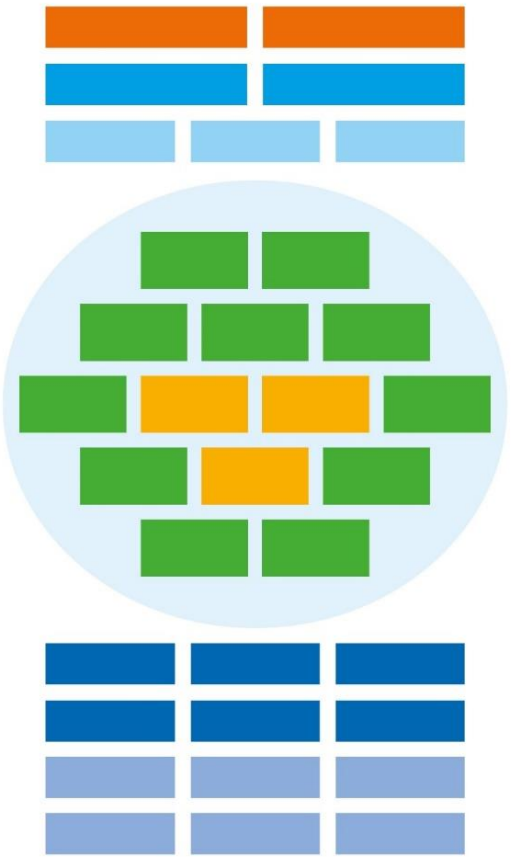
Government of the Netherlands

Strategy to
Strengthen Research and Innovation Ecosystems



1. Introduction

The Dutch government wants to strengthen existing ecosystems and promote new, leading-edge ecosystems, such as ecosystems on key enabling technologies and solutions to societal challenges. This strategy describes how ecosystems can be strengthened.

As described in the *Long-term Growth Strategy for the Netherlands*[1], in addition to the current research and innovation policy, there are further opportunities that can be seized to strengthen Dutch research and innovation ecosystems and thereby increase our prosperity. Research, innovation and innovative entrepreneurship thrive in well-connected ecosystems where there is strong cohesion and cooperation, and where healthy competition also plays an important role.[2] As part of the growth strategy it has been announced that the national government will develop a strategy to strengthen research and innovation ecosystems, partly in the framework of the National Growth Fund (hereinafter: Growth Fund).

The strategy first provides a shared conceptual framework, a common language, for research and innovation ecosystems (Section 2). Central to this framework is the connection between different types of activities and cooperation between a variety of actors. The conceptual framework also addresses indicators and data to analyse ecosystems. Moreover, the strategy provides a description of the Dutch landscape of research and innovation ecosystems (Section 3) and 10 challenges faced by many ecosystems in the Netherlands (Section 4).[3] Ecosystems differ and are constantly evolving, so supporting and strengthening them often requires a customized approach. The challenges involved are nevertheless similar. Insight into these challenges helps to highlight strengths and obstacles in ecosystems and to improve interventions by government bodies and other organisations.

The strategy provides points of reference for the Growth Fund (its R&D and innovation pillar/area) and inspiration for other instruments, such as the Mission-driven Top Sector and Innovation Policy and instruments within science policy, education policy, regional economic policy and the policy areas focused on well-being and societal challenges. Finally, the strategy announces the establishment of a learning community to connect organisations and communities that contribute to or study ecosystems (Section 5).

Box 1: National Growth Fund[4]

Targeted public investments are made through the Growth Fund to contribute to the Netherlands' long-run economic growth. The three pillars or investment areas are: 1) knowledge development; 2) R&D and innovation; 3) physical infrastructure. In addition, the social costs and benefits of a proposal, such as quality of life, must be positive. Finally, a proposal must not conflict with the government's ambitions, for example in terms of the business environment, spatial planning and climate.

In order to develop this strategy, the research firm Dialogic conducted a background study[5] and (online) interviews and meetings were held with more than a hundred leading researchers in the area of research and innovation policy and experts/practitioners in the field who have been active in ecosystems for many years. The experts know from the inside what works well and how ecosystems can be strengthened. We would like to thank all the researchers and other experts for their valuable contributions.

[1] Parliamentary paper 29696, no. 7 dated 13 December 2019.
[2] There is a tradition in both scientific literature and policy practice of thinking in terms of research and innovation ecosystems (and related terms), as described in *De Innovatiemotor* by Hekkert, M. and Ossebaard, M. (2010). *De Innovatiemotor*; Stam, E. (2015). *Entrepreneurial Ecosystems and Regional Policy: a Sympathetic Critique (In:* European Planning Studies, 23(9), 1759–1769); AWTI (2018). *Verspreiding - De onderbelichte kant van innovatie;* Brede Maatschappelijke Heroverweging Innovatieve Samenleving (2020); and the background study compiled by Dialogic for the ecosystems strategy.
[3] The full text of the Dutch strategy for strengthening research and innovation ecosystems (in Dutch) also addresses current Dutch policies – and a selection of EU programmes – to address the 10 challenges. The Dutch version was published 30 October 2020, the English translation March 2021.
[4] Parliamentary paper 35300 no. 83, dated 7 September 2020.
[5] Dialogic (2020). *Onderzoeks- en innovatie-ecosystemen in Nederland*

