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Innovating and Achieving with Impact

RIS3 South Netherlands 2021-2027

Regional Innovation Strategy for Smart Specialisation for European Fund Programmes

Innovating and Achieving with Impact

RIS3 South Netherlands 2021-2027

Presented to:
Provinces of Limburg, Noord-Brabant and Zeeland
21 April 2020

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Summary of RIS3 South Netherlands 2021-2027

This document is the RIS3 South Netherlands 2021-2027: Innovating and Achieving with Impact. This **R**egional **I**nnovation **S**trategy for **S**mart **S**pecialisation[1] aims to direct the use of regionally available European public funds, linked to central government and provincial funds from the Netherlands. It is not a blueprint to use all public and private funds for R&D, but an innovation compass for parties in South Netherlands. In an interactive process with regional SMEs, knowledge institutions, authorities, and other stakeholders, the region has drawn up its strategy for innovation and smart specialisation.

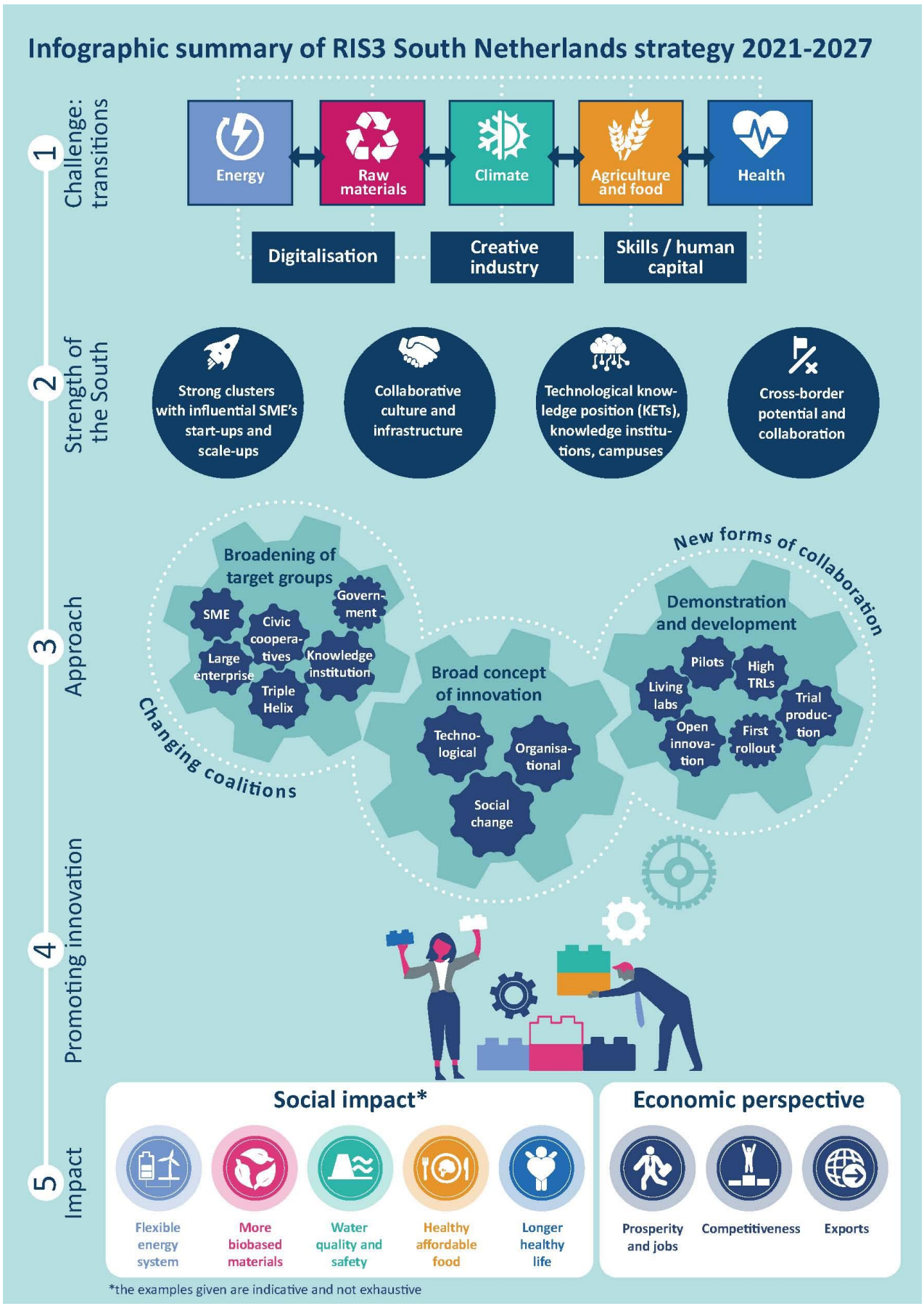
Strength of the South: strong innovation system thanks to robust SMEs, knowledge position, and a collaborative culture and infrastructure

The South's innovation policy aims to leverage and boost South Netherlands' economic and innovative strength. That strength lies in the unique combination of internationally leading knowledge parties and campuses that occupy a trendsetting position in technology, innovative SMEs, and a strong manufacturing industry able to bring innovations to market. But this extends beyond South Netherlands' strong knowledge position; the collaborative culture and infrastructure and application of knowledge – combined with creativity and design – means the region has a strong innovation system. Technology is essential and the challenge for the region is to use innovation to leverage the South's technological power sensibly, on the scale of humankind, animal, and nature.

South Netherlands has strong innovation ecosystems around its national and international top clusters (specified in the previous RIS3 as high-tech systems and materials, agrifood and chemistry, life science and health, biobased, logistics, and maintenance). International market leaders operate within this context with start-ups and scale-ups, campuses, triple-helix organisations, and regional development companies to form a strong innovation system. Parties in South Netherlands work with an open mind, proactively seeking connections with partners outside the region, both at home and abroad.

