

**STRENGTHEN THE ROLE OF  
SCIENCE, TECHNOLOGY AND  
INNOVATION IN SOCIETAL  
TRANSITIONS**



The Advisory council for science, technology and innovation (AWTI) advises the Dutch government and parliament on policy in the areas of scientific research, technological development and innovation. The AWTI provides advice when it is applied for or when the council deems it necessary. It enjoys an independent position towards the Ministers and their Departments, as well as towards other parties involved. The advisory council consists of a maximum of 10 members, each originating from different sectors of society, such as research institutes and trade and industry. The members do not represent any special interests.

The Advisory council for science, technology and innovation consists of the following members:

prof. dr. U. (Uri) Rosenthal (voorzitter)  
prof. dr. ir. J.P.H. (Jos) Benschop  
prof. dr. ing. D.H.A. (Dave) Blank  
prof. dr. R. (Roshan) Cools  
prof. dr. ir. K. (Koenraad) Debackere  
prof. dr. ir. T.H.J.J. (Tim) van der Hagen  
dr. ir. S. (Sjoukje) Heimovaara  
prof. dr. E.M. (Emmo) Meijer  
drs. N. (Nienke) Meijer  
prof. dr. E.H.M. (Ellen) Moors  
mr. J.J.G. (Anneke) Bovens (secretaris)

The office is located in the Netherlands:

Prins Willem-Alexanderhof 20

2595 BE Den Haag

t. 070 3110920

e. [secretariaat@awti.nl](mailto:secretariaat@awti.nl)

w. [www.awti.nl](http://www.awti.nl)

# **Strengthen the role of science, technology and innovation in societal transitions**

maart 2020

Photography	Bas Kijzers Fotografie
Design	2D3D Design; Infographics: Kate Snow Design
Printing	Quantes
	maart 2020
ISBN	978-90-77005-86-6

All publications may be downloaded free of charge from [www.awti.nl](http://www.awti.nl).

## Copyright

All rights reserved. Subject to the inclusion of a correct source reference, this publication or parts thereof may be reproduced, stored or made public without the prior written consent of AWTI. A correct source reference must as a minimum state clearly the name of the organisation as well as the name and year of the publication.

# Contents

<b>Summary</b>	<b>5</b>
<b>Report</b>	<b>8</b>
<b>1 Background: science, technology and innovation do not contribute enough to transitions</b>	<b>10</b>
1.1 Present make-up of society is not sustainable	10
1.2 Transitions bring both ‘pain’ and opportunities	11
1.3 Science, technology and innovation currently not being used to full advantage	12
1.4 Request for advice: How can better use be made of science, technology and innovation?	17
<b>2 Advice: Make better use of STI with an inspiring story about the future and a radical approach</b>	<b>18</b>
2.1 A clear story about the future will foster investments and coordination and build support	19
2.2 The time is ripe for an overarching narrative	20
2.3 An accompanying radical approach will bring in newcomers and encourage learning	21
<b>3 Three recommendations:</b>	<b>26</b>
3.1 Build a future narrative as a series of windows	26
3.2 Give transformative coalitions a stimulating mission	31
3.3 Set up a future centre in each government ministry	33



## Summary

The Netherlands is a prosperous country with a flourishing economy. However, as a nation we face a number of urgent societal challenges in areas such as food, healthcare, mobility, safety and sustainability. Goal-oriented societal transitions are urgently needed on these and other fronts, and have to some extent already been initiated. Science, technology and innovation (STI) could play a stronger, more effective role in this process. That is the subject of this report.

### **How can the government improve the contribution made by science, technology and innovation to societal transitions?**

The Council believes that much better use can be made of science, technology and innovation to foster societal transitions. To achieve this, the government must organize the making of an inspiring story about the Netherlands in the future and adopt a more radical approach to achieving transitions. Together, these would make targeted investments possible, avoid wasting time and money and bring together innovators with new and creative parties.

There is currently no bigger picture behind the different actions being taken to address societal transitions. A number of visions documents have been written and a variety of social agreements on the direction of change have been reached between parties in certain sectors. However, these are generally based on the current situation and on existing possibilities. Often they are not focused on the long-term future, nor are they interlinked. Thus, choices in one area can stand in the way of choices in another.

There is also a general lack of focus on radical change and innovation: why is change necessary, what benefits will it have? In which innovations do we want to invest and which developments do we specifically not want in the future? All in all, these omissions lead to a situation in which the Netherlands is not making full use of science, technology and innovation to accelerate transitions. The Advisory Council for Science, Technology and Innovation (AWTI) addresses this problem in three recommendations to the government:

- ▶ Organize the making of an inspiring story about the Netherlands in the future; build this story up as a series of 'windows' and adjust the narrative regularly, to keep it in sync with social and technological developments. Place the responsibility for the story with a Cabinet subcommittee for societal transitions
- ▶ Develop a network of interconnected transformative coalitions, consisting of a variety of (new and unexpected) parties who work together and learn from each other.

- ▶ Ask each government ministry to set up a 'future centre' or 'future group', and to give these a stimulating mission.





# Report

The background features a complex geometric pattern of triangles. A large maroon triangle is positioned at the top, pointing downwards. Below it, a dark blue triangle points upwards. The bottom half of the image is dominated by a large white triangle pointing upwards, which is partially overlaid by a dark blue triangle pointing downwards. In the upper right quadrant, there are two overlapping triangles: a smaller maroon one pointing down and a light blue one pointing up.



# Background: science, technology and innovation do not contribute enough to transitions

The Netherlands is a prosperous country with a flourishing economy. However, the way in which Dutch society is currently arranged is unsustainable in the longer term. Our societal systems are seizing up. Transitions in a variety of fields such as food, care, mobility, safety and sustainability are needed urgently, and have already been initiated to some extent. Science, technology and innovation (STI) could play a stronger and more effective role in these transitions. How can the government foster this?

## 1.1 Present make-up of society is not sustainable

The way in which the Dutch society and economy are organised and structured, the ways in which we produce and consume, are not sustainable in the long run. The pressure on existing resources, natural resources and human resources (the labour force) is increasing. It is key to ensure that, while we maintain high standard of living, we do not negatively impact future generations, be they in the Netherlands or elsewhere. We must take action to ensure that our society and economy become future-proof. This means we must change many segments of society: the social domain, the fields of energy, healthcare, food, safety and mobility. We must progress towards becoming an inclusive, liveable and sustainable society. If we fail to achieve this great societal mission, it is doubtful whether the Netherlands of the future will still be the prosperous country with the high living conditions and flourishing economy that it has today.<sup>1</sup>

The Netherlands must therefore find a way to develop into a future-proof society which maintains prosperity and well-being under continuously changing circumstances. This society must meet the needs of the present-day population, without jeopardising the needs of future generations.<sup>2</sup> The changes needed for this - transitions - are radical and will impact our daily lives profoundly. These transitions can be described as fundamental, long-term changes in the structure, culture and infrastructure of a society.<sup>3</sup> They are radically uncertain, in the sense that it is not possible to determine in advance (or even to

---

1. See e.g. World Economic Forum (2019).

2. In line with Brundtland (1987).

3. The term 'transitions' follows the concept put forward in Hölscher et al. (2018). Terms such as 'transformations' and 'system innovation' (OECD 2015) are also allied to transitions. DRIFT describes a transition as 'a process of fundamental and irreversible changes in culture, (institutional) structure and procedures at system level.' (DRIFT 2019).

imagine) what the world thereafter will be like . Moreover, the contours of transitions shift constant in response to new situations, insights and views.<sup>4</sup> Some societal transitions take place, or have taken place, more or less spontaneously, as a result of social and technological developments.<sup>5</sup> Over the coming years, however, deliberately initiated transitions will be needed, which we as a society will endeavour to steer in the right direction and to accelerate. Examples are the energy transition, the healthcare transition and the transition to a circular economy.

## 1.2 Transitions bring both 'pain' and opportunities

Societal transitions do not take place without struggle and frictions, or 'transition pains'.<sup>6</sup> This was recently to be seen in the protests by Dutch farmers and builders in response to changing legislation around nitrogen and harmful chemicals (PFAS). Major changes can have adverse effects on some sections of the population and occupations, and on organisations which are strongly rooted in and thrive in the existing situation. Frictions are thus to be expected and government policy must anticipate them.

Transition pains will become more frequent in the future. Sometimes buildings, networks and infrastructures will have to be adapted before the end of their economic life. Sometimes they will even become unsaleable. Tax revenues generated from 'old' practices could fall. The price of products could increase as a result of transition measures; examples are the higher costs of materials and transport which occur when a producer (builder, farmer, manufacture) takes additional measures to combat pollution. Businesses or even whole sectors will lose their core business, or will have to make expensive adaptations. We may find new solutions ugly (wind turbines, solar panels), whereas we have become accustomed to the appearance - sometimes also not overly attractive - of old infrastructure (e.g. power stations).

Change also bring opportunities, but these take longer to be realised. Until then, people and organisations will have to defer the gratification of their needs; parties that initially do not derive benefits from the changes will still have to go along with the developments. The Netherlands will have to work to achieve an equal distribution of (and where necessary compensation for) transition pains.

Societal transitions can provide new impetus and opportunities for scientists, innovative companies and entrepreneurs.<sup>7</sup> This is most likely to happen if the Netherlands becomes an international leader of change in certain areas of strength and a leader in the quest for

---

4. Grin et al. (2010).

5. Examples include the Industrial Revolution, the sexual revolution, secularisation and the digitalisation of society.

6. The nature of societal transitions this is discussed at length in the scientific literature (see list of references in section 1.4).

7. See also AWT (2013).

new possibilities and solutions. Then, the Netherlands will co-create the direction of developments, and will be able to compete on the world market for innovations. Leading the field will enable the Netherlands to avoid having solutions devised by other countries imposed, as happened with many digital innovations in the recent past.