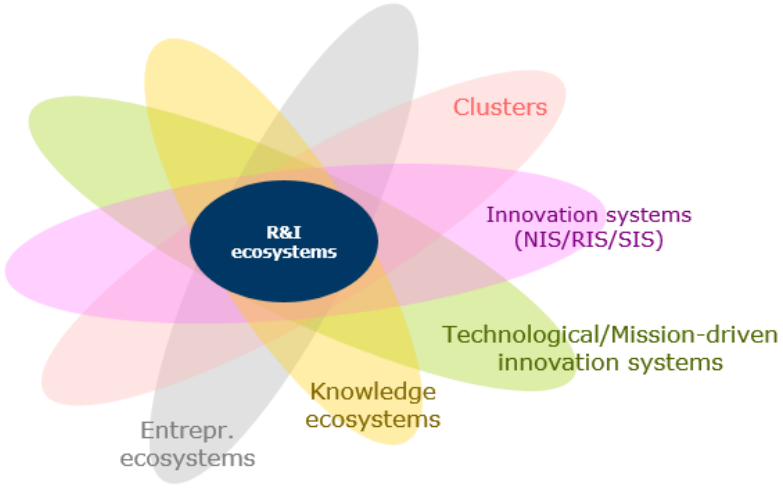
2. Definition, conceptual framework and measurement of ecosystems

The research and innovation ecosystems concept helps in gaining a better understanding of how knowledge, research and innovations arise and become embedded in society. This process involves an interplay of individual actors, businesses and organisations – an ecosystem.

An ecosystem for research and innovation comprises a dynamic set of related actors, activities, facilities and rules that are important for the research and innovation capability of individual actors and groups of actors and hence for the creation of value (Dialogic, 2020).

In order to arrive at the definition and conceptual framework for research and innovation ecosystems, the research firm Dialogic has drawn on five main streams in the relevant scientific literature, see Figure 1. The streams are as follows: (1) clusters (with the emphasis on regions and value chains); (2) innovation systems (national, regional and sectoral); (3) knowledge ecosystems (with the emphasis on research and education); (4) entrepreneurial ecosystems; and (5) technological and mission-driven innovation systems.[6] A number of key characteristics of ecosystems are first set out below, after which the conceptual framework is presented.[7]

Figure 1: Research and innovation ecosystems and streams in the literature



Source: Dialogic (2020), Onderzoeks- en innovatie-ecosystemen in Nederland

A research and innovation ecosystem is characterized by coherence and cooperation. It mainly involves links between mutually reinforcing organisations and, in particular, people. Coherence requires shared ambitions and agendas, for example in the form of research agendas, digitization strategies and technology roadmaps. Leadership and trust are important in order to achieve coherence. Cooperation benefits from proximity (including physical proximity).[8] This means spaces for scheduled and unscheduled meetings. Such meetings take place, for example, on campuses, during events and when using research facilities. Proximity involves not only cooperation, but also sometimes competition, for example when attracting talent or marketing a new product as quickly as possible. Healthy competition, both within and outside the ecosystem, keeps an ecosystem resilient.[9] The national/international dimension is also important in cooperation and competition. Ecosystems benefit from good connections with other ecosystems, both within and outside the

[6] Other terms are also used in policy in addition to the scientific streams. The European Commission, for example, uses the terms 'Industrial Ecosystems' with a focus on the production phase and 'Innovative Ecosystems' with a focus on the innovation phase.
[7] The Dialogic report includes a detailed description.
[8] Joint Research Centre of the European Commission (2017). *JRC Science for Policy report – Place-based Innovation Ecosystems*; Moretti, E. (2012). *The new geography of jobs.* Digital proximity is also important; it is not only a question of physical proximity. The coronavirus crisis, for example, has accelerated many digital applications for home working and maintaining contact. Unscheduled meetings are less feasible, however, in the case of digital proximity.
[9] Porter, M.E. (2000). *Location, competition, and economic development: local clusters in a global economy*; TNO (2021). *Regionale innovatie ecosystemen, Onderzoek naar optimale vormgeving van en dynamiek in regionale ecosystemen*.

Netherlands and Europe, for example to build up knowledge and develop and test new products, services and processes.[10]

Investments are essential for the functioning of research and innovation ecosystems. These comprise investments in the knowledge base as well as targeted investments. Examples are basic funding for research and talent development, research facilities and valorisation activities in public educational and knowledge institutions[11]; generic tax facilities such as the tax credit for research and development; risk capital for innovative startups; private investments by existing businesses; resources for the development and management of research facilities; and the budget for Dutch Research Council (NWO) instruments and Netherlands Enterprise Agency (RVO) programmes.[12] Rules influence the functioning of ecosystems. These are rules and regulations, for example on intellectual property, standards and regulations that can impede or stimulate the development of new products. There are also informal rules (social norms).[13] The entrepreneurship culture and the degree of trust and openness, for example, can impede or stimulate the functioning of ecosystems.

Dynamics and evolution are important characteristics of research and innovation ecosystems. The starting point of each ecosystem is unique and offers many different paths. An ecosystem has different stages, can be young and emerging or mature and established.[14] An ecosystem's ambitions and agendas can also change or an ecosystem can transform into phases of growth and maturity. Mature ecosystems can enter a phase of renewal and can or may have to reinvent themselves. Ecosystems are often also open, with organisations joining and leaving. Cross-fertilization with other ecosystems is also possible, both nationally and internationally. This all makes an ecosystem dynamic and strengthens its resilience and adaptability.

A research and innovation ecosystem creates new knowledge, skills and innovations, including social innovation to address societal challenges such as climate change and inclusion. This creates value in different ways for participating actors and organisations as well as society. In general more value is created when more actors start participating in the ecosystem, coherence remains possible and dynamism increases. The value involved lies both in the creation of economic value such as productivity growth, employment, strengthening of the business environment and long-run economic growth and in the ecosystem's contribution to welfare and well-being in the broad sense. In the case of basic research the value also lies in scientific breakthroughs and a better understanding of people, society, nature and the world. The value for individual organisations translates among other things into a willingness to invest in the ecosystem themselves.

