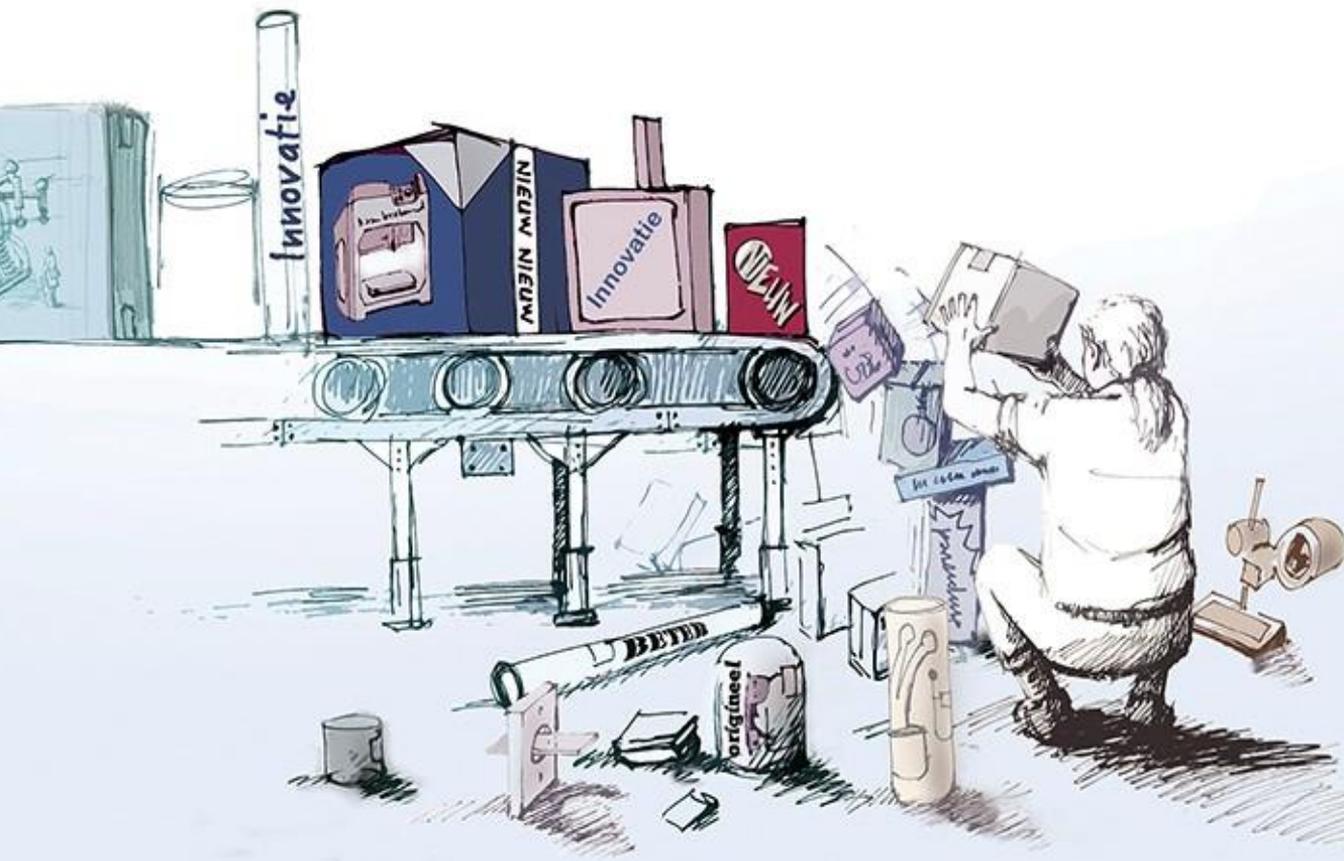


Spread of innovation

THE UNDEREXPOSED SIDE OF INNOVATION POLICY





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The underexposed side of innovation policy

september 2018

Photography	Ernst de Vogel
Design	2D3D Design
Printing	Xerox/OBT, The Hague
	september 2018
ISBN	9789077005835

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Contents

Summary	5
1 Do we get enough out of our innovations?	7
1.1 The Netherlands <i>produces</i> many innovations	8
1.2 How well do innovations spread?	10
1.3 Request for advice: How do innovations spread? What could be improved?	13
2 The heart of the matter: Stimulate the spread of innovations	15
2.1 Favourable conditions for spread of innovation by no means present everywhere	16
2.2 The government must act where others cannot	19
2.3 Five situations where the government needs to act	21
2.4 Policy analysis: little attention for spread of innovation in innovation policy	33
3 Recommendations: Three steps to better spread of innovation	38
3.1 Stimulate demand for innovation	38
3.2 Ask government ministries to devote policy attention to the spread of innovation	42
3.3 Make spreading innovation an explicit part of the innovation policy of the Ministry of Economic Affairs and Climate	45
Appendix 1 Interviewees	48
Appendix 2 References	49

Summary

The Netherlands has a long tradition of innovation; past innovations have made a visible contribution to the wealth of the country; and today one of the great strengths of the Dutch is still the ability to develop new products, services and processes. In order to be of genuine value for the economy and society, however, innovations must also be able to spread readily and widely, so they can be used by lots of people and organisations. That is the focus of this report.

Do innovations spread easily in the Netherlands? Are the conditions right for innovations to spread? What role can central, regional and local government play in this process?

Spread of innovation enables innovative companies to earn back the money they have invested and reinvest it in other projects. It also generates benefits of scale, making it possible to offer innovations, which have been improved along the way, at a lower price, so that they can in turn be spread further. A degree of spread is often a precondition for the usability of an innovation – a fact that will have been clear to the owner of the first telephone. Innovation spread also has public value, for example contributing to more efficient public services in care or education, thus leading to lower public costs. And as innovations reach and benefit more people, it becomes easier to defend the investment of public time and resources in innovation.

Despite the great importance of spreading innovation, there is little systematic knowledge of how innovations actually spread in practice in the Netherlands. It is known from the literature that innovations almost by definition encounter practical obstacles and resistance to change. Case studies were compiled for this report and practical examples gathered which show that innovations in the Netherlands regularly stay small or spread inadequately, sometimes even after a great deal of time and – sometimes public – money has been invested.

In the light of this situation, the Dutch government is advised to work towards creating better conditions for spreading innovations in several areas and in relation to various issues, in addition to the activities undertaken by innovators themselves. This approach will ultimately enable the government to achieve more with the same investments. The government needs to be more active on two fronts: stimulating the demand for innovations and eliminating obstacles to the spread of innovation.

The Dutch Advisory Council for Science, Technology and Innovation (AWTI) translates this advice into three recommendations for the government.

- ▶ Stimulate demand for innovations with societal value.
- ▶ Ask ministries to devote policy attention to the spread of innovation and strive for interdepartmental collaboration on this point.
- ▶ Make spread of innovation an explicit part of the innovation policy of the Ministry of Economic Affairs and Climate.

Do we get enough out of our innovations?

The Netherlands is an innovative country. One of our great strengths lies in the development of new products, services and processes, and our country scores highly in international innovation rankings. But how easily do Dutch innovations spread so as to maximise their benefit for the economy and society? What role does the government have to play here?

A great deal is expected of innovation, both at EU level and more widely. Innovation is a driving force behind the development of economies and societies; it leads to more wealth, more well-being and more jobs.¹ And it can contribute to solving many of the problems facing today's societies, such as climate change, scarcity of natural resources, population ageing and pressure on the care system. Many countries therefore have a policy aimed at stimulating innovation by businesses and public authorities and in public sectors such as care and education.

What is innovation?

AWTI follows the OECD (2005), which defines innovation as: “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method”. This definition draws a distinction between a good idea or invention and its translation into something that is of practical value for people, economy or society (innovation). Innovation can be something entirely new, or a new combination of existing things. An innovation can be technical, but can also occur in organisational processes, business models and in the social domain, and in both market and non-market environments. In the remainder of this report, we follow the views espoused by Hartley.² She argues that small, continual changes should not be regarded as innovation, but that the term should be reserved for developments which are new for the innovating organisation and which are large, general and long-lasting enough to change the working methods or character of that organisation.

¹ OECD (2017).

² Hartley (2006).

The Netherlands: land of innovation

The Netherlands has a long tradition of innovation; past innovations have made a visible contribution to the wealth of the country. Past innovation has enabled the Netherlands to consistently stay ahead of developments in other countries, for example in agriculture – think of the windmill – and shipping. The government has played a key role in this, by maintaining a framework of basic facilities such as ports, the legal system and the education system.³

The Netherlands is still a great innovator, figuring time after time in international rankings as an innovation leader.⁴ The Netherlands is in the world top 10 in some rankings, and in others comes into the top five. High-grade basic amenities are still our greatest strength; they include education and research, health care, market efficiency, ICT and entrepreneurship. The Netherlands is also good at establishing links between the parties that are important for innovation, namely research institutes and businesses. We score highly on indicators for the ‘innovation ecosystem’. The Netherlands boasts innovative companies, sectors and regions, for example Brainport Eindhoven with companies such as ASML and Philips, award-winning SMEs such as Greentom Operations, which develops innovative baby buggies and pushchairs, and Additive Industries, with its innovative 3D metal printing.⁵ There are also a number of innovative sectors such as the water, agrifood and medical industries.

1.1 The Netherlands produces many innovations

The image presented above of the Netherlands as a land of innovation, whilst probably accurate, is incomplete: available facts and figures about innovation relate only to factors involved in the creation and production of innovations. To what extent innovations created in the Netherlands spread through society and have a broad impact is unclear as this is difficult to measure.

The statement that the image of the Netherlands as an innovative country is *probably* accurate reflects the difficulty of measuring and directly comparing the degree of

³ See WRR (2013) for a description of the history of economic growth through innovation.

