economy. Apply predictable levies which increase over time (such as an emissions tax). Phase out non-functional exemptions, including free emissions rights and degressive tariffs for certain energy-intensive or polluting sectors.¹⁹⁹
- ▶ Introduce stricter, mandatory standards which become more stringent over time, and anchor them in legislation and regulations. Provide clarity on the timeline so that parties know where they are and have time to develop and/or switch to alternatives.

199. See AWTI (2016).

- ▶ Use subsidies (including in 'hybrid funding'²⁰⁰ combinations with loans) mainly to stimulate the development and upscaling of new technologies and innovations which offer a sustainable alternative. In combination with pricing and standardisation, this helps innovators to devise sound business cases. Exclude non-sustainable technologies from the generic innovation policy so as to remove perverse incentives.²⁰¹ Generic instruments are important to strengthen innovation in a broad sense and can also generate new directions, technologies and ideas. However, this kind of stimulation does not support transformations if it cannot be reconciled with supporting technologies or methods.

3.3 Recommendation 3: Make better use of innovative strengths in society and give top priority to knowledge and expertise in policy and politics

The future vision can only become reality in close collaboration with companies, researchers, civil-society organisations and citizens. More knowledge and expertise is needed in government concerning the underlying problems and challenges for transformations.

AWTI recommends that the government adopt a more 'society-driven' approach to transformations, so that innovation initiatives from society are given maximum scope. This is necessary to ensure better alignment of policy with the needs, wishes and ideas of Dutch society. It will also strengthen the resilience of society and help break through existing structures and the inhibiting influence of established parties.²⁰² An appealing future vision will stimulate and inspire these societal initiatives.

Ultimately, it will be necessary to take concrete actions and make specific agreements with companies, researchers, civil-society organisations and citizens. Those agreements will focus on who does what (what will the government do, what will it leave to the market?) and on the distribution of the costs, benefits and risks of transformations.

200. See AWTI (2021b).

201. See AWTI (2016). By 'non-sustainable', AWTI means technologies and innovations that do not contribute to the transformation of societal systems which are socially, ecologically and economically more sustainable and therefore more future-proof. What counts as non-sustainable should follow from the future vision as suggested in Recommendation 1. Examples might include technologies and innovations based on burning fossil fuels, but also innovations which are highly energy-intensive or lead to pollution of air, water and soil, threaten biodiversity or could harm human and animal health.

202. See also AWTI (2022c); Soete & Stierma (2023); Schwaag Serger et al. (2023).

Government: create better conditions for societal initiatives and co-creation

- ▶ Use the future vision as a basis from which to outline the (non-optional) frameworks, goals and conditions within which society itself can make judgements and can investigate, innovate, experiment and implement. The frameworks must offer sufficient scope and flexibility and must be fair, just and predictable.
- ▶ Ensure that civil-society partners have the necessary financial basis and drivers to participate, for example via innovation-driven tenders and ‘right to challenge’ trajectories.²⁰³ New financial and legal arrangements are also needed for public-civil and private-civil partnerships.²⁰⁴

AWTI will provide more detailed advice in a separate advisory report on how these better conditions can be created as part of a transformative policy mix.

Government and parliament: give top priority to knowledge and expertise in policy and politics

Politicians and civil servants need knowledge about the domains in which the problems and challenges occur. They also need knowledge, experience and skills to actively create new networks, coordinate different activities, determine which interventions are important and when, and be less susceptible to lobbying.

AWTI has highlighted the importance of knowledge and expertise in policy and politics in several advisory reports, and has put forward numerous recommendations in this regard.²⁰⁵ The Council recommends that genuine efforts be made to take the steps it has set out previously towards better utilisation of knowledge in policy processes. Implementing these steps will be good preparation for government ministries, executive agencies and parliament for their role in the necessary transformations.

- ▶ Nurture knowledge and subject experts. Give subject experts specific tasks and also recruit specialists. Set aside part of the working week for this. Reduce the job rotation of policy staff, directors and senior officials in government ministries and executive agencies.²⁰⁶

203. In a ‘right to challenge’ approach, a group of (organised) residents can be given an opportunity to take over tasks from the government if they think they can be performed differently, better, smarter and/or more cheaply.

204. Overlegorgaan Fysieke Leefomgeving (2022); Schoenmaker & Schramande (2019); see also European project CROWD THERMAL <https://www.crowdthermalproject.eu/>

205. See e.g. AWTI (2018), AWTI (2020b), AWTI (2021a) and AWTI (2021b).

206. See AWTI (2021a) for more details on this recommendation.

- ▶ Enrich the knowledge of government ministries and executive agencies and create scope to counter internal groupthink. Consider setting up an internal future group in each ministry, in which staff who are at some remove from the day-to-day work can make a start on open policy development around transformation questions. This group will have the brief of investigating what needs to change within the ministry in order to accelerate transformations.²⁰⁷
- ▶ Develop a structured and structural approach for bridging the gap between knowledge and policy. AWTI has previously recommended setting up a ‘national lab’ as a collaboration and experimentation hub for policy staff from different ministries, together with scientists and stakeholders from society at large.²⁰⁸ One possibility would be to organise a fellowship programme in which scientists are temporarily seconded to a ministry to study policy issues while policymakers spend a period working at research institutes to study an issue in more detail.²⁰⁹ Consideration could also be given to appointing a Chief Scientific Advisor in each government ministry,²¹⁰ something that is normal practice in the United Kingdom. These are senior scientists who are temporarily attached to a ministry to act as ‘knowledge brokers’ and provide scientific advice to the ministry. Chief Scientific Officers report to the Government Chief Scientific Advisor; in the Netherlands, this person would need to report to the Ministry of General Affairs, so that the Prime Minister and the entire cabinet are provided with scientific advice.²¹¹
- ▶ Continue strengthening the Analysis and Research Department to build a robust parliamentary knowledge and expertise centre for parliament, with substantial capacity and (specialist) expertise for analysing large information flows, building an institutional memory and providing advice.²¹² This expertise centre would function as a knowledge bank and build new, collective knowledge in collaboration with knowledge institutes. The Parliament & Science partnership²¹³ plays an essential

207. See AWTI (2020b) and AWTI (2021a) for more details.

208. See AWTI (2018) and AWTI (2021a); ABDTopconsult (2023) made a similar recommendation.

209. This is a tried and tested approach in the United Kingdom. See e.g. <https://www.ukri.org/opportunity/ukri-policy-fellowships-2023/>; <https://www.thebritishacademy.ac.uk/funding/innovation-fellowships-scheme-route-b-policy-led-2023-24/> and <https://www.ucl.ac.uk/public-policy/support/development-opportunities/fellowship-programme>

210. Three government ministries already have a Chief Science Officer (CSO), though the positions and levels are not the same. Other ministries have different roles, arrangements or incidental activities for knowledge management; see ABDTopconsult (2023).

211. See also the recommendation by the Subramaniam Committee (2023) following the evaluation by the Netherlands Scientific Council for Government Policy (WRR).

212. A meaningful step in enlarging the Analysis and Research Department was taken with the adoption of the Bergkamp amendment for the fiscal year 2022, which provides for an increase of ten FTE to strengthen the support for the legislative tasks and auditing responsibilities of parliament. See Tweede Kamer (2021).

213. See <https://parlementenwetenschap.nl/>

role here. Knowledge is also needed in the areas covered by the standing parliamentary committees, and also on cross-border topics such as technology development and design & experimentation methodology.²¹⁴

3.4 Recommendation 4: Develop a transformative policy mix

Speeding up the formulation of a future vision and realising transformations and system changes requires a comprehensive, cohesive mix of policy measures. AWTI recommends that the government set about formulating a transformative policy mix.

AWTI will give more detailed advice in a separate advisory letter on the elements of such a comprehensive and cohesive transformative policy mix.

Government: apply the following principles to guide a transformative policy mix

- ▶ Start from the perspective of the future, societal challenges and associated interests, and do not be guided solely by future earning capacity in drafting policy instruments and selecting projects.
- ▶ Ensure that the policy mix spans several years, with interventions at the right times in the specific phases through which transformations progress and in the development phases of innovations. Provide sufficient scope for early-phase development of new knowledge and technologies which could eventually contribute to the necessary transformations. Stimulate large-scale upscaling and dissemination of promising solutions. Introduce measures aimed at phasing out activities and products which no longer fit in with the envisaged transformation. Build a strong relationship between innovation policy and sectoral policy. Policy not only ‘pushes’ the development of innovative solutions, but also creates demand for those solutions and stimulates the dissemination of innovations. Examples include policy interventions in relation to infrastructure, labour market, market organisation, funding opportunities and standards, as well as pricing and standardisation (Recommendation 2) and innovation-driven and socially responsible procurement by the government as a ‘launching customer’.²¹⁵ Special attention needs to be given to inhibiting legislation and licensing procedures. Cohesion, coordination and

214. See AWTI (2021a) for more details. The working group set up to strengthen the roles of parliament (Werkgroep versterking functies Tweede Kamer) (2021) also advises the Presidium to substantially strengthen the official and substantive support of the committees and the House.

215. See also AWTI (2018). The Council also refers to the recent findings and recommendations of the innovation-driven procurement working group (Werkgroep Innovatiegericht Inkopen)/Pianoo (2022).