Transitions give rise to new needs and therefore new markets for innovative companies. There are plenty of examples. During the digital transition, millions of new jobs were created worldwide. The transition led to new ways of working, doing business and doing science; different lifestyles became possible. The forthcoming transitions will also offer opportunities. The growing demand for sustainable products, services and lifestyles is, for example, already leading to new fields of science, to innovation and to new employment opportunities. An example is the Dutch company 'The Vegetarian Butcher' which, together with all 90 employees, was recently taken over by Unilever, and is now able to expand internationally. Another example is the company Ioniqa, which developed and marketed a technique for recycling coloured bottles to create new raw materials. The Netherlands is in an excellent starting position, both scientifically and commercially, in a number of new fields, and has the potential to become a leading exporter of sustainable products and services.

### 1.3 Science, technology and innovation currently not being used to full advantage

Science, technology and innovation are inextricably linked to societal transitions. Despite this, the Netherlands is not yet making sufficient use of STI to speed up transitions.<sup>8</sup> There is both an **overestimation** and an **underutilisation** of science, technology and innovation.

The **overestimation** stems from the fact that plans and programmes expect too much of technology and innovation and appear to assume that they will deliver all the solutions, with examples such as: 'we needn't fly less because there will be electric aeroplanes in the future'. However, the idea that technology will provide a solution to every problem is too simplistic, and thinking in this way undermines the public debate that is needed on the role of science, technology and innovation in transitions.<sup>9</sup>

**Underutilisation** of science, technology and innovation arises because there is no clear framework for the efficient use of available creative energy and developmental capacity. What exactly is expected of scientists and innovators? Also, the exact sciences and

---

8. Examples of policy are 'Nederland circulair in 2050' ('A circular economy in the Netherlands in 2050'), the 'national environmental vision' programme, the vision for agriculture, the focus on prevention and transformation in parts of the healthcare sector, the commitments in the climate agreement and the shift in the Top Sectors approach in the direction of shared missions.

9. See also Tucker (2013).

technological sciences and innovation are not well connected to parties which put forward non-technological solutions or articulate a diversity of societal needs and different ways of thinking. Examples of such parties include those in the humanities and social sciences, creative professionals, artists, non-governmental organisations (NGOs) and young people.

### **Six shortcomings in the present STI policy framework for societal transitions**

Future-oriented policy creates clear and powerful conditions which enable scientists, in partnership with other (commercial and creative) innovators, to contribute to societal transitions. These conditions enable stakeholders to anticipate 'transition pains' and deal with them adequately. However, the existing policy framework does not mobilise science, technology and innovation in this way. The Council observes the following shortcomings.

#### **► Innovation policy is insufficiently focused on transitions**

The government's innovation policy is largely generic and non-specific. The largest financial instruments (e.g. the WBSO tax credit scheme for R&D or the 'innovatiebox' tax breaks for innovation) stimulate all kinds of research, development and innovation to an equal extent. There is little direct connection with societal transitions, and as a result companies are not encouraged to adopt societally desirable directions of innovation. Moreover, the generic policy mainly incentivises incremental innovation (small steps), whereas radical innovation is needed.<sup>10</sup> Finally, innovation policy is mainly supply-driven ('technology push') and does not help to develop demand for innovations which contribute to transition missions.<sup>11</sup> Those policy instruments which do focus on demand development and market creation<sup>12</sup> (such as Small Business Innovation Research (SBIR) and Green Deals) do not play a central role in policy, partly because of their limited size and scope.<sup>13</sup>

#### **► No incentive to experiment with radical solutions and demand articulation**

Missions that are measurable and clearly defined (in terms of time and money) do not incentivise parties to experiment with radical solutions and creative options for change. Moreover, such technocratic missions provide no way to address cultural, structural or behavioural changes. Achieving transitions requires shared learning by stakeholders about future societal needs. These needs may be radically different from what we need today. The knowledge and innovative strength of research institutes and businesses must be stimulated to focus on such future issues and

---

10. See AWTI (2018b).

11. Frenken & Hekkert (2017).

12. As also described in the recent knowledge and innovation covenant 2020-2023.

13. Janssen (2018).

learn from them. At present, these learning processes take place on an ad hoc basis, and they have little power and make too little impact at the national level.

► **No public mission for research institutes to focus on transitions**

The scientific community and the higher education do not have an explicit public mission. AWTI recently suggested that a more clearly defined mission is necessary.<sup>14</sup> The applied research system also has no clearly defined public mission.<sup>15</sup> Public funding flows are not explicitly goal-oriented, which means public research institutes are unable to choose properly.

► **The mission-driven Top Sectors and Innovation policy has too little effect on transitions**

The government's top sector approach was developed further in 2018 into a mission-driven innovation policy. The purpose of this move was to steer the top sectors in the direction of four societal themes: Energy and Sustainability; Agriculture, Water and Food; Health and Care; and Safety. The policy does too little to accelerate transitions, because it builds on existing technologies, industries and institutions and involves established stakeholders, each with their own interests.<sup>16</sup> The compromise-based 'polder model' which accompanies that approach makes it difficult to take decisions. The policy is also limited in both funding and scope. The specific missions at the heart of the policy are highly technocratic in design and are time-limited (see point 2).<sup>17</sup> This speeds up the quest for solutions in the short term, but carries the risk that solutions will be chosen which exacerbate problems over the longer term or create new problems: 'fixes that fail'.

► **Policy that does target transitions and innovation is fragmented**

Most government ministries have some form of innovation policy, and some have made a start with a policy on transitions (e.g. the Ministry of Infrastructure and Water Management in relation to the circular economy). Currently, however, there is virtually no interdepartmental coordination.<sup>18</sup> Contacts between ministries in relation to transitions and innovation are frequently ad hoc and dependent on individuals.<sup>19</sup> Initiatives have however recently been developed to improve this situation, with the Secretaries-General of four ministries joining forces in a mission-driven approach, for example.<sup>20</sup>

---

14. AWTI (2018).

15. AWTI (2017).

16. Janssen et al. (2019b); See also Hightech (2019), p.8. This communication does not lead to a call for a new structure.

17. Analogous to the move towards mission-driven policy that can be observed in several countries and in European policy. See Mazzucato (2018; 2019).

18. Raad van State (2019). With the exception of the climate agreement and mission-driven innovation policy.

19. The Dutch Council for the Environment and Infrastructure (Rli) makes this point regarding the transition to sustainability. See Rli (2019).

20. Ministerie van Algemene Zaken (2017).



► **Insufficient transition-focused research and innovation capacity**

The funding of science and research institutes is under pressure due to declining public investments.<sup>21</sup> This makes it difficult for universities, universities of applied sciences, TNO and other public research institutes to work with the business community to bring together sufficient research and innovation capacity to enable long-term and large-scale joint (transdisciplinary and multidisciplinary) research to be carried out on societal transitions.

Without the focused and combined involvement of science, technology and innovation, societal transitions will not happen. Scientific knowledge is essential for thoroughly understanding the societal systems we wish to change and to underpin collective decision-making in transition processes.<sup>22</sup> Technology and innovation are indispensable for developing (partial) solutions for change.

**The potential role of science, technology and innovation in societal transitions**

► **Broad academic knowledge as a breeding ground for transitions**

Scientists explore, describe, understand, explain and test the reality and come up with possibilities for change. This is how science increases our understanding of the world; it inspires, innovates, problematizes and devises solutions.<sup>23</sup>

► **Innovative entrepreneurship produces business models which transform sectors**

New business models can transform whole sectors.<sup>24</sup> Innovating entrepreneurs are not content with prevailing views and norms, and are capable of changing institutions; this is also described as 'institutional entrepreneurship'.<sup>25</sup> Thus, entrepreneurs can actively contribute to solutions to transitions challenges; they see needs or market demand arising to which they adapt their offer.<sup>26</sup>

► **Knowledge about transition processes; research into 'what works'**

Scientists concern themselves with interdisciplinary issues which bear a direct relation to transition processes. For example, they carry out research on changing complex societal systems, on how (sustainable) innovations are created in innovation systems, or on the role of innovation in change processes. They also study what we can learn from past and ongoing transitions. Some of

---

21. AWTI (2019).

22. SAPEA (2019).

23. See the work of the Rathenau Instituut on the future of our knowledge society (2019a).

24. Kavadias et al. (2016).

25. Van Rijnsoever (2019).

26. Proka et al. (2018).

this research is commissioned by the government.<sup>27</sup> There are also scientists studying which policy leads to transformation or, in more concrete terms, ‘what works’ in achieving societal change.

▶ **Using applied knowledge in the quest for solutions**

Applied research looks for solutions to practical problems and societal issues. Much of this research is carried out by publicly funded organisations beyond the scope of academia. These organisations combine research and knowledge-intensive service provision. Thus the applied research system reinforces the innovative power of business, contributes to addressing transition challenges and improves the quality of government policy.

▶ **Technology as an enabler and catalyst**

New technological possibilities can support and speed up societal transitions. Research in the technical sciences and applied research<sup>28</sup> translates new knowledge and insights into practical technical and (technological) products, systems and processes which can contribute to transitions.

▶ **Transfer of knowledge, skills and expertise**

Scientific knowledge impinges on and shapes the content of education, from primary education through to university programmes. Public research institutes are also suppliers of knowledge to politicians, policy, public organisations and the media. International knowledge about transitions, technology, etc. comes to the Netherlands via the international, global scientific community,<sup>29</sup> so that society can absorb this knowledge. In this way, the world of science and research provide the tools and skills needed by today’s generation and the next generation to help bring about societal transitions.