The conceptual framework in Figure 2 (see next page) gives an insight into the different elements that are important for functioning of a research and innovation ecosystem. Figure 2 shows that many activities are relevant to an ecosystem, such as giving direction and showing leadership, conducting basic and applied research and experimental development, production and strengthening of human capital. Figure 2 does not specify any actors because most actors can perform different activities. Actors include large businesses, SMEs, startups, institutions for applied research (TO2 institutions), National Knowledge Institutions (RKIs), secondary vocational establishments, universities of applied sciences, universities, government bodies, finance providers, campus organisations, social organisations, public agencies, employees, consumers and citizens. For example, institutions for applied research (TO2 institutions) and universities perform different types of research and development and manage research facilities, while businesses, not only

[10] Rathenau Instituut (2015). *R&D goes global: policy implications for the Netherlands as a knowledge region in a global perspective*.
[11] For the sake of readability, distinctions will be drawn only where relevant between universities, University Medical Centres, universities of applied sciences, secondary vocational establishments, institutions for applied research (TO2 institutions), National Knowledge Institutions (RKIs), Dutch Research Council (NWO) institutions and Royal Netherlands Academy of Arts and Sciences (KNAW) institutions.
[12] Rathenau Instituut (2015). *R&D goes global: Policy implications for the Netherlands as a knowledge region in a global perspective;* AWTI (2016). *Houd de basis gezond: Prioriteiten voor extra investeringen in onderzoek en innovatie.*
[13] Klein Woolthuis R.J.A. et al. draw a distinction between on the one hand formal (hard) institutional failure in laws and regulations and on the other hand soft (informal) failure in political culture and social values (social standards). Klein Woolthuis, R.J.A. et al. (2005). *A system failure framework for innovation policy design.*
[14] Mack, E. and Mayer, H. (2016). *The evolutionary dynamics of entrepreneurial ecosystems*.

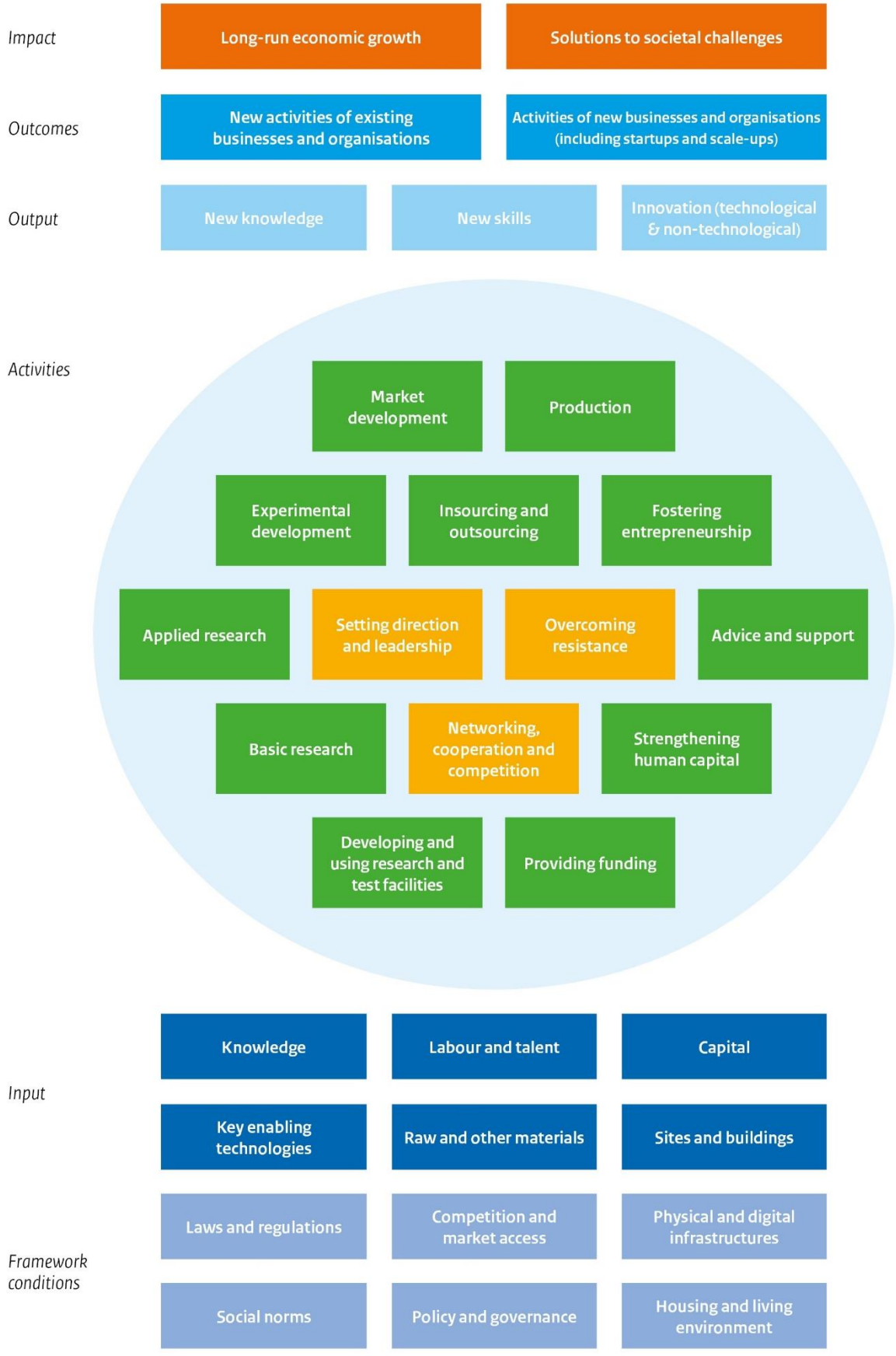
conduct applied research, innovate and contribute to new and existing value chains, but may also manage test facilities and perform basic research. The government also has an important role. This can involve, for example, helping to guide the ecosystem by means of policy, laws and regulations, boosting the demand side and financing different types of research.