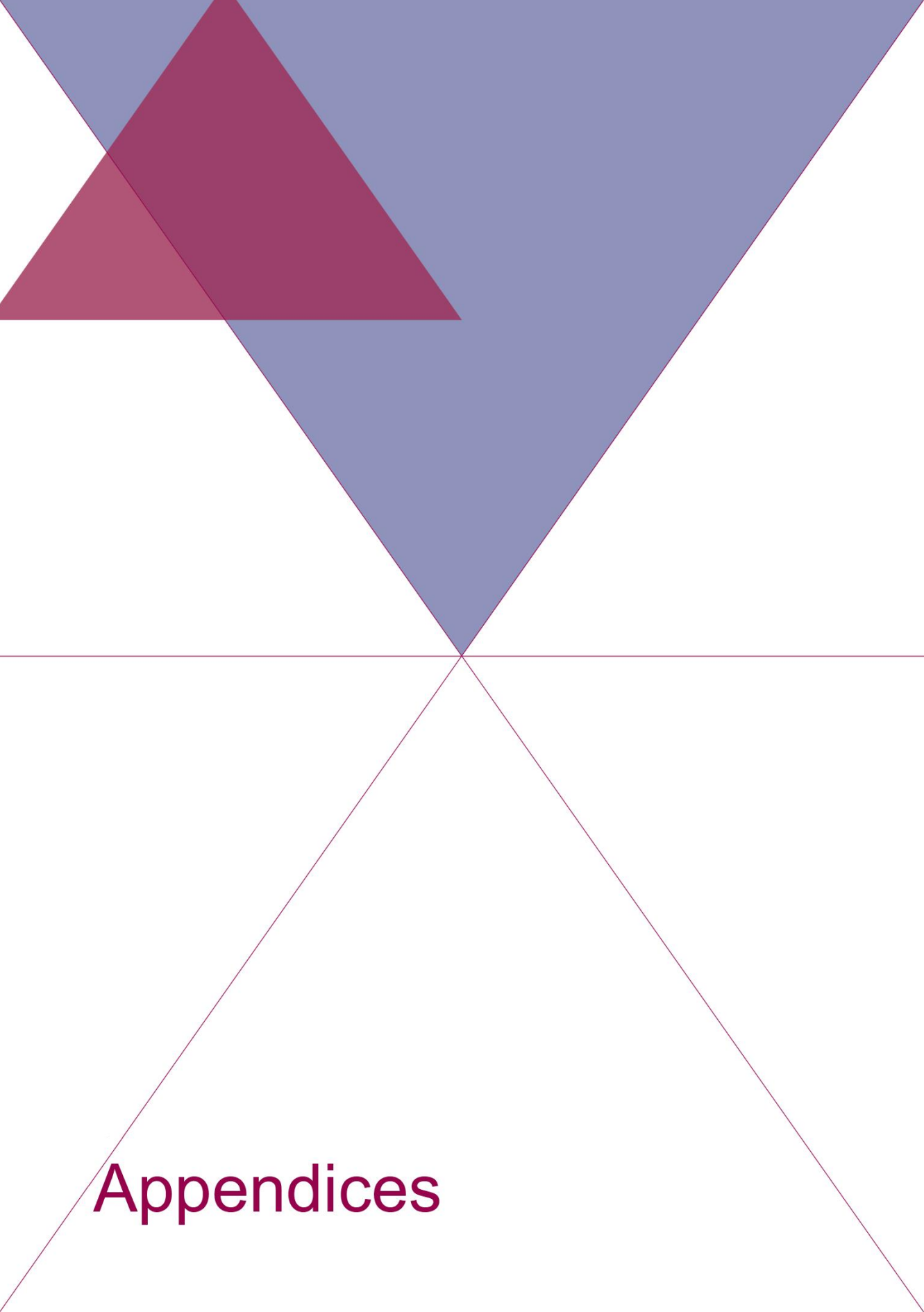
consistency across the different laws is needed to prevent projects, companies and citizens being confronted with conflicting or uncoordinated legislation, or comparable problems being resolved in different ways under different pieces of legislation.²¹⁶

- ▶ Create a coherent mix of European, national and regional policy aimed at achieving the transformation objectives.²¹⁷ Ensure that Dutch and EU policy instruments, including in relation to tax, complement or reinforce each other (via substantive and financial leverage). Carry out an ‘EU check’ to determine which EU regulations exist in a given area and make a well-considered choice on how national or regional regulations can be aligned with them. Carry out periodic ex-post evaluation of the entire policy mix (incorporating both EU and national policy instruments) to identify where different regulations reinforce or conflict with each other, or where there are gaps.
- ▶ Make better use of knowledge and innovation from the social sciences and humanities for achieving transformations. Facilitate and stimulate innovation in these disciplines by taking more account in the innovation policy mix of the specific characteristics of this type of innovation. AWTI will publish an advisory report in 2024 on how the Netherlands can make optimum use of the social sciences and humanities to address different issues in society, now and in the future.
- ▶ Offer more scope to a broad array of actors, including non-established parties, creatives and thinkers, citizen collectives and other civil-society partners. See also Recommendation 3.
- ▶ Organise continuous monitoring and evaluation of transformative policy interventions. Designing an effective approach is a continual process in which policymakers and other stakeholders experiment with new alternatives and learn what does and does not work. To develop a transformative evaluation approach, align with the frameworks and methods developed in the report ‘Dare to learn, keep on measuring: in search of frameworks and methods for evaluating system and transition policy’ (‘Durf te leren, ga door met meten: op zoek naar kaders en methoden voor de evaluatie van systeem- en transitiebeleid’), which was compiled at the request of the Ministry of Economic Affairs and Climate Policy.²¹⁸

216. See Dieperink (2022).

217. See AWTI (2023) for more details on this recommendation.

218. Ter Weel et al. (2022).



Appendices

Annex 1 Methodology

AWTI went through a number of steps in compiling this advisory report. The process began with a preliminary study by Karin Wittebrood, who was commissioned by AWTI to write a paper explaining a number of relevant terms, exploring the development of innovation policy in recent decades and outlining the principal dilemmas surrounding present innovation policy. In addition to a limited literature review on innovation and societal transitions, she conducted interviews with nine experts, each of whom is involved in different ways with societal transitions. They were asked for their views on effective innovation policy for the future. This resulted in a summary outlining a number of challenges for transformative innovation policy. The report is available separately (in Dutch) at www.awti.nl.

Next, AWTI began a further investigation of the topic. We carried out an initial review of the literature and policy approach and spoke to policy advisers at the Dutch Ministry of Education, Culture and Science and the Ministry of Economic Affairs and Climate Policy. On 18 November 2022, during the ‘Innovember’ innovation conference organised by the National Innovation Community, we organised an online session with and for government officials, to discuss the central question: ‘How can innovation policy accelerate societal transitions?’ Highlights of the session can be found on LinkedIn²¹⁹ and Vimeo²²⁰. These exploratory activities culminated in a project document setting out which subsequent steps would be taken in compiling this advisory report.

The next phase involved an extensive review of the scientific literature in this field. Document selection was carried out using a combination of search engines, expert advice and snowball methodology. The analytical categories applied in the literature review were the characteristics of transformative innovation policy, frequently occurring challenges and the type of associated policy instruments. References to all literature used in the advisory report can be found in Annex 2.

To add a practical dimension to the insights gained from the literature and the preliminary study, AWTI studied two different transformations in detail: the agrifood system and the energy system. These two transformations are happening in real time and differ in terms of the complexity, progress, approach and innovation challenges. We analysed the progress of both transformations by studying the literature and through a series of interviews with experts and stakeholders. A list of all interviewees can be found in Annex

219. See <https://www.linkedin.com/feed/update/urn:li:activity:7004398258852663296>

220. See <https://vimeo.com/776138265>

3. AWTI does not offer specific advice on these two transformations, but uses them as examples to illustrate the complexity.

We also compiled an inventory of national policy instruments which impinge on knowledge and innovation for the transformation of the agrifood and energy systems. Outline insights are incorporated in chapter 2; A detailed analysis and recommendations will be published in a separate advisory letter. AWTI also collaborated with the Flemish Advisory Council for Innovation and Entrepreneurship (VARIO) to study transformative innovation policy in a number of countries: what instruments are used and what are the experiences? AWTI specifically studied the approach in Sweden and also compiled an inventory of instructive examples from other countries. VARIO looked at the approach taken in Switzerland and Austria. VARIO and AWTI also informed each other of the approach taken in their own respective countries. The analyses are available as a background study.

In the final phase, all insights from the analysis were brought together, interpreted and worked up into an advisory report. The results of the various individual analyses, the thrust of the advice and recommendations were discussed during several Council meetings. The draft advisory report was submitted to Dr Elie Ratinckx (Council staff member at VARIO) and Professor Wim Derksen for reading and comments. Their comments were subsequently incorporated in the advisory report under the responsibility of the Council.

Annex 2 References

- ▶ ABDTOPConsult (2023), *Kennisrijk samenwerken. Verkenning Rijksbrede kennisfunctie*, Den Haag.
- ▶ AgriHolland (2023), 'Discussie over heffing op broeikasgasemissie door veehouderij in Nieuw-Zeeland', 25 August 2023, accessed at: <https://www.agriholland.nl/nieuws/250438/> [30 August 2023].
- ▶ Alkemade, F., & H. de Coninck (2021), 'Policy mixes for sustainability transitions must embrace system dynamics', *Environmental Innovation and Societal Transitions*, 41, 24-26.
- ▶ Alkemade, F., B. de Bruin, A. El-Feiaz, F. Pasimeni, L. Niamir & R. Wade (2023), 'Social tipping dynamics in the energy system', *Earth System Dynamics Discussion* [preprint], in review.
- ▶ Ambec, S., M.A. Cohen, S. Elgie & P. Lanoie (2010) 'The Porter Hypothesis at 20: Can environmental regulation enhance innovation and competitiveness?', Chair's paper, Montreal, Canada, 27-28 June 2010, accessed at: https://www.isc.hbs.edu/Documents/pdf/PorterHypothesis_at20_Montreal.pdf [30 October 2023].
- ▶ Andrès, K., M. Scheepers, R. van den Brink & R. Smokers (2022), *De energietransitie moet sneller: dit is nodig om de klimaat doelstellingen te halen*, Den Haag, TNO.
- ▶ D'Arcangelo, F.M., I. Levin, A. Pagani, M. Pisu & Å. Johansson (2022), 'A framework to decarbonise the economy', *OECD Economic Policy Papers*, No. 31, Paris, OECD Publishing.
- ▶ AWTI (2016), *Oppakken en doorpakken. Durven kiezen voor energie-innovatie [Grasp the challenge - Daring to go for energy innovation]*, Den Haag.
- ▶ AWTI (2017), *Onmisbare schakels. De toekomst van het toepassingsgericht onderzoek [Vital links - The future of applied research]*, Den Haag.
- ▶ AWTI (2018), *Verspreiding. De onderbelichte kant van innovatie [Spread of innovation The underexposed side of innovation policy]*, Den Haag.
- ▶ AWTI (2019), *Het stelsel op scherp gezet. Naar toekomstbestendig hoger onderwijs en onderzoek [Shaking-up the system - Towards a future-proof higher education and research system]*, Den Haag.
- ▶ AWTI (2020a), *Krachtiger kiezen voor sleuteltechnologieën [A more forceful choice for key technologies]*, Den Haag.
- ▶ AWTI (2020b), *Versterk de rol van wetenschap, technologie en innovatie in maatschappelijke transitie [Strengthen the role of science, technology and innovation in societal transitions]*, Den Haag.