⁴ Familiar rankings include the OECD Science, Technology and Industry Scoreboard; the Global Competitiveness Index; the Innovation Union Scoreboard and the Global Innovation Index.

⁵ Winners of the MKB Innovatie Top100 innovation award for SMEs.

innovation in any given country. Adding together innovations and comparing the totals across countries is impossible for a number of – interconnected – reasons:

- ▶ Innovations are so different that they cannot be simply added together. Does one new yoghurt flavour plus one renewable source of energy equal two innovations? Innovations sometimes follow each other in rapid succession, for example apps and software packages, and sometimes more slowly, as in the aircraft industry. This by no means implies that one sector of industry is more innovative than another. Many innovations are also difficult to define: is every technical invention that comes to market an innovation, or is it only the result that counts as an innovation? The CD-ROM, for example, incorporated more than 20,000 patented technical inventions. Innovations are increasingly the result of international cooperation, and it can then be difficult or impossible to determine precisely what role each country played in that process.
- ▶ Rankings and research on innovation mainly measure product innovations and tend to have a ‘technology bias’, attaching relatively high importance to parts of the innovation process that are commonly concerned with technology, such as Research & Development (R&D) and patents. The underlying assumption is that more R&D and more patents lead to more innovations. In many sectors of industry, however, innovations do not result (or at least not directly) from R&D, but are the outcome of a complex and often chaotic process.⁶ Moreover, many indicators are difficult to measure: for example, what exactly is R&D?⁷
- ▶ Many innovations fall outside the scope of our study because of the difficulty of measuring them. Examples include innovations in services, working processes and business models, or innovations by organisations other than commercial companies, for example in the public sector or operating in a non-market environment.⁸ In reality, no one knows precisely how to measure innovation in the care sector, education or public services, for example, despite regular attempts to do so.⁹
- ▶ Finally, new kinds of innovation, such as social innovation, free innovation, user innovation and co-creation, currently figure relatively little in innovation research and rankings, and therefore receive only very partial attention in the ‘national knowledge

⁶ Van der Ven et al. (1999).

⁷ Zie Freeman & Soete (2009). De opstellers van de ranglijsten sleutelen voortdurend aan de indicatoren om dit te verbeteren.

⁸ Baron (2017).

⁹ Freeman & Soete (2007). A preliminary study was recently carried out with a view to developing a global health innovation index. The researchers concluded that great caution is called for, citing the limitations described in this report. See PIRU (2017).

and innovation system'. Gaining an impression of their significance would require the translation of new factors into new indicators.¹⁰

Since directly measuring and simply adding together all innovations is not possible, scientists look for other ways to gain an insight into how innovative different countries are. For example, they look at whether a country has the capacity to innovate, and assume that the higher that capacity is, the more innovations that country will deliver. One widely accepted definition of this 'innovative capacity' is the capacity of a country, region or economic sector to continually produce innovations.¹¹ Others define it as the ability to deliver 'a stream of innovations'. International rankings then translate innovative capacity into a series of indicators which together map the parameters for innovation; these then collectively constitute the 'national knowledge and innovation system'. The rankings are compiled by gathering national empirical data on these indicators and comparing them across countries. As stated, the Netherlands consistently emerges from this exercise as an innovation leader.

1.2 How well do innovations spread?

To be of value for the economy and society, innovations need to be widely spread so that they are accessible to lots of people and organisations.¹² Some innovations can then prove to have such far-reaching impact they replace entire sectors of industry or influence the development of society as a whole; think of the introduction of penicillin, the steam train, electricity, the Internet or the smartphone.¹³ Spread of innovation is important to reinforce the earning capacity of the Netherlands.¹⁴ It is the only way that innovative businesses can earn back their money and reinvest it in new innovations. A certain level of diffusion is itself often decisive for the usability of the innovation, as the owner of the first telephone in the Netherlands might testify. Companies can also draw on the experiences of first users to develop an innovation further so that it appeals to a wider group of users. Spread generates benefits of scale, making it possible to offer

¹⁰ A number of researchers are working on this; see von Hippel (2017).

¹¹ Jeschke et al. (2011).

¹² Fagerberg (2015).

¹³ Bakker (2017).

¹⁴ WRR (2013).

innovations, which have been improved along the way, at a lower price, so that they can in turn spread further.

The adequate spread of innovation is equally important for society, as it increases their value in the public domain; as innovations reach and benefit more people, it is easier to defend the investment of public time and resources in innovation. The spread of innovation can also contribute to more efficient delivery of public services, for example in the care system or in education, leading to reduced public costs. Wide spread of innovations with societal value also improves the quality and efficiency of more public tasks and reduces environmental impact in more sectors, regions and organisations. In reality, innovation without spread is worthless.

Spreading, upscaling, implementation: what exactly are we talking about?

In this report we frequently use the term 'spread' as a catch-all concept, as an everyday alternative to terms such as upscaling, implementation, diffusion, spreading, adoption, etc. This enables us to capture different forms of the spread of innovation in one term. The word 'spread' also has active connotations and implies a degree of control over the process: something can be actively spread. The research literature on diffusion and adoption tends more towards describing processes which run their course more or less autonomously, without external agency.

From the moment of first implementation, innovations spread via the market or other channels to a variety of consumers, countries, regions, sectors, markets and businesses. They can be spread by the innovators to the end-users, consumers or professionals, or to other organisations which adopt the innovation, implement it in their processes or use it to develop new products or services themselves. Upscaling refers to the broader implementation and application of an innovation within an organisation or sector. But it can also mean that small businesses and start-ups expand their activities. These are both forms of innovation spread.

Innovations can spread across the boundaries between companies, sectors, departments, occupational groups or government agencies such as industries and provincial and municipal authorities. During this process the innovation can change as organisations or users adapt it to their specific situations or use it to forge new combinations, or in response to user feedback to the innovating organisation, which uses it to improve the innovation.

Adoption and diffusion of innovation

The research literature on the adoption and diffusion of innovation offers insights into the factors that play a role in the spread of innovation. The behavioural scientist Everett Rogers introduced the terms 'adoption' and 'diffusion' in the 1960s.¹⁵ By 'adoption' he means the process which people go through in adopting and using an innovation, or not doing so: knowledge (learning about the innovation); persuasion (actively seeking more information); decision (deciding whether to adopt or reject the innovation); implementation (using the innovation); and confirmation (seeking confirmation that they have made the right decision). Rogers describes five characteristics which determine whether an innovation is accepted: its relative advantage; its compatibility with existing habits and behaviours; its complexity; its trialability or testability; and its observability. Other researchers have broadened this definition over time to include variables such as image, voluntariness of use and visibility of results.¹⁶

The term 'diffusion' focuses on the group or system level: what process does an innovation have to go through in order to be accepted by an entire social system? Rogers showed that the diffusion process takes the form of an S-curve: an innovation is first taken up by the 'early adopters', then by the majority, and lastly by the 'laggards'. Through this process, the innovation gradually becomes 'mature'; ultimately everyone who wants it has it, the demand becomes saturated or reduces, and new innovations emerge.

What was new about this model was the realisation that people adopt innovations at different times and that social processes play an important part in this. An innovating organisation can take this into account in its marketing and distribution strategies. The model has also been criticised; in reality, users of innovations do not play a passive role, but modify or use innovations in different ways from those intended. Innovations also generally do not stand alone, but form part of a broader, historical process which influences the method of adoption and spread.

¹⁵ Rogers (2003)

¹⁶ Moore & Benbasat (1991).

The spread of innovation is also difficult to measure

Despite its great importance, little is known about *how* innovations spread in the Netherlands. This is because it is even more difficult to capture the spread of innovation in facts and figures than innovation itself. There are several reasons for this:

- ▶ The production and spread of an innovation cannot be precisely distinguished from each other. An innovation has already been implemented or taken to market, and has thus already spread to some extent.
- ▶ Innovations often continue to develop after they have been taken into use, as organisations and people build on and adapt them. When can we still speak of the spread of an innovation, and when does it in reality become a new innovation?
- ▶ Innovation differs in different sectors and different fields of technology. How quickly do innovations succeed one another in a given sector? Innovations also spread internationally.¹⁷ All this makes it difficult to obtain a picture of the current status of innovation spread national level.

1.3 Request for advice: How do innovations spread? What could be improved?

The questions addressed in this report are as follows:¹⁸

Do innovations spread easily in the Netherlands? Are the conditions right for innovations to spread? What role can central, regional and local government play in this process?

Approach

Owing to the lack of information about the spread of innovation in practice, explorative case studies were compiled for this report in six widely differing fields, with a common focus or based on a particular technology: eHealth in the care sector; construction; radar technology; biotechnology; legal services or 'legaltech'; and financial services or 'fintech'.¹⁹ The case studies are presented in chapter 2 as examples of areas in which innovations are able to spread less or more easily. The report also draws examples from other fields.²⁰

¹⁷ The rankings attempt to quantify this using indirect indicators for the quality of the ecosystem in which business and other innovations spread. The assumption is that the better the ecosystem, the more successfully innovations will spread.

¹⁸ This report is an elaboration of a report announced in the AWTI programme (2017) focusing on the innovative capacity of the Netherlands. Later, in consultation with the commissioning ministries, the Council shifted the focus to the spread of innovation.

¹⁹ See background memorandum 1 to this report (in Dutch) at, www.awti.nl.

²⁰ AWTI normally also looks at other countries, but in this case too little was known about this.

Scope

This report is about the spread of innovations. It is also extremely important that the government gives direction for innovation, pursues a strategy for exploiting innovations to resolve issues such as the increasing scarcity of natural resources, the overburdening of care systems and the consequences of increasing population density. According to many observers, the Netherlands needs a government strategy which identifies and formulates missions, facilitates cooperation between different stakeholders in achieving those missions over the longer term, and which creates markets for innovations, in many cases based on public and private investments.²¹ AWTI addressed this theme in its report 'Vital links', which recommended the setting up of a system of mission-driven research and innovation consortia.