The European innovation stimulation funds are vital for this innovation system to function; for example, in the 2014-2020 EU Programming Period, projects in South Netherlands received over €1 billion in grants, almost half of which came from Horizon 2020. Added to public and private co-financing, this leads to a multibillion-euro incentive for innovation. It is impossible in this summary to do justice to all the leading innovation projects supported in the last EU Programming Period. That said, iconic projects from the last operational programme (OP) include Aqua Valley (innovations for stable, strong, and sustainable aquaculture in Zeeland); Photon Delta (boost for business activity and regional innovative strength in integrated photonics); Beam NL (bringing innovations in biomedical science to the market faster); Fieldlab Campione (making maintenance for chemical and process companies 100% reliable); and Biorizon (bioaromatics as a sustainable alternative to petrochemical aromatics). Over the past seven years, these and more than 110 other projects have contributed towards a stronger, more sustainable, and more innovative South Netherlands. Innovation funds have flowed into the whole region; in the wake of Brainport as an international standard-bearer, building a solid foundation has also been the focus in Limburg (Brightlands campuses/Kennis-As), Zeeland (through Campus Zeeland), and other regions of Brabant.

[1] The R in RIS3 originally stood for Research, but Regional and Research are used interchangeably within the European Commission (EC). In this document, we use it to mean 'regional'.


Infographic summary of RIS3 South Netherlands strategy 2021-2027
1 Challenge: transitions
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Climate
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Digitalisation
Creative industry
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2 Strength of the South
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*the examples given are indicative and not exhaustive

RIS3 mission: innovation with economic return and social impact on five transitions
With this RIS, South Netherlands is building on the successful approach of the past period and adding three new elements: a mission-driven approach, the ambition to achieve impact, and a broader concept of innovation.

The mission of the RIS3 is to stimulate innovation, based on South Netherlands' specific strength, which has an economic impact in the South and leads to social impact on a regional and international scale. Five major transitions, both global and specific to South Netherlands and in line with the themes of the Green Deal, are at the heart of this mission: the energy, raw materials, climate, agriculture and food, and health transitions. These are all global challenges that South Netherlands also faces, and where the region can achieve breakthroughs thanks to its powerful innovation system.

To us, innovation is more than just technological modernisation. Within the innovation chain, the RIS3 focuses mainly on developing services and products (created in collaboration with triple-helix partners, including SMEs). Products and services that providers can both implement in South Netherlands to benefit the five transitions and scale up for a national and international market. South Netherlands will make it more attractive for SMEs to participate in European programmes. In the new regional European programmes, the region aims to simplify and reduce the administrative burden, in line with new European proposals.

RIS3 vision: innovating with an open mind in the South and making a difference worldwide
Based on the distinctive strength of South Netherlands, the vision of the RIS is to respond to the international character of the transitions and capitalise on the related international market opportunities. South Netherlands does this by coming up with new solutions for the major challenges facing Europe and the world, and by demonstrating in the South that these new solutions work, for example in trial productions, pilots, first roll-outs, and living labs. We also look for ways to connect these South Netherlands solutions interregionally with complementary solutions in European value chains. This is how we ensure social impact and make progress within the transitions, both in South Netherlands and internationally.

Although technology and science remain essential for innovation, there will be no impact without collaboration. European regional programmes will thus provide scope for new forms of collaboration ('organisational innovation') and a broadening of target groups. Over the next decade, people, businesses, civic collectives, triple helices, development companies, municipalities, provinces, water boards, and all kinds of new forms of organisations will be tackling major challenges. South Netherlands thus gives a new impulse to the well-known motto 'think global, act local'.

To achieve successful transitions, the entire innovation chain is important: from basic research, through development, to market launch. During the coming EU Programming Period, South Netherlands will put its innovation strategy into practice in various ways and align with the mission-driven national policy and the government's growth letter (Letter to the Lower House of the Dutch Parliament on the long-term growth strategy for the Netherlands).

To make progress within the transitions, having sufficient personnel, with the right knowledge and skills, is indispensable. This means that education of knowledge and skills and innovation-related labour market aspects are relevant themes for programming regional EU funds. In regional and provincial education and labour market policy, attention to 'skills development' throughout the education chain (from senior secondary vocational to university level) and to 'lifelong learning' is also an essential framework condition for making progress in social transitions.

Ample opportunities for the South in the Green Deal and Digital Europe
With its new regional innovation strategy, South Netherlands aligns well with the main European policy goals for the coming decades. 'Green and Smart' are at the heart of the next EU Programming Period. As for 'green', the RIS3 dovetails with the European Green Deal: the European Commission's ambitious package of measures and financing plan for the sustainable green transition to a climate-neutral continent by 2050. The RIS3 aligns fully with those European ambitions; the transitions to a sustainable energy system, a circular economy, and a climate-adaptive region also occupy a central position here. In this way, South Netherlands is putting itself in a position to use European funds to give these transitions a boost.

Like Europe, the RIS3 also focuses on 'smart' and digital. South Netherlands points out in the RIS3 that digitalising the economy and society yields opportunities within all transitions, and works on leveraging these opportunities and bringing them to market. Thanks to its strong position in key enabling technologies and Artificial Intelligence (AI), and a culture of collaboration and joint innovation, the region has an excellent starting point at this level. In this way, the region is a good match for the European Commission's second major new funding programme: Digital Europe.

From strategy to implementation: OP, Interreg, EU thematic funds, and more
Regional authorities will use the RIS3 in the next EU Programming Period to steer regional innovation policy. First, obviously the RIS serves as a foundation for the regional European funds that South Netherlands itself helps design. These include the South's new Operational Programme (OP) for the European Regional Development Fund (ERDF), the CAP Innovation Programme (formerly RDP) as part of the National Strategic Plan (NSP) for Agriculture, and the Interreg A funds.

Second, based on the South's broad strength (technological and non-technological) and its commitment to social transitions, the RIS3 also offers a host of other opportunities in European and national innovation. The thematic European funds are always important and there are also ample opportunities here for South Netherlands in the new EU Programming Period. The further development of key enabling technologies and Artificial Intelligence, for example, is and will remain significant because of the region's longer-term earning capacity and is also in line with this RIS3. This is viewed as the domain of Horizon Europe and other thematic EU programmes. The aim of this RIS3 is to inspire parties in the South when determining their commitment to Horizon Europe, Digital Europe, LIFE+, InvestEU, the Interregional Innovation Investment Scheme, Single Market Programme, and more. Besides the thematic EU funds, South Netherlands also aligns well through this RIS3 with the mission-driven innovation policy (as set out in the Knowledge and Innovation Agendas or KIAs) and the government's growth letter. And lastly, when the RIS3 was produced, we also considered the connection with provincial and regional economic policy for structural strengthening and innovation in South Netherlands. The RIS3 also gives direction to this aspect.