- ▶ AWTI (2020c), *Beter van start. De sleutel tot doorgroei van kennisintensieve start-ups [A better start - The key to growth of knowledge-intensive start-ups]*, Den Haag.
- ▶ AWTI (2020d), *Briefadvies Nationaal Groeifonds*, Den Haag.
- ▶ AWTI (2021a), *Rijk aan kennis. Naar een herwaardering van kennis en expertise in beleid en politiek [State of knowledge - Restoring the value of knowledge and expertise in policy and politics]*, Den Haag.
- ▶ AWTI (2021b), *Samen de lat hoog leggen. Regio en rijk bundelen krachten voor innovatie [Raising the bar together - Regional and central government working together for innovation]*, Den Haag.
- ▶ AWTI (2022a), *Grenzeloos onderzoeken. Stimuleer interdisciplinariteit met twee onderscheidende overheidsrollen [Unbounded research - Promoting interdisciplinarity through two distinctive government roles]*, Den Haag.
- ▶ AWTI (2022b), *Briefadvies over de Nationale Wetenschapsagenda*, Den Haag.
- ▶ AWTI (2022c), *Samen grip krijgen op wicked problems. Lessen uit de coronacrisis*, Den Haag.
- ▶ Bavel, B. van, S. Hardeman & A. Rijpma (2019), 'Vervolgstappen voor integrale welvaartsmeting', *ESB*, 104(4772S), 11 April 2019.
- ▶ Beers, P.J. (2016), *Welke nieuwe businessmodellen geven de landbouw toekomst?*, 's-Hertogenbosch, HAS Hogeschool.
- ▶ Black, S., A. Liu, I. Parry & N. Vernon (2023), 'IMF Fossil Fuel Subsidies Data: 2023 Update', *IMF Working Papers*, WP/23/169, Washington D.C., International Monetary Fund, accessed at: <https://www.imf.org/en/Publications/WP/Issues/2023/08/22/IMF-Fossil-Fuel-Subsidies-Data-2023-Update-537281> [30 October 2023].
- ▶ Boer, A. C. L. den, K. P. W. Kok, M. Gill, J. Breda, J. Cahill, C. Callenius, P. Caron, Z. Damianova, M. Gurinovic, L. Lähteenmäki, T. Lang, R. Sonnino, G. Verburg, H. Westhoek, T. Cesuroglu, B.J. Regeer, B. & J.E.W. Broerse (2021), 'Research and innovation as a catalyst for food system transformation', *Trends in Food Science and Technology*, 107, 150-156.
- ▶ Bos, L., B. van der Lelij & J. Geelen (2023), *Verduurzaming van de landbouw door agrarisch ondernemers met een gemiddelde landbouwpraktijk*. Rapportage van een kwantitatief onderzoek, in opdracht van ministerie van LNV, Geelen consultancy en Motivaction.
- ▶ Boschma, R., E. Miguelez, R. Moreno & D.B. Ocampo-Corrales (2023), 'The Role of Relatedness and Unrelatedness for the Geography of Technological Breakthroughs in Europe', *Economic Geography*, Volume 99, 2023 - Issue 2, 117-139.
- ▶ Bouman, M. (2023), 'Alles en nog wat tot 'fossiele subsidie' verklaren helpt het klimaat niet', rubriek Radarwerk in *Het Financieele Dagblad*, 8 September 2023, accessed at: <https://fd.nl/economie/1488760/alles-en-nog-wat-tot-fossiele-subsidie-verklaren-helpt-het-klimaat->

niet?utm_medium=social&utm_source=app&utm_campaign=earned&utm_content=20230911&utm_term=app-ios [30 October 2023].

- ▶ Braams, R. (2021), *De ambtenaar als hoeder van maatschappelijke transitie*, online essay at: <https://specials.publiekdenken.nl/publiek-denken-31-2021/essay-rik-braams-over-transformatieve-overheid/> [30 October 2023].
- ▶ Braams, R. B., J.H. Wesseling, A.J. Meijer & M.P. Hekkert (2021), 'Legitimizing transformative government. Aligning essential government tasks from transition literature with normative arguments about legitimacy from Public Administration traditions', *Environmental Innovation and Societal Transitions*, 39: 191–205.
- ▶ Braams, R.B., J.H. Wesseling, A.J. Meijer & M.P. Hekkert (2022), 'Understanding why civil servants are reluctant to carry out transition tasks', *Science and Public Policy*, 49, 905–914.
- ▶ Bradford, A. (2020), *The Brussels Effect. How the European Union rules the world*, Oxford University Press
- ▶ Brink, C. & H. Vollebergh (2021), 'Klimaatbeprizing in Nederland ligt onvoldoende op koers', *ESB*, 106(4804), 23 December 2021.
- ▶ Brink, C., A. Trinks, H. Vollebergh & P. Zwaneveld (2023), *Afschaffing fossiele-energiesubsidies: eerder een hersenkraker dan een no-brainer*, Den Haag, Centraal Planbureau en Planbureau voor de Leefomgeving.
- ▶ Bruyn, de S., R. Vergeer, H. Croezen, I. Nieuwenhuijse & M. van Lieshout (2018), *Effecten van CO2-beprizing in de industrie. CO2-reducties, kostprijsverhoging en koolstoflekkage*, Delft, CE Delft.
- ▶ CBS (2023), *Monitor Brede Welvaart en de Sustainable Development Goals 2023*, accessed at: <https://www.cbs.nl/nl-nl/dossier/brede-welvaart-en-de-sustainable-development-goals/monitor-brede-welvaart-en-de-sustainable-development-goals-2023> [30 October 2023].
- ▶ Conijn, F. & R. Smit (2023a), 'Bureaucratie is groot obstakel voor bedrijven die willen verduurzamen', *Het Financieele Dagblad*, 29 March 2023, accessed at: <https://fd.nl/bedrijfsleven/1471498/weg-naar-verduurzaming-bedrijf-ligt-vol-obstakels> [30 October 2023].
- ▶ Conijn, F & R. Smit (2023b), 'Kleine ondernemer grijpt naast groene subsidie vanwege geldgebrek', *Het Financieele Dagblad*, 23 June 2023, accessed at: <https://fd.nl/bedrijfsleven/1479579/kleine-ondernemer-grijpt-naast-groene-subsidie-vanwege-geldgebrek> [30 October 2023].
- ▶ Cooper, R. (1990), 'Stage-gate systems: A new tool for managing new products', *Business Horizons*, Volume 33, Issue 3, 44-54.
- ▶ CPB (2016), *Kansrijk innovatiebeleid*, Den Haag, Centraal Planbureau / CPB (2020), *Update Kansrijk innovatiebeleid*, Den Haag, Centraal Planbureau.

- ▶ David, M. (2017), 'Moving beyond the heuristic of creative destruction: Targeting exnovation with policy mixes for energy transitions', *Energy Research & Social Science*, 33, 138-146.
- ▶ David, M. & M. Gross (2019), 'Futurizing politics and the sustainability of real-world experiments: what role for innovation and exnovation in the German energy transition?', *Sustainability Science*, 1-10.
- ▶ Davidson, D. J. (2019), 'Exnovating for a renewable energy transition', *Nature Energy*, 4(4), 254.
- ▶ Dieperink, M.A.M. (2022), *Zonder visie geen transitie. Het recht als accelerator van de klimaat- en energietransitie*, Den Haag, Boom juridisch.
- ▶ Diercks, G., D. Loorbach, M. van der Steen et al. (2020) *Sturing in transities: een raamwerk voor strategiebepaling*. Rapport Drift en Nederlandse School voor Openbaar Bestuur.
- ▶ Diercks, G & F. Avelino (2022), 'Voorbij de triple helix', Blog op: <https://drift.eur.nl/nl/publicaties/voorbij-de-triple-helix/> [30 October 2023].
- ▶ Dijk, J. van, R. Verburg, H. Runhaar & M. Hekkert (2018), 'Een transitie naar natuur-inclusieve landbouw: van 'waarom' naar 'hoe'', *Me Judice*, 3 May 2018, accessed at: <https://www.mejudice.nl/artikelen/detail/een-transitie-naar-natuurinclusieve-landbouw-van-waarom-naar-hoe> [30 October 2023].
- ▶ Dijk, J. van, G. van der Veer, M. Woestenburg, J. Stoop, M. Wijdeven, K. van Veluw, R. Schrijver, J. van den Akker, E. van Woudenberg, D. Kerkhoven & M. Slot (2020), *Onderzoek naar een kennisbasis voor natuurgedreven landbouw*, Bunnik, Waardevolle Informatie Natuurgedreven Kwaliteit - WINK.
- ▶ Dreijerink, L.J.M. & R.A. Peuchen (2020), *Maatschappelijk draagvlak voor klimaat- en energiebeleid. Resultaten van een vragenlijstonderzoek*, Amsterdam, TNO.
- ▶ Dreijerink L. en M. Klösters (2021), *Wat is het maatschappelijk draagvlak voor klimaatbeleid? Onderzoek naar beleidsopties*, Studiegroep Invulling klimaatopgave Green Deal, Amsterdam, TNO.
- ▶ Duijnmayr, D. (2023), 'We moeten nu keihard werken aan het eindbeeld van de energietransitie', *Energieia Nieuws*, 4 April 2023, accessed at: <https://energieia.nl/energieia-artikel/40106302/we-moeten-nu-keihard-werken-aan-het-eindbeeld-van-de-energietransitie> [30 October 2023].
- ▶ Eppinga, A. (2022), 'Floor Alkemade onderzoekt hoe de energietransitie sneller kan', *Innovation Origins*, 29 December 2022, accessed at: https://innovationorigins.com/nl/floor-alkemade-onderzoekt-hoe-de-energietransitie-snel-kan/#_msocom_1 [30 October 2023].
- ▶ Erisman, J.W. & K. Poppe (2020), *Essay: De economie van de landbouw en de mogelijkheden voor regio's om te verduurzamen*, Den Haag, College van Rijksadviseurs