Format of this report

The format of this report is different from usual. Chapter 2 starts by addressing the heart of the matter, advising the government to seek to improve the conditions for the spread of innovation. It underscores this message by highlighting where things go wrong and what the government can do to improve things. Chapter 3 puts forward recommendations on how those improvements can be made. For readers interested in a more in-depth substantiation of the report, three underlying analyses have been published separately (in Dutch) on the AWTI website (www.awti.nl):

1. A case analysis: how does innovation spread in practice in six fields?
2. A policy analysis: which area of government policy focuses on stepping up the spread of innovation, and where are the 'blind spots'?
3. A literature analysis: what can the literature on innovation systems tell us about the spread of innovation?

This report was prepared by a project group consisting of Council members Valerie Frissen, Emmo Meijer, Tim van der Hagen and Koenraad Debackere, assisted by staff members Kathleen Torrance and Annelieke van der Giessen.

²¹ E.g. Mazzucato (2017) and Hekkert & Frenken (2017).

The heart of the matter: Stimulate the spread of innovations

The Netherlands stands to benefit more from its innovations if they spread easily. Many examples can be given where the spread of innovation is currently faltering. The government needs to be more active in creating favourable conditions to facilitate the spread of innovations and thus enhance their value to society. It can do this by stimulating the demand for innovation and removing obstacles.

The government, and especially central government, is advised to work on creating better conditions for the spread of innovations in a number of fields and sectors and in relation to a number of specific issues. Ultimately this will help the government achieve more for the same effort and investment. Innovations, which often emerge thanks to government investments, will then spread more easily and thus benefit more people and organisations. Current innovation policy needs to be bolstered through more active government engagement on two fronts: stimulating the demand for innovations, and removing the obstacles impeding the spread of innovation.

The Netherlands is a strong, internationally competitive innovator in several fields, including food, agriculture, water, high-tech systems and the medical sector.²² It has achieved this in part thanks to government policy, with investments for example in research and education, programmes which support innovation, policy to promote links between research institutes and industry, and facilities and support for start-ups and other entrepreneurs. The resultant spread of innovations is however an underexposed theme in policy and is too often inadequate. The emphasis in the fragmented Dutch innovation policy lies too heavily on the development and market introduction of innovations, in other words the supply side. There is scope for the government to improve this situation.

²² See also WRR (2013).

This chapter underscores the above message by showing where things are going wrong with the spread of innovation and what the government can do to make improvements.²³ Chapter 3 puts forward three recommendations to help the government achieve this.

2.1 Favourable conditions for spread of innovation by no means present everywhere

The observation that innovations often spread slowly and falteringly is not news. Although there is little in the way of systematic knowledge, there is no shortage of practical experience.²⁴ The literature on diffusion, adoption and implementation of innovations in organisations, for example, makes clear that innovations almost by definition encounter practical obstacles and resistance to change from people and organisations. Innovations too often remain small or lie unused because of insufficient spread or upscaling (see chapter 1 for a discussion of the term ‘spread’). This sometimes happens despite the investment of a great deal of time and – sometimes public – money.

Climate for spread of innovation varies depending on the innovation system

Innovations always emerge within a particular environment, involving particular players and within a particular political, economic and cultural context: in other words, within an *innovation system*. Innovation systems accumulate knowledge and seek resources; people work together within innovation systems to create innovations. The actors within the innovation system then develop a market for the innovations so that they can spread them. For this report, we focus the innovation system approach on the six cases described earlier²⁵ and on the factors that determine how innovations spread.

Innovation system approach explained

The innovation system approach was developed as a way of describing the context in which innovations arise and of showing how and why innovations arise within that context. This approach is a response to the outmoded linear model of innovation.²⁶ An innovation system can be seen as a collective of actors, their networks, the available

²³ As stated, the underlying analyses can be found (in Dutch) at www.awti.nl.

²⁴ The only figures supporting the notion that spread of innovation could be improved in the Netherlands come from the European Scoreboard. This shows that the sale of innovative products by Dutch companies (the sales impact) in 2017 lagged well behind the European average. Dutch exports of medium and high-tech products are also lower than the European average. See European Commission (2017).

²⁵ See background analyses 1 and 2 to this report (in Dutch) at www.awti.nl

²⁶ The linear model posited that basic research (step 1) leads to more practical, applied research and development (step 2) and subsequently to the production and diffusion of the innovation (Godin, 2005).

resources such as machines, roads, capital and social institutions such as legislation and regulations, customs, values, etc. The system consists of a supply of and demand for innovation. Companies, research institutes, financiers and consumers all form part of the innovation system. Innovation systems can be based on a country or region, in which case they are referred to as national and regional innovation systems; or they can be based on the sector or technology around which the innovation system is organised.

Researchers who carry out innovation system analyses²⁷ first identify the innovation system, for example Germany's national innovation system or the biotech innovation system, and then follow the stepping stones outlined above: Who are the relevant actors? How do they work together? Under which social institutions?, and so on. They then determine how well the innovation system functions by performing detailed analyses of the functions fulfilled by the system and the interactions between those functions. Seven functions are considered: entrepreneurial activities; knowledge development; knowledge-sharing; control and vision; market formation; mobilisation of resources; and creation of legitimacy. Finally, an innovation system analysis identifies elements which hinder innovation and its diffusion: the 'systemic problems'.

Examples of favourable and unfavourable conditions for innovation spread

Each of the cases compiled for this report also has its own climate for the spread of innovation, made up of favourable and unfavourable conditions.²⁸ Three examples are given below of cases where unfavourable conditions prevail, and one example of a domain with very favourable conditions.

Three examples of predominantly unfavourable conditions for innovation spread

- ▶ **eHealth.** Care systems throughout the world, including in the Netherlands, face major challenges in the need to reform. A great deal is expected of eHealth in this context, and there is no shortage of initiatives, some of which are promising and deliver measurable results in terms of quality, patient satisfaction and affordability.²⁹ However, the Dutch Council for Health and Society (RVS) has shown that at present eHealth applications do not spread readily throughout the care system. Different

²⁷ Freeman (1987); Carlsson & Stankiewicz (1991); Lundvall (1992); Nelson (1993); Edquist (1997); Kuhlmann & Arnold (2001); Malerba (2002); Jacobsson & Bergek (2004); Hekkert et al (2007); Bergek et al. (2008). For an overview of the development in thinking about innovation systems, see Soete, Verspagen & Ter Weel (2010); Fagerberg (2013); Warnke et al (2016).

²⁸ See background analysis 1 (in Dutch) at www.awti.nl.

²⁹ Letter to Parliament (2016) from the Minister of Health, Welfare and Sport, Edith Schippers

professional groups each have their own training pathways, institutions, customs and networks, fall under different regulatory regimes, and sometimes have nothing to gain from the spread of an innovation that falls outside the boundaries of their profession or institution. Patients and clients often do not ask for eHealth, either because they are not aware of it or because they derive no benefit from the savings it delivers.

- ▶ **Genetically modified organisms.** These innovations result from partly publicly funded R&D in the biotechnology sector, but almost never appear on the market and do therefore not spread. This is due to the restrictive rules which in turn stem from the ongoing social and political debate about what is or is not desirable. New technological developments lead to new regulatory discussions, and regulations are unable to keep up with developments in the biotechnology industry.³⁰ Biotech companies find it very difficult to obtain licences and, because each country has its own legislative and regulatory regime stipulating what is and is not permitted, there is no level playing field between countries within Europe and between Europe and other countries such as the United States..
- ▶ **Fintech.** More and more ICT-based innovations are emerging in the financial sector. The Netherlands is not an innovation leader in this field, although the climate for fintech does appear to be improving.³¹ However, the products coming to market are not yet growing to any great extent. Experts cite the lack of demand for fintech products as a key reason for this.³² The fact that the Netherlands has a long history of excelling in financial innovation plays a role here, with the current system being so good that consumers feel little desire for new applications. Moreover, people are used to and trust their existing bank, and will therefore not readily switch to innovative financial service-providers. There is also a supply-side factor, in that businesses are bound by strict regulation which often precludes innovation. The Netherlands sometimes goes further than required by the EU rules in this regard. Moreover, regulators and supervisory authorities sometimes lack the knowledge needed to assess the very latest fintech innovations.

³⁰ COGEM (2016); COGEM (2015); COGEM and Gezondheidsraad (2016).

³¹ <https://www.emerce.nl/nieuws/sterke-groei-fintech-ondernemingen-nederland>

³² A series of experts were interviewed for the thesis by Zuidema (2016).

An example of a technology with predominantly favourable conditions for innovation spread

- ▶ **Radartech.** Innovations in radar technology are developing rapidly and spread readily throughout the maritime sector. This is due to the intensive collaboration between the industry, government and research institutes.³³ The Navy is an important client and launching customer for the Dutch shipbuilding cluster, with which it works in direct partnership. The maritime cluster is able to spread military innovations through both the military and civil markets.³⁴ Spread of innovation outside the maritime sector is less successful; although there are spin-offs, the Navy is sometimes an unknown entity for start-up businesses outside the sector and does not have an immediate interest itself in efforts directed towards broader spread.

2.2 The government must act where others cannot

Some factors which promote the spread of innovation are in the hands of the authorities and government, because other stakeholders do not have the power to change them. The Dutch government has a role in such cases because it wishes to maximise the societal value of innovations developed in the Netherlands, where appropriate with the help of public investments. The government can and must then stimulate the spread of innovation and remove barriers.

The actions of the government always complement and support what people and organisations within an innovation system are doing themselves to spread innovation, much of which goes well, especially if the parties concerned have a clear earnings model, share common interests and have a clear picture of the expectations and objections of those who will use the innovation. Organisations often work together in networks and ecosystems on the development and implementation of activities to spread innovations.

³³ Karreman (2015), Webers et al (2011).