▶ **Innovation systems add impact to radical innovations**

Businesses, civil-society organisations and (groups of) individuals create innovations in a certain context: an ‘innovation system’.<sup>30</sup> These innovations only have impact if they have sufficient scale and are disseminated;<sup>31</sup> think of the steadily improving solar panels, electric vehicles and bicycles, meat replacements, sustainable restaurants, as well as developments such as e-health (care provided via the Internet and smartphone). Underlying societal transitions is often a layer of more radical innovations, or a cascade of

---

27. See e.g. Lodder et al. (2017).

28. In theory, technological development can also take place outside science and large companies. K this rarely occurs, however, owing to the high costs and the need for research infrastructure and collaboration.

29. Wright (2019).

30. Hekkert et al. (2007).

31. AWTI (2018).

innovations (e.g. the steam engine, the car or the personal computer).<sup>32</sup> It depends on the broader innovation system whether or not an innovation becomes widespread and successful, and thus leads to structural and cultural change. The system is at least as important a factor as the characteristics of the innovation itself and of the party which develops it (often a company).<sup>33</sup>

## 1.4 Request for advice: How can better use be made of science, technology and innovation?

The subject of this request for advice is as follows:<sup>34</sup>

***How can the government improve the contribution made by science, technology and innovation to societal transitions?***

### **Creation of this report**

In preparing this advisory report, we carried out desk research on societal transitions. This literature deals with the nature of societal transitions, how they take place and how they can be steered. This scientific basis has frequently been consolidated, including internationally.<sup>35</sup> In addition, AWTI talked to a number of scientists and experts from business and government ministries. To obtain feedback on a first draft of this report, an expert meeting was organised in July 2019.<sup>36</sup>

This report was prepared by a project group consisting of Council members Emmo Meijer (chair), Tim van der Hagen and Roshan Cools and staff members Kathleen Torrance, Michiel van Well and Chris Eveleens.

---

32. Bakker (2017); Mokyr (2016).

33. AWTI (2018c).

34. See the AWTI research programme 2019 (AWTI 2018d).

35. See e.g. OECD (2015); Köhler et al. (2018); Goetheer et al. (2018); Geels (2011); Hekkert et al. (2007); Mazzucato (2011); Markard et al. (2012); EEA (2018); Schot & Steinmueller (2018); Weber & Rohracher (2012).

36. See Appendix 1 for a list of discussion partners.

## Advice: Make better use of STI with an inspiring story about the future and a radical approach

**The Council believes that much better use could be made of science, technology and innovation to foster societal transitions. To achieve this, the government must create an overarching narrative about the Netherlands in the future, accompanied by a radical approach to achieve transitions. This would make possible targeted investments, avoid wasting time and money, make it easier to deal with resistance and bring together innovators with new and creative parties.**

There is currently no central narrative behind the transitions in areas such as healthcare, energy, food and transportation. Vision documents have been written for certain segments (vision on agriculture, vision on the circular economy, work in progress on visions for spatial policy), and some social agreements on the direction of change have been reached (raw materials agreement, construction agreement).<sup>37</sup> However, these are mostly based on existing situations and possibilities, not focused on the future and not interlinked. Choices made in one area can then stand in the way of choices made in another.

There is also a general lack of focus on radical change and innovation: why is change necessary, what benefits will it have? In which innovations do we want to invest and which developments do we specifically not want in the future? The Advisory Council for Science, Technology and Innovation (AWTI) addresses this problem in three recommendations to the government:

The need for an overarching narrative which offers an attractive perspective for the future becomes greater by the day, partly because of the strong focus of attention on what goes wrong in transitions. All in all, these omissions lead to a situation in which the Netherlands is not making full use of science, technology and innovation to accelerate transitions

This narrative on the future needs to be accompanied by a radical approach: an approach in which a variety of (including new) parties work together and learn from each other. Due to their uncertain and disruptive nature transitions are difficult to steer through of existing

---

37. Examples of policy are 'Nederland circulair in 2050' ('A circular economy in the Netherlands in 2050'), the 'national environmental vision' programme, the vision for agriculture, the focus on prevention and transformation in parts of the care sector, the commitments in the climate agreement and the shift in the Top Sectors approach in the direction of shared missions.

policies and systems of consultation, but that is what is currently happening. AWTI's advice is to develop an approach based around new, transformative coalitions.

This chapter describes the narrative on the future vision and the accompanying approach and explains why they are necessary. Chapter 3 describes how the narrative and the radical approach can be created.

## 2.1 A clear story about the future will foster investments and coordination and build support

Steering and adjusting societal transitions is one of the most important and most complex challenges facing government and parliament. Their democratic mandate makes them the only parties who can set a common course. With a clear and ambitious story about the future, they can prepare the way for scientists, technology developers, entrepreneurs and other innovators, who develop and disseminate products, services, new business models, different ways of working and other things necessary to make transitions possible. An overarching narrative reflects basic values (how would we like things to be?), as do expectations and ideals (how could it be?). It also opens the door to new ways of thinking and doing. The future narrative offers actors perspective because it shows what is desirable and possible and what is achievable.<sup>38</sup> It also makes clear what we do *not* want.<sup>39</sup>

Setting a common course calls for clear choices between alternative development pathways (following from systems analyses<sup>40</sup>). This makes it easier for businesses, entrepreneurs, scientists and other innovators to stick to the desired course over an extended period of time and to focus on solutions to societal challenges that are radically different from the norm.<sup>41</sup> Businesses and entrepreneurs will then have more clarity about future markets, enabling them to invest in the development of innovative solutions.<sup>42</sup> Knowledge development and innovations which fit with the chosen development pathways will enjoy wider acceptance thanks to the directional future narrative. This will give rise to efficient learning processes, complementarity and easier access to capital.<sup>43</sup> An overarching story thus will give direction to public and private investments and to shared actions.

Such a story will also help to maximise the coordination of societal transitions and make it possible to address conflicting policy objectives. Shared reflection on the future will show

---

38. Hajer (2017).

39. Schot & Steinmueller (2018).

40. Grin et al. (2010).

41. AWTI called in 2016 for more scope for radical innovation as a contribution to the energy transition.

42. At a time when the risk of negligible growth is a real one (Lukasz & Summers, 2019).

43. Smith et al. (2005); Berkhout (2006).

us what inconsistencies and tensions exist between policy goals and which blind spots there are in the thinking about the Netherlands of the future. Current tensions between different transitions, and between transitions and other societal goals are an example of this. The goal of reducing greenhouse gas emissions, for example, is helped by burning renewal biomass fuels, while that same biomass is needed for biodegradable products in a transition towards a circular economy.<sup>44</sup> Another example: data-driven healthcare offers many possibilities, but not all of them are in tune with goals in relation to safety and privacy.<sup>45</sup> During the energy transition, new jobs will be created and old jobs will disappear. People will not always immediately have the necessary skills for those new jobs, and this mismatch will create uncertainty in the labour market.<sup>46</sup> The government and those in the field (business, civil-society organisations) will be better able to address issues such as these if they are acting from the basis of an integrated, long-term narrative on the future.<sup>47</sup> Such a story will also help the government and field parties to mount an adequate response to resistance.

## 2.2 The time is ripe for an overarching narrative

Many societal transitions have been under way for some time: think of the transition from fossil fuels to clean fuels, of the use of ICT in healthcare, or of the decentralisation of social policy. In their initial phase, transitions benefit from research that identifies problems and feeds the agenda, as well as from a variety of innovations. But there comes a point in every transition process when a common narrative for the future is needed, as an inspiration and as a basis for making choices.<sup>48</sup> That moment is now for various transitions.<sup>49</sup> Researchers, innovators and society need clear transition pathways and goals on which they can focus. It is no longer tenable to keep all options open. An example of this is the energy sector: sustainable energy technologies are becoming gradually embedded and are increasingly competing with old technologies.

We in the Netherlands are used to engaging in dialogue with a broad coalition in order to resolve issues such as these. It is no coincidence that the Netherlands ranks at number 1 in the Global Competitiveness Index 2019 for the number of 'Environment-related treaties'. However, this is not a good approach for the societal transitions facing the Netherlands at this juncture. Certain groups, including young people, are generally poorly represented in the renowned, compromise-based 'polder model'. Moreover, dialogue is a

---

44. Schut (2019).

45. Ottes (2016).

46. SER (2018).

47. EEA (2019).

48. The literature on transitions sees giving direction as a key building block of transition policy. See e.g. Weber & Rohracher (2012).

49. Lodder et al (2017).

lengthy process and the outcome is often a compromise which is insufficiently effective to serve as a solution to the problems.

### **A clear future narrative complements technology-based missions**

Companies and research institutes are currently being invited to work on closely defined goals with specific deadlines. Recently, this has been happening within the context of technology-based missions such as 'carbon-neutral in 2050', which are used to drive transitions in the Netherlands. To achieve the targets set in these missions, stakeholders focus mainly on the scientific, technological and innovative possibilities which are (almost) ready today. This leads to a growing focus on the short term and on incremental solutions, rather than a quest for more radical solutions which will stand the test of time.<sup>50</sup> The overarching future narrative advocated by AWTI could provide a counter to this approach and thus serve as a necessary addition to these missions.

## **2.3 An accompanying radical approach will bring in newcomers and encourage learning**

Societal transitions will only succeed if they are backed by a governance approach that places them high on the political agenda, is solidly embedded in the governance framework and involves different layers of society in activities and development pathways. As well as a clear story about the future, therefore, a radical and integrated approach is needed (in the jargon: a 'transformative' approach).