1 Introduction and positioning of RIS3 2021-2027: focus on social transitions

1.1 *Reason and mission of RIS3*

Reason
The European Union is on the eve of a new seven-year policy period: 2021-2027. For the Netherlands, the EU's cohesion policy, innovation policy and the Common Agricultural Policy are important components of this policy period. In the last EU Programming Period, the RIS3 ('Research and Innovation Strategy for Smart Specialisation') from 2013 helped steer the innovation strategy of South Netherlands and the use of European funds. For the next EU Programming Period, South Netherlands has updated and renewed its RIS3 in an interactive process with regional companies, knowledge institutes, authorities, and other stakeholders. This document is the result of this process: the 'Regional Innovation Strategy for Smart Specialisation for South Netherlands 2021-2027: Innovating and Achieving with Impact'.

South Netherlands – the provinces of Limburg, Noord-Brabant, and Zeeland – is one of the most innovative and competitive regions in Europe. In this RIS, the South builds on its strengths, described in the previous RIS and since reinforced: top clusters with international companies, highly innovative SMEs, interesting start-ups and scale-ups, an open innovation system with influential campuses, good quality of life, strong working population, and a collaborative mentality. In doing so, South Netherlands also knows how to leverage the strength of its international environment in Germany and Belgium.

A national or regional research and innovation strategy such as the RIS3 is a European Commission requirement for the innovation line in regional European programmes, such as OPZuid. There is also an innovation component within the RDP and INTERREG (cross-border and transnational), for which the RIS is used as a framework. The RIS is an innovation strategy, later fleshed out in the programming of the specified programmes. It is also a source of inspiration for South Netherlands' joint efforts in thematic innovation funds, such as Horizon Europe and Digital Europe. In the new EU Programming Period, there may be a separate programme for interregional investments in innovation, for which the RIS will also be significant. The European Fund for Strategic Investment (EFSI) and Connecting Europe Facility (CEF) for infrastructure are also relevant for roll-out and upscaling.

Mission of RIS3 South Netherlands 2021-2027
The RIS aims to boost the five major social transitions occurring in the South and on a national and international scale. To this end, the RIS promotes innovation based on the South's specific economic, technological, and social strength, which has an economic impact and contributes towards accelerating transitions. For this purpose, innovation is interpreted as more than just technological modernisation. Within the innovation chain, the RIS mainly focuses on the development of services and products by SMEs (in cooperation with triple-helix partners). Products and services that providers can both implement in South Netherlands to benefit the five transitions and scale up for a national and international market.

Charcoal sketch: focus on five social transitions
In December 2018, the three provinces outlined the contours for this RIS in a charcoal sketch. A central element of this sketch is further development, from using top technology in and between top clusters (high-tech, chemistry, agrifood) to promoting innovation aimed at **five major transitions: energy, raw materials, climate, agriculture and food, and health**. The core idea is twofold: economic structural strengthening through open innovation and social impact on these five transitions. This further development is in line with changes in the national innovation policy, which has chosen a 'mission-driven

innovation policy'. The provinces are also striving for a balanced geographical distribution of the use of regional European funds.

Five global social transitions and specific challenges in South Netherlands

- **Energy transition**: It has been agreed worldwide to allow a rise in the percentage of renewable energy sources to reduce greenhouse gas emissions that cause climate change. The Paris Agreement aims to limit global warming to 1.5 degrees by finding alternatives to fossil fuels and significantly reducing greenhouse-gas emissions. In the Climate Agreement, the Netherlands has set the target of a 49% reduction in greenhouse gases by 2030 compared to 1990. The energy system set-up for electricity, heat, and storage will have to become increasingly interwoven to provide the necessary flexibility. This calls for a energy system set-up with smart control that is understandable both to professional and general-public users of energy. It will also have to be sufficiently affordable, reliable, and safe, both during the 30-year conversion period and after this transition.
- **Raw-materials transition**: the limited and uncertain availability of raw materials worldwide calls for a transition to a circular economy and more efficient use of materials. In line with the Sustainable Development Goals (SDGs), the government has drawn up the Raw Materials Agreement, the Netherlands Circular 2050 programme, and the KIA for the Circular Economy. The aim is to be completely circular by 2050, by switching to a biobased economy and reducing waste and residual flows. Specific challenges exist for South Netherlands in the manufacturing industry, chemistry, and agrifood.
- **Climate transition**: Greenhouse gas emissions are leading to climate change worldwide. Both mitigation and adaptation measures are needed to limit climate change and its consequences. Mitigation measures include switching to fossil-free energy sources and capturing CO_2. The world must also prepare for the consequences of climate change (adaptation). Flooding, droughts, heat stress, and soil issues, among others, are on the increase. The central government is responding to this with the National Adaptation Strategy (NAS) and the Delta Spatial Adaptation Plan. Water safety (flood protection) and soil quality (salinisation, impoverishment, erosion) are significant challenges in South Netherlands.
- **Agriculture and food transition**: a growing world population, climate change, and increasing environmental pressures make sustainable, nutritious, and healthy food production of paramount importance. The Netherlands is one of the world's leading agricultural exporters, and that creates a responsibility in relation to how we produce and the nutritional value of our products. The South has a broad knowledge base that can contribute towards this transition. The challenge lies in achieving sustainable agriculture in balance with the environment and preventing food and other waste throughout the chain.
- **Health transition:** good health and well-being is one of the 17 SDGs. The KIA for Health and Care has set the goal for the Dutch to live healthy lives for at least five years longer by 2040 and for the health differences between groups of people to decrease. A commitment to prediction, prevention, personalisation, and participation is necessary for this to happen. In South Netherlands, the increasing ageing of the population and the shortage of labour are making the transition to more efficient and personalised care a pressing one, particularly in the more rural regions.