- ▶ Erisman, J.W. & B. Strootman (2021), *Naar een ontspannen Nederland*, accessed at: <https://ontspannennederland.nl/> [30 October 2023].
- ▶ ESABCC (2023) *Scientific advice for the determination of an EU-wide 2040 climate target and a greenhouse gas budget for 2030–2050*, Copenhagen, European Scientific Advisory Board on Climate Change
- ▶ European Commission (2018), *Mission-Oriented Research Innovation in the European Union: A Problem-solving Approach to Fuel Innovation-led Growth*, By Mariana Mazzucato, Brussels, Directorate-General for Research and Innovation European Commission.
- ▶ European Commission (2019), *Country Report The Netherlands 2019. Including an In-Depth Review on the prevention and correction of macroeconomic imbalances*. Accompanying the document 2019 European Semester: Assessment of progress on structural reforms, prevention and correction of macroeconomic imbalances, and results of in-depth reviews under Regulation (EU) No 1176/2011, Brussels COM/2019/150 final.
- ▶ European Commission (2021), *The strategic use of public procurement for innovation in the digital economy. Final Report*, compiled by PwC EU Services, Brussels, Directorate-General for Communications Networks, Content and Technology European Commission.
- ▶ European Commission (2023), *European Innovation Scoreboard 2023*, Brussels, Directorate-General for Research and Innovation European Commission.
- ▶ European Commission (undated) https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/development-eu-ets-2005-2020_en [30 October 2023].
- ▶ Europese Rekenkamer (2021), *Het gemeenschappelijk landbouwbeleid en het klimaat*, speciaal verslag 16/2021, Luxembourg.
- ▶ Europese Rekenkamer (2023), *De klimaat- en energiedoelstellingen van de EU*, speciaal verslag 18/2023, Luxembourg.
- ▶ Expertteam Energiesysteem 2050 (2022), *2050 is begonnen. Versnellen, sturen en meenemen voor een geslaagde energietransitie*, Tussenrapportage, accessed at: <https://www.etes2050.nl/publicaties/tussen-rapportage/default.aspx> [30 October 2023].
- ▶ Expertteam Energiesysteem 2050 (2023), *Energie door perspectief: rechtvaardig, robuust en duurzaam naar 2050*, accessed at: <https://www.etes2050.nl/publicaties/outlookenergiesysteem2050/default.aspx> [30 October 2023].
- ▶ Fischer, C. & R.G. Newell (2008), 'Environmental and technology policies for climate mitigation', *Journal of Environmental Economics and Management*, 55(2), 142–162.

- ▶ Forray, D., C.D. Mowery & R.R. Nelson (2012), 'Public R&D and social challenges: What lessons from mission R&D programs?', *Research Policy*, 41 (10), 1697-1702,
- ▶ Frenken, K., M. Hekkert & M. Janssen (2021), 'Betrek alle ministeries en samenleving bij aanjagen innovatie via missies', *ESB*, 106(4799), 15 July 2021.
- ▶ Geels, F.W. (2002), 'Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case study', *Research Policy*, 31 (2002) 1257-1274.
- ▶ Geels, F.W. & J. Schot (2007), 'Typology of sociotechnical transition pathways', *Research Policy*, 36 (2007) 399-417.
- ▶ Geels, F. (2020), 'Transformative innovation and socio-technical transitions to address grand challenges', *R&I paper series working paper*, 2020/02, Brussels, Directorate-General for Research and Innovation European Commission.
- ▶ Gerlagh, R & H. Vollebergh (2023), 'De energiecrisis versnelt de energietransitie', *ESB*, 108(4817), 26 January 2023.
- ▶ *Global Entrepreneurship Index (2023)*, accessed at: <http://thegedi.org/global-entrepreneurship-and-development-index/> [30 October 2023].
- ▶ *Global Entrepreneurship Monitor (2023)*, accessed at: <https://gemconsortium.org/report/20222023-global-entrepreneurship-monitor-global-report-adapting-to-a-new-normal-2> [30 October 2023].
- ▶ Goetheer, A., F.A. van der Zee & M.J.L de Heide (2018), *Staat Nederland Innovatieland 2018: Missies en 'Nieuw' Missiegedreven Beleid*, Den Haag, TNO.
- ▶ Grin J, J. Rotmans & J. Schot (2010), *Transitions to sustainable development: new directions in the study of long term transformative change*, New York, Routledge.
- ▶ Hart, R. (2019), 'To everything there is a season: Carbon pricing, research subsidies, and the transition to fossil-free energy', *Journal of the Association of Environmental and Resource Economists*, 6(2), 349–389.
- ▶ Hebinck, A., Diercks, T. von Wirth, P.J. Beers, L. Barsties, S. Buchel, R. Greer, F. van Steenbergem & D. Loorbach (2022), 'An actionable understanding of societal transitions: the X-curve framework', *Sustainability Science*, 17(3):1009-1021.
- ▶ Hensen, C. & L. van Lonkhuyzen (2023), 'Staat steunt olieproject, want 'overgangperiode'; Kabinet omzeilt belofte Glasgow: 'overgangsfase', *NRC*, 6 April 2023, accessed at: <https://www.nrc.nl/nieuws/2023/04/05/staat-steunt-nieuw-braziliaans-olieplatform-met-verzekering-ondanks-klimaatbelofte-want-overgangperiode-a4161458> [30 October 2023].
- ▶ Hers, S., C. Oliveira Machado dos Santos, S. Lamboo, T. van Dril, J. Raadschelders, W. Mallon, M. de Ronde, C. Goemans, I. de Klerk, S. Tonneijck, H. van Dijk, R. Kreiter, A. de Haas & A. ten Cate (2021), *Elektrificatie is cruciaal voor een duurzame industrie: routekaart elektrificatie in de industrie*, Den Haag, TNO.

- ▶ Heyen, D., L. Hermwille & T. (2017), 'Out of the comfort zone! Governing the exnovation of unsustainable technologies and practices', *GAIA-Ecological Perspectives for Science and Society*, 26(4), 326-331.
- ▶ Homolová, A. L. de Korte & T. Joosten (2022), 'Landbouwmiljonairs en minimumlonen: Europees subsidiebeleid vergroot ongelijkheid onder boeren', *Follow the Money*, 2 July 2022, accessed at: <https://www.ftm.nl/artikelen/glb-miljarden-voor-de-boer-wie-krijgt-wat-van-brussel> [30 October 2023].
- ▶ Hynes, W., M. Lees & J. Müller (eds.) (2020), *Systemic Thinking for Policy Making: The Potential of Systems Analysis for Addressing Global Policy Challenges in the 21st Century, New Approaches to Economic Challenges*, Paris, OECD Publishing.
- ▶ Hölscher, K., J. M. Wittmayer & D. Lorbach (2018), 'Transition versus transformation: What's the difference?', *Environmental Innovation and Societal Transitions*, 27 (2018) 1–3.
- ▶ *IMD World Competitiveness Ranking* (2023), accessed at: <https://www.imd.org/centers/wcc/world-competitiveness-center/rankings/world-competitiveness-ranking/2023/> [30 October 2023].
- ▶ Intergovernmental Panel on Climate Change – IPCC (2023), *Climate Change 2023, Synthesis Report, Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, H. Lee and J. Romero (eds.)]. Geneva, IPCC.
- ▶ International Monetary Fund (2019), *Article IV Consultation – The Kingdom of the Netherlands. Country Report No. 2019/044*, Washington D.C.
- ▶ Inwonerraad Energie (2023), *Een eerlijk energiesysteem voor iedereen. Eindrapport Inwonerraad Energie*, De Inwonerraad Energie is in opdracht van het Expertteam Energiesysteem 2050 uitgevoerd door de Rijksdienst voor Ondernemend Nederland (RVO), bureau EMMA, Bureau Burgerberaad en de Rijksuniversiteit Groningen.
- ▶ Janssen, C. (2022), 'Deense boeren wacht geen 'woest aantrekkelijke' uitkoopregeling', *Foodlog*, 13 December 2022, accessed at: <https://www.foodlog.nl/artikel/deense-boeren-wacht-geen-woest-aantrekkelijke-uitkoopregeling/> [30 October 2023].
- ▶ Janssen, M., M. Hekkert & K. Frenken (2019), 'Missiegedreven innovatiebeleid: Twee vliegen in één klap?', *Me Judice*, 25 September 2019, accessed at: <https://www.mejudice.nl/artikelen/detail/missiegedreven-innovatiebeleid-twee-vliegen-in-eeen-klap> [30 October 2023].
- ▶ Janssen, M. (2020), *Post-commencement analysis of the Dutch 'Mission-oriented Topsector and Innovation Policy' approach*, Mission-Oriented Innovation Policy Observatory (MIPO) Copernicus Institute of Sustainable Development Utrecht University.

- ▶ Janssen, M., J. Wesseling, J. Torrens, K.M. Weber & C. Penna (2022), 'Missions as a boundary object in umbrella frameworks: The case of the Dutch Mission-oriented Topsector and Innovation Policy' in *Extended abstracts, Eu-SPRI 2022 conference*, 'Challenging science and innovation policy', Utrecht, 1-3 June 2022.
- ▶ Janssen, M., I. Wanzenböck, L. Fünfschilling & D. Pontikakis (2023), *Capacities for transformative innovation in public administrations and governance systems: Evidence from pioneering policy practice*, JRC Science for Policy Report, Luxembourg, European Commission.
- ▶ Jongsma, M. & R. de Lange (2023), 'Verduurzaming is te veel een feestje voor ambtenaren en consultants', *Het Financieele Dagblad*, 10 April 2023, accessed at: <https://fd.nl/samenleving/1472735/verduurzaming-is-te-veel-een-feestje-voor-ambtenaren-en-consultants-vjd3calatNTO> [30 October 2023].
- ▶ Kalantzis, F. (2021), *Firms brace for climate change*, European Investment Bank, accessed at: <https://www.eib.org/en/essays/european-climate-survey> [30 October 2023]
- ▶ Kalden, C. (2023), *Kom in beweging*, Verslag van de voorzitter van het Landbouwakkoord, 5 July 2023, accessed at: <https://www.landbouwakkoord.nl/documenten/publicaties/2023/07/05/aanbiedingsbrief-en-verslag-landbouwakkoord> [30 October 2023].
- ▶ Kerr, R., Bloomfield, G., & Schot, J. (undated), *A Top-line Guide to Sustainability Transitions*, Transformative Innovation Policy Consortium (TIPC).
- ▶ KIA Maatschappelijk Verdienvermogen (undated), <https://maatschappelijkverdienvermogen.nl/> [30 October 2023].
- ▶ Kleijne, K. de, S.V. Hanssen, L. van Dinteren, M. A.J. Huijbregts, R. van Zelm & H. de Coninck (2022), 'Limits to Paris compatibility of CO2 capture and utilization', *One Earth*, Volume 5, Issue 2, 18 February 2022, 168-185.
- ▶ Kleimann, D., N. Poitiers, A. Sapir, S. Tagliapietra, N. Véron, R. Veugelers & J. Zettelmeyer (2023), *How Europe should answer the US Inflation Reduction Act*, Policy Contribution Issue n°04/23 | February 2023, Brussels, Bruegel, accessed at: https://www.bruegel.org/sites/default/files/2023-02/PB%2004%202023_0_1.pdf [30 October 2023].
- ▶ Klimaatstichting HIER en Energie Samen (2023), *Lokale Energie Monitor 2022*, accessed at: <https://www.hier.nu/LEM2022> [30 October 2023].
- ▶ Klimaatwet <https://wetten.overheid.nl/BWBR0042394/2020-01-01> [30 October 2023].
- ▶ Kloosterman, R., M. Akkermans, C. Reep, M. Wingen, H. Molnár - In 't Veld & J. van Beuningen (2021), *Klimaatverandering en energietransitie: opvattingen en gedrag van Nederlanders in 2020*, Den Haag, CBS, accessed at: <https://www.cbs.nl/nl->

nl/longread/rapportages/2021/klimaatverandering-en-energietransitie-opvattingen-en-gedrag-van-nederlanders-in-2020?onepage=true [30 October 2023].