This is an approach in which different, new and unexpected partners collaborate on transitions and learn from each other. They link what they learn back both to the field of science, technology and innovation and to the national level of government, parliament and government agencies. AWTI advises setting up a new network for this purpose comprising of interconnected transformative coalitions. Each coalition is formed around a particular transition mission (e.g. food supply, housing or healthcare). In addition, each coalition is closely linked to an extensive population of enquiring, creative and innovative people. The link to government, parliament and government agencies arises via a Cabinet subcommittee which should be established and dedicated to societal transitions. This approach makes optimum use of the creative and innovative capacity in Dutch

---

50. See also Rli (2019).

society, while transitions receive the governance attention they need. Chapter 3 discusses this in more detail. The need for this approach is substantiated below.

A radical, integrated approach will enable the government to retain the initiative that is necessary. The government will thus facilitate a governance structure that will serve as a link between the national level on the one hand and science, technology and innovation on the other. This new structure is needed because existing platforms and discussion partners are insufficiently able to accelerate transitions. Acceleration of transitions requires new knowledge and innovation practices, the deployment of (new) actors and room to experiment. The debate about the future is currently dominated by technology experts in large companies, senior scientists and government, each of which have their own (vested) interests. It is essential to bring in new players and involve more 'ordinary people', who may devise solutions that go beyond the norm, increase the legitimacy of hard choices and improve the societal embedding of technology and innovations.<sup>51</sup>

An additional requirement is that the wide range of parties who need to be involved must be able to learn together about what works in transitions. This will incentivise people and organisations to experiment further with new possibilities.

### **Transitions are achieved in cyclical learning processes**

The overarching story of the Netherlands of the future and the transformative coalitions form part of the cyclical learning process in which transitions takes place.<sup>52</sup> A vision inspires people in coalitions and organisations; they undertake actions, reflect on them, apply the vision as necessary to the new insights or situation, undertake new actions, and so on.

Transitions require learning processes lasting twenty years or more. During this period, research institutes can focus on generating a better understanding of the societal challenges facing the Netherlands and developing solutions to them. Innovative entrepreneurs can anticipate future markets and adapt their products and services to the transition. As part of the learning processes, we must give less prominence to existing interests, step outside our comfort zone and make use of collective intelligence to find new solutions. All this is difficult to achieve within the platforms and the structures set up in the past, for other purposes, and which are often characterised by 'in-group thinking'<sup>53</sup> and 'lock-in'. The Dutch government's top sector approach is a good example; large swathes of those working in the field of science, technology and innovation –such as climate and earth scientists, innovative SMEs, social entrepreneurs and innovators<sup>54</sup> –

---

51. Nesta (2019).

52. Loorbach (2007); Lachman (2013); Kemp et al. (2007).

53. Janssen et al. (2019a).

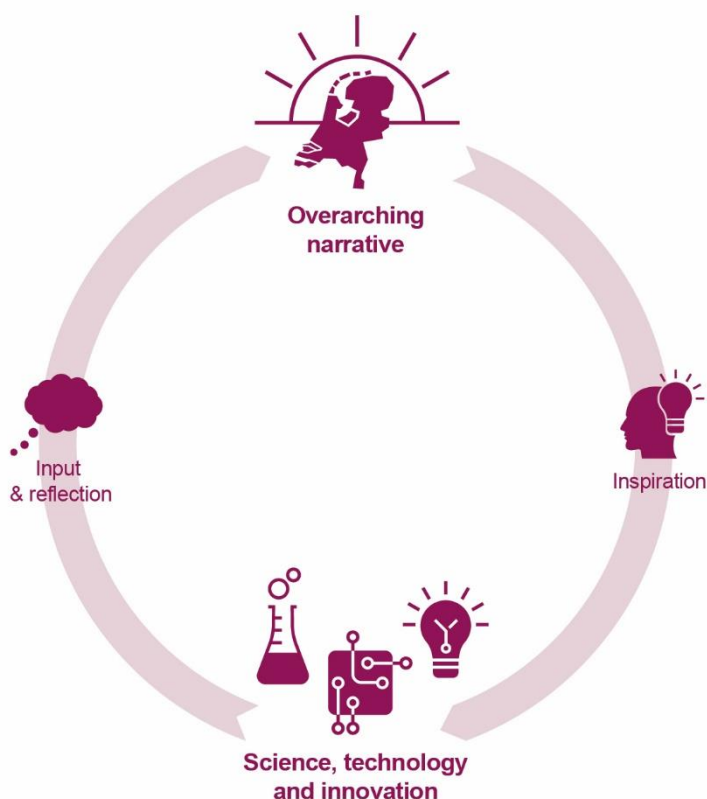
54. AWTI (2015).



are underrepresented in this approach<sup>55</sup> or have little say in it.<sup>56</sup> The same applies to newly created programmes in which the participants are mainly the ‘usual suspects’; think of the climate roundtables and the nationwide programme on the circular economy. Furthermore, top sectors are set up on a sectoral basis, whereas transitions cut across sectors. It is therefore important that the links between sectors are greatly reinforced.<sup>57</sup>

---

The overarching narrative on the future and the transformative coalitions are part of the cyclical learning process in which transitions take place.



---

55. See Dialogic (2017). The Top sector approach scores only moderately on 'openness'. "In practice, however, challengers have to go to some lengths to join and participate in knowledge and innovation activities, especially in those sectors with many established large players." p. 97.

56. A further relevant factor in the debate on climate-related transitions is that scientists do not always express their concerns because they are afraid of the public reactions (Lammerse, 2019).

57. Janssen en Frenken (2019).

## Involve the creative sector more

One of the new groups that must be involved in the new approach to transition-related issues advocated here is the flourishing creative and cultural sector in the Netherlands. Creative thinkers and makers are essential as a source of inspiration for science, technology development and innovation. They include artists, entertainers, scientists in creative fields, bloggers and vloggers, architects, gamers, creative entrepreneurs, science fiction writers, television, theatre and film makers, comedians, presenters, columnists, etc., etc. Transitions require radically new ideas; what those ideas are cannot be determined in advance, so it is important to utilise the creativity of those who are able to step away from the well-trodden paths. Creative thinkers and makers can dream up original and intelligent interventions which appeal to and mobilise people, and which lead to 'design-for-change'.<sup>58</sup> Plus: only if you can imagine something you have a chance of creating it in the future.<sup>59</sup>

Creatives can look at complex problems and societal challenges from a different perspective and show how things could be done differently. Societal transitions are moreover accompanied by cultural change and a recalibration of norms, values and behaviours. Artists and other performers can help us reflect on what we consider normal, odd and important, and why.<sup>60</sup>

The creative and cultural sector is currently not sufficiently involved in societal transitions.<sup>61</sup> Including the creative industry in the top sector approach was a recognition that creative organisations can, in addition to their intrinsic value, have economic significance.<sup>62</sup> In recent years it has become increasingly normal for the creative sector to experiment in living labs, field labs and social labs.<sup>63</sup> Creatives experiment with new applications for technology and knowledge which emanate from science and other public research institutes.<sup>64</sup> This makes it all the more striking that the creative sector is still barely used to help optimise the role of STI in societal transitions.

A closer alignment between creative professionals on the one hand and science, technology and innovation on the other will improve the common quest for ways to accelerate societal transitions. In the next chapter, the AWTI puts forward three recommendations on how to achieve this.

---

58. ClickNL (2018).

59. 'If you can imagine it, you can create it. If you can dream it, you can become it' - William Arthur Ward.

60. The Economist (2019).

61. Bruggmans & Stikker (2019).

62. AWTI (2015).

63. Maas et al. (2017).

64. See <https://www.clicknl.nl/fieldlabs/>.



## Three recommendations

As described in chapter 2, the AWTI advises the government to organize the making of an inspiring story about the future of the Netherlands and to develop an accompanying radical approach to transitions. This chapter proposes three recommendations to the government on how to achieve this.

Chapter 2 showed that a common direction is needed for transitions, linked to a transformative approach. Only then can the Netherlands make maximum use of science, technology and innovation to address the societal challenges facing the country. The appropriate party to initiate both the overarching future narrative and the radical approach, and to embed them in policy and legislation, is the government, in view of its democratic mandate and the checks and balances exercised by parliament. Once the process for developing a future narrative and a radical approach has been set in motion, it will become adaptive: in other words, the first results determine the next phase.

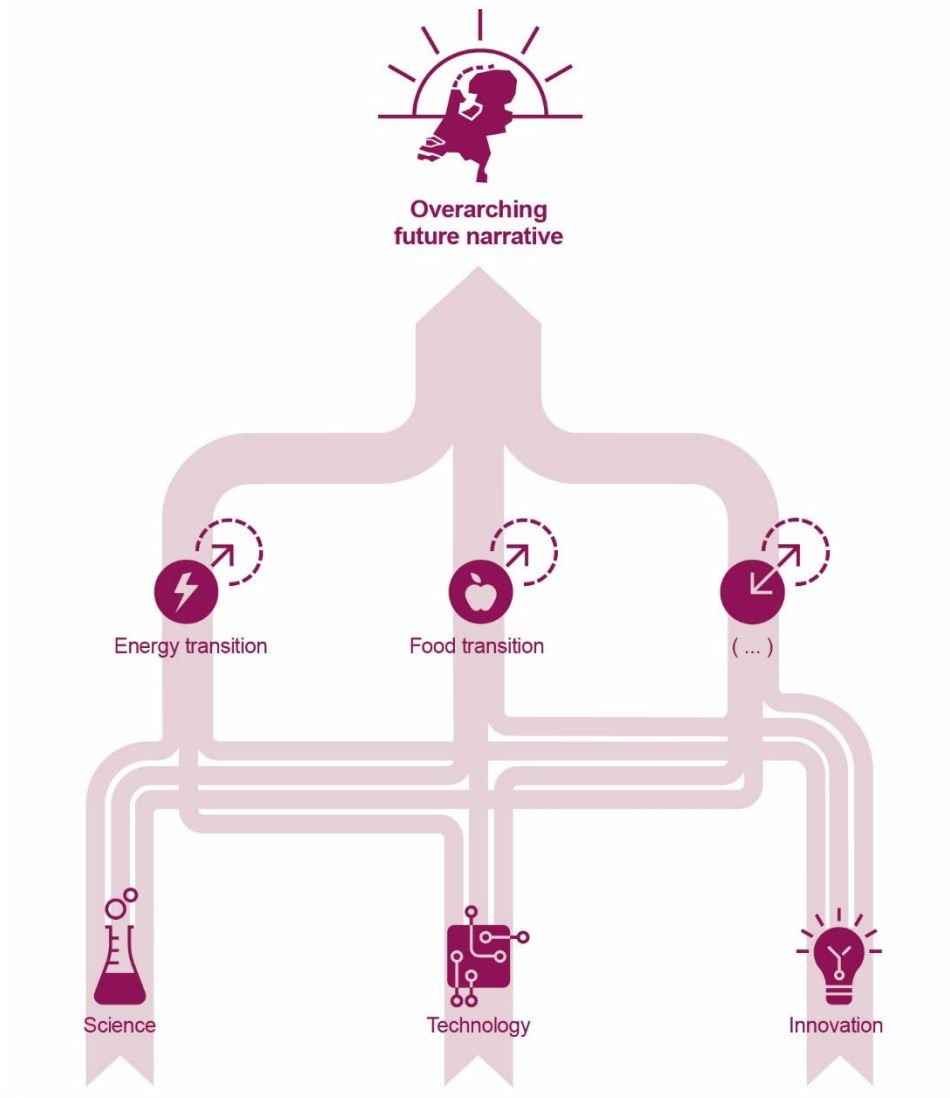
AWTI advises the government to take the following steps.