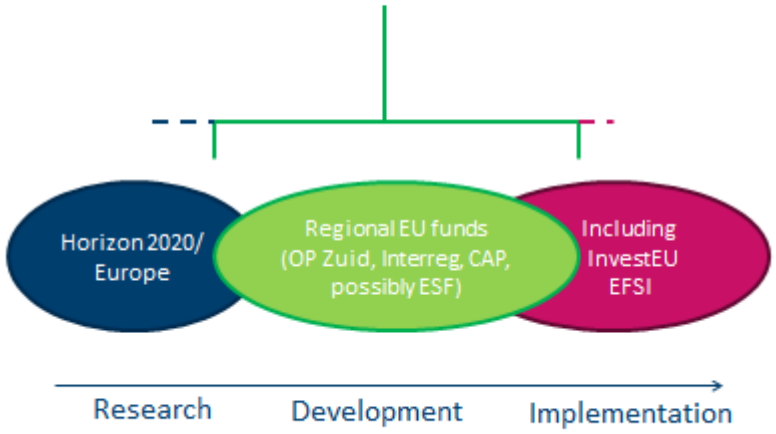
Societal changes and innovation accelerators

The five transitions cannot be considered in isolation from several major social trends and developments that influence and are influenced by the transitions. This spectrum is extensive, but in the context of the RIS, we pay specific attention to the **labour market** and **digitalisation**. Within the labour-market theme, it is essential that labour supply matches the demand-side requirements that are changing under the influence of both social transitions and demographic developments. Within digitalisation, we mainly look at the opportunities to accelerate the transitions and reap the benefits here as South Netherlands.

1.2 *Positioning of RIS3 in relation to innovation policy at national and EU level*

RIS3 looks at the entire innovation chain to promote societal transitions
To achieve successful transitions, the entire innovation chain is important: from research, through development, to market launch. For this innovation chain to function properly, it is vital that European and national resources are well-matched (with as little overlap as possible) and cover the entire chain (no gaps). Ideally, public and private efforts should also boost each other as much as possible. This is achieved in the Netherlands (and therefore also in South Netherlands) in various ways, including the public-private thematic Knowledge and Innovation Agendas (KIAs; also see below) and the Strategic Action Plan for Artificial Intelligence.

Both basic research focused on the key enabling technologies and development processes leading to the market launch of new products/services are essential for the societal transitions at the heart of this RIS3. The largest European funding stream for promoting innovation will soon be the Horizon Europe programme and, as a corollary of that, a programme such as Digital Europe and other thematic EU programmes. For the innovation system in South Netherlands and in view of the transitions, the continued successful use of this programme is of paramount importance. This RIS emphasises that point. Besides a vision of the innovation system, the RIS also serves as a foundation for the EU regional funds, including OPZuid, ESF+, INTERREG, CAP Innovation Programme (formerly RDP). In South Netherlands' vision, these funds will be used to complement those from Horizon Europe by focusing on the development part of the innovation chain. This is shown indicatively in the figure below. The overlapping ovals mean that there is no strict boundary: in Horizon Europe there is also scope for more applied research, and regional funds can also be used for research that is likely to have an impact within the transitions.



South Netherlands has a strong innovation system; RIS3 builds on this foundation

This RIS3 obviously does not start from scratch. In recent decades, strong innovation ecosystems have been developed in South Netherlands around the international top clusters (high-tech systems and materials, agrifood and chemistry) and the top clusters with international potential (life science & health, biobased, logistics, and maintenance). Campuses, triple-helix organisations, and regional development companies are part of South Netherlands' strong innovation system. In the wake of Brainport as an international standard-bearer, work on a solid foundation has also been carried out in Limburg (Kennis-As), Zeeland (through Campus Zeeland, the partnership of knowledge institutes, the business community and the government), and in the other regions of Brabant. The European innovation promotion funds are also vital for this innovation system to function; for example, in the 2014-2020 EU Programming Period, projects in South Netherlands received over €1 billion in grants, almost half of which came from Horizon 2020 (until spring 2019). Other significant contributions come from the CEF, ESF, EAFRD/RDP, and OPZuid (see Annex 1 for details). Including co-financing from the state, the region, and corporate contributions, this forms a substantial and indispensable part of the regional innovation efforts. And with good results.

RIS3 ties in with innovation policies and national and EU funds

The chosen focus in this RIS3 must promote critical mass and sufficient funding for private and public R&D in South Netherlands. The use of regional EU funds will thus be as complementary as possible to that of the provinces themselves, the national government, and the EU:

- The RIS3 and use of regional European funds is complementary to other European innovation funds. Horizon Europe, Europe's main framework programme for research and innovation, focuses on developing cutting-edge technology and research. Developing South Netherlands' strong position in key enabling technologies is in line with this RIS3 and will run through Horizon Europe, among other programmes. South Netherlands wants to use the regional European funds as a supplement for the next part of the innovation chain in particular: the demonstration and pre-market launch phase. Other European strategies/programmes have a specific thematic focus – e.g. Digital Europe – or require more pan-European cooperation, and are thus complementary to regional European programmes anyhow. In Part II, Chapter 2, we elaborate on the positioning of the RIS3 in relation to the European funds and on the opportunities for the South within the funds.
- South Netherlands wants to use regional European funds in addition to national policy aims and funds for promoting innovation. Central government works with a mission-driven top sector and innovation policy, which is fleshed out in Knowledge and Innovation Agendas (KIAs), among other things. The KIAs – four thematic, one cross-cutting on key enabling technologies, and one on social earning capacity – are shaped by public-private partnerships in which the business community, knowledge institutes, and regions participate in varying compositions alongside the central government.[2] In terms of themes, this RIS aligns with these KIAs: 'Energy Transition & Sustainability', 'Agriculture, Water, and Food', 'Health and care' and those on key enabling technologies. The same societal challenges take centre stage. The central government's efforts focus to a greater extent on the research part of the innovation chain. The funds used for innovation through the Netherlands Organisation for Scientific Research (NWO) and Applied Research Organisations (TO2) also contribute towards this. South Netherlands sees scope and necessity to use its strength – highly innovative SMEs in an open innovation system – and to focus its efforts on the development side of innovation. An actual impact on transitions is achieved through applications in pilots, trial production, first roll-outs, and living labs. The 'SME innovation stimulation for top sectors' (MIT) – a joint national and regional scheme with various instruments – is an easily accessible addition, specifically linked to the top sectors. At national level, the RIS3 aligns with regional economic policy for structural strengthening and innovation, and provides direction in this respect.
- And the RIS3 ties in with existing or planned provincial funds for other phases of the innovation cycle. In both province of Limburg and province of Noord-Brabant, for example, there are energy transition funds with risk capital for scaling up innovation. For energy, the focus is mainly on the large-scale roll-

[2] These parties recently committed to a new Knowledge and Innovation Agreement. The provinces of South Netherlands are also participants.

out of existing renewable energy technologies. And innovation involves a revolving commitment in the later stages of development. The use of the regional European programmes is complementary to this.