Another point illustrated in Figure 2 is the dynamic nature of an ecosystem. Activities influence each other and also affect the input and framework conditions. The process is not linear, but based on feedback loops. The process of basic and applied research, for example, leads to entrepreneurship and innovation, and vice versa, while an engaging and shared agenda helps to mobilize talent and investment.

The varied set of activities and actors in an ecosystem makes it both necessary and challenging to organise coherence and cooperation in ecosystems, without loss of energy and speed. This can be particularly challenging for emerging ecosystems which have arisen from new areas of research and innovation or societal challenges. Despite these challenges, the Netherlands has a wealth of thematic and regional ecosystems, thanks to the efforts of organisations, partnerships and inspiring and connecting people. These ecosystems add up to the Dutch ecosystem, which is embedded in European and global ecosystems.

Dialogic describes various reasons (rationales) for the government to intervene in research and innovation ecosystems. In addition to market failures, for example in terms of positive externalities of research and innovation, these include systemic and transformation failures. The concept of system failures is used to identify the points in an ecosystem where it is not running smoothly or is unable to progress to the next step, for example because talent lacks the right skills or sufficient time and space to contribute. Other issues may be an inability to break from established paths and outdated systems, fragmented social networks and a lack of coordination. Transformation failures occur, for example, when the ecosystem is hardly oriented towards market demand or societal challenges. It is essential that policies pursued do not distort the market, are not aimed at specific technologies and innovations without good reason and stay on track as well as possible (these are possible government failures).

Figure 2: Conceptual framework of a research and innovation ecosystem



Source: Dialogic (2020), Onderzoeks- en innovatie-ecosystemen in Nederland

Identifying and analysing research and innovation ecosystems
Despite the variety of ecosystems and dynamics within ecosystems, it is possible to identify an ecosystem and assess whether an ecosystem is complete and developing positively, not with the aim of benchmarking ecosystems, but as a basis on which organisations and people within the ecosystem, including government bodies, can strengthen it.

With input from experts, Dialogic has developed a set of indicators, a menu, to analyse ecosystems.[15] For each element of the conceptual framework of an ecosystem, indicators have been formulated which can be used for almost all ecosystems. The Dialogic background study presents a broader set of indicators, some of which are relevant to a limited number of ecosystems. The indicator set to some extent allows for a uniform method of analysing ecosystems, the key point being that each ecosystem is unique, can formulate different target values and can use additional indicators, both qualitatively and quantitatively.

To analyse research and innovation ecosystems it is sensible to make clear first which actors fall within the ecosystem, what level of aggregation of the ecosystem is most relevant, what topics and themes are addressed and which activities can be attributed to the ecosystem. Such demarcation is challenging because ecosystems have fluid boundaries with constantly changing organisations and activities (dynamic nature) and because ecosystems are interconnected. The connections have to do not only with the content of individual ecosystems but also with the fact that organisations operate across multiple ecosystems.[16] Ecosystems can also be part of a larger ecosystem, so to a certain extent they can be aggregated. Young ecosystems are sometimes difficult to map out due to incomplete data. Another challenge in mapping out ecosystems is finding indicators that describe the coherence and cooperation within the ecosystem. Examples are cooperation in research, the use of publications and intellectual property and dual or joint appointments at universities and companies. When mapping out ecosystems it is possible to use data available from sources such as Statistics Netherlands, the Association of Universities in the Netherlands, the Netherlands Association of Universities of Applied Sciences, the Dutch Research Council, the Netherlands Enterprise Agency, institutions for applied research (TO2 institutions)[17], the Rathenau Instituut and Techleap.nl. A number of ecosystems have also set up their own monitor and it is possible to use Top sector reports, the Monitor of Well-being of Statistics Netherlands and other monitors of planning agencies and National Knowledge Institutions.

3. Landscape and challenges of research and innovation ecosystems in the Netherlands

The landscape of research and innovation ecosystems in the Netherlands
The Netherlands has a wide variety of research and innovation ecosystems, as can be seen in the inventory by the research firm Dialogic. The non-exhaustive list of ecosystems is included in the Dialogic report.[18] This list also illustrates the connections between ecosystems. For example, there are various ecosystems in agriculture and fisheries that contribute to the food transition. Moreover, the activities and actors within an ecosystem are constantly changing. The inventory of ecosystems in the Netherlands is therefore an incomplete snapshot.

There are differences in terms of the approach and demarcation of ecosystems. The Netherlands, for example, has thematic ecosystems with a number of strong regional focal points, such as automotive and photonics, but others with a more national profile such as construction innovation and smart energy systems. Ecosystems also increasingly organise themselves around a societal challenge (Box 2).

[15] Dialogic (2020). *Onderzoeks- en innovatie-ecosystemen in Nederland.*
[16] The Dialogic report sets out the challenges and possible solutions in further detail.
[17] Institutions for applied research (TO2 institutions) use the indicators in the Evaluation and Monitoring of Applied Research (EMTO) protocol among others. This protocol was developed by the Rathenau Instituut.
[18] This non-exhaustive list of research and innovation ecosystems in the Netherlands was promised in the General Consultation on Innovation of 5 February 2020.