1. Organize the making of an inspiring story about the Netherlands in the future; build this story up as a series of 'windows'. Place responsibility for the story and its update with a new Cabinet subcommittee for societal transitions.
2. Establish a network of transformative coalitions with the brief of contributing to the future narrative. Once again, the Cabinet subcommittee for societal transitions would have responsibility for this.
3. Ask each government ministry to set up an internal 'future centre' or 'future group' and give them a stimulating brief.

### 3.1 Build a future narrative as a series of windows

The government must develop an inspiring and overarching story on the future of the Netherlands which sets out a direction for knowledge development and innovation. This narrative will accelerate transitions and expose potential frictions and blind spots. AWTI recommends that the **content** of the story be built as a series of interconnecting windows. As regards the **process**, the advice is to create the narrative in collaboration with societal actors. It must also be placed high on the parliamentary agenda. By doing all of this, the government will be opening the way for choices for, between and against certain development pathways.

An overarching narrative on the future of the Netherlands is needed to act as a signpost for science, technology and innovation.



### **Content of the narrative: incorporate both destinations and routes in windows**

The overarching future narrative envisaged by AWTI describes how the Dutch would *like* the Netherlands to be (basic values) and how the Netherlands *could* be (expectations and ideals). The Council recommends outlining the contours of both the destinations and the routes to achieving them, but cautions against building in too many, too measurable technocratic goals.<sup>65</sup>

The story of the future should reflect tangible aspects of society, such as the structure of cities and of mobility flows. It should also include aspects relating to social institutions, such as how people interact and what value is attached to nature and culture. The narrative can be built up as a series of interconnected windows; the Canon of Dutch History (*Canon van Nederland*) can serve as an example here.<sup>66</sup> The Canon presents a history of the Netherlands divided into fifty windows or themes, each providing information on key events, individuals and objects from Dutch history.

AWTI recommends that the future narrative be presented not just in textual form, but also in images (infographics, illustrations, cards, icons) and that, like the Canon of Dutch History, it be published via a website.

### **An inspiring example from Sweden which could also be used in the Netherlands**

Sweden's 'Vision Zero' is based on the principle that loss of life due to the transport system is never acceptable. The ultimate goal is therefore that there should be zero fatal accidents or serious injuries caused by use of the road infrastructure. A further principle is an acceptance that road users make mistakes, and that the design of the transport system must take that into account. Responsibility for road safety is thus placed with the system as a whole.<sup>67</sup> Vision Zero has led to a better transport system through the introduction of traffic-calming measures, well-signed intersections, separate cycle paths, use of vehicle technology, etc. Companies such as Volvo have embraced Vision Zero and are using it as a focus for their innovation efforts. The Vision Zero strategies have now also been introduced in Norway, Denmark and parts of the United States.

---

65. Such as a reduction of x tonnes of CO2 emissions or of x euros in the costs of care.

66. See [www.canonvannederland.nl](http://www.canonvannederland.nl) and <https://www.entoen.nu/en/downloads> for an English translation of the canon and its intentions.

67. Tingvall & Haworth (1999).

### **Process: The government must take the lead and solicit input from the public**

Establishing the future narrative means displaying leadership. As stated above, this is the responsibility of the government in the first place, but it is key that the narrative is developed in collaboration with society<sup>68</sup> and must ultimately enjoy wide support in parliament. It is vital to recognise and reflect the fact that transitions affect the whole of society.<sup>69</sup>

The government must therefore incorporate input from the public in the development process. It should encourage parties used to viewing societal issues over the long term to consult their stakeholders and put forward initiatives. Examples might include government policy research and advisory bodies, ministries, public research institutes and advisory councils. Existing projects and (partial) narratives should be incorporated in the process where possible (see box for an example). The narrative should be continually adapted in response to new insights gained regarding the course and progress of the societal transitions.

#### **Mapping the future: 'The Netherlands in 2120'**

A team of ecologists and landscape architects from Wageningen University & Research has developed a map showing a vision of the Netherlands in 2120.<sup>70</sup> It is accompanied by a narrative about a future in which ample space is given over to nature. The amount of woodland and forest has doubled, the total area of farmland has been halved and livestock production has fallen to a third of its present level. Farming is concentrated on suitable land in the provinces of Zeeland, Groningen and in Flevopolder. Some food production has been relocated to floating islands at sea (marine animals, seaweed).

Towns and cities on the map have become greener thanks to the planting of urban woodlands and food forests. New housing development takes place mainly in the less densely populated eastern and southern regions of the Netherlands. The River IJssel has doubled in width in order to carry away surplus water from the Rhine. The coastal dunes are also twice as wide, in order to protect the Netherlands against rising sea levels. The Netherlands of the future portrayed in this vision makes intensive use of the North Sea for food production and for the generation of solar and wind energy.

---

68. Via instruments such as foresight studies, scenario planning and 'participatory futuring' (Nesta 2019).

69. EEA (2019), OECD (2015).

70. <https://magazines.wur.nl/climate-solutions-nl/nederland-in-2120/>.

The team from Wageningen deliberately opted not to carry out a scenario study, but instead to present just one vision which sets out what the research team believes is the direction of travel the Netherlands needs to take.

AWTI recommends that the government be specific and concrete regarding aspects where there is consensus or the prospect of consensus. For more controversial issues, the narrative must allow scope for rapprochement between parties.<sup>71</sup> This could be done by experimenting in small-scale studies to determine precisely what the problem is and what the possible solutions may be. It will be impossible to obtain complete consensus on all aspects of the future narrative, but the commitment is to secure the support of a large majority of Dutch society for the core of the narrative.

### **Make regular adjustments to the narrative**

By its nature, the future narrative will never be finished, and must therefore be regularly updated and adjusted. Periods of transition are marked by continual changes in what people consider important, normal and desirable. New technological possibilities and innovative ideas also emerge along the way. The lessons and experiences from previous knowledge development and innovation projects are a constant source of input for the next version of the story. Adjustments are gradual and take place at regular intervals. One possibility would be to update the narrative in the year preceding a general election, so that it offers guidance and frameworks for a new Coalition Agreement.

### **Place overall responsibility with a Cabinet subcommittee**

The overarching story about the future of the Netherlands and the radical approach to societal transitions are so important that ultimate responsibility must rest directly with the Prime Minister. The government can organise this by setting up a committee for societal transitions, which reports to Cabinet and is chaired by the Prime Minister. The Danish approach (see box) can serve as an example here. AWTI suggests that ministers from a number of directly involved ministries sit on the committee. It is usual to appoint a coordinating minister for a Cabinet subcommittee; AWTI proposes that this task be assigned to the Ministry of the Interior and Kingdom Relations, in order to embed the interdepartmental nature of the approach and to establish a relationship with civic participation.

---

71. Wanzenbock et al (2019).



### The Danish approach to developing a future vision

There have been a number of initiatives in Denmark aimed at establishing a vision for the future of the country through a shared process. The most recent initiative was the Danish Disruption Council (2017-2019). Its purpose was to prepare Denmark for a disruptive future. The Council was chaired by the Prime Minister and also contained eight ministers plus thirty representatives from business, the scientific community and other groups in society. Together, the Council members analysed and discussed proposals for dealing with the major changes occurring in the fields of work, technology and the labour market. The Council also issued recommendations, taking positive ambitions as the starting point. Ultimately, this culminated in a strategy document for the future of Denmark.<sup>72</sup>

## 3.2 Give transformative coalitions a stimulating mission

Transitions require an approach that involves several (new and unexpected) parties working together and learning from each other. These collaborating partners are in contact with the world of science, technology and innovation, as well as with the national level of government, parliament and government agencies. AWTI advises setting up a new network for this purpose comprising interconnected 'transformative coalitions'. Each coalition is formed around a particular transition mission (e.g. food supply, housing or healthcare). Participants in these coalitions put themselves forward or are invited if they have a positive attitude towards transitions and have ideas for change. A total of between, say, five and seven coalitions could be formed. The Cabinet subcommittee for transitions takes the initiative, while the coordinating ministry is responsible for the implementation.