1.3 *Structure/reading guide*

The main text of this RIS, Part I, consists of two follow-up chapters. Chapter 2 discusses the strength of South Netherlands. An essential feature of an RIS is that it reflects that regional strength. Besides the South's generic strength, this RIS is also about its strengths in relation to the five transitions. The actual innovation strategy is detailed in Chapter 3. It describes the main features and transcends transition.

For this RIS, we have used the 'Entrepreneurial Discovery Process' (EDP) to collect a lot of information about directions in which South Netherlands can make a difference within the five transitions. The EDP took shape through interviews with business owners (including 'unusual suspects': emerging and innovative companies) and knowledge institutions, interactive sessions on the transitions, a broad briefing session, several consultations with a guidance group (consisting of triple-helix parties in South Netherlands) and administrative meetings. In the last two months of the process, we held an additional meeting with all South Netherlands triple-helix organisations (under ENZuid[1]) and the guidance group, and an administrative meeting with representatives of the B5 (five largest municipalities in Brabant) and the Brabant triple-helix organisations. We have incorporated the output of these conversations in this version of the RIS3. The strategy (section 3.7) explains how this process will be followed up during the implementation of the RIS3 ('continuous entrepreneurial discovery'). The process is described in more detail in Annex 4.

In the first chapter of Part II ('Deepening Strategy'), we describe the output from the 'transition sessions' for each social transition in more detail. A reader who is specifically interested in the 'agriculture and food transition', for example, is referred to Part II, section 1.4. Part II also includes an overview of EU funds and opportunities for South Netherlands. Lastly, there is a supplementary report, with:

- a further substantiation of the economic analysis and innovative strength of South Netherlands, including underlying data material (Annex 1)
- an analysis of the strength of the South within key enabling technologies (Annex 2)
- a SWOT analysis of the South (Annex 3)
- the process of producing the RIS and an overview of the parties involved (Annex 4)
- endnotes (Annex 5)

We describe promising perspectives and sample projects in various parts of the text. These are intended to clarify and enliven the sometimes abstract text. Of course, the examples are not exhaustive and parties cannot derive a preferential position from them.

2 The strength of the South

Introduction: the distinguishing strength of South Netherlands in innovation

In the previous RIS3 (2014-2020), we named three internationally distinctive top clusters in the South: High-Tech Systems and Materials (HTSM), Agrifood, and Chemistry, plus four clusters with international potential (logistics, biobased, life science, and maintenance). By strengthening these clusters, connecting them with other clusters in the South, and looking for crossovers, the region has successfully invested in its economic structure and competitiveness over the past EU Programming Period.

Seven years later, the international clusters of South Netherlands are still very influential and characteristic of the region. In this new RIS3 (2021-2027), we thus still assume the strength of these clusters. What is more, the region has everything it needs to make the most of this strength and find economically viable solutions to major social challenges. The South stands out because of its ability to innovate, thanks to a unique combination of:

- the presence of internationally leading top companies, knowledge institutes, and campuses that occupy a trendsetting position in key enabling technologies
- innovative SMEs and a strong manufacturing industry, capable of applying innovations in South Netherlands and worldwide
- the culture of collaboration and the tradition of applying knowledge. Lines are moreover short and there is a mentality of 'pulling together'
- a matching infrastructure that stimulates cooperation, thanks to specialised campuses and triple-helix organisations
- creativity, digitalisation, and design as enabling drivers of innovation
- the excellent international competitive position and the strategic geographical location in the heart of Western Europe, with the Randstad, Flemish Diamond, and Ruhr Valley as immediate neighbours.

Strength of the South covers the entire innovation chain

The 'strength of the South' is also characterised by the fact that the South Netherlands innovation system, built up of various innovation ecosystems, covers the entire **innovation chain**. Not only research, but also the ability to transform this into products and services, is an essential feature of the strength of the South. Parties in the Entrepreneurial Discovery Process have also noted that a higher return is feasible in this development. In the current EU Programming Period, we have gained significant experience in using this strength by seeking **connections** between and across top clusters (crossovers). **Collaboration**, in the form of regional consortia supplemented with knowledge and capacity elsewhere (inside and outside the Netherlands) is indispensable, and we have successfully sought and found this in the South at various scale levels. The search for connection and cooperation in this RIS is not limited to technological innovation or to the top clusters.

2.1 *Economic context and innovative strength in South Netherlands*

The economic strength of South Netherlands and the region's distinguishing capacity to innovate are evident from these findings:

Growing and internationally competitive economy of South Netherlands

The South Netherlands economy is developing favourably in terms of employment and added value (GRP), although growth rates vary within the region. This favourable development can also be seen in the top clusters; the number of jobs in Agrifood, HTSM, Logistics, and since 2017, also Life Science and Chemistry is growing. Labour market shortages pose a risk to the future development of the economy. The South is also competitive internationally, as the scores on the Regional Innovation Scoreboard and the Regional Competitiveness Index show.

Influential international clusters in South Netherlands

A major part of South Netherlands' economic strength consists of three internationally distinctive clusters: HTSM, Agrifood, and Chemistry. The region also has four national clusters with an international perspective: logistics, biobased, life science, and maintenance. These seven clusters formed the basis of South Netherlands' last RIS3. These clusters are still characteristic of the strength of the South. They are well-represented throughout the region and have international leaders in large enterprises, SMEs, and promising start-ups and scale-ups. Above all, thanks to their scale and knowledge position, the clusters have the potential to take substantial steps in the five social transitions facing South Netherlands.
Before explaining the strength of each cluster, let us first make a general observation: the RIS3 is not based on a sectoral innovation policy, but rather focuses on collaborating in broad coalitions around major social transitions, regardless of sectoral classification. Even so, the major economic players of South Netherlands are now mostly organised along sectoral lines. The seven clusters are thus a major part of the South's strength and a starting point for promoting innovation.