Box 2: Chemicals, materials and circularity

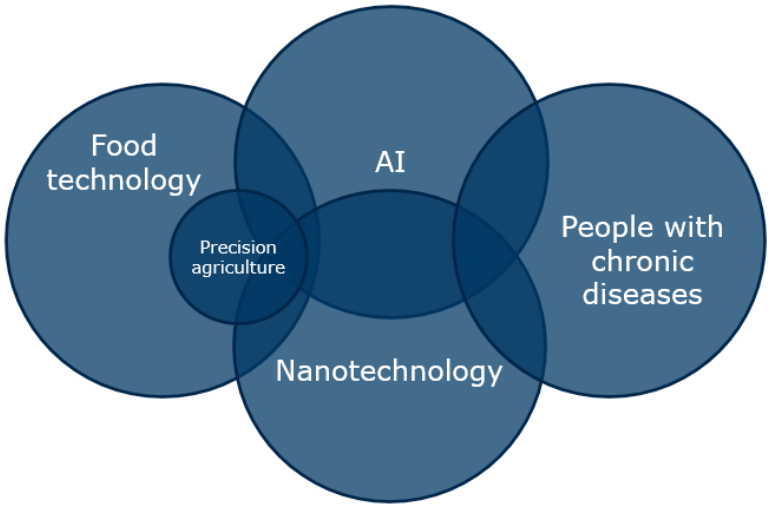
The Brightlands Chemelot Campus is a partner in the Chemelot Circular Hub. This comprises businesses, knowledge institutions and government bodies in and around the South Limburg region working on a cooperation agenda in which innovative chemistry contributes to circularity, economic development and sustainability. The work includes crossovers with the energy, agrifood and health sectors and the connection of disciplines. Attention is also devoted to the involvement of SMEs and citizens, to education and training and cooperation within the Euregio.

The Netherlands also has a number of regional ecosystems. Within these regions multiple regional focal points of thematic ecosystems come together, for example in Amsterdam, Eindhoven, Twente and Wageningen. An added value of these regional ecosystems is the ability to connect multiple disciplines, technologies and thematic ecosystems. Regional ecosystems are also increasingly interconnected, as can be seen in the cooperation between Leiden University, Delft University of Technology, Erasmus University Rotterdam and Erasmus Medical Centre focused on health and medical technology. The national research and innovation ecosystem consists of a combination of thematic and regional ecosystems, with cross-cutting aspects such as talent, financing and framework conditions such as laws and regulations.[19] The international embedding of an ecosystem is important for its (well) functioning; this embedding is a feature of almost all ecosystems in the Netherlands, whether they are thematic or regional, for example through multilateral or European public-private partnerships.

The Dutch research and innovation ecosystems also differ in terms of their historical origin and the phase in which they are operating. In the Eindhoven region, for example, a developed regional ecosystem sprang up from the strong role of Philips in the region and then evolved further. The ecosystem around quantum technology arose from a scientific breakthrough, is still relatively young and has now begun the transition to the innovation phase. In the ecosystem focused on people with chronic diseases, the societal challenge is increasingly emphasized and contributions come from multiple disciplines, technologies and sectors.

It can be concluded that research and innovation ecosystems in the Netherlands may have different approaches, overlap to some extent, have different phases and historical origins and are often part of larger international ecosystems. This is illustrated in Figure 3.

Figure 3: Overlapping and nested research and innovation ecosystems



Source: Dialogic (2020), Onderzoeks- en innovatie-ecosystemen in Nederland

[19] The activities of Techleap.nl, for example, promote the Dutch startup and scale-up ecosystem.

4. Challenges for research and innovation ecosystems

Although there is a wide variety of ecosystems, there are 10 challenges faced by a large number of ecosystems in the Netherlands. These have been identified on the basis of literature research and eight case studies and workshops by Dialogic and many discussions with experts and stakeholders. It is important to address the challenges that impede the functioning of ecosystems in order to achieve strong and resilient ecosystems.[20] The challenges are illustrated in text boxes based partly on the case studies by Dialogic.[21]

Box 3: Ten challenges for research and innovation ecosystems

1. Long-term view and coherence in investments in research and innovation
2. Investment in research and test facilities
3. Funding for startups and scale-ups: early-stage capital and growth capital
4. Involving users in research and innovation and market creation
5. Skills and absorption capacity in SMEs
6. Developing, attracting and retaining top-class talent
7. Strengthening knowledge transfer and the valorisation process for greater impact
8. Organisational capability of research and innovation ecosystems
9. Connections between ecosystems
10. Devoting attention to laws and regulations earlier in the process

Challenge 1: Long-term view and coherence in investments in research and innovation

The Netherlands has for many years failed to meet the target of investing 2.5% of GDP in research and innovation.[22] In the current investment landscape the lack of long-term financing and coherence between the different activities and cooperation between the actors is seen as an obstacle. Getting from research to market launch requires a long, iterative process and this process is disrupted if investments are not coherent and predictable. Private operators will more readily join research and innovation projects if the government is a long-term co-investor and there is coordination or overall direction. Addressing economic and particularly societal challenges also requires a long-term approach. Long-term investment in all activities in research and innovation ecosystems is therefore very important. After all, research and innovation are not a linear process in which activities such as basic research and the construction of test facilities 'are finished' and where it is possible to switch to applied research and support for startups. It is ideally an iterative process, with many feedback loops in the ecosystem. There must be sufficient scope for adjustment during the process. That therefore requires a combination of long-term financing and periodic reassessment.

Box 4: Coherent investments in the food and agriculture system

The OECD investigated the Dutch food and agriculture system in 2015. It praised the long tradition and investments in research and innovation, which generate revenues in the Netherlands and strong exports. The OECD recommended increasing the coherence of these investments, focusing more attention on climate and sustainability (more comprehensively) and on the basis of a vision drawn up by government bodies jointly with other actors. The recommendations were included among other things in the 2018 Vision for Agriculture, Nature and Food Quality.