### Mission for the coalitions

The coalitions are not 'talking shops' but 'action groups'. Their mission is twofold.

#### 1. **Contribute to the shared narrative on the future of the Netherlands**

The coalitions draw on parts of the future narrative from the scientific and creative sectors, and from organisations and partnerships such as field labs, think tanks, future studios, etc. They look for ways of bringing together the different parts of the story and reaching consensus on them. Examples might include links between the

---

72. The Danish Government (2019).

'Netherlands in 2120' map developed by Wageningen University & Research, the agricultural vision developed by the Ministry of Agriculture, Nature and Food Quality, and visions of the future of mobility (for example developed by the Netherlands Environmental Assessment Agency (PBL) and Utrecht University's Urban Future Studio).

## 2. **Initiate a learning process about what is needed to contribute to transitions**

What do people and organisations need? What are their 'transition questions'? What will our nutritional needs be in the future, for example, and what knowledge and innovation can contribute to achieving them? What wishes and requirements do we in the Netherlands have with regard to housing, and what technological developments can be helpful in achieving that? When do the Dutch feel – and when are they in reality – safe, and what technologies should or should not be used to achieve this? Questions such as these are being asked all over the Netherlands and answers are being provided in relation to specific segments.<sup>73</sup> The mission of the coalitions is to take on board these answers and pass them on to the field of STI and the national level (the latter via the Cabinet subcommittee).

### **Composition of the coalitions**

The coalitions are composed of creative thinkers and makers with a positive and innovative view of the particular transition for which they have come together. The coalitions also include stakeholders who have a clear interest in resolving the societal challenge at hand.<sup>74</sup> AWTI recommends seeking out parties that are able to come up with original solutions, such as artists, academics and innovative entrepreneurs. Young people must also have a sufficiently strong voice in the coalitions, since they will experience the societal changes (or lack of them) to a greater extent. Other coalition members might include environmental organisations, water authorities and research institutes (for the climate transitions), patient associations, health insurers and government agencies (for healthcare), local authorities, households, employers (for mobility), households and nature organisations (for the food supply), and so on. The government also participates in these coalitions, based on its different roles of problem-owner, moderator, financier and/or legislator.

Finally, AWTI calls for an approach to evaluating the transformative coalitions which is focused on learning and utilising what has been learnt, rather than on achieving a particular envisaged end-goal. A project is successful if it leads to new insights.

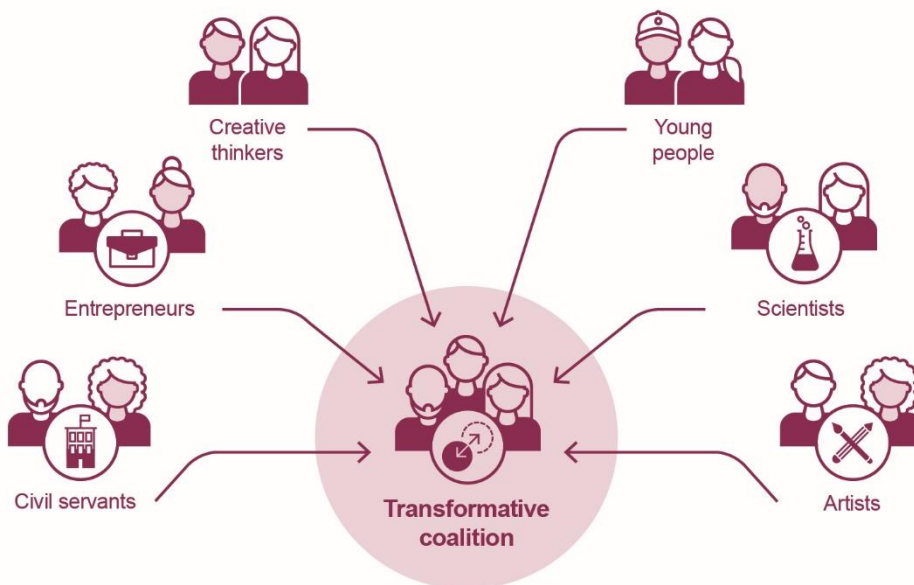
---

73. Potjer (2019).

74. Rathenau Instituut (2019b).

---

Each transformative coalition consists of various parties who work together around a particular societal transition. The coalitions form a link between science, technology and innovation and the overarching narrative on the future of the Netherlands.



---

### 3.3 Set up a future centre in each government ministry

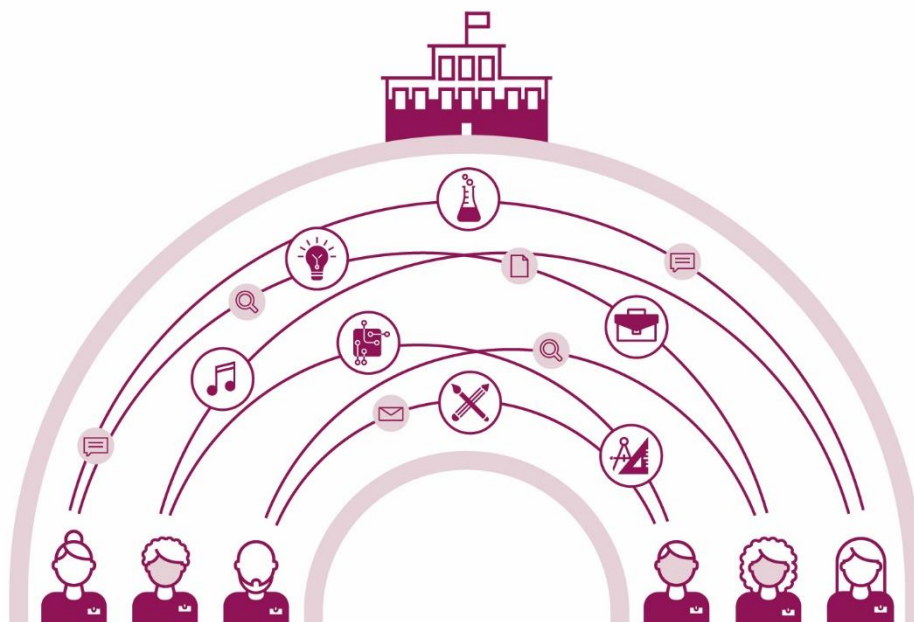
AWTI recommends that an internal 'future centre' or 'future group' be set up in each government ministry, in which staff are able to engage in open policy development in relation to transition issues at a remove from the day-to-day work of the ministry. Each group examines what needs to change within the ministry in order to accelerate and facilitate transitions, how existing tasks could be carried out in a more transition-oriented way, and how the ministry could reinforce the role of science, technology and innovation. In due course each ministry, each government implementing body, each provincial executive and each municipal authority should have such a future group with the brief of shaking things up and identifying and speeding up new development pathways for transitions.

Transitions can only be achieved if the government, too, learns and goes with the flow. Ultimately, the government itself will also have to transform, but there is a tension here between the organising and controlling tasks of the government on the one hand and the required flexibility and adaptability on the other. A government organisation is configured

primarily to carry out its existing activities as well as possible, and this leads to a certain inertia and resistance to change.<sup>75</sup> Within government ministries, too, established positions, routines, unwritten rules, the emphasis on ‘usual suspects’ and hard to change reflexes can impede societal transitions. Unwritten rules can so constrain the thinking and actions of civil servants that the ability to genuinely address ‘wicked problems’ is lost.<sup>76</sup>

---

Each ministry needs its own future group. This group prompts the ministry to make the changes needed to achieve societal transitions.



To break through this impasse, all government agencies need to have their own ‘future centres’, or future groups, starting with government ministries.<sup>77</sup> These groups will contain idiosyncratic but loyal employees from all layers of the organisation. Members will volunteer because they take a positive view of transitions, have ideas for change and are not afraid to express a critical opinion when necessary. They are given the explicit task of swimming against the tide and not allowing themselves to be influenced by unwritten rules, for example by involving ‘unusual suspects’ in policy processes and making

---

75. Kotter (2014), March (1991).

76. Herold (2017).

77. Dvir et al. (2006).

proposals for open policy development, even if this delivers results that run against the current policy.

Each future group maintains contacts with their counterparts at other ministries, and the different groups work together in a network where possible. This will enable them to offer a counterweight to the policy fragmentation that is inherent in a subdivision of societal tasks across ministries.

The future groups stimulate thinking about transitions and make proposals for transition-oriented actions and policy. The proposals are different for each ministry. A few examples:

- ▶ Ministry of Education, Culture and Science: facilitating more transition-oriented interdisciplinary and transdisciplinary research; creating scope for experimentation in education; more mission-driven research policy;<sup>78</sup> greater use of art and culture that inspires reflection on the future of the Netherlands (for example via science fiction<sup>79</sup>, novels, exhibitions<sup>80</sup>, debates).
- ▶ Ministry of Economic Affairs and Climate: refocus current non-specific support for innovation to create support for societally desirable innovation; more emphasis on instruments such as Small Business Innovation Research (SBIR) and Green Deals; add new instruments to support and scale up social innovation and social entrepreneurship.
- ▶ Ministry of the Interior and Kingdom Relations: transition-oriented procurement policy;<sup>81</sup> urban policy to include things such as living labs; link civic participation to societal transitions.
- ▶ Ministry of Finance: transition-oriented financing.