First, let's look at the three international clusters:

- **HTSM**: the High-Tech Systems & Materials (HTSM) cluster is spread throughout South Netherlands, with major players in the Eindhoven region and North and Central Limburg. These include well-known names such as Philips, ASML, and VDL, but also the ecosystem of small and medium-sized enterprises around them. The HTSM cluster performs well economically, with growth in the number of jobs in South Netherlands in recent years. Innovations in this cluster can have an impact on raw-material transition, for instance by increasing resource efficiency and reducing waste, and energy transition through more efficient production processes.
- **Agrifood**: the Agrifood cluster covers the entire agricultural and food chain, from primary production to end retail and consumption, and all links in between. The number of Agrifood jobs is also growing in South Netherlands. The region has trendsetting industrial activity and expertise in all links of the chain (genetics, primary production, processing, distribution, food service, and retail). This also distinguishes South Netherlands from other parts of the country. Through collaboration with other sectors (chemicals, HTSM, logistics, and the creative industry) and technological and organisational innovation, the cluster can achieve breakthroughs with an impact on the agriculture and food transition, but also contribute to other transitions, for example by increasing resource efficiency and climate adaptation in rural areas.
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Eco-Tech AgriFood:
South Netherlands is building the food systems of the future
South Netherlands produces food for the Netherlands and neighbouring countries, and exports knowledge and expertise worldwide, usually in the form of high-quality technological production systems.
As a result, the South is well-placed to create demand-driven smart and transparent chains that focus on added value, use the existing improvement potential with the use of ICT, and achieve sustainable solutions for welfare, climate neutrality, and food quality and safety.
Connecting the three international clusters even closer with each other, around the ambition to achieve the smartest agrifood chains from farm to fork, will create a world-class agrifood

- **Chemistry**: the chemistry cluster in South Netherlands is strong thanks to the presence of three of the six major national chemical clusters: the Ghent-Terneuzen Canal Zone, Moerdijk, and Chemelot. After a previous contraction in this cluster, employment has gradually increased in recent years. Collaboration between these chemical clusters, including in a cross-border context, offers opportunities for breakthroughs in the biobased industry and raw-material transition. Examples of cross-border collaborations include AMIBM (Aachen Maastricht Institute for Biobased Materials), Smart Delta Resources, and the Biorizon Shared Research Center (Dutch-Flemish collaboration

between the Netherlands Organisation for Applied Scientific Research (TNO)/ Flemish Institute for Technological Research (VITO) aimed at developing bioaromatics for chemical applications), but also infrastructural connections such as to the Flemish chemical hubs (Port of Antwerp and along the Albert Canal) and the Ruhr Valley.

Now, let's look at South Netherlands' four national clusters with international potential:

- **Logistics**: thanks to its geographical location between Rotterdam, the Randstad, the ports of Moerdijk, the Flemish Diamond, and the Ruhr Valley, logistics is a strong cluster in South Netherlands. Logistics are strongly interwoven with the manufacturing industry and HTSM, maintenance, and agrifood. For the energy transition, it is important to focus on sustainable energy carriers and urban logistics.
- **Biobased**: the biobased cluster in South Netherlands is strongly represented, with Biobased Delta, BioTreatCenter, and the shared research centre Biorizon, among others, as major parties. Biobased has a strong link with raw-material transition. This cluster is expanding and becoming increasingly intertwined with other clusters. For example, agrifood plays an important role in developing biobased materials with a link to chemistry, for example in developing bioaromatics for chemical applications.
- **Life science**: the life science cluster is strongly linked to the health transition (also see section 1.5, Part II). South Netherlands has several highly innovative parties at this level. The life-science cluster is closely intertwined with agrifood (healthy food) and HTSM (IT, robotics, nanotechnology, etc.).

Personalised medicine: working towards minimum side effects, minimum costs, as close as possible to home

Personalised medicine, a significant development in the life science and health sector, focuses on a treatment that fits in with the disease process of individual patients.
By identifying environmental factors, lifestyle, genetic information, and disease progression, the effect of a medicine on an individual patient can be better predicted. This ensures minimum side effects, at minimum cost, as close as possible to home. Advancing personalised medicine requires multidisciplinary collaboration – between the country's university medical centres (UMCs), between parties in the biomedical world, and also in cooperation with IT and data parties.
South Netherlands has a strong life-science cluster and can play an important role in developing personalised medicine.

- **Maintenance**: the region occupies a strong position in maintenance with the Dutch Institute World Class Maintenance (DI-WCM) and Gate2, among others. The maintenance cluster is related to the HTSM cluster, the chemical cluster, and the agrifood industry, and plays a significant role in energy transition, for example in installation technology, efficient processes, and maintenance and control of the energy system.

Green hydrogen in the delta
The delta area in South Netherlands is home to an influential cross-border industrial cluster of chemical, steel, energy, and food companies.
The companies in this cluster are committed to contributing towards the climate goals of 2030 and 2050. The use of green hydrogen plays an important role in this.
The delta area has the necessary ingredients for the large-scale use of green hydrogen.
Large enterprises, SMEs, start-ups, scale-ups, authorities, and knowledge institutes are working jointly on scaling up the application of green hydrogen.
Excellent and flexible integration opportunities exist at companies, the electricity from large offshore wind farms comes ashore, and there is a powerful collaboration platform with Smart Delta Resources. By capitalising on a combination of transitions (climate, raw materials, and energy), the delta area will be able to sustainably achieve its social and economic value.

The South has a strong knowledge base and innovative SMEs
The South has a strong knowledge base and internationally leading knowledge institutions. The region has a diverse range of academic universities and universities of applied sciences (Figure 2.2) and private R&D investment is above average. South Netherlands also has innovative SMEs. The number of companies with successful technological innovation projects is above the national and European average[2], as is the number of patent applications. The region is home to innovative growers ('unusual suspects') such as Lightyear, Blue Rock Logistics, Additive Industries, Ecovat, Vanrijssingen, Hemcell, and many others. And large enterprises are also trendsetters, with leaders such as ASML, Philips, VDL-Nedcar, DSM, Dow Benelux and Yara, to name but a few.