- ▶ Klösters, K., G. Paradies, L. Schlindwein & A. Batenburg (2022), *Burgers over klimaatbeleid. Een onderzoek naar zorgen en oplossingen*, Amsterdam, TNO.
- ▶ Kraan, O. (2023), 'Durf harde normen te stellen om doelen te halen', *Het Financieele Dagblad*, 18 April 2023, accessed at: <https://fd.nl/ opinie/1473842/durf-harde-normen-te-stellen-om-doelen-te-halen> [30 October 2023].
- ▶ Krohn, P. (2023), 'Vrije markt en duurzaamheid kunnen heel goed samengaan', *Het Financieele Dagblad*, 27 April 2023, accessed at: <https://fd.nl/ opinie/1472933/vrije-markt-en-duurzaamheid-kunnen-heel-goed-samengaan> [30 October 2023].
- ▶ Larrue, P. (2021), 'The design and implementation of mission-oriented innovation policies: A new systemic policy approach to address societal challenges', *OECD Science, Technology and Industry Policy Papers*, No. 100, Paris, Paris, OECD Publishing.
- ▶ Lazo, C., A. Geurts, R. Huijbregts & A.F. van Veenstra (2023), *Agenda voor actieonderzoek naar maatschappelijke innovatie*, Den Haag, TNO.
- ▶ Leefmans et al. (2022), 'Stop met subsidies voor fossiele brandstoffen', Opinion article *ESB*, 29 November 2022, accessed at: <https://esb.nu/stop-met-subsidies-voor-fossiele-brandstoffen/> [30 October 2023].
- ▶ Loorbach, D. (2007), *Transition Management, new mode of governance for sustainable development*, Utrecht, International Books.
- ▶ Loorbach, D. (2022), 'Vooruit, struikelen!' Blog, accessed at: <https://drift.eur.nl/nl/publicaties/vooruit-struikelen/> [30 October 2023].
- ▶ Manifest (2023), *Het Nederlands landbouwakkoord gaat verder dan Nederland: bied duurzame boeren en consumenten wereldwijd perspectief*, 24 April 2023, accessed at: <https://www.oxfamnovib.nl/persberichten/manifest-nederland-kan-met-landbouwakkoord-internationale-voetafdruk-verkleinen> [30 October 2023].
- ▶ Mazzucato, M. (2022), *Mission Economy: A moonshot guide to changing capitalism*, London, Penguin Books.
- ▶ McKinsey (2022), *Building a world-class Dutch start-up ecosystem*, accessed at: <https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/building-a-world-class-dutch-start-up-ecosystem#/> [30 October 2023].
- ▶ Meijden, G. van der & C. Withagen (2022), 'Groene subsidies spelen hooguit ondersteunende rol in het klimaatbeleid', *ESB*, 107 (4814), 20 October 2022.
- ▶ Metten, A. (2021), 'Subsidie voor fossiele brandstoffen ongekend groot', *Me Judice*, 28 January 2021, accessed at: <https://www.mejudice.nl/artikelen/detail/subsidie-voor-fossiele-brandstoffen-ongekend-groot> [30 October 2023].

- ▶ Metten, A. (2023), 'Belastingvoordelen voor fossiele brandstoffen nóg veel groter', *Me Judice*, 23 March 2023, accessed at: <https://www.mejudice.nl/artikelen/detail/belastingvoordelen-voor-fossiele-brandstoffen-nog-veel-groter> [30 October 2023].
- ▶ McDonald, O. (2023), 'Kabinet durft nieuwe klimaatbelastingen nog niet aan', *Het Financieele Dagblad*, 27 April 2023, accessed at: <https://fd.nl/politiek/1474698/kabinet-durft-nieuwe-klimaatbelastingen-nog-niet-aan> [30 October 2023].
- ▶ Minister van Economische Zaken en Klimaat (2022), *Kamerbrief Innovatie en Impact*, Letter to House of Representatives, 11 November 2022, accessed at: <https://www.rijksoverheid.nl/documenten/kamerstukken/2022/11/11/kamerbrief-innovatie-en-impact> [30 October 2023].
- ▶ Minister van Economische Zaken en Klimaat (2023a), *Een nationaal programma voor versnelde verduurzaming van de industrie*, Letter to House of Representatives, 24 March 2023, accessed at: <https://www.rijksoverheid.nl/documenten/kamerstukken/2023/03/24/een-nationaal-programma-voor-versnelde-verduurzaming-van-de-industrie> [30 October 2023].
- ▶ Minister van Economische Zaken en Klimaat (2023b), *Herijkte missies van het missiegedreven innovatiebeleid*, Letter to House of Representatives, 30 May 2023, accessed at: <https://www.rijksoverheid.nl/ministeries/ministerie-van-economische-zaken-en-klimaat/documenten/kamerstukken/2023/05/30/herijkte-missies-van-het-missiegedreven-innovatiebeleid> [30 October 2023].
- ▶ Minister van Financiën (2022), *Brede welvaart in de begrotingssystematiek*, Letter to House of Representatives, 23 May 2022, accessed at: <https://www.rijksoverheid.nl/ministeries/ministerie-van-financien/documenten/kamerstukken/2022/05/23/kamerbrief-brede-welvaart-in-de-begrotingscyclus> [30 October 2023].
- ▶ Minister voor Klimaat en Energie (2022), *Kamerbrief over eerste contouren (ideeën) van het Nationaal Plan Energiesysteem 2050*, 10 June 2022, accessed at: <https://www.rijksoverheid.nl/documenten/kamerstukken/2022/06/10/contouren-nationaal-plan-energiesysteem> [30 October 2023].
- ▶ Minister voor Klimaat en Energie (2023a), *Voorjaarsbesluitvorming Klimaat*, Letter to House of Representatives, 26 April 2023, accessed at: <https://www.rijksoverheid.nl/documenten/kamerstukken/2023/04/26/voorjaarsbesluitvorming-klimaat> [30 October 2023].
- ▶ Minister voor Klimaat en Energie (2023b), *concept Nationaal Plan Energiesysteem 2050*, accessed at: <https://www.rijksoverheid.nl/documenten/rapporten/2023/07/03/bijlage-1-hoofddocument-concept-npe> [30 October 2023].

- ▶ Minister voor Klimaat en Energie (2023c), *Openstelling SDE++ 2023*, Letter to House of Representatives, 17 February 2023, accessed at: <https://www.rijksoverheid.nl/documenten/kamerstukken/2023/02/17/openstelling-sde-2023> [30 October 2023].
- ▶ Minister voor Klimaat en Energie (2023d), *Contouren Klimaatplan 2024*, Letter to House of Representatives, 27 October 2023, accessed at: <https://www.rijksoverheid.nl/documenten/kamerstukken/2023/10/30/contouren-klimaatplan-2024> [30 October 2023].
- ▶ Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2023), *Contourennotitie Nota Ruimte*, Den Haag, September 2023, accessed at: <https://www.rijksoverheid.nl/documenten/rapporten/2023/09/30/contourennotitie-nota-ruimte> [30 October 2023].
- ▶ Ministerie van Economische Zaken en Klimaat (2022), *XIII Economische Zaken en Klimaat Rijksbegroting 2023*, accessed at: <https://open.overheid.nl/documenten/ronl-c9fe83a1d4c1e5708c7d0ffa19096d10bd3a9760/pdf> [30 October 2023].
- ▶ Ministerie van Economisch Zaken en Klimaat (2023a), *Concept-Nationaal plan energiesysteem: Ambtelijk werkdocument D - Voorwaarden voor het energiesysteem*, accessed at: <https://www.rijksoverheid.nl/documenten/rapporten/2023/07/03/bijlage-5-ambtelijk-werkdocument-d-voorwaarden-voor-het-energiesysteem> [30 October 2023].
- ▶ Ministerie van Economische Zaken en Klimaat (2023b), *Perspectief op de Nederlandse economie: Innovatief, duurzaam, sterk en welvarend*, Den Haag, June 2023.
- ▶ Ministerie van Financiën (2023), *Miljoenennota 2024, Begroting, XIII Economische Zaken en Klimaat Beleidsartikel 4 Een doelmatige energievoorziening en beperking van de klimaatverandering*, accessed at: <https://www.rijksfinancien.nl/memorie-van-toelichting/2024/OWB/XIII/onderdeel/2142637> [30 October 2023].
- ▶ Ministerie van Infrastructuur en Waterstaat (2020), *Report Publieke Waarde Scan: Circulaire Economie*, September 2020.
- ▶ Mons, G. (2022), 'Nieuw-Zeelandse boeren gaan betalen voor uitstoot broeikasgas', *Melkvee*, 22 October 2022, accessed at: <https://www.melkvee.nl/artikel/560433-nieuw-zeelandse-boeren-gaan-betalen-voor-uitstoot-broeikasgas/> [30 October 2023].
- ▶ Moor, T. de (2023), *Shakeholder society? Social enterprises, citizens and collective action in the community economy*, inaugural lecture 17 February 2023, Rotterdam, Erasmus Universiteit.