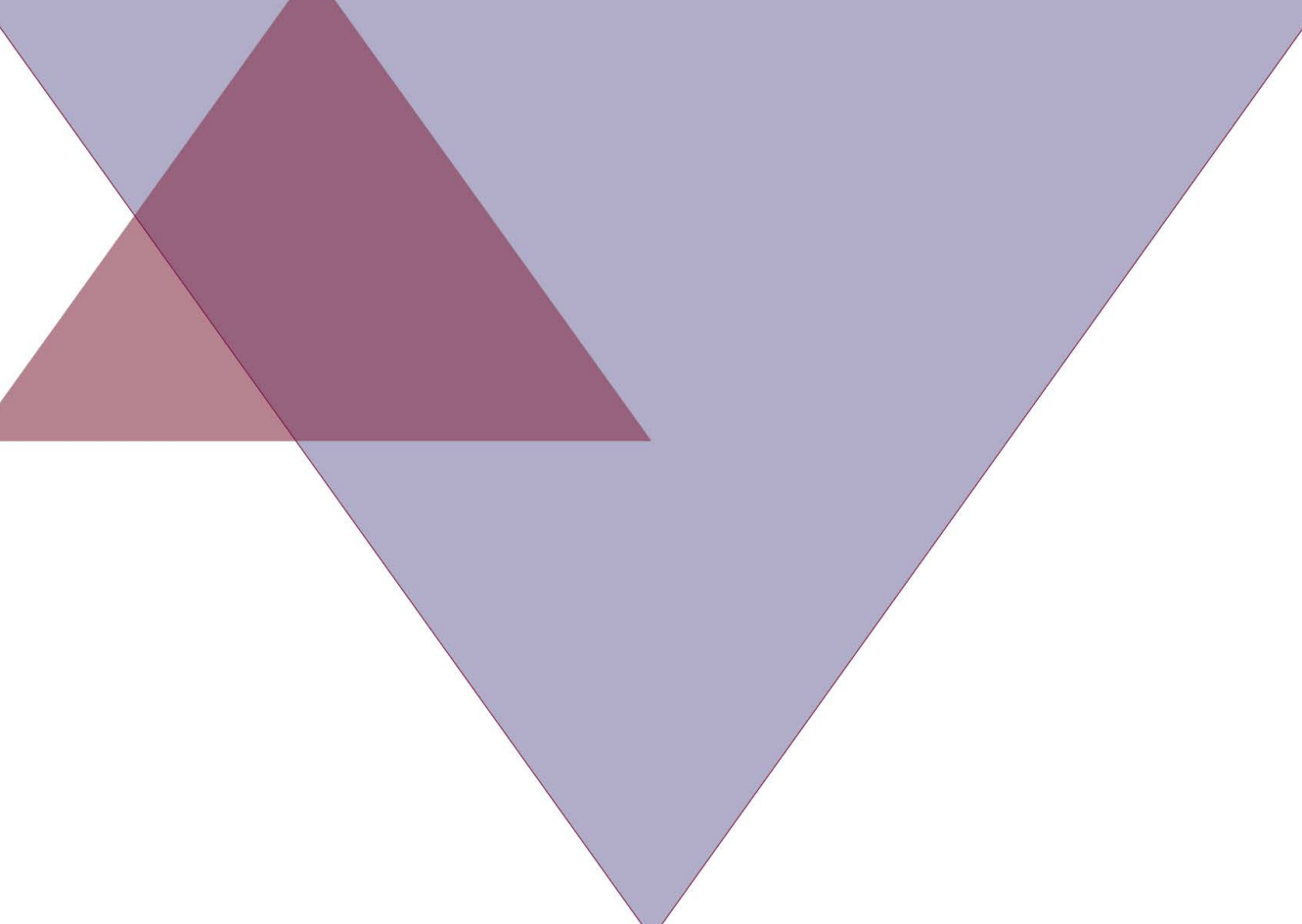
---

78. Rathenau Instituut (2019b), Sikma et al. (2019).

79. Van Gaal (2015).

80. Van Heeswijk (2016).

81. ABDTOPConsult (2018).



# Annexes

## Appendix 1: Discussion partners

▶ Lilian van den Aarsen	Ministry of Infrastructure and Water Management
▶ Colette Alma	VNCl, Huntsman Holland B.V.
▶ Jasper van Alten	Royal Netherlands Society of Engineers (KIVI)
▶ Jose Andringa	Netherlands Enterprise Agency (RVO)
▶ Luc Boot	Council for the Environment and Infrastructure (Rli)
▶ Harriëtte Bos	Wageningen University & Research
▶ Rik Braams	Ministry of Infrastructure and Water Management
▶ Christine Carabain	Netherlands Institute for Social Research (SCP)
▶ Tom Demeyer	Waag
▶ Geert Draijer	Ministry of Infrastructure and Water Management
▶ Albert Faber	Ministry of Economic Affairs and Climate
▶ Arjen Goetheer	TNO
▶ John Grin	University of Amsterdam
▶ Marko Hekkert	Utrecht University
▶ Hans Hillebrand	Ministry of Agriculture, Nature and Food Quality
▶ Ron Hillebrand	Council for the Environment and Infrastructure (Rli)
▶ Annemarth Idenburg	Netherlands Scientific Council for Government Policy (WRR), Trendbureau Overijssel
▶ Pieter de Jong	Council for Public Administration (ROB)
▶ Margrethe Jonkman	FrieslandCampina, AcTI
▶ Marjo Knops	Ministry of Infrastructure and Water Management
▶ Harry Lintsen	Eindhoven University of Technology
▶ Arnoud Molenaar	Rotterdam City Council
▶ Vera Pieterman	Ministry of Agriculture, Nature and Food Quality
▶ Renze Portengen	Ministry of Education, Culture and Science
▶ Peter Schmeitz	Ministry of Economic Affairs and Climate
▶ Johan Schot	Utrecht University
▶ Adriaan Slob	TNO
▶ Katrien Termeer	Wageningen University & Research, Social & Economic Council of the Netherlands (SER)
▶ Bart Thorborg	Council for the Environment and Infrastructure (Rli)
▶ Alexander van der Vooren	Social & Economic Council of the Netherlands (SER)
▶ Ib Waterreus	Ministry of Education, Culture and Science
▶ Robert Went	Netherlands Scientific Council for Government Policy (WRR)
▶ Tiny van der Werff	Council for the Environment and Infrastructure (Rli)

## Appendix 2: References

- ▶ ABDTOPConsult (2018), *Transitie te koop? Beleid, opdrachtgever en inkoper samen aan de slag*, The Hague
- ▶ AWT (2013), *Waarde creëren uit maatschappelijke uitdagingen*, Advisory Council for Science and Technology, The Hague
- ▶ AWTI (2015), *De kracht van sociale innovatie*, Advisory Council for Science, Technology and Innovation, The Hague
- ▶ AWTI (2015), *De waarde van creativiteit*, Advisory Council for Science, Technology and Innovation, The Hague
- ▶ AWTI (2016), *Oppakken en doorpakken, Durven kiezen voor energie-innovatie [Grasp the challenge, shape the future. Daring to go for energy innovation]*, Advisory Council for Science, Technology and Innovation, The Hague
- ▶ AWTI (2017), *Onmisbare schakels – De toekomst van het toepassingsgericht onderzoek [Vital links - The future of applied research]*, Advisory Council for Science, Technology and Innovation, The Hague
- ▶ AWTI (2018a), *Verspreiding. De onderbelichte kant van innovatie [Spread of innovation - The underexposed side of innovation policy]*, Advisory Council for Science, Technology and Innovation, The Hague
- ▶ AWTI (2018b), *Beleidsanalyse, Background study for AWTI report 'Verspreiding van innovatie' [Spread of innovation]*, Advisory Council for Science, Technology and Innovation, The Hague
- ▶ AWTI (2018c), *Verspreiding van innovatie in de innovatiesysteembenadering, Background study for AWTI report 'Verspreiding van innovatie' [Spread of innovation]*, Advisory Council for Science, Technology and Innovation, The Hague
- ▶ AWTI (2018d), *Research programme 2019*, Advisory Council for Science, Technology and Innovation, The Hague
- ▶ AWTI (2019), *Het stelsel op scherp [Shaking up the system]*, Advisory Council for Science, Technology and Innovation, The Hague
- ▶ Bakker, S. (2017), *From luxury to necessity, What the railways, electricity and the automobile teach us about the IT revolution*, Boom uitgevers, Amsterdam
- ▶ Berkhout, F. (2006), 'Normative expectations in systems innovation', *Technology Analysis and Strategic Management* 18(3-4), pp. 299-311
- ▶ Brugmans, G. & M. Stikker (2019), 'Zonder creativiteit geen toekomst', *NRC*, 14 June 2019
- ▶ Brundtland, G. (1987), *Report of the World Commission on Environment and Development: Our Common Future*, United Nations General Assembly document A/42/427