³⁴ <https://time.tno.nl/en/articles/it-s-all-about-radar/>

Five examples

The following are examples of actions undertaken by innovators to foster the spread of innovation:

- ▶ **Enabling users to gain experience with the innovation.** Examples of ways organisations can do this is by introducing trial periods, giving demonstrations, developing showcases, offering new products at a reduced price for a limited period or giving products away for free. Local authorities or municipalities work in collaboration with research partners, businesses and the local community to develop and test innovations in 'living labs'.³⁵ Sometimes 'nudging' techniques are used,³⁶ for example offering an eHealth consultation as standard; patients who do not want this must specifically ask for a physical consultation, rather than the other way around. This nudges people into at least trying the innovation. They are then often found to be happy with it and willing to use it again next time.³⁷
- ▶ **Helping people use the innovation.** Potential users sometimes lack the experience to use an innovation. In response to this practical environments, trial grounds and field labs have been set up in several sectors in which companies and research institutes develop, test, implement and learn to use innovative applications. For example, many farmers have insufficient expertise for the proper application of innovations in precision agriculture,³⁸ and trial grounds have been set up at national and regional level in which experts help farmers. The results are then broadly shared throughout the agricultural sector.
- ▶ **Combining multiple 'sub-demands' into one overarching demand.** Stakeholders can combine their wishes into one overarching demand. As an example, the Dutch Homeowners' Association (*Vereniging Eigen Huis*) and the Dutch Consumer Association (*Consumentenbond*) offer their members the opportunity for collective purchase of energy and decorating services. Similarly, online platforms such as *Patients Like Me* bring together the knowledge, experiences and needs of patients, sell their combined data and work closely with pharmaceutical companies and clinical institutions to speed up the development and application of new treatments.

³⁵ Maas et al. (2017).

³⁶ Nudging is a motivation technique taken from behavioural psychology which encourages people to behave in a desired way.

³⁷ See background analysis 1 to this report (in Dutch) at www.awti.nl

³⁸ Van der Wal et al. (2017).

- ▶ **Developing common standards.** Innovations sometimes only spread if they meet certain standards that are shared by different businesses and organisations.³⁹ Initiatives have been developed in several sectors aimed at developing such shared standards and innovation agendas; there is often a role for the government in these initiatives. An example is Smart Industry, in which the Dutch employers' organisation for the technology industry FME, TNO Research and the Dutch Standards Institute NEN have joined forces to develop a set of standards for The Internet of Things. Another example is the computer industry, where roadmaps are being used to map out a path for future business investments.⁴⁰
- ▶ **Spread of innovations by 'self-innovators'.** Innovations are increasingly being developed by consumers and citizens themselves, because they have a personal problem they want to solve, are curious or have a hobby.⁴¹ The innovator in these cases makes something for their own or for local use, but there is no broader spread, either because there is no incentive or reward for spreading the innovation or because the innovator does not have access to the usual distribution channels or knows too little about introducing products to the market. An example are the DIY applications developed by carers and patients to solve the problems they encounter. These are often lost because there is no forum in which to share them. The *fablabs*, platforms and learning communities developed by organisations such as the Waag Society offer a solution here. They provide a space where self-innovators can share their ideas and solutions, and bring together care providers, care recipients, designers, businesses and care authorities, thus enabling the applications to spread.⁴²

2.3 Five situations where the government needs to act

An analysis carried out for this report⁴³ identified five situations which require government policy or measures to speed up the spread of innovation:

³⁹ Bergeek et al. (2008).

⁴⁰ Between 2001 and 2015 the Semiconductor Industry Association published a technology roadmap every two years (International Technology Roadmap for Semiconductors) in a partnership between American, European and Asian companies. Since 2015, IEEE (Institute of Electrical and Electronics Engineers) has been working on the development of an International Roadmap for Devices and Systems for the global computer industry.

⁴¹ Von Hippel (2016).

⁴² E.g. <https://waag.org/nl/project/made4you> and the catalogue for the exhibition 'Chronic Health: Designing a Healthy Future' which took place during Dutch Design Week on 21-29 October 2017 in Eindhoven, <https://www.dropbox.com/s/z9zwmuteszl9r5/chronic%20health%20-%20programma%20boekje%20-%20DEF.pdf?dl=0>

⁴³ See background analysis 3 to this report (in Dutch) at www.awti.nl

1. There is insufficient individual demand for a particular innovation, sometimes due to societal resistance, even though there is a collective need for it.
2. Powerful parties with strong vested interests hold back the spread of innovations. Or established structures which put a brake on spread.
3. Existing rules and laws impede the spread of innovation.
4. The right conditions are not in place for collectively used infrastructure. Examples are ICT and other physical infrastructure, but also education and research, for example.
5. A sector or innovation system consists of lots of small parties who are not able to interconnect, or the demand is not uniform.

The government mainly has a role to play in these situations if innovations contribute to shared societal goals, such as maintaining a competitive edge and raising productivity, employment, earnings and ultimately the prosperity and well-being of people and society.⁴⁴ Not every innovation is by definition desirable or good for society or humanity, and it is therefore necessary to constantly examine innovations about which there are doubts, to subject them to technology assessment, discuss them in the public domain and take on board the results of risk analyses when formulating policy.

The above five situations are discussed in more detail below. The boxes contain examples from the cases studied;⁴⁵ these are supplemented with other examples in the text.

Situation 1:

Insufficient individual demand but a collective need

The extent of the demand for an innovation determines the extent to which it is able to spread.⁴⁶ Innovation spread may falter because of insufficient individual demand, even though there is a collective societal need for the innovation. In such a situation, there is a role for the government in stimulating the spread of the innovation.

An innovation will spread more quickly and more widely if more people derive more 'relative benefit' from it.⁴⁷ This relative benefit will be insufficient if the potential target group does not benefit directly, for example because they do not have to pay for it

⁴⁴ Van Waarden (1996).

⁴⁵ Not every impediment is relevant for every case.

⁴⁶ Di Stefano et al (2012); Edler (2010).

⁴⁷ Volgens het model van Rogers (2003).

themselves. An example is someone who rents a house that the housing association wants to renovate; or a health insurance policy which reimburses consultations with care professionals. Such situations are particularly common in the care sector, though are also quite widespread in the construction sector. Sometimes the 'payer' rules out an innovation from which the target group would benefit because of the high price or the low possibility of recouping the investment costs. In such situations, companies may well develop an innovation, but will have to charge a higher price than the potential user is able and willing to pay. This is the case for the installation of fast fibre-optic Internet connections in sparsely populated areas, for example.

Individual demand may be low if someone is unable to try out and experience the benefits of the innovation, as the following example illustrates.

Case study: low demand for innovation in the construction sector

There is virtually no explicit demand for innovation among end-users of homes, buildings and infrastructure. People who are remodelling their home give little priority to energy-saving innovations; tenants may not want to see an increase in their rent.⁴⁸ Similarly, owner-occupiers will often opt for lower costs than for extra value that will be delivered only in the very long term. Innovations which deliver more comfortable living and a healthier internal climate, for example, are difficult to 'demonstrate' in advance: occupants have to experience them. And they can experience the value of a shampoo or a breakfast product more quickly than that of the internal climate of their home.

The end-user also plays a limited role on the demand side for construction or infrastructure projects. This demand stems from commissioning bodies, often in the public sector, through tenders. In the invitation to tender, which defines what they want to build, they can create scope for innovative solutions, but often do not do so. Commissioning bodies such as school boards, local authorities, government agencies, developers and businesses often give priority to the shorter term and the lowest price. They too experience virtually none of the value of many innovations in advance.

⁴⁸Sunnika (2017).

Strong resistance in society

Demand for an innovation can also be reduced by resistance on the part of businesses, potential consumers or other users, even though there is a societal need for the innovation. Doubt is cast on the need for the innovation and it is rejected. Interest groups can play a role here, but so can politicians. Businesses can boost the legitimacy of their innovation by providing information and lobbying, engaging in activities to enable potential users to become acquainted with the innovation, or modifying the innovation. The government can try to break through the resistance by organising a public and political debate on the importance of the innovation and seeking to dismantle the societal objections.

Situation 2:

Vested interests or established structures impede the spread of innovation

Innovation spreads less readily in an innovation system in which there are companies or other stakeholders with powerful positions and strong vested interests, and in systems with firmly established structures, cultures and customs. Economists use the term 'lock in' for this, reflecting the fact that stakeholders are effectively 'trapped' in their existing situation and that it is very difficult for them to change these structures and markets by their own efforts. If the supply side is limited to a few large players, or to innovations within existing structures, those on the demand side have less choice or fewer opportunities to switch to a different provider, and at high cost. There is a role for the government here, as the only entity that can stand above the stakeholders and enforce change, for example through competition regulations.

Strong vested interests impede innovation and newcomers

Established parties will try to hold back an innovation if they see it as a threat to their own position. There are various ways they can do this:

- ▶ By stressing the drawbacks of the innovation and dismissing its value. For example, in lobbying activities and sector consultations they constantly downplay the expectations regarding the feasibility and impact of the innovation. Established parties are generally well organised and have easy access to politicians and the media. They are often the regular and principal discussion partners of government and intermediary organisations, for example on issues concerning regulation and human capital agendas.

- ▶ By participating in joint programmes and acting as an inhibitor, for example by making choices during the development of common roadmaps and selection criteria which mean that the existing solution pathways score highly and are therefore incorporated in the roadmaps.⁴⁹
- ▶ By buying up the ‘challengers’ or innovators in order to gain control over the innovations.

New players with alternative ideas and a different voice consequently have little chance of being seen and heard and new, alternative solutions spread less easily. The barriers facing aspiring new entrants to the market can be high, with excessive initial investments or a field that is fiercely protected by an array of patents taken out by the established parties. In addition, established parties can block access to the market for newcomers by excluding them from their networks, for example, or refusing to share data which could enable other companies to develop new applications.