Challenge 2: Investment in research and test facilities

The Netherlands has limited resources available for research facilities. These concern research infrastructure such as supercomputers, large-scale databases and observation and measuring instruments such as satellites and telescopes, as well as pilot and test facilities in laboratories or real-life environments, such as field labs and living labs. These facilities are not only required for research, innovation and the performance of public functions, for example in the field of security,

[20] Vogelaar et al. (2020). Economisch beleid regio: naar een missie-gestuurde ecosysteembenadering, ESB, 8 October 2020.
[21] The full text of the Dutch strategy for strengthening research and innovation ecosystems (in Dutch) also addresses current Dutch policies – and a selection of EU programmes – to address the 10 challenges.
[22] This can be explained in part by the sector structure in the Netherlands, see Parliamentary paper 33009, no. 63 dated 13 July 2018

accessibility, health and the living environment, but they are also places where people and organisations work together, can exchange knowledge and develop new ideas.[23] New facilities also attract talent and high-tech businesses, which are often essential during construction and use. Research facilities are also relevant to education (internships, practical assignments and stimulating interest in technology) and informing potential users, investors and legal experts.[24] Research facilities can help businesses to develop new products, because they come into contact with other potential future users and can thus co-create products for which there will be demand.

Box 5: Strong ecosystems and research infrastructure
Medicon Valley is a regional ecosystem built on the strong knowledge base in Life Sciences and Health in the border region of Sweden and Denmark. The close cooperation between high-calibre knowledge and research institutions, innovative SMEs and big pharmaceutical companies was crucial in the creation and growth of this ecosystem. The development of the ecosystem culminated in hosting and developing two large-scale pan-European research infrastructures (the Synchrotron MAX IV radiation facility and European Spallation Source), further reinforcing the ecosystem.

Challenge 3: Funding for startups and scale-ups: early-stage capital and growth capital
Innovative startups and scale-ups are essential in order to generate new knowledge and innovations within the ecosystem, as are connections between these businesses and other actors in the ecosystem. The funding of successful startups in the Netherlands nevertheless has to overcome two clear obstacles: the lack of early-stage capital and continued lack of growth capital for scale-ups.[25] Knowledge-intensive startups have difficulty raising early-stage capital on the right terms, with the result that promising innovations become trapped in the '*valley of death'.*[26] It is also difficult for Dutch scale-ups to attract sufficient growth capital because Dutch venture capital funds have insufficient 'big tickets' available.[27] This impedes the success of promising innovative businesses.[28] The attendant risk is that young businesses, and the talent working in them, may relocate abroad.

Box 6: Targeted support for startups: CERN Business Incubation Centre
The Netherlands invests in CERN, the European particle physics laboratory on the Swiss-French border. The research and development work required for the research facilities provides opportunities for Dutch researchers and businesses. The CERN Business Incubation Centre (BIC) in Amsterdam and the HighTechXL incubator in Eindhoven provide financial and practical support for researchers and businesses that have built up knowledge for CERN and want to exploit it more widely. Since this knowledge is often unique, there are opportunities for startups and expanding businesses.

Challenge 4: Involving users in research and innovation and market creation
A successful innovation depends crucially on having positive impacts on the user, whether that user is an entrepreneur, professional, consumer or private individual.[29] Without users there is no market. And without a market, innovations will not be widely used. Proper and above all timely involvement of users in ecosystems is therefore essential.

[23] In its report, BCI Global points to the importance of shared facilities and the associated cooperation. BCI Global (2018). *Meerwaarde van campussen in Nederland;* Brenner, T. and Mühlig, A. (2007). *Factors and Mechanisms Causing the Emergence of Local Industrial Clusters – A Meta-Study of 159 Cases*.
[24] Rathenau Instituut (2018). *De impact van grootschalige onderzoeksinfrastructuren: Een nieuwe meetmethode voor de opbrengst van internationale onderzoeksfaciliteiten*; OECD (2014). *The Impacts of Large Research Infrastructures on Economic Innovation and on Society: Case Studies at CERN*; OECD (2019). *Reference framework for assessing the scientific and socio-economic impact of research infrastructures*.
[25] Stangler, D. et al (2018). *From global expansion to global integration: How can the Netherlands become a top 5 ecosystem?*
[26] This refers to a situation in which a startup has insufficient resources available at the beginning of the innovation process because the product or service is still generating too little income.
[27] EIB Investment Report (2019/2020). *accelerating Europe's transformation*; WEF (2020). *Bridging the Gap in European Scale-up Funding.*
[28] WEF (2020). Bridging the Gap in European Scale-up Funding.
[29] Dialogic (2018). *Evaluatie van het valorisatieprogramma 2010-2018.*

Box 7: Offshore wind energy in Germany: government promotes market creation
Logically, Germany's offshore wind industry is concentrated mainly in northern Germany. Based on a long-term vision (the Energiewende), German government bodies promote offshore wind energy by investing in research and innovation (including knowledge institutions and test facilities) and introducing tariff regulation that persuades energy grid operators to purchase wind energy.