- ▶ ClickNL (2018), *Kennis- en innovatieagenda creatieve industrie 2018-2021*, Topteam Creatieve Industrie, Eindhoven
- ▶ Dialogic (2017), *Evaluatie Topsectorenaanpak, Deel 1 – Hoofdrapport*, 2016.049.1701, Utrecht
- ▶ DRIFT (2019), Website <https://drift.eur.nl/nl/over-drift/transities/>
- ▶ Dvir, R., Schwartzberg, Y., Avni, H., Webb, C., & F. Lettice (2006), 'The future center as an urban innovation engine', *Journal of knowledge management*, 10(5), 110-123
- ▶ EEA (2018), *Perspectives on transitions to sustainability*, European Environment Agency, Copenhagen, doi: 10.2800/332443
- ▶ EEA (2019), *Sustainability transitions: policy and practice*, European Environment Agency Copenhagen, doi:10.2800/641030
- ▶ Frenken, K. & M. Hekkert (2017), 'Innovatiebeleid in tijden van maatschappelijke uitdagingen', in: V. Minten & M. te Pas (eds.) *Sturen in een Verweven Dynamiek: Perspectieven op complexiteit en oriëntaties voor beleid* (The Hague: Ministry of Economic Affairs), pp. 46-57
- ▶ Geels, F.W. (2011), 'The multi-level perspective on sustainability transitions: Responses to seven criticisms', *Environmental innovation and societal transitions*, 1(1), 24-40
- ▶ Goetheer, A., F.A. van der Zee, M.J.L. de Heide (2018), *De Staat van Nederland Innovatieland 2018, Missies en 'nieuw' missiegedreven beleid*, TNO, The Hague
- ▶ Grin, J., J. Rotmans & J. Schot (2010), *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change*, Routledge, London
- ▶ Hajer, M. (2017), *De Macht van verbeelding*, Inaugural lecture, Utrecht University
- ▶ Hekkert, M.P., R.A.A. Suurs, S.O. Negro, S. Kuhlmann & R.E.H.M. Smits (2007), 'Functions of innovation systems: A new approach for analysing technological change', *Technological Forecasting and Social Change*, 74, pp. 413-432
- ▶ Herold, M.E.J. (2017), *Omggaan met ongeschreven regels, Hoe beleidsambtenaren zélf ruimte kunnen creëren voor openheid in de beleidsontwikkeling*, Doctoral thesis, Erasmus University Rotterdam
- ▶ Holland Hightech (2019), *Kennis- en Innovatieagenda Sleuteltechnologieën 2020-2023*, Eindhoven
- ▶ Hölscher, K., J.M. Wittmayer & D. Loorbach (2018), 'Transition versus transformation: What's the difference?', *Environmental innovation and societal transitions*, 27, 1-3
- ▶ Janssen M.J. (2018), 'Effect transformatief innovatiebeleid lastig te meten', *ESB*

- ▶ Janssen, M.J & K. Frenken (2019), 'Cross-specialisation policy: rationales and options for linking unrelated industries', *Cambridge Journal of Regions, Economy and Society*, Volume 12, Issue 2, July 2019, pp. 195–212
- ▶ Janssen, M.J., M. Bogers & I. Wanzenböck (2019a), 'Do systemic innovation intermediaries broaden horizons? A proximity perspective on R&D partnership formation', *Industry and Innovation*, 1-25
- ▶ Janssen, M.J., M. Hekkert & K. Frenken (2019b), 'Missiegedreven innovatiebeleid: Twee vliegen in één klap?', *Me Judice*, 25 September 2019
- ▶ Kavadias, S., K. Ladas & C. Loch (2016), 'The transformative business model', *Harvard Business Review*, October Issue
- ▶ Kemp, R., D. Loorbach & J. Rotmans (2007), 'Transition management as a model for managing processes of co-evolution towards sustainable development', *The International Journal of Sustainable Development and World Ecology*, 14(1), 78-91
- ▶ Köhler, J., F.W. Geels, F. Kern, J. Markard, A. Wieczorek, F. Alkemade, F. Avelino, A. Bergek, F. Boons, L. Fünfschilling, D. Hess, G. Holtz, S. Hyysalo, K. Jenkins, P. Kivimaa, M. Martiskainen, A. McMeekin, M.S. Müllemeier, B. Nykvist, E. Onsongo, B. Pel, R. Raven, H. Rohracher, B. Sandén, J. Schot, B. Sovacool, B. Turnheim, D. Welch, & P. Wells (2019), *An agenda for sustainability transitions research: State of the art and future directions*, *Environmental Innovation and Societal Transitions*
- ▶ Kotter, J.P. (2014), *Accelerate: Building strategic agility for a faster-moving world*, Harvard Business Review Press
- ▶ Lachman, D. A. (2013), 'A survey and review of approaches to study transitions', *Energy Policy*, 58, 269-276
- ▶ Lammerse, V. (2019), 'Mag je als wetenschapper je stem laten horen in het klimaatdebat?', 8 October 2019, *Scientias.nl*
- ▶ Lodder, M., C. Roorda, D. Loorbach, C. Spork, (2017), *Staat van Transitie: patronen van opbouw en afbraak in vijf domeinen*, DRIFT, Erasmus University Rotterdam
- ▶ Loorbach (2007), *Transition Management, New Mode of Governance for Sustainable Development*, Proefschrift Erasmus University Rotterdam, International Books Uitgeverij, Utrecht
- ▶ Lukasz, R. & L. Summers (2019), *On Secular Stagnation in the Industrialized World*, NBER Working Paper No. w26198
- ▶ Maas, T., J. van den Broek & J. Deuten (2017), *Living labs in Nederland - Van open testfaciliteit tot levend lab*, Rathenau Instituut, The Hague
- ▶ March, J. G. (1991), 'Exploration and exploitation in organizational learning', *Organization science*, 2(1), 71-87
- ▶ Markard, J., R. Raven & B. Truffer (2012), 'Sustainability transitions: An emerging field of research and its prospects', *Research Policy*, 41(6), 955-967
- ▶ Mazzucato, M. (2011), *The entrepreneurial state*, *Soundings* 49.49: 131-142

- ▶ Mazzucato, M. (2018), *Mission-oriented research and innovation in the European Union*, Europese Commissie, Brussels
- ▶ Mazzucato, M. (2019), *Governing Missions: Governing Missions in the European Union*, Europese Commissie, Brussels
- ▶ Ministerie van Algemene Zaken (2017) *Brief gezamenlijke sg's aan informateur Schippers*, The Hague
- ▶ Mokyr, J. (2016), *A culture of growth: the origins of the modern economy*, Princeton University Press
- ▶ Nesta (2019), *Our futures; by the people, for the people*, London
- ▶ NRC (2019) Series of interviews by W. van Noort and M. Stellinga with three key economic scientists Andrew McAfee ('Klimaatverandering bestrijd je met méér kapitalisme'), Joseph Stiglitz ('Klimaatverandering is onze wereldoorlog') and Carlota Perez ('Klimaatverandering kan een gouden tijdperk inluiden')
- ▶ OECD (2015), *System Innovation Synthesis Report*, Paris
- ▶ Ottes, L. (2016), *Big data in de zorg*, Working paper nr. 19. WRR, The Hague
- ▶ Potjer, S. (2019) *Experimental governance, from the possible, to the doable, to the mainstream*, Urban Futures Studio, Utrecht
- ▶ Proka, A., P.J. Beers & D. Loorbach (2018), 'Transformative Business Models for Sustainability Transitions', in *Sustainable Business Models* (pp. 19-39), Springer, Cham
- ▶ Rathenau Instituut (2019a), *De toekomst van onze kennissamenleving*, Webpage, <https://www.rathenau.nl/nl/de-toekomst-van-onze-kennissamenleving>
- ▶ Rathenau Instituut (2019b), *Missiegedreven innovatiebeleid*, Brief aan het parlement
- ▶ Rli (2019), *Naar een duurzame economie*, Raad voor de leefomgeving en infrastructuur, The Hague
- ▶ SAPEA (2019), *Making sense of science; for policy under conditions of complexity and uncertainty*, Evidence Review Report Executive Summary
- ▶ Schot, J., & W.E. Steinmueller (2018), 'Three frames for innovation policy: R&D, systems of innovation and transformative change', *Research Policy*, 47(9), 1554-1567
- ▶ Schut, G. (2019), 'Hoeveel spanning is er tussen klimaatbeleid en circulaire economie?', *Technisch Weekblad*, 8 October 2019
- ▶ SER (2018), *Energietransitie en werkgelegenheid; Kansen voor een duurzame toekomst*, Publiekversie, Social and Economic Council of the Netherlands (SER), The Hague
- ▶ Sikma, T., P. Verhoef & J. Deuten (2019), *Vorbereid op de praktijk – Anticiperen op de maatschappelijke inbedding van innovatie bij onderzoeks- & ontwikkelprogramma's*, Rathenau Instituut, The Hague

- ▶ Smith, A., A. Stirling & F. Berkhout (2005), 'The governance of sustainable socio-technical transitions', *Research Policy*, 34(10), 1491-1510
- ▶ The Danish Government (2019), *Prepared for the future of work*, Follow-up on the Danish Disruption Council, The Ministry of Employment
- ▶ The Economist (2019), *Food for thought: Climate change is a challenge for artists*, 21 September 2019
- ▶ Tingvall, C. & N. Haworth (1999), *Vision Zero – An ethical approach to safety and mobility*, ITE Conference paper, Monash University, Melbourne
- ▶ Topsector HTSM (2019), *Kennis- en Innovatieagenda Sleuteltechnologieën 2020-2023*
- ▶ Tucker, I (2013), Interview with Evgeny Morozov: 'We are abandoning all the checks and balances', *The Guardian*
- ▶ Van Gaal (2015), 'Sci-fi professor Etienne Augé: Nederland heft sciencefiction nodig', *Motherboard*, Vice 19, May 2015
- ▶ Van Heeswijk, J.A.M. (2016), 'Preparing for the not-yet, In: Slow reader, a resource for design thinking and practice', Eds: A.P. Pais en C.F. Strauss. Valiz, Amsterdam.
- ▶ Van Rijnsoever, F. (2019), 'Voorlopen, volgen, vastzitten en vertragen: ondernemerschap in de duurzaamheidstransitie', *Mejudice*, 22 April 2019.
- ▶ Wanzenböck, I., J. Wesseling, K. Frenken, M. Hekkert & M. Weber (2019), *A framework for mission-oriented innovation policy: Alternative pathways through the problem-solution space*
- ▶ Weber, M. & H. Rohracher (2012), 'Legitimizing research, technology and innovation policy for transformative change Combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework', *Research Policy*, 41, pp. 1037-1047
- ▶ World Economic Forum (2019) *The Global Competitiveness Report 2019*, K. Schwab (ed.) Geneve, Zwitserland, ISBN-13: 978-2-940631-02-5, [www.weforum.org/gcr](http://www.weforum.org/gcr)
- ▶ Wright, A. (2019), 'Universities' critical thinking is in a critical state', *Times Higher Education World University Rankings*, 25 July 2019