Strong collaborative culture and infrastructure in South Netherlands; the challenge is to achieve greater social return
To find solutions to social challenges, it is necessary to work together. Innovation processes are thus increasingly implemented in collaboration with specialised SMEs, innovative start-ups, and knowledge institutions. South Netherlands is known for its collaborative culture and tradition of putting knowledge into practice. The region has a fully-fledged innovation infrastructure that promotes collaboration and innovation. Triple-helix network organisations and development companies operate in the region, including AgriFood Capital, Brainport Eindhoven, Greenport Venlo, Economic Board Zeeland, LIOF, BOM, REWIN, and Impuls Zeeland. The South also has influential campuses where knowledge institutions and companies come together and work on innovation. Examples include Brightlands campuses (Kennis-As), the High-Tech Campus Eindhoven, Pivot Park (pharmaceutical sector), Green Chemistry Campus (biobased), the Automotive Campus, and Campus Zeeland (see Figure 2.2). The campuses, triple-helix organisations, and development companies are a close community of scientists, students, process technicians, and engineers, among others, who come together and work easily and quickly. In this way, strengths are combined and added value is created through open and shared research.

Briefly put, with the presence of efficient triple-helix organisations, campuses, and development companies throughout South Netherlands, the region has a strong framework for promoting innovation. Less so than in many other European regions, there is an urgent need to expand or strengthen the innovation system. The challenge for the coming years lies mainly in increasing the returns on promoting innovation. South Netherlands scores well on the traditional 'innovation indicators' (patents and R&D investments), but the challenge lies in commercialisation: getting innovations to market. This is a national challenge; based on this observation, national innovation policy also focuses more than before on commercialisation and market creation and endorses the important role of start-ups and scale-ups in this regard[3]. It follows from the Entrepreneurial Discovery Process and the data analysis[4] that this is also important in South Netherlands. SMEs – and the start-ups and scale-ups within them – play a crucial role in this regard. Chapter 3 explains how RIS3 contributes to this.

Internationalisation and cross-border collaboration as an important element in the South's innovation system

Given its strategic location between the Randstad, the Flemish Diamond, and the Ruhr Valley, international and cross-border collaboration is an unmistakable part of the South's DNA. Collaboration occurs at three levels: interregional within the Netherlands, cross-border, and international in a European perspective and beyond. Collaborating and innovating 'with an open mind', with other parties in the Netherlands and abroad, is an important way of bringing innovations to market. This is a two-way street: knowledge and skills from 'outside the South' can be a valuable addition to the innovation chain, and innovations created in the South can be applied elsewhere in the Netherlands and the EU. In this way, the regional innovation system as a whole is also strengthened further. The strategy fleshes out this point.

Within the Netherlands, parties in the South already frequently cooperate with the West (Port of Rotterdam, TU Delft, Leiden University, VU, UvA, universities of applied sciences, and companies) and the East (WUR, Radboud, University of Twente, universities of applied sciences, and companies). Within all transitions, cooperation with the other regions of the country is crucial to achieve breakthroughs.

South Netherlands has a strong record of cross-border collaboration with Germany and Flanders. The collaboration in the Kennis-As, for example, leads to many collaborative projects with foreign partners, such as AMIBM with RWTH Aachen and UMC Maastricht with medical centres in Liège, Aachen, and Luxembourg. Biorizon, where TNO, VITO, and Biobased Delta work jointly to accelerate the biobased economy, is also an example of cross-border cooperation. As is the RegMed XB project, in which other Dutch and Flemish parties participate alongside TU Eindhoven, UM, and KU Leuven. In Zeeland, there is structural cooperation with Flanders on delta issues with Ghent University, and in the water area with VLAKWA. The Brabant knowledge institutions actively participate in cross-border collaboration and in more pan-European or global projects. Companies also frequently work together across borders.

And intensive collaboration also occurs in an interregional context, with South Netherlands contributing towards the creation of innovative interregional value chains. The Vanguard Initiative, a partnership of 35 European regions aimed at a 'smart' strengthening of European manufacturing and industrial innovation (Smart Industries) deserves a special mention here. In the South, Vanguard focuses on HTSM, Biobased, and Maintenance[5]

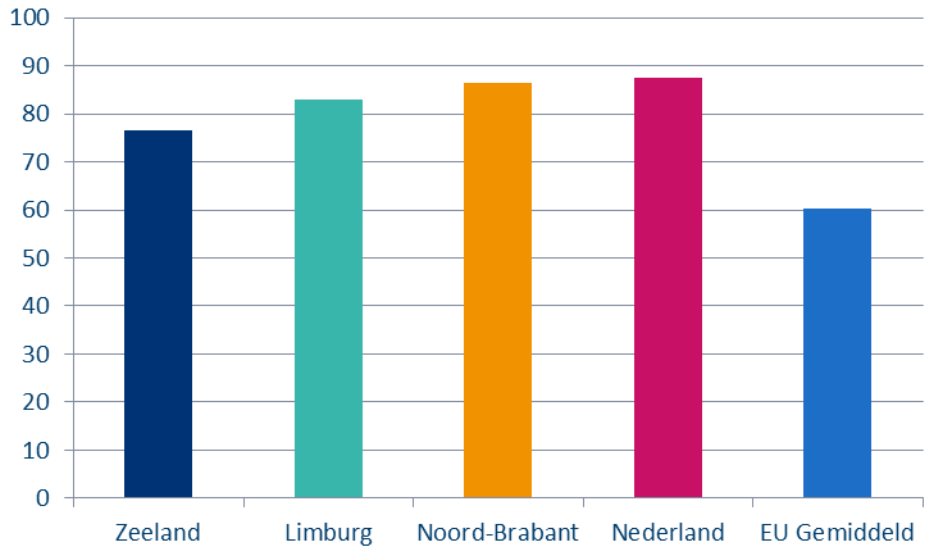
Symbiosis 4 Growth

Symbiosis4Growth is a collaborative platform that aims to accelerate and achieve industrial symbiosis at companies in West-Brabant and Zeeland. The goal is to link companies so they can exchange residual and other materials, energy, knowledge, capacity, facilities, and innovation with each other. The yield: cost savings for companies, a positive environmental contribution through CO2 reduction, and new innovative opportunities in the region. This contributes towards the economic strengthening of West and Central Brabant and Zeeland.