The rise of the major tech companies in Silicon Valley has sparked a new debate about monopolists.⁵⁰ Recent research⁵¹ shows that the profit margins of American companies in all kinds of sectors have grown spectacularly since the 1980s, from around 20% in the 1980s to 67% in 2014. This is an indication of the access barriers facing newcomers and highlights the market power of established players. Research has shown that this market power has a negative impact on pay structures, employment and purchasing power. If newcomers are denied space and employment and wages fall while prices rise, it becomes more difficult for innovations to spread.

Established structures produce only ‘suitable’ innovations

Existing structures and systems can be so closely interwoven with or defined in regulations, cultures and customs that the only innovations which have a chance of succeeding are those which fit in with those structures. Alternative approaches are not given a chance. One example can be found in the education sector: schools do not look for genuinely innovative teaching materials or other products; they are too entrenched in the traditional syllabus-based year group system and in a network of interested parties such as publishers, research institutes, regulators, etc. The result is that organisations

⁴⁹ For examples from the cement industry, see Wesseling & Van der Vooren (2016).

⁵⁰ E.g. reports in *The Economist* (18 January 2018; 23 September 2017).

⁵¹ De Loecker & Eeckhout (2017).

only develop educational innovations which fit within that system, such as summer schools or homework support programmes, whereas a great deal more is possible, for example adaptive schools with flexible teaching hours and programmes.⁵²

Case studies: how vested interests and established structures influence the spread of innovation

Before they can be applied, sustainable concretes have to meet all kinds of standards and the members of the committees who define these standards and allocate the certificates are representatives of the companies which together constitute the established order. They have no interest in amending standards in a way that favours sustainable concrete innovations.⁵³

In the field of legal services, collaboration with organisations from other sectors is impeded by stringent professional rules. This makes it difficult for innovative services to spread. For example, the Netherlands Bar (NovA) has a collaboration agreement with a number of other sectors such as the ICT industry in order to guarantee the independence of the legal profession; and the Royal Dutch Association of Civil-law Notaries (KNB) went to court to contest the offering of legal services by the HEMA store chain, which it argued was in conflict with the professional rules.

The care sector is also one of separate worlds. Think of hospitals, GP practices, as well as other professional groups which often operate according to their own procedures and cultures. There is little by way of chain coordination or shared interest; the interests of the individual organisations are given priority over the interests of the system as a whole. This occurs mainly because the benefits of an innovation do not go to the organisation which invests in it.

Situation 3:

Regulation and procedures impede the spread of innovation

As the legislator, the government defines the playing field for innovation systems. Laws and regulations facilitate economic activities such as innovation by providing stable currencies, standard measures and weights, guarantees and monitoring of property rights

⁵² M. Ploegman during OCW Kennislunch seminar 'Voorwaarden voor onderwijsinnovatie' ['Conditions for educational innovation'], 7 December 2017.

⁵³ Wesseling & Van der Vooren (2016).

and contracts, imposition of sanctions on irregular behaviour, etc.⁵⁴ Regulations can also arise as an expression of societal resistance to certain innovations.

However, laws, rules, procedures and protocols can also *constrain* the space available to adopt innovations. If an innovation does not fit within the existing regulatory regime, its spread will be impeded.⁵⁵ Amending formal legislation and regulations is by definition a task for the government, though other parties can take the initiative in persuading the government to revise existing statutes, for example highlighting problem areas and proposing alternatives. An example is the successful lobbying by medical specialists and patient organisations to accelerate the spread of personalised cancer drugs. They succeeded in persuading hospital managements to set aside money for this, and on their initiative the Dutch Parliament and the relevant ministries amended the existing rules and guidelines.⁵⁶

the government can also encourage self-regulation, for example through codes of conduct, standards and covenants. It can do this by bringing the relevant parties together or by imposing self-regulation through the announcement of new legislation and regulations if parties fail to reach voluntary agreement. Stakeholders are often capable of self-regulation, though not always, for example if they are unable to find common ground.

Unintended and intended influence of rules

Rules can influence the spread of innovations in intended and unintended ways. The influence is unintended if rules are logical and useful in a particular context and work well for a certain application but impede innovations which do not fit into that framework.

Rules originating from different perspectives or domains can also accumulate and be adapted, making it impossible to keep track of all the regulation – think of the piling up of laws and regulations intended to protect people and planet against the risks of exposure to various materials, and which has become an obstacle to better utilisation of residual waste flows.⁵⁷ Regulations can also lead to unintended administrative burden and thus slow the introduction and diffusion of innovations.

Rules impede innovations intentionally when they are designed to reduce risks in areas such as safety or privacy, for example, or if an innovation is controversial. An example is

⁵⁴ Van Waarden (1996).

⁵⁵ The Rathenau Instituut has analysed which challenges innovations present for existing legislation and regulations. See Maclaine Pont et al. (2016).

⁵⁶ Moors et al (2017).

⁵⁷ See the final report of the Commission on Biomass Sustainability (Commissie Duurzaamheidsvraagstukken Biomassa) (2016).

the ban on human reproductive cloning. Conversely, rules or self-regulation can deliberately encourage or enforce the spread of an innovation – think of vehicle emissions standards or the prescribed maximum wattages for vacuum cleaners. These rules prompt manufacturers to find innovative solutions.

New rules are sometimes needed

Innovations can lead to behaviour for which the existing legislation and regulations are not equipped. The regulatory regime then lags behind the reality and offers no scope for experimentation, as is the case in the biotechnology sector, for example. An innovation can also raise questions about the principles and legitimacy of regulations, or change the balance between different interests. This is the case with the regulation of genetically modified organisms, for example; safety is the guiding theme here, whereas other considerations also play a role in society, such as food security, ethics and health gains. ‘Outmoded’ legislation and regulations can mean that negative effects of innovations are insufficiently clear and therefore difficult to combat. For example, for a long time the recreational use of drones fell under the guidelines for radiographically controlled aircraft. The rules took too little account of the increase in nuisance caused by the greatly expanded use of these devices, including privacy infringements, noise nuisance and posing a danger to aircraft.⁵⁸

Case studies: the influence of rules on the spread of innovation

In order for a new drug or treatment to be eligible for reimbursement and approved for use in the care sector, it must fit within existing procedures, protocols and standards. The organisation and financing of this sector leaves virtually no scope for experimentation, however, and many care innovations consequently spread only with difficulty. Creating scope for experimentation can help; an example is the policy rule on ‘Innovation for small-scale experiments’ developed by the Dutch Healthcare Authority (NZA). This rule allows organisations to spend up to a year carrying out small-scale experiments in areas which fall within the scope of the Health Insurance Act (Zvw) or the Long-term Care Act (Wlz). These experiments also make clear whether and how the existing rules need to be amended.

The rules in the construction sector mean that every construction project has to go through a comprehensive process of testing and approval, whereas manufacturers in

⁵⁸ Maclaine Pont et al (2016).

other sectors only need to obtain one certificate of approval for a product. The construction industry is governed by an extensive and fragmented regulatory framework, including local spatial planning policy, building regulations, safety rules and often also a requirement to obtain the consent of a planning committee. In order to meet all the various rules, permits have to be obtained. For larger projects there are also requirements for consultation meetings, environmental impact reports, rules in relation to nuisance, and potential delays due to requirements imposed by the Nature Protection Act (formerly the Flora and Fauna Act).⁵⁹ Rules are necessary, but stakeholders in the construction industry believe they are applied too inflexibly. Too often, a strict interpretation of building regulations leaves little scope for the introduction of new methods and products. The sector believes that the government has a central role to play in reducing these obstacles. A key point here is the lack of stability and regulation, with changes pushed through by each successive government. According to many, the 'government's short-termism and dithering' pose an obstacle to long-term investments in construction.⁶⁰ Examples include the decision to scrap grants for solar panels and move the goalposts on energy-neutrality. This uncertainty leads companies to adopt a wait-and-see attitude and to defer investments in innovation.

Legislation and regulations are of great importance for innovation in the biotech sector. Innovators must for example obtain permits for all activities involving the use of genetically modified organisms (GMOs) in agriculture. The applicant must demonstrate that the GMO does not pose a risk to people, wildlife or the environment. There are also rules relating to environmental protection, the use of animals, human-based research, labelling of products containing GMOs, and rules on safety. The licensing procedures are lengthy, costly and uncertain. The EU awards the permits, but each EU Member State can make its own judgements and set its own rules. According to the industry, it is virtually impossible to have a GMO approved in Europe and there is therefore not a level playing field compared with countries such as the US (where it is easier). Strikingly, these GMO regulations are also a major driver of innovation, as companies seek to circumvent the regulations by developing new techniques which mean the organism does not have to be classed as a GMO. Dutch

⁵⁹ Doreé (2001).

⁶⁰ EIB (2016).

breeding companies are among those which have successfully adopted this approach. Yet some of these techniques raise questions; there is for example a great deal of debate about whether or not certain new techniques (such as CRISPR-Cas) lead to mutations which ought to be covered by the GMO regulations. This creates new uncertainties in the innovation process and thus impedes the spread of innovations.

Situation 4:

Infrastructure is not fit for purpose; insufficient private investment

If an innovation does not fit into an existing physical infrastructure, it is difficult for major innovations to spread. A mobile telephone only works if there is a mobile network, and electric vehicles require a sufficiently widespread charging infrastructure: the availability of this is just as key for the spread of electric vehicles as range or price. Sometimes a completely new infrastructure is needed – the network of electric vehicle charging points being a good example – and sometimes there is already an infrastructure in place but steps are needed to facilitate connection. An example of the latter are the existing networks and systems for energy generation and delivery. These are large, centrally configured systems and new, sustainable energy production facilities fit in poorly with this infrastructure, being more suited to small-scale applications and transmission.⁶¹

Infrastructure generally requires large-scale, high-risk investments which can only be recouped over a long period and only if they are used sufficiently. At the same time, it is only attractive to use an innovation if the necessary infrastructure is sufficiently accessible. This ‘chicken and egg problem’ makes it less appealing for private players to invest to the full. On top of this comes the uncertainty about which variants will become standard, as well as fears of ‘free-rider behaviour’ by competitors, who make use of a good or service without having to pay for it or contribute to its maintenance. All of this demands government intervention.