- ▶ Moor, T. de, T. Duffhues, E. Karlas & C. Veldsink (2020), *Collectieve Kracht. Krachtiger als collectief. Uitdagingen van burgercollectieven in Nederland, anno 2020*, Rotterdam.
- ▶ Mot, E. & A. Trinks (2022), 'Groene innovatie krijgt meer aandacht in Rutte IV, maar hoeveel is onduidelijk', *ESB*, 107 (4814) 20 October 2022.
- ▶ Mowery, C.D., R.R. Nelson & B.R. Martin (2010), 'Technology policy and global warning: why new policy models are needed (or why putting new wine in old bottles won't work)', *Research Policy*, 39 (8), 1011-1023.
- ▶ Mulder, M., J. Bollen, J. Cozijnsen, S. Lomme, F. Rooijers, J.P. van Soest & E. Woerdman (2023), 'Europees emissiesysteem bepaalt halen CO2-doelen, fossiele subsidies secundair', *ESB*, forthcoming, accessed at: <https://esb.nu/europees-emissiesysteem-bepaalt-halen-co2-doelen-fossiele-subsidies-secundair/> [30 October 2023].
- ▶ Nationaal Klimaat Platform (2023a), *Verslag Inspiratiesessie Boeren met toekomst*, accessed at: <https://nationaalklimaatplatform.nl/documenten/default.aspx#folder=2352886> [30 October 2023]
- ▶ Nationaal Klimaat Platform (2023b), *Eerste rapportage Nationaal Klimaat Platform: Richting, ruimte, rechtvaardigheid*, accessed at: <https://nationaalklimaatplatform.nl/nieuws12/2498597.aspx?t=Eerste-Signalenrapport-naar-minister-Jetten> [30 October 2023].
- ▶ Nationaal Groeifonds (undated), <https://www.nationaalgroeifonds.nl/over-de-commissie>
- ▶ Nederlandse Vereniging Duurzame Energie (2023), 'Voorkom desinvesteringen, wees tijdig duidelijk over stop nieuwe fossiele apparaten en opbouw alternatieven' News bulletin 31 January 2023, accessed at: <https://www.nvde.nl/nvdeblogs/nvde-voorkom-desinvesteringen-wees-tijdig-duidelijk-over-stop-nieuwe-fossiele-apparaten-en-opbouw-alternatieven/> [30 October 2023].
- ▶ Nelson, R.R. (1974), 'Intellectualising about the moon-ghetto metaphor: a study of the current malaise of rational analysis of social problems.', *Policy Sciences*, 5 (4), 375-414.
- ▶ Nelson, R.R. (1978), *The Moon and the Ghetto. An Essay on Public Policy Analysis*. New York, W.W. Norton.
- ▶ Nelson, R.R. (2011), 'The Moon and the Ghetto revisited', *Science and Public Policy*, 38, 681-690.
- ▶ Noailly, J., L. Nowzohour & M. van den Heuvel (2022), 'Does Environmental Policy Uncertainty Hinder Investments Towards a Low-Carbon Economy?', *NBER Working Paper*, No. w30361.

- ▶ Nordhaus, W.D. (2015), *The Climate Casino. The Climate Casino Risk, Uncertainty, and Economics for a Warming World*, Yale University Press.
- ▶ NOS (2022). 'Van der Wal: 'De woest aantrekkelijke opkoopregeling betaalt 100 procent'', 15 July 2022, accessed at: <https://nos.nl/nieuwsuur/collectie/13910/artikel/2436893-van-der-wal-de-woest-aantrekkelijke-opkoopregeling-betaalt-100-procent> [30 October 2023].
- ▶ NWO (undated), <https://www.nwo.nl/nieuws/nwo-brengt-focus-aan-nwa-programma> [30 October 2023].
- ▶ OECD (2015a), *The Innovation Imperative, Contributing to Productivity, Growth and Well-being*, Paris, OECD Publishing.
- ▶ OECD (2015b), *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development*, Paris, OECD Publishing.
- ▶ OECD & Eurostat (2018), *Oslo Manual, Guidelines for collecting, reporting and using data on innovation*, Third edition, Paris, OECD Publishing.
- ▶ OECD (2019), *Economic Policy Reforms 2019: Going for Growth, Country Note The Netherlands*, Paris, OECD Publishing.
- ▶ OECD (2021), *Policies for a Carbon-Neutral Industry in the Netherlands*, Paris, OECD Publishing.
- ▶ OECD (2023), *OECD Science, Technology and Innovation Outlook 2023: Enabling Transitions in Times of Disruption*, Paris, OECD Publishing
- ▶ OECD (2023b), *Policies for the Future of Farming and Food in the Netherlands*, OECD Agriculture and Food Policy Reviews, Paris, OECD Publishing.
- ▶ Oers, L.M. van (2019), 'Een duurzaam voedselsysteem vraagt om meer dan innovatie: een pleidooi voor een 'exnovatiestrategie' in voedselbeleid'. In J. Lanjouw (ed.), *Boze boeren, LED-lampen en kipdino's : Over de noodzaak van een nieuw voedselsysteem*, Amsterdam, Uitgeverij Van Gennip.
- ▶ Oers, L.M. van, G. Feola, E. Moors & H. Runhaar (2021), 'The politics of deliberate destabilisation for sustainability transitions', *Environmental Innovation and Societal Transitions*, 40 (2021) 159–171.
- ▶ Ongering, L. (2022), 'Overheidsregie in een wereld die verandert', *ESB*, 107(4805), 20 January 2022.
- ▶ Oorschot, M. van, H. Wilting, D. Nijdam & H. Bredenoord (2021), *Halveren van de Nederlandse voetafdruk. Reflectie op een nieuwe ambitie van het Nederlandse nationale en internationale natuurbeleid*, Den Haag, PBL.
- ▶ Oosterhuis, F., J. Bouma & A. Hanemaaijer (2013), *Het reboundeffect bij resource efficiency*, Amsterdam /Bilthoven, IVM Instituut voor Milieuvraagstukken en PBL
- ▶ Overlegorgaan Fysieke Leefomgeving (2022), *Nieuwe coalities in aardgasvrij. Van lerende overheid naar lerende maatschappij*. Eindverslag, Den Haag, Overlegorgaan Fysieke Leefomgeving.

- ▶ Planbureau voor de Leefomgeving (2018), *Naar een wenkend perspectief voor de Nederlandse landbouw. Voorwaarden voor verandering*, Den Haag, Planbureau voor de Leefomgeving
- ▶ Planbureau voor de Leefomgeving (2023), *Balans van de Leefomgeving 2023. Toekomstbestendig kiezen, rechtvaardig verdelen*, Den Haag, Planbureau voor de Leefomgeving
- ▶ PBL, TNO, CBS & RIVM (2022), *Klimaat- en Energieverkenning 2022*, Den Haag, Planbureau voor de Leefomgeving.
- ▶ PBL, TNO, RIVM (2023), *Beleidsoverzicht en factsheets beleidsinstrumenten*. Achtergronddocument bij de Klimaat-en Energieverkenning 2022, Den Haag, Planbureau voor de Leefomgeving.
- ▶ PBL, TNO, RIVM (2023), *Klimaat- en Energieverkenning 2023. Ramingen van broeikasgasemissies, energiebesparing en hernieuwbare energie op hoofdlijnen*. Den Haag, Planbureau voor de Leefomgeving.
- ▶ Porter, M. (1991), 'America's Green Strategy', *Scientific American*, 264(4), 168
- ▶ Porter, M. E., & F. Reinhardt (2007), 'Grist: A Strategic Approach to Climate' Forethought, *Harvard Business Review*, 85, no. 10 (October 2007): 22–26.
- ▶ Porter, M.E. & M.R. Kramer (2011), 'Creating Shared Value', *Harvard Business Review*, Vol 89 (January-February), 62-77.
- ▶ Raad voor de leefomgeving en infrastructuur (2019), *Naar een duurzame economie: Overheidssturing op transities*. Den Haag, Raad voor de Leefomgeving en Infrastructuur.
- ▶ Raad voor leefomgeving en infrastructuur (2021), *Boeren met toekomst*, Den Haag, Raad voor de Leefomgeving en Infrastructuur.
- ▶ Raad voor leefomgeving en infrastructuur (2022), *Financiering in transitie. Naar een actieve rol van de financiële sector in een duurzame economie*, Den Haag, Raad voor de Leefomgeving en Infrastructuur.
- ▶ Raad voor leefomgeving en infrastructuur (2023), *Goed water goed geregeld*, Den Haag, Raad voor de Leefomgeving en Infrastructuur.
- ▶ Raad voor de Toekomst (2023), *Duurzaam durven denken. Reflectie op de toekenning van middelen uit het Nationaal Groeifonds*, Den Haag, Sociaal-Economische Raad.
- ▶ Raad voor Volksgezondheid en Samenleving (2022), *De kunst van het innoveren. Tijd voor een maatschappelijk perspectief op zorginnovatie*, Den Haag, Raad voor Volksgezondheid en Samenleving.
- ▶ Raad voor Volksgezondheid & Samenleving (2023), *Met de stroom mee. Naar een duurzaam en adaptief stelsel voor zorg en ondersteuning*, Den Haag, Raad voor Volksgezondheid & Samenleving.

- ▶ Rathenau Instituut (2019), 'Missiegericht innovatiebeleid in uitvoering', Report to parliament, 5 April 2019, accessed at: <https://www.rathenau.nl/sites/default/files/inline-files/20190402%20BAP%20Innovatie%20%28aangepast%29.pdf> [30 October 2023].
- ▶ Rathenau Instituut (2020a), 'Maak werk van opgavegericht innovatiebeleid', Report to parliament, 3 December 2020, accessed at: https://www.rathenau.nl/sites/default/files/2020-12/Bericht_aan_het_parlement_Maak_werk_van_opgavegericht_innovatiebeleid_Rathenau_Instituut.pdf [30 October 2023].
- ▶ Rathenau Instituut (2020b), *Voorbij lokaal enthousiasme – Lessen voor de opschaling van living lab*, Den Haag, Auteurs: Broek, J. van den, I. van Elzakker, T. Maas & J. Deuten.
- ▶ Rathenau Instituut (2022), 'Ontwikkeling van het wetenschappelijk onderzoeksprofiel van Nederland', *Factsheet*, 19 July 2022, accessed at: <https://www.rathenau.nl/nl/wetenschap-cijfers/output/publicaties/ontwikkeling-van-het-wetenschappelijk-onderzoeksprofiel-van> [30 October 2023].
- ▶ Rathenau Instituut (2023), *Totale Investerings in Wetenschap en Innovatie 2021-2027 - Revision*, Den Haag. Authors: Vogelesang, S. & A. Vennekens
- ▶ Remkes, J. (2022), *Wat wel kan. Uit de impasse en een aanzet voor perspectief*, Den Haag, Rijksoverheid.
- ▶ Rijksdienst voor Ondernemend Nederland (2022), *Stand van RVO. Met minder complexiteit naar meer impact*, Den Haag, RVO.
- ▶ Rijksdienst voor Ondernemend Nederland (2023a), *Regeling Rapportage Energie Innovatie 2022*, Den Haag, RVO.
- ▶ Rijksdienst voor Ondernemend Nederland (2023b), *Quickscan effecten van het LNV instrumentarium op natuur en biodiversiteit*, Den Haag, RVO.
- ▶ Rijksoverheid (2020), *Tenminste houdbaar tot: Bewegen naar een duurzaam voedselsysteem. Brede maatschappelijke heroverweging*, Den Haag.
- ▶ Rijksoverheid (2021), *IBO Financiering Energietransitie: Beleidsmatige keuzes in kosten, prikkels en verdeling*, Den Haag.
- ▶ Rijksoverheid (2023a), *Scherpe doelen, scherpe keuzes. IBO aanvullend normerend en beprijzend nationaal klimaatbeleid voor 2030 en 2050*, Den Haag.
- ▶ Rijksoverheid (2023b), *Zevende Nationale SDG Rapportage Nederland Ontwikkelt Duurzaam*, Den Haag.
- ▶ Rijksoverheid (2023c), *Bijsturen met het oog op de toekomst*, 17^e Studiegroep Begrotingsruimte, Den Haag.
- ▶ Rijksoverheid (2023d), *Extra pakket maatregelen dicht gat tot klimaatdoel 2030*, Nieuwsbericht, 26 April 2023, accessed at:

- <https://www.rijksoverheid.nl/actueel/nieuws/2023/04/26/extra-pakket-maatregelen-dicht-gat-tot-klimaatdoel-2030> [30 October 2023].
- ▶ Rijksoverheid (undated)
<https://www.rijksoverheid.nl/onderwerpen/klimaatverandering/klimaatbeleid> [30 October 2023].
 - ▶ Rijn, J. van & J.H. van Dijk (2023), 'De innovatiebox bevordert voornamelijk belastingconcurrentie', *Me Judice*, 23 March 2023, accessed at: <https://www.mejudice.nl/artikelen/detail/de-innovatiebox-bevordert-voornamelijk-belastingconcurrentie> [30 October 2023].
 - ▶ Rip, A. & R. Kemp (1998), 'Technological change', in: Rayner S, Malone EL, editors. *Human choice and climate change*, Columbus, Battelle Press, 327–399.
 - ▶ Ronde, K. de (2023), 'Kabinet: herziening elektriciteitsmarkt gaat verder dan noodzakelijk', *Energieia Nieuws*, 26 April 2023, accessed at: <https://energieia.nl/energieia-artikel/40106458/kabinet-herziening-elektriciteitsmarkt-gaat-verder-dan-noodzakelijk> [30 October 2023].
 - ▶ Ros, G.H., W. de Vries, R. Jongeneel & M. van Ittersum (2023), *Gebieds- en bedrijfsgerichte handelingsperspectieven voor een duurzame landbouw in Nederland*, 12 April 2023, Wageningen Universiteit, accessed at: <https://www.wur.nl/nl/nieuws-wur/show-home/eerlijk-stimuleren-afrekenen-en-belonen-van-boeren-voor-een-duurzame-landbouw.htm> [30 October 2023].
 - ▶ Rotmans, J. (2003), *Transitiemanagement: Sleutel voor een duurzame samenleving*, Assen, Koninklijke Van Gorcum.
 - ▶ Rotmans, J. & M. Verheijden (2021), *Omarm de chaos*, Amsterdam, De Geus
 - ▶ Rozendaal, R.L. & H.R.J. Vollebergh (2021), 'Policy-induced innovation in clean technologies: Evidence from the car market', *CESifo Working Paper*, 9422.
 - ▶ Rozendaal, R. & H. Vollebergh (2022), 'Stringente standaarden stimuleren innovatie en doorbraaktechnologieën', *ESB*, 107(4814), 20 October 2022.
 - ▶ Runhaar, H.(2017), 'Governing the transformation towards 'nature-inclusive' agriculture: insights from the Netherlands', *International Journal of Agricultural Sustainability*, 15 (4), 340-349.
 - ▶ Runhaar, H.A.C., Th.C.P. Melman, F.G. Boonstra, J.W. Erisman, L.G., Horlings, G.R. de Snoo, C.J.A.M. Termeer, M.J. Wassen, J. Westerink & B.J.M. Arts (2017), 'Promoting nature conservation by Dutch farmers: a governance perspective,' *International Journal of Agricultural Sustainability*, 15 (3), 264–281.
 - ▶ Runhaar, H., L. Fünfschilling, A. van den Pol-Van Dasselaard, E. Moors, R. Temminka & M. Hekkert (2020), 'Endogenous regime change: Lessons from transition pathways in Dutch dairy farming', *Environmental Innovation and Societal Transitions*, 36 (2020) 137–150.

- ▶ Runhaar, H. (2019), *Position paper voor het Rondetafelgesprek Klimaattafel 'Landbouw'*, Den Haag, Tweede Kamer.
- ▶ Runhaar, H. (2021) 'Four critical conditions for agroecological transitions in Europe', *International Journal of Agricultural Sustainability*, 19:3-4, 227-233
- ▶ Runhaar, H. (2023), 'Sturen op een duurzaam watersysteem in Nederland: Eerst duidelijke keuzes over de ruimtelijke ordening!', essay for Raad voor Leefomgeving en Infrastructuur (2023) *Goed water goed geregeld*.
- ▶ Rusu, A., E. Mot & A. Trinks (2021), 'Green innovation policies: a literature and policy review', *CPB Background Document*, Den Haag, Centraal Plan Bureau.
- ▶ RVO (undated) <https://www.rvo.nl/subsidies-financiering/sde> [30 October 2023].
- ▶ Schotanus, F. (2022), *Een betere wereld begint bij publieke inkoop*, oratie 1 July 2022 Universiteit Utrecht.
- ▶ Schoenmaker, D. & W. Schramade (2019), 'Financing environmental and energy transitions for regions and cities: creating local solutions for global challenges', *Background paper for an OECD/EC Workshop* on 18 October 2019 within the workshop series "Managing environmental and energy transitions for regions and cities", Paris, OECD.
- ▶ Schot, J. & W. Edward Steinmueller (2018), 'Three frames for innovation policy: R&D, systems of innovation and transformative change', *Research Policy*, Volume 47, Issue 9, 554-1567.
- ▶ Schwaag Serger S., L. Soete & J. Stierna (eds), *The Square: Putting place-based innovation policy for sustainability at the centre of policymaking*, European Commission Joint Research Centre, 2023.
- ▶ Sociaal-Economische Raad (2019), *Hoge verwachtingen: Kansen en belemmeringen voor jongeren in 2019*, Den Haag, Sociaal-Economische Raad.
- ▶ Sociaal-Economische Raad (2021), *Naar duurzame toekomstperspectieven voor de landbouw Verkenning van een landbouwakkoord*, Den Haag, Sociaal-Economische Raad.
- ▶ Sociaal-Economische Raad (2022), *Evenwichtig sturen op de grondstoffentransitie en de energietransitie voor brede welvaart*, Verkenning 22/6, Den Haag, Sociaal-Economische Raad.
- ▶ Soete, L. & J. Stierna (2023), 'Revisiting Schumpeter in Europe: Place-based innovation and transformative industrial policy', *UNU-MERIT Working Paper Series*, 2023-022.
- ▶ SIRA consulting (2022), *Mogelijke toepassing van de Generatietoets bij NGF-voorstellen*, Den Haag.
- ▶ SIRA consulting (2023), *Generatietoets toegepast bij het Klimaatfonds. Voorstel voor het Nationaal Isolatieprogramma*, Den Haag.

- ▶ Smink, M.M., M.P. Hekkert & S.O. Negro (2015), 'Keeping sustainable innovation on a leash? Exploring incumbents' institutional strategies', *Business Strategy and the Environment*, Vol. 24, Issue 2, 86-101.
- ▶ SOMO, Oil Change International en Milieudefensie (2023), *Rechtvaardig afbouwen van fossiele subsidies, minder CO2 en meer inkomsten*, accessed at: <https://milieudefensie.nl/actueel/onderzoek-grote-vervuilers-krijgen-37-5-miljard-aan-fossiele-subsidies>
- ▶ Staatssecretaris van Financiën. Fiscaliteit en Belastingdienst (2023), *Aanbieding pakket Belastingplan 2024*, Letter to the House of Representatives, 19 September 2023, accessed at: <https://www.rijksoverheid.nl/onderwerpen/prinsjesdag/miljoenennota-en-andere-officiële-stukken> [30 October 2023].
- ▶ Strategy& (2023), *Speelveldtoets 2023. Effecten van de aanscherping van het energie- en klimaatbeleid op de industrie*, Amsterdam, PricewaterhouseCoopers Advisory N.V.
- ▶ Steen, M. van der, M. Hajer, J. Scherpenisse, O. van Gerwen & S. Kruitwagen (2014), *Leren door doen. Overheidsparticipatie in een energieke samenleving*, Den Haag, NSOB en PBL.
- ▶ Stigler, J. (1971), 'The theory of economic regulation', *The Bell Journal of Economics and Management Science*, Vol. 2, No. 1, 3-21.
- ▶ Taskforce Versnelling Innovatieproces Stalsystemen (2020), *Ruimte voor ondernemerschap en innovatie*, accessed at: <https://www.rijksoverheid.nl/documenten/rapporten/2020/11/19/ruimte-voor-ondernemerschap-en-innovatie> [30 October 2023].
- ▶ Termeer, K. (2019), *Het bewerkstelligen van een transitie naar kringlooplandbouw*, Memorandum compiled at the request of the Parliamentary Committee for Agriculture, Nature and Food Quality, Wageningen University & Research, accessed at: <https://edepot.wur.nl/500675> [30 October 2023].
- ▶ Teeuw, J. (2023), *Ik wil er niets van weten. Hoe visie, tijd en kennis uit Den Haag verdwenen*, Hilversum, Uitgeverij Verloren.
- ▶ The Sustainable Industry Lab (2023) Groene keuzes voor de Nederlandse basisindustrie. Klimaatneutrale productie in een circulaire economie, Utrecht.
- ▶ Transitiecoalitie Voedsel (2019), *Missiegedreven innovatie vereist overkoepelende transitiemissies, inhoudelijke regie en nieuwe governance*. Voorstellen van Transitiecoalitie Voedsel voor missiegedreven innovatiebeleid van de overheid, 9 October 2019, accessed at: <https://transitiecoalitievoedsel.nl/wp-content/uploads/Voorstellen-missiegedreven-innovatie-van-TcV.pdf> [30 October 2023].