Challenge 5: Skills and absorption capacity in SMEs

A challenge for the wider SME sector is the application and upscaling of innovations. Here there are opportunities particularly in the improvement of online services and digital systems to support production processes.[30] People's skills are critically important in this regard. Businesses that have good operational management and keep the skills and knowledge of their entrepreneurs, managers and employees up to date, implement innovations faster and more successfully.[31] This requires a focus on lifelong learning.[32] It increasingly takes the form of modular education delivered by private and public providers. Nevertheless, there are parts of the Dutch workforce that lack a learning culture, while appropriate (formal) training opportunities are in short supply. The absorption capacity among SMEs is affected by education and training but also by cooperation and exchanges of knowledge between businesses and knowledge institutions. There is less cooperation between SMEs and knowledge institutions in the Netherlands than in other European countries.[33]

Box 8: SCALE.AI Canada: absorption capacity as part of a broad approach
The SCALE.AI Supercluster in Quebec and Montreal (Canada) promotes the development and use of Artificial Intelligence (AI). The first action line promotes the adoption and marketing of AI for production chains. The second offers employee training, in cooperation with accredited training and education providers. The third action line is focused on promoting AI startups and their growth.

Challenge 6: Developing, attracting and retaining top-class talent

Top-class talent contributes to many activities in the ecosystem, not only education, research and entrepreneurship, but also, for example, agenda-setting and leadership, inspiring and convincing investors, also when it concerns investments in young businesses. Finding top-class talent is challenging, partly because the competition to secure top-class talent is highly international. The presence of good research facilities and the freedom, relevance and impact of research, including blue sky research, acts as a magnet for scientific and other talent. The prospect of a permanent contract is also important for attracting and retaining talent. Universities face a challenge in this respect.[34] The presence of innovative businesses, as customers and innovation partners, and of finance providers and business support initiatives increases the attractiveness for innovative startups. Finally, top-class talent will also choose an attractive residential and living environment and a place where other talent can be found (top-class talent attracts top-class talent). With regard to the residential and living environment, scarcity of houses and apartments is a concern, particularly in urban areas.[35]

Box 9: The international competition for talent: quantum technology
A quantum technology ecosystem arose in the Netherlands partly as a result of scientific breakthroughs by Dutch researchers. The study by Dialogic states that one of the challenges facing this ecosystem, which has a particular role for the QuTech research institute, is the training, recruitment and retention of top-class talent. This challenge is increasing as the potential of quantum technology becomes clearer and other countries invest more in quantum technology. QuTech wants to attract top-class talent, among other things by investing in research facilities, cooperation with leading researchers in other countries and businesses that have a pioneering role in the use of quantum technology.

[30] OECD (2019). *Enhancing SME productivity - Policy highlights on the role of managerial skills, workforce skills and business linkages.*
[31] OECD (2020). *Laggard firms, technology diffusion and its structural and policy determinants.*
[32] WRR (2013). *Towards a learning economy*.
[33] Eurostat (2016). *Community Innovation Survey.*
[34] The Netherlands scores less well than other European countries on this point. Compared to those abroad, Dutch universities mainly have a lot of temporary contracts in the post-doctoral phase. Rathenau Instituut (2020). *Tijdelijke contracten bij universiteiten in perspectief.*
[35] European Commission (2018). *Attracting qualified R&D staff in the public and private sectors;* Rathenau Instituut (2015). *R&D goes global: policy implications for the Netherlands as a knowledge region in a global perspective*.

Challenge 7: Strengthening knowledge transfer and the valorisation process for greater impact
Using knowledge to achieve economic and social impact is a central challenge for ecosystems. In short, it is about generating a return from knowledge in the market and in society. Ecosystems are still having insufficient success in generating new startups or engaging small and medium-sized businesses and public organisations in order to transfer knowledge.[36] More must therefore be done to turn scientific knowledge into value by strengthening knowledge transfer and the valorisation process. This 'step' is not automatic and requires more support for innovative businesses and making public-private partnerships more accessible. Knowledge Transfer Offices (KTOs/TTOs), incubators and Centers for Entrepreneurship & Expertise, institutions for applied research (TO2 institutions) and regional partnerships such as Brainport Eindhoven play an important role in the valorisation process. These valorisation infrastructures support businesses and researchers by providing knowledge and expertise and connect them with mentors, partners, customers and finance providers. However, these valorisation infrastructures lack sufficient power to have substantial impact.[37]

Box 10: Nanotechnology: knowledge transfer and valorisation
The NanoNextNL valorisation programme illustrates how national, thematic initiatives for knowledge transfer and valorisation complement the support provided by individual knowledge institutions. This involves not only encouraging startups but also connecting new knowledge and existing businesses.

Challenge 8: Organisational capability of research and innovation ecosystems
The organisational capability of ecosystems in the Netherlands faces multiple challenges. It is difficult to secure long-term joint financing of partnerships. Another important issue is the organisation and financing of campuses as physical collaboration sites and meeting places, as highlighted by the recently published Toplocaties 2020 manifesto.[38] Bringing actors and ideas together in an ecosystem requires time and energy. In particular, partnerships involving a large number of actors with divergent interests cannot be created overnight. It takes time to build up trust, formulate a joint agenda, establish governance and agree financing (including contributions from individual organisations). It is therefore important to facilitate these efforts in the ecosystem. A key issue is the openness of ecosystems to new challengers and critical experts who call into question existing innovation processes (to break free from obsolete standards, technologies and business models) or are direct competitors of established actors.

Box 11: WaterCampus Leeuwarden
The WaterCampus provides a place where entrepreneurs, researchers, students and public or semi-public organisations such as waterworks and water boards can come together. In this way the WaterCampus helps maintain coherence and cooperation in the water technology ecosystem. The three managing partners of the WaterCampus are Wetsus, CEW and the Water Alliance. Wetsus is the European centre of excellence for sustainable water technology, with an emphasis on basic research. CEW is the knowledge and innovation centre for applied research and product development in the field of water technology. The emphasis in the Water Alliance is on businesses and cooperation within knowledge institutions and government bodies.