Case studies: infrastructure as a condition for innovation spread

ICT-based innovations, for example in the care sector or new financial services, are sometimes a poor fit for the existing systems. This is the result of the ICT legacy: the

⁶¹ Negro et al, 2011.

existing networks are mostly fairly old, complex and difficult to maintain or modify, making this costly and time-consuming. The necessary investments are an obstacle to the implementation of new applications.

Another example can be found in the industrial biotechnology sector. In order to spread innovative biofuels, producers have to take costly steps to enable them to supply gas to the existing gas network. This is because the methane content is different from that of traditional natural gas. Quality standards for biofuels also stipulate that mixing with conventional fuels must be possible. The biofuel producers therefore have to take additional, expensive steps to purify and upgrade their product, putting them at a price disadvantage compared with conventional fuels.⁶²

Situation 5:

Fragmented sector or lack of overarching demand

Where a sector is highly fragmented, with lots of small players and weak or non-existent mutual relationships, it is also often difficult for innovations to spread. The demand may also not be uniform, or different target groups may each have their own demands for different innovations. There are several situations in which stakeholders themselves find it difficult to share knowledge and to instigate collaboration, or where there is an actual or apparent lack of overarching demand. In such cases, the government can play an incentivising and binding role.

Stakeholders are too small and not able to link up with others

The businesses and other stakeholders in a particular sector are sometimes unable to pool their strengths and help spread innovation. It is known that smaller companies have more difficulty in earmarking time and resources to attract talent, provide training, cooperate with others and gain access to new knowledge. Moreover, developing shared activities often involves a lengthy process of collaboration based on trust and transparency.⁶³ In some sectors, such as the construction industry (see box below), the conditions for linking up and collaborating with others do not exist to a sufficient degree. In such situations it can be helpful if the government takes action aimed at promoting networking or collaboration focused on common goals. Depending on what is needed, the government can organise events and networking meetings, set up platforms or work

⁶² Negro et al, 2011.

⁶³ AWTI (2016).

environments or develop cross-sector training activities. Under current policy, networking already takes place through the Top Sectors approach. Another example is part of the Smart Industry programme, which acquaints entrepreneurs with applications and encourages them to use them themselves in workshops and masterclasses.

The demand is too small or is not uniform

In some innovation systems, it is the demand that is not uniform. The development and spread of innovative medicines, for example, often involves small patient populations, given the complexity and rarity of the diseases involved. It is then difficult to develop drugs for all the different diseases in a way which enables the innovators to earn back their investment. This impedes the spread of innovation. And in the construction sector, different commissioning bodies and clients often have differing wishes, whilst the sector is also characterised by lots of small operators.

Construction sector: small players and 'mini-demands' impede the spread of innovation

The construction industry often produces unique and one-off products which are developed during construction projects. Each client or commissioning body has their own wishes; each location presents new circumstances. Innovation then has to fit in with the existing infrastructure, for example, or a specific land type demands a particular type of foundation.

Organisations, construction companies and clients/commissioning bodies work together on projects and in occasional coalitions, held together by contracts and for a period whose duration is dependent on the particular project. The process demands flexibility and improvisation from construction workers, suppliers and customers. The coalition is moreover constantly changing in size depending on the phase of the project. All of this makes for complex logistics management of people, materials and agreements.

Broader adoption of modular construction methods, combined with a standardised planning system, could improve this situation. Some of the work could then be carried out in the standardised environment of a production plant. But more widespread modular construction will only be possible if there are sufficient volumes and shared standards, for example in relation to module dimensions. Volume will not build on its own in the fragmented landscape of commissioning bodies such as school boards

and care authorities, municipalities, public authorities, developers and businesses, and of many, mainly small, construction companies. Agreeing on common standards requires a lengthy process of cooperation between many stakeholders, based on trust and transparency – something which is largely absent in the construction sector.⁶⁴ At present, therefore, individual companies develop their own, individual, modular systems. The consequence is that modules developed for one project are not acceptable for use in another.

The construction sector is an example of a highly fragmented industry consisting of a few large players but above all many small companies and sole traders. Their size means they are less able to release people and resources for the development of their own innovations, but also often lack the knowledge and experience to implement new building concepts and materials which are available on the market. In an attempt to initiate knowledge-sharing, the 'Building Campus' (*Bouwcampus*) has been created in Delft; it offers a neutral meeting place where clients, contractors and research institutes can work together to devise innovative solutions.

2.4 Policy analysis: little attention for spread of innovation in innovation policy

There is no questioning that the Dutch government's current innovation policy helps create a favourable climate for innovation.⁶⁵ However, the policy could achieve more by placing more emphasis on innovation spread as an explicit policy theme. That would also help bring together the different parallel strands of innovation policy. The policy analyses carried out by AWTI in preparing this report support this conclusion.⁶⁶

In reality, the current policy is the sum of different policies developed by different government agencies, viz.:

- ▶ General innovation policy: the responsibility of the Ministry of Economic Affairs and Climate.

⁶⁴ Jauregui (2017)

⁶⁵ Ministerie van Economische Zaken (2017).

⁶⁶ See background analysis 2 (in Dutch) at www.awti.nl

- ▶ The innovation policies of other ministries and agencies such as Rijkswaterstaat and the police.
- ▶ Regional and local innovation policy developed by provincial and municipal authorities.
- ▶ Specific national programmes which can be characterised as innovation policy.

General innovation policy contains limited instruments aimed at innovation spread

The government's general economic innovation policy, for which the Ministry of Economic Affairs and Climate is responsible, comprises a mix of policy instruments. Only by way of exception does this mix allow scope for promoting spread of innovation after the first introduction of an innovation to the market. The innovation policy is part of the overall business policy aimed at creating a favourable business climate. The Ministry seeks to achieve this by reducing the amount of red tape and administrative burden, increasing access to capital market finance, and supporting businesses with good public and fiscal services. The policy focuses mainly on two components of innovation processes. The first is the development of innovations: the policy encourages R&D, entrepreneurship and collaboration. The second is the introduction of innovations to the market or users, with support in the form of a valorisation policy and instruments to foster innovation-driven procurement across government, such as the Small Business Innovation Research (SBIR) scheme. Another tool aimed at improving the spread of innovation is part of the Smart Industry programme; it is described in the box below.

Smart Industry

The Dutch Ministry of Economic Affairs and Climate coordinates the Smart Industry programme, which is aimed at exploiting opportunities for digitalisation to foster innovation of products, production processes and business models within industry.

The programme seeks to ensure that Dutch companies implement innovations which emerge from the Smart Industry or that these innovations spread through the business community.

The programme has three principal aims:

1. To convey knowledge about Smart Industry innovations to the business community and to increase the awareness of them among individual businesses.
2. To set up field labs in which businesses and research institutes develop, test and implement new applications.

3. To reinforce digital skills and promote the development of standardisation, and the sharing of data and solutions for cyber security.

A recent example of the lack of policy attention for the spread of innovation is the letter to Parliament from the Ministry of Economic Affairs and Climate on the investment of an additional 75 million euros in applied research and innovation in 2018.⁶⁷ This letter contains one explicit intention concerning spreading of innovation policy, in the form of extra investments in the SBIR scheme.⁶⁸

Little stimulation of demand

Innovation policy should ideally focus not just on stimulating the supply of innovation, but also the demand for it. In reality, however, the policy in many countries, including the Netherlands, is heavily focused on the supply side.⁶⁹ Where Dutch innovation policy does take a demand-led approach, this often relates to the demand for research. In other words, the needs and demands of businesses, research institutes and public authorities shape the direction of research within the Top Sectors. The only policy instrument focusing on the demand side of innovation is the encouragement of innovation-driven procurement by public authorities.⁷⁰

Occasional attention for spread of innovation from other ministries and government agencies

Virtually all government ministries encourage innovation in the policy fields or regions for which they are responsible. There are also a number of nationwide policy programmes which can be characterised as innovation policy. Provincial and local authorities, and especially larger cities, often pursue their own innovation policy.

Nonetheless, overall the policy includes relatively few programmes and instruments concerned explicitly with creating favourable conditions for the spread of innovation. They do exist, as illustrated by the examples in the box below, but their reach could be greater. Provided their own knowledge systems are in order, ministries and local/regional authorities know the sectors or regions which are relevant for their policy domains well.

⁶⁷ Ministerie van Economische Zaken en Klimaat (2018).

⁶⁸ 42 million euros is being invested in applied research organisations (TO2), 15 million euros in the 'Top Sectors' and 18 million euros in strengthening the innovative capacity of the SME sector; of this latter amount, 7.5 million euros will be shared between start-ups, SBIR, the 'technology pact' between schools and the technology industry (Techniekpact) and valorisation activities.

⁶⁹ Edler (2016). Edler et al (2016).

⁷⁰ See background analysis 2 to this report (in Dutch) at www.awti.nl

They know how favourable the conditions are and where the obstacles lie to the spread of innovation, and could devise measures to improve those conditions and eliminate the obstacles.

Examples of policy aimed at the spread of innovation

A national programme to ensure that the Dutch economy is fully circular by 2050 was launched in 2016 under the banner 'Nederland Circulair in 2050'. In a fully circular economy, there is no longer any waste because products are designed more efficiently and materials reused. The programme lists five types of intervention which are intended to remove obstacles to the circular use of raw materials and which individual stakeholders are unable to tackle alone. This too requires innovation: new production processes and products, innovative business cases and new materials. The programme not only encourages the development of innovation, but also its spread via the market. As far as possible, the government aligns with current policy programmes and other policy domains in this regard. The five intervention areas are being worked up in more detail into five transition agendas for biomass and food, plastics, manufacturing, construction and consumer goods.