- ▶ Transitiecoalitie Voedsel (2021), *Toekomstverkenning agrofood 2050*, accessed at: <https://transitiecoalitievoedsel.nl/wp-content/uploads/Toekomstverkenning-Transitiecoalitie-Voedsel-final.pdf> [30 October 2023].
- ▶ Trinks, A. & E. Hille (2023), 'Carbon costs and industrial firm performance: Evidence from international microdata', *CPB Discussion Paper*, Den Haag, Centraal Plan Bureau.
- ▶ Tweede Kamer (2019), *35300 Nota over de toestand van 's Rijks Financiën, Motie van de leden Segers & Jetten*, Nr. 24, voorgesteld 19 September 2019, accessed at: <https://www.tweedekamer.nl/kamerstukken/moties/detail?id=2019D36541&did=2019D36541> [30 October 2023].
- ▶ Tweede Kamer (2023) *Vaststelling van de begrotingsstaat van de Staten-Generaal (IIA) voor het jaar 2022- Amendment by MP Bergkamp et al.*, Kamerstuk 35925 IIA, nr. 5, 24 November 2021, accessed at: <https://www.tweedekamer.nl/downloads/document?id=2021D45702> [30 October 2023].
- ▶ Universiteit Utrecht (2023) <https://www.uu.nl/achtergrond/landbouwtransitie-als-de-weg-naar-herstel-biodiversiteit> [30 October 2023].
- ▶ Velzing, E. (2021), 'Miljarden uit de innovatiebox kunnen nuttiger besteed worden', *ESB*, 107(4806), 17 February 2022.
- ▶ Venema, T., A. Troeman, W. van Leeuwen, T. van Swieten & I. Bronstring (2022), *Versnelling verduurzaming industrie*, Boston Consulting Group
- ▶ Vermunt, D.A., N. Wojtynia, M.P. Hekkert, J. Van Dijk, R. Verburg, P.A. Verweij, M. Wassen, H. Runhaar (2022), 'Five mechanisms blocking the transition towards 'nature-inclusive' agriculture: A systemic analysis of Dutch dairy farming', *Agricultural Systems*, 195 (2022) 10328.
- ▶ Vringer, K. & C. Carabain (2019), *Maatschappelijk draagvlak voor transitiebeleid. Een verkennend onderzoek naar de legitimiteit van transitiebeleid rond energie en circulaire economie*, Den Haag, Planbureau voor de Leefomgeving.
- ▶ Wanzenböck, I., J.H. Wesseling, K. Frenken, M.P. Hekkert en K.M. Weber (2020), 'A framework for mission-oriented innovation policy: Alternative pathways through the problem-solution space', *Science and Public Policy*, 47 – 4, 474-489.
- ▶ Weel, B. ter, M. Bijlsma, C. Koopmans, M. Janssen, P.J. de Boer (2022), *Durf te leren, ga door met meten*, Den Haag, Ministerie van Economische Zaken en Klimaat.
- ▶ Werkgroep Innovatiegericht Inkopen (2022), *Innovatie inkopen in de publieke sector. Knelpunten in beeld, oplossingen in het vizier*, Den Haag, Pianoo.

- ▶ Werkgroep versterking functies Tweede Kamer (2021), *Versterking functies Tweede Kamer. Meer dan de som der delen*, House of Representatives report, 16 December 2021.
- ▶ Wesseling, J.H & A. van der Vooren (2016), 'Lock-in of mature innovation systems. The transformation toward clean concrete in the Netherlands', *Papers in Innovation Studies*, Paper no. 2016/17, Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE), Lund, Lund University.
- ▶ Wetenschappelijke Klimaatraad (2023), *Wetenschap onderstreept noodzaak tot versterking klimaatbeleid*, Letter to parliament, 29 August 2023, accessed at: <https://www.wkr.nl/documenten/brieven/2023/08/29/wkr-brief-aan-eerste-en-tweede-kamer> [30 October 2023].
- ▶ Wetenschappelijke Raad voor het Regeringsbeleid (2014), *Naar een voedselbeleid*, WRR-Rapport 93, Den Haag, WRR.
- ▶ Wetenschappelijke Raad voor het Regeringsbeleid (2021), *Kiezen voor houdbare zorg. Mensen, middelen en maatschappelijk draagvlak*, WRR-Rapport 104, Den Haag, WRR
- ▶ Wetenschappelijke Raad voor het Regeringsbeleid (2023a), *Rechtvaardigheid in klimaatbeleid. Over de verdeling van klimaatkosten*, WRR-Rapport 106, Den Haag, WRR.
- ▶ Wetenschappelijke Raad voor het Regeringsbeleid (2023b), *Goede zaken. Naar een grotere maatschappelijke bijdrage van ondernemingen*, WRR-Rapport 107, Den Haag, WRR.
- ▶ Wij.land, BoerenNatuur, De Plaatsen, Transitiecoalitie Voedsel, BoerenRaad (2023), *Plan BoerenPerspectief*, 31 March 2023, accessed at: https://www.boerennatuur.nl/wp-content/uploads/2023/04/Plan-BoerenPerspectief-21_4_2023.pdf [30 October 2023].
- ▶ Wijnbergen, S. van, R. van der Ploeg & P. Gautier (2023), 'Fossiele subsidies zijn toch echt de verwarming die tegen de airco in werkt', Blog on *ESB.nu*, accessed at: <https://esb.nu/fossiele-subsidies-zijn-toch-echt-de-verwarming-die-tegen-de-airco-in-werkt/> [30 October 2023].
- ▶ Wojtynia, N., J. van Dijk, M. Derks, P.W.G. Groot Koerkamp & M.P. Hekkert (2021), 'A new green revolution of agribusiness as usual? Uncovering alignment issues and potential transitions complications in agri-food system transitions', *Agronomy for Sustainable Development*, 41: 77.

Annex 3 Interviewees

- ▶ Floor Alkemade Eindhoven University of Technology
- ▶ J.P. Beers DRIFT for transition
- ▶ Kees Blom Ministry of Education, Culture and Science
- ▶ Mart van Bracht Energy Innovation NL
- ▶ Lenneke Braam Cordaid
- ▶ Heleen de Coninck Eindhoven University of Technology
- ▶ Marjolein Dieperink VU Amsterdam
- ▶ Vince Douwes Ministry of Agriculture, Nature and Food Quality
- ▶ André Faaij TNO Research, Utrecht University
- ▶ M Riaz Hamidullah Ambassador of Bangladesh
- ▶ Anita Hardon Wageningen University & Research
- ▶ Paulien Herder Delft University of Technology
- ▶ Fokie Flapper Ministry of Agriculture, Nature and Food Quality
- ▶ Olof van der Gaag Dutch Association for Renewable Energy (NVDE)
- ▶ Gijs Kremers Ministry of Education, Culture and Science
- ▶ Kees de Gooijer TKI Agri&Food
- ▶ Willem Lageweg Food Transition Coalition (Transitiecoalitie Voedsel)
- ▶ Maita Latijnhouwers Ministry of Agriculture, Nature and Food Quality
- ▶ Veerle Linseele VARIO
- ▶ Katja Primozic Ministry of Economic Affairs and Climate Policy
- ▶ Ruben Prins Ministry of Economic Affairs and Climate Policy
- ▶ David van der Plas Ministry of Economic Affairs and Climate Policy
- ▶ Danielle Raspoet VARIO - Flemish Advisory Council for Innovation and Entrepreneurship
- ▶ Elie Ratinckx VARIO - Flemish Advisory Council for Innovation and Entrepreneurship
- ▶ Hens Runhaar Utrecht University
- ▶ Aline van Veen Ministry of Economic Affairs and Climate Policy

Annex 4 Notes on method used to calculate the share of specific investment in research and innovation in total government investments

The analysis was based on the dataset from the publication by the Rathenau Instituut (2023) on total government investments in science and innovation (TWIN) in the period 2021-2027, after a correction in October 2023. That report and the associated data are available on the website of the Rathenau Instituut. Please refer to reports by the Rathenau Instituut for a description of the data collection method.

AWTI used the following components from the data collected by the Rathenau Instituut:

- ▶ Amounts:
 - ▶ Actual 2021
 - ▶ Provisional actual 2022
 - ▶ Draft budget 2023
 - ▶ Multi-year estimate 2024-2027
- ▶ Funding method:
 - ▶ Institutional funding: Expenditure related to more or less fixed amounts paid by a government department to research institutes. This funding does not involve direct selection of projects or programmes by the funding provider nor any direct departmental influence over their content. The funding can take the form of core funding aimed at maintaining a basic provision, and/or targeted funding which the institution can use at its discretion. This does not of course exclude the possibility that the wishes of the funding department may play a role.
 - ▶ Project funding: Funding by a government department for research that is carried out by the department itself or by its own research departments or outsourced to universities, institutes or other third parties (private nonprofit or private actors). This funding is awarded to a group or individual to carry out a particular R&D activity with a relatively restricted scope, budget and timeframe, and usually on the basis of a submitted research proposal which describes the research activities.
- ▶ NABS code category:
 - ▶ NABS is a classification compiled by the EU statistics agency (Eurostat) to classify public financing of R&D on the basis of the objectives of the funding department.

- ▶ Budget and budget line as per the TWIN data.

For this analysis, AWTI used R&D funding with or without an innovation component, public spending on innovation and spending on fiscal arrangements as a whole.

To supplement the data collected by the Rathenau Instituut, AWTI added a number of categories:

- ▶ Allocation by specific and generic policy
 - ▶ Generic: Generic policy is policy that is deployed for all forms of R&D and innovation and does not give any direction to the target group of the policy, except possibly for general stimulation of R&D and innovation. This category in any event includes all budget lines that are assigned NABS codes in the TWIN data for non-applied R&D and all institutional funding.
 - ▶ Specific: Specific policy refers to policy focused on stimulating R&D and innovation in a particular sector or domain or for a defined societal challenge or mission. All budget lines from the National Growth Fund (NGF) budget and the NGF resources already added to departmental budgets fall into the 'specific' category. We also class budget lines from the Ministry of Economic Affairs and Climate Policy budget that are related to mission-driven innovation policy as specific. We treat the tax breaks for research and development (WBSO) as generic. All items with a single NABS code which do not fall under generic policy are also assigned to this category.
 - ▶ Where it was not possible to classify an item based on already available categories, or where an item had clearly been placed in the wrong category, the classification was refined manually. Where there was doubt or it was not possible to make an assessment, the budget line concerned was classified as 'other'.

Data processing and analysis were carried out using R. Data; the codes used are available on request.

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