Challenge 9: Connections between ecosystems
It is important to promote connections between ecosystems, so that they can find and reinforce each other, thereby minimizing duplication in the development of knowledge. For example, an ecosystem may start off small and regional but gradually become relevant to other ecosystems and regions. Key enabling technologies such as IT, biotechnology, nanotechnology and artificial intelligence are increasingly relevant to other ecosystems due to their enabling nature. Hence there is not only a challenge but also an opportunity. In addition to regional and national cooperation,

[36] AWTI (2020). *Beter van start – De sleutel tot doorgroei van kennisintensieve start-ups*. See also recommendations in the Dialogic report (2018). *Evaluatie van het valorisatieprogramma 2010-2018* and the policy response to the evaluation: Parliamentary paper 32637, no. 339 dated 11 December 2018.
[37] Dialogic (2018). *Evaluatie van het valorisatieprogramma 2010-2018.*
[38] *Manifest Toplocaties 2020*.

the 'global pipelines' are important in ensuring renewal through connections with related ecosystems worldwide.[39] Geopolitical factors can play a role in such international cooperation in research, innovation and value chains, particularly when national security is at stake. The initiative in promoting connections between ecosystems lies primarily with the actors involved and the organisations themselves, but government (including national government) can play a facilitating role by providing financial and other support, bringing actors together and offering guidance.

Box 12: The Netherlands AI Coalition: hub-and-spoke model

Artificial intelligence (AI) is a key enabling technology that will be used in almost all private and public sectors. Coordination within the ecosystem is a challenge, for example when combining scientific disciplines such as IT and behavioural sciences. At least as challenging is the connection with ecosystems in which AI is used. The Dialogic study states that the ecosystem operates through the AI Coalition on the basis of a hub-and-spoke model. The hubs in the model have an organising role and focus attention on generic themes such as ethical frameworks for AI. The spokes are aimed at regional embedding and key themes such as AI and smart industry in the Eindhoven region.

Challenge 10: Devoting attention to laws and regulations earlier in the process

On the one hand, innovation can be boosted with challenging laws and regulations and tax incentives. On the other hand laws and regulations can erect barriers, for example to challengers, because they are often modelled on existing technologies and processes and do not keep pace with innovative developments. Questions on ethics and privacy, for example, are important. But the development of technologies liable to be affected by these fundamental objections must not be impeded unnecessarily.[40] Some ecosystems, such as water technology and medical technology, have to comply with stringent security regulations and the question can arise as to whether these rules are still necessary, in the current form. In the case of ecosystems where innovations occur rapidly, new laws and regulations may be necessary or laws and regulations from other markets may play an important role. Examples are precision agriculture with questions on data management and protection and regenerative medicine with questions on cell therapies. Another issue is that laws and regulations can be used and abused in order to deny or impede access to (national) markets.

Box 13: European laws and regulations: harmonization and application

Medical scientific research is one of the many areas where a lack of harmonization of European rules (and their application) can be an obstacle to researchers, businesses, finance providers and patients. An example is regenerative medicine, a category of treatments and medicines involving the use of stem cell and gene therapies among others. European frameworks provide scope for national interpretation and, particularly, application. The Netherlands is working to accelerate the licensing of medicines and treatments with genetically modified organisms.

5. Further action

The Netherlands has a wealth of research and innovation ecosystems, mainly thanks to the efforts of inspiring and connecting people. Where possible, government bodies play a stimulating or facilitating role. Thriving research and innovation ecosystems help in increasing the long-run economic growth and addressing societal challenges. The importance of healthy ecosystems and the 10 challenges within them are an important starting point for the strengthening of research and innovation ecosystems in the Netherlands. The Growth Fund can give a major boost to ecosystems. A range of existing instruments are also relevant, within the mission-driven top sectors and innovation policy, science policy, education policy, regional economic policy and the policy areas focused on well-being and societal challenges.

[39] Bathelt et al. (2004). *Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation.*

[40] The Rathenau Instituut describes, for example, how the government and its policy, laws and regulations are an essential component of the research and innovation process; the OECD describes the interaction between regulation and innovation, particularly in the digital era. For example, data policy and regulations must be designed with multiple sectors in mind. Rathenau Instituut (2016). *Met beleid vormgeven aan socio-technische innovatie;* OECD (2019). *Fostering Science and Innovation in the Digital Age.*

The conceptual framework and language in this strategy can be used not only by policymakers but also by people and organisations playing a leading role in research and innovation ecosystems. Many businesses and knowledge institutions have been thinking in terms of ecosystems, innovation systems or clusters for many years. The same is true of regional government bodies, public-private partnerships, regional development agencies and the Techleap.nl network. The actors involved are often best placed to identify the challenges in the ecosystem, optimize cooperation and increase the economic and social contribution. The strategy can also contribute to the dialogue with other ecosystems and with national government.

Finally, not only are ecosystems dynamic in themselves, but the thinking about ecosystems is also evolving. It is important for national government to maintain a dialogue with experts and key figures in the ecosystems, including businesses, knowledge institutions and regional government bodies. A learning community is being developed for this purpose. This is being done by bringing together various communities that already exist. These include, for example, communities from particular regions or communities that are focused on specific societal challenges, industries and research topics or on supporting startups. Ecosystem players can exchange experiences and best practices with regard to monitoring, governance, leadership and connecting different phases of the research and innovation process. Contact between the ecosystems can also lead to interesting cross-fertilization and innovative partnerships. The learning community will be connected to international communities.[41] The intention is to organise a conference (online if necessary) and/or a series of webinars in 2021 to strengthen the learning community of research and innovation ecosystems in the Netherlands.

[41] Various networks are available for this at the international level, such as the European Innovation Council (EIC) and the Knowledge and Innovation Communities of the European Institute for Innovation and Technology (EIT).