The Fast Track e-Health initiative supports SMEs wishing to upscale high-quality, high-impact e-Health initiatives. The initiative makes available venture capital and expertise, and provides support in forging upscaling coalitions of key stakeholders such as health and care insurers, care institutions, local authorities and end-users to develop a shared vision on upscaling and specific plans for its implementation, for example in the form of a Health Deal.

Rijkswaterstaat has its own knowledge and innovation agenda which informs businesses and research institutes about the need for innovation in the medium term. Part of this agenda is the Innovation Test Centre; the Centre tests innovations in practical situations, in partnership with market operators. This provides an insight into the added value and risks of the innovations. If the outcome is positive, Rijkswaterstaat approves the innovation.

EU policy: a step further?

EU innovation policy appears to have gone a step further, at least in terms of thinking about the spread of innovation. At the heart of this policy is still the encouragement of

research through successive framework programmes, but in addition there are a number of programmes and instruments aimed at market development, innovation-driven procurement and other ways of improving the spread of innovation.⁷¹ The Lamy Report in preparation for the successor to the Horizon 2020 programme recommends devoting more attention to rapid upscaling of innovations and to the development of future markets. The Report explicitly argues that innovation does not only stem from research and is not only technological in nature, but that many other forms of innovation are also essential for creating impact. The Report cites regulation, public procurement and other demand-side innovation policy as essential for creating an attractive ecosystem. The Lamy Report calls among other things for the setting up of a European Innovation Council. The European Commission has taken this recommendation on board and has launched a pilot. The EU Commissioner for Research & Innovation, Carlos Moedas, has stressed that the future framework programme must devote more attention to the use of technology, in addition to the development of new technologies: *“To speed up economic growth, Europe needs to start paying more attention to deploying technology throughout society rather than solely on developing it.”*⁷²

⁷¹ See background analysis 3 to this report (in Dutch) at www.awti.nl

⁷² <https://sciencebusiness.net/framework-programmes/news/policy-memo-brussels-focus-deploying-technology-faster>

Recommendations: Three steps to better spread of innovation

AWTI advises the Dutch government to focus more attention on the spread of innovation and suggests three steps for achieving this: stimulate demand for innovations with societal value; strengthen the role of government ministries; and make spread of innovation as an integral part of the innovation portfolio of the Ministry of Economic Affairs and Climate.

As the analyses underpinning this report show, more explicit and structured policy attention is needed to improve the climate for spreading innovation in the Netherlands. In time this would enable more innovations to reach more parties, in turn enabling more organisations and people to benefit from them. That would increase the return on the activities already being undertaken by various stakeholders to make the Netherlands a highly innovative country.

To supplement the existing innovation policy, the government needs to be more active on two fronts: stimulating demand for innovations with societal value, and eliminating obstacles which impede the spread of innovation.

AWTI translates this advice into three recommendations to the government:

1. Stimulate demand for innovations with societal value.
2. Ask government ministries to devote policy attention to the spread of innovation and strive for interdepartmental collaboration in this regard.
3. Make spread of innovation an explicit part of the innovation policy of the Ministry of Economic Affairs and Climate.

3.1 Stimulate demand for innovation

The government must include more activities and instruments in its innovation policy designed to stimulate demand. The extent and nature of this demand is decisive for the spread of innovation, as the previous chapter illustrated. The spread of societally useful innovations too often falters in the Netherlands because of insufficient demand. There is a role for the government in these cases.

The innovation policy both of the Dutch Ministry of Economic Affairs and Climate and of other government ministries and their implementing agencies could focus more on stimulating demand. It is important here that ministries have sufficient knowledge about the factors that can foster or inhibit the spread of innovation in the areas for which they are responsible.

Depending on the situation, demand can be stimulated via the potential users or the suppliers of an innovation. The government could deploy instruments to persuade the potential target group to adopt the innovation by increasing the perceived benefit. It could also deploy instruments to help businesses or other providers of innovations develop their earnings model. The government could moreover call on other government agencies, such as provincial and city authorities, to focus more on stimulating demand.

Activities to stimulate demand

Government ministries could focus their policy on a variety of goals, depending on the situation:

- ▶ Supporting and stimulating practical initiatives, such as field labs in the manufacturing industry and living labs concerned with urban issues. Businesses and research institutes could develop their innovations here and work on creating demand. Potential purchasers or users of innovations could use these facilities to become acquainted with and learn to apply innovations.
- ▶ Configuring legislation and regulations in a way that stimulates the spread of innovation.
- ▶ Forging deals with innovators to remove practical obstacles to the spread of innovation.
- ▶ Helping businesses strengthen their business model by making necessary amendments to regulations.
- ▶ Bringing parties together – e.g. municipalities or schools – with a view to formulating a common demand and developing joint standards.
- ▶ Facilitating public debate on values in situations where lack of demand is mainly caused by societal resistance.
- ▶ Stimulating attention for innovation in public tendering and procurement.
- ▶ Subsidising innovations with societal value in order to lower the price and thus boost demand.
- ▶ Strengthening the position of innovative companies relative to established companies.
- ▶ Acting as the (launching) customer of such businesses.

Innovation-driven procurement as a trump card

Every government ministry, provincial or municipal authority or implementing body, acting alone or in concert with other public authorities, can include innovation as an element in its tendering and procurement. While this does already take place, it will only happen on a larger scale if the government consistently stresses its importance and stimulates innovation-driven procurement. The instruments to do this exist (see box below), but could be used much more and much more widely. In stimulating innovation it is important that those at the front end of the procurement process are involved in the thinking about innovative solutions, for example by installing a 'sounding board' tender committee, a committee of experts who provide advice at certain points during a tender process.⁷³ In addition, scope for innovative solutions needs to be built into tender processes. An example is a local authority which does not invite tenders for a bridge, but for 'a link between two riverbanks'.

Public authorities have sizeable budgets to procure the various products and services needed to perform their tasks. If a proportion of these budgets is spent on more innovative products and services, this will boost demand for innovation and thus its spread. In some countries, this is actually the principal way of achieving these goals.⁷⁴ In the Netherlands, such an approach would require a cultural sea-change, towards a government that sometimes takes conscious risks: innovations do not always work optimally straight away, and may initially demand additional input rather than simply following the usual pathway.

For public authorities and government agencies, 'innovation-driven procurement' should be the norm rather than the exception in public tenders. The first Dutch government under Prime Minister Mark Rutte (Rutte I) set a target of 2.5% of total spending for innovation-driven procurement.⁷⁵ It is unclear whether this target was achieved: innovation-driven procurement is difficult to measure. To move closer to it, the government introduced a great deal of policy: the Urgent Innovation Procurement programme (*Inkoop Innovatie Urgent*), followed by the Innovation-driven Procurement programme (*Innovatiegericht Inkopen*). To support this drive, the Tendering Expertise Centre of the Ministry of Economic Affairs and Climate (PIANOO) developed a range of

⁷³ <https://www.pianoo.nl/sites/default/files/documents/documents/watiseentenderboard.pdf>

⁷⁴ Aschoff & Sofka (2009); Appelt & Galindo-Rueda (2016).

⁷⁵ According to the 2013 progress report, it is not possible to say whether the target of 2.5% has been achieved.

instruments such as the ‘innovation toolbox’ (Innovatiekoffer), tools and practical tips for everyone in the public sector who is concerned with procurement and tendering.⁷⁶

Utilise existing opportunities and offer support

The SBIR (Small Business Innovation Research) programme facilitates the pre-commercial development and procurement of innovations.⁷⁷ Some government ministries and public authorities do not use SBIR, and that is a pity. SBIR should also not end with the development of an innovative solution; rather, the government should grasp the opportunities to purchase the innovations and support the innovators in the further commercialisation process. This could be achieved by smoothing the way on non-technical issues, such as regulation or certification.

The Public Procurement Act also offers many opportunities to challenge the market to devise and spread new solutions, for example by initiating a market consultation process to engage in dialogue with market operators about procurement of innovations, or by selecting contract award criteria which focus on rewarding innovation, or applying a tender procedure which offers ample scope for innovation, perhaps through an innovation partnership, competitor-focused dialogue or a competition.

Many small and medium-sized municipalities already join forces with other municipalities to procure products and services, and their number is growing.⁷⁸ This provides a good basis for innovation-driven procurement, but the extent of this practice is unclear. The government could stimulate innovation-driven procurement by local authorities, for example by offering support in the form of knowledge transfer or training.

Greater awareness about innovation-driven procurement would help, as would a stronger focus on demand techniques, criteria and procedures which promote the procurement of innovative solutions. The proposed campaigns as part of the Better Procurement Action Agenda (*Actieagenda Beter Aanbesteden*) could certainly play a role here, as could learning good practices for innovation-driven procurement such as those being gathered and elucidated by PIANOo.

⁷⁶ See <https://www.pianoo.nl/themas/innovatiegericht-inkopen>.

⁷⁷ See Dialogic (2017); Ministerie van Economische Zaken en Klimaat (2018b).

⁷⁸ <https://www.pianoo.nl/actueel/nieuws/pianoo-brengt-in-kaart-ruim-200-gemeenten-kopen-gezamenlijk-in>.

3.2 Ask government ministries to devote policy attention to the spread of innovation

Government ministers should urge their ministries and implementing bodies to improve the spread of innovations. A key element here is to gain a better insight into the division of tasks and responsibilities between the Ministry of Economic Affairs and Climate and all other ministries which conduct innovation policy. In addition, the government needs to strive for more collaboration between ministries on shared issues for which the spread of innovations could help provide a solution.⁷⁹

This recommendation applies almost universally, given that almost every ministry has in place policy to stimulate innovation. In addition, almost every ministry should have a knowledge of the sectors that are relevant for its policy domain and the key issues in those sectors, as well as of ongoing innovation programmes, and should be capable of deploying measures aimed at promoting the spread of innovation.

Policymakers need to think right from the start of the development of a policy about how the spread of innovation could be made easier. New and where possible current innovation programmes could include an analysis of the anticipated spread of the innovations developed, linked to a specific approach, which should as a minimum focus on two questions: ‘Can policy stimulate demand for innovations that have been developed?’ and ‘Can policy help remove obstacles to the spread of innovation?’ The five situations identified in chapter 2, all of which require government intervention, could be useful input here.

A key condition for this is that ministries have sufficient substantive and network-based expertise to enable them to identify obstacles to and opportunities for innovation spread and react to them. In previous years, ministries have had insufficient opportunity to build knowledge and have lost a great deal of expertise, so there is a good deal of catching up to do; the recent financial commitments by the government partly meet this need. A second condition is that the analysis is carried out in collaboration with those in the field, including – and perhaps especially – newcomers and more innovative players with whom the ministry normally has less contact.

⁷⁹ See also AWTI (2017).

Start with the intentions set out in the Coalition Agreement

The Coalition Agreement⁸⁰ contains a series of long-term government goals and intentions in relation to sustainability. Many of these goals fall within the scope of the proposal to create a 'National Climate and Energy Agreement'. Examples of measures relating to these goals are set out in the box below. Goals and measures such as these incentivise stakeholders to go in search of new solutions, because they give the market an idea of the direction favoured by the government. They also boost demand for innovation if they generate additional benefits for those on the demand side, such as a lower purchase price due to a subsidy. All this can offer a pragmatic starting point for some ministries to generate more policy attention for spreading innovation.

Proposed measures for a 'National Climate and Energy Agreement'

The most important goal of this proposed Agreement⁸¹ is a 49% reduction in CO₂ emissions by 2030. This target has been translated on an indicative basis into a series of targets at sector level, specifically the industry, transport, built environment, electricity, land use and agriculture sectors. Under the proposed Agreement, the government has announced a raft of measures intended to encourage stakeholders to try out and adopt innovations. They include:

1. **Financial incentives**, for example tax breaks for landlords if they invest in energy-saving measures, road pricing for freight traffic, grant schemes for homeowners who invest in energy-saving measures, and tax shifts (higher for gas, lower for electricity).
2. **Setting stricter standards**, for example a higher energy performance standard for new-build property, a minimum carbon price in the electricity industry, and all cars emission-free by 2030.
3. **Scaling back energy generation which impacts on the climate**, such as coal-fired power stations and gas heating, and creating scope for sustainable forms of energy generation such as offshore wind energy and geothermal energy.
4. **Identifying pinchpoints in regulation, supervision and enforcement** which stand in the way of sustainable innovations in relation to the circular economy and which could potentially be resolved.

⁸⁰ Coalition Agreement (Regeerakkoord) (2017).

⁸¹ The 'Outline Agreement Proposal' ('Voorstel voor hoofdlijnen van het akkoord') was published immediately before this report went to press.

Collaboration and experimentation by ministries

Complex societal problems increasingly go beyond the scope of the policy domains of individual ministries and can only be addressed in concert with other societal actors and in an international context. For this reason, ministries are increasingly working together in coalitions and interdepartmental programmes and in public-private partnerships. This sharing of responsibilities also offers a basis for ministries to collaborate on spreading and promoting innovations.

Trying things out and experimenting play a key role in this process. It is also important that one or more 'innovation development hubs' are set up within government which operate across individual policy domains.⁸² The government should therefore consider setting up a nationwide experimentation site where government ministries can work with each other and with innovators and potential innovation users, carry out experiments and learn from each other about innovation and the spread of innovation. This could take the form of an 'innovation lab', for example, based on examples from other countries; see the box below for further details. An innovation lab can be regarded as a step towards a broadly supported transformation to a new, connecting role for government.⁸³

Innovation labs

Innovation labs⁸⁴ are network organisations set up by the government to promote innovation in the public sector and across government.⁸⁵ Some are part of a specific ministry, city or region, while others serve several ministries. Their tasks depend on the design; they may be intended only to develop innovative solutions or also to test, implement and disseminate them. Other goals include involving society in government decision-making, initiating system changes and change within government.

A characteristic of innovation labs is that they apply innovative methods, sometimes in combination with traditional methods. Examples include open innovation, social innovation, design thinking, rapid prototyping, experimenting, competitions and contests. The innovation teams differ in their physical, financial and administrative

⁸² Dominique Guellec, Head of the OECD Directorate for Science, Technology and Innovation, recently spoke about the need for such hubs <https://sciencebusiness.net/framework-programmes/news/how-do-you-pronounce-synergy>.

⁸³ ROB (2015).

⁸⁴ Also called innovation units or innovation teams.

⁸⁵ See: Puttick et al. (2014). Their study compares 20 government initiatives.

distance from government. Being close to government means short lines of communication and more opportunities for direct influence, but can limit the scope for devising radical solutions and organising experiments.

A well-known example is MindLab in Denmark, set up in 2002 by the Danish Ministry of Economic Affairs. Initially it was a platform for creative thinking within the Ministry, but has since grown into a physical innovation lab where several government departments work together with local authorities, members of the public, companies and civil-society organisations to develop solutions to problems in society and the business community. MindLab devises and designs innovations, tests them, applies them and encourages their spread.

3.3 Make spreading innovation an explicit part of the innovation policy of the Ministry of Economic Affairs and Climate

Finally, AWTI calls for more attention for aspects of innovation spread in the innovation policy of the Ministry of Economic Affairs and Climate.⁸⁶ That innovation policy is part of the business policy and currently focuses mainly on the production and market introduction of innovations. More attention to the spread of innovation could be built into the existing policy in at least three areas:

- ▶ **In the Top Sectors approach.** More attention is needed for innovation-driven procurement, strengthening the participation of smaller, innovative players, and support in the development of facilities for demonstrating and testing innovations.⁸⁷
- ▶ **In the strategic PPPs.**⁸⁸ The spread of innovations can be essential for creating impact and earning back the substantial investments. The opportunities and inhibitors for innovation spread could be considered right at the outset, during the research phase. Whilst outreach and tech transfer activities do currently take place, their emphasis is on the development of innovations and new technologies. On the other hand, there are good practices which offer a good basis for further

⁸⁶ AWTI's predecessor also advocated this. See AWT (2003)

⁸⁷ Evaluations and analyses of the Top Sectors approach show that companies, research institutes and public authorities are able to work together successfully on joint agendas, but develop fewer activities aimed at the spread of innovations.

⁸⁸ Strategic PPPs aim for breakthroughs in research and innovations in areas that are of great importance for society and the economy, such as cancer research and building a more sustainable chemical industry.

development: RegMedXB and Oncode, for example, involve patient organisations in the shaping of demand-led research.

- ▶ **In valorisation programmes.**⁸⁹ These programmes should include goals relating to the spread of innovation. The mid-term review in 2015 showed that these programmes currently often stop where the spread of innovation begins, i.e. immediately after the moment of market introduction.⁹⁰

The Hague, September 2018

Professor Uri Rosenthal, Chairman

Anneke Bovens, Secretary

⁸⁹ The Ministry of Economic Affairs and Climate and the Ministry of Education, Culture and Science are the leaders of the Valorisation Programme, which has been running since 2010 and supports valorisation activities by 13 regional consortia, each grouped around a research institute. The Programme offers scope for activities in the phase after market introduction, but does not focus explicitly on this.

⁹⁰ Panteia (2015). Currently (June 2018), Dialogic is evaluating the valorisation programme.

Appendices

Appendix 1 Interviewees

In preparing this report, interviews were held or correspondence exchanged with the following persons:

- ▶ Maurits Barendrecht The Hague Institute for Innovation of Law
- ▶ Ernst Brand PA Consultancy Group Netherlands
- ▶ Jacqueline Cramer Utrecht University
- ▶ Floris de Boer PIANOo, Tendering Expertise Centre
- ▶ Marina de Lint Council for Health and Society (RVS)
- ▶ Nathalie Dijkman The Hague Institute for Innovation of Law
- ▶ Roelof Jan Donner Ministry of Economic Affairs and Climate
- ▶ Andre Doreé University of Twente
- ▶ Dolf Grasveld Ministry of Economic Affairs and Climate
- ▶ Thomas Grosveld Confederation of Netherlands Industry and Employers (VNO-NCW)

- ▶ Joop Halman University of Twente
- ▶ Marko Hekkert Utrecht University
- ▶ Baldwin Henderson PIANOo, Tendering Expertise Centre
- ▶ Pieter Heringa Ministry of Economic Affairs and Climate
- ▶ Willem Hol Ministry of Defence
- ▶ Eimert Hornstra Ministry of Defence
- ▶ Hans Houmes PA Consulting Group Netherlands
- ▶ Karin Jongkind Ministry of Economic Affairs and Climate
- ▶ Wik Jongasma Ministry of Defence
- ▶ Alfred Kleinknecht Delft University of Technology
- ▶ Ton Lennaerts Rechtbank Noord Nederland Court
- ▶ Antonie Meijers Eindhoven University of Technology
- ▶ René Orij Nyenrode Business University
- ▶ Sjoerd Romme Eindhoven University of Technology
- ▶ Annemieke Roobeek Nyenrode Business University
- ▶ Frans van der Doelen Ministry of Security and Justice
- ▶ Jelle van Veenen Dutch Legal Tech
- ▶ Marijke ter Voert Ministry of Security and Justice
- ▶ Henk Volberda Erasmus University Rotterdam
- ▶ Carlo Wesseling Ministry of Defence
- ▶ Andre Wijnveld Ministry of Defence
- ▶ Emile de Wijs Stichting Achmea Rechtsbijstand (legal assistance)
- ▶ Jeroen Zweers Kennedy van der Laan Advocatie (law firm)

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