Parties in South Netherlands already work frequently with other European partners on innovative projects. An analysis of EU grants[6] shows that parties in South Netherlands are able to find their way to European funding. Of the top sectors, HTSM and Life Sciences & Health, in particular, know how to find their way to EU funds (jointly accounting for more than 50% of EU funds in the South).

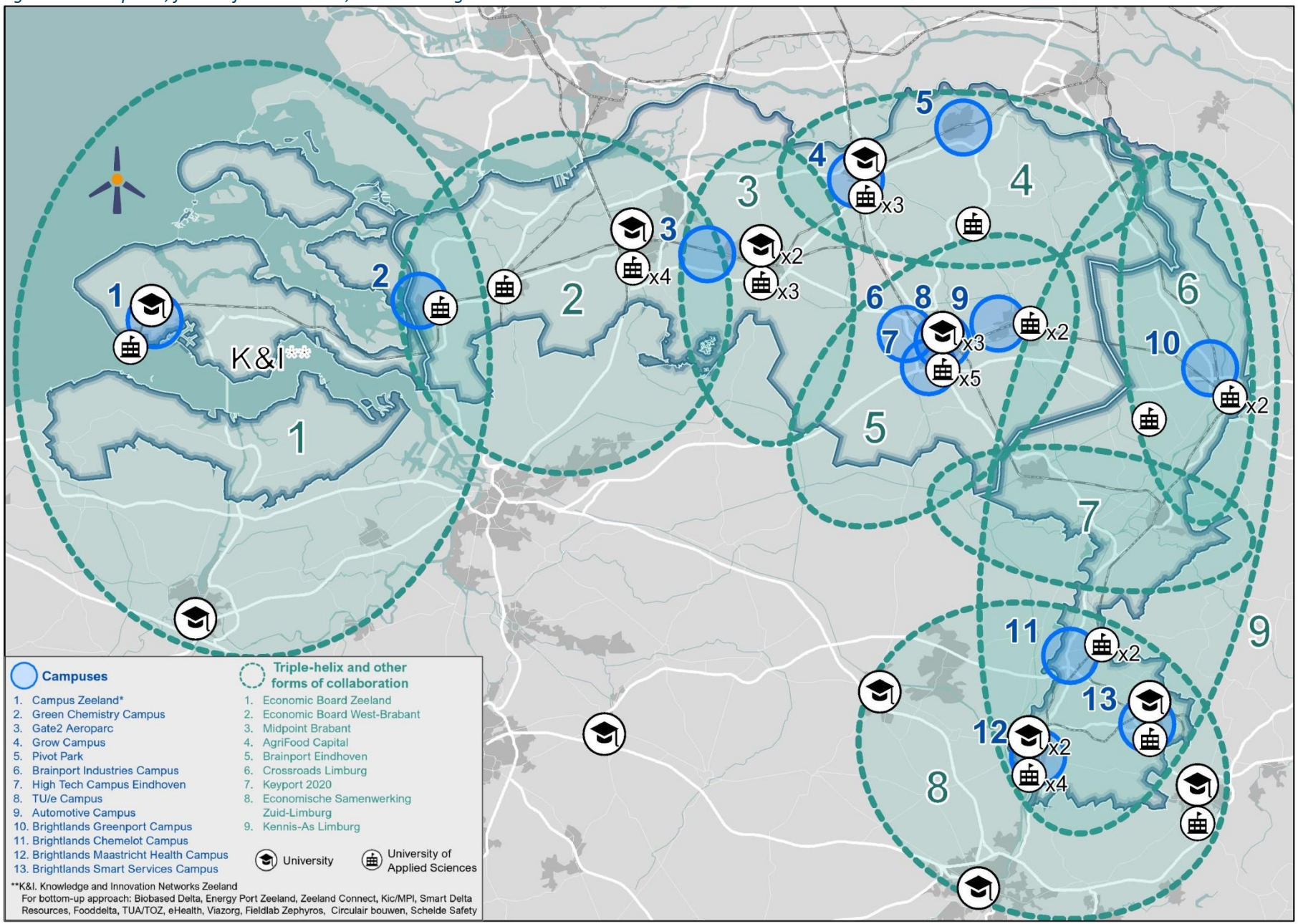
Annex 1 contains an in-depth analysis of South Netherlands' economy with further quantitative substantiation. Figure 2.1 shows South Netherlands' score on the Regional Competitiveness Index 2019 from a national and international perspective. Figure 2.2 also shows some important cross-border innovation partnerships.

Figure 2.1: Score of the South Netherlands provinces on the Regional Competitiveness Index (2019)



Source: Regional *Competitiveness Index, 2019 (converted to index 0-100)*

Figure 2.2: Campuses, forms of collaboration, and knowledge and educational institutions in South Netherlands



Source: BCI, 2018, websites of triple-helix organisations and websites of educational institutions

*Campus Zeeland does not have a physical hub, but is a collaboration between companies, authorities, and knowledge and research institutions throughout the province of Zeeland

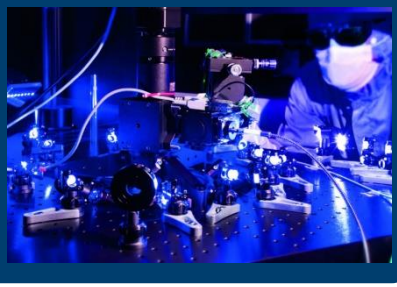
2.2 *Technological strength in the South and the importance of key enabling technologies*

Key technologies, such as photonics, nanotechnology, and digital technologies, 'are crucial for earning capacity and solving societal challenges'[7] and therefore occupy an important position in European and national innovation policies. For example, besides the thematic KIAs, the national government has drawn up horizontal 'KIA key enabling technologies' from the top sectors, with long-term programmes that will steer research and innovation in the coming years.[8] The Strategic Action Plan for Artificial Intelligence (2019) is also relevant here.

South Netherlands has a strong technological knowledge base and is an international leader in several key enabling technologies and their subareas. Annex 2 contains a comprehensive analysis of the knowledge position and of relevant players and collaborations in the South within each of the key enabling technologies[9] Although the summary below does not do justice to the rich palette, we can sum up by saying the region is strong in areas that include:

- **Digital technologies**. The South has a strong ICT and control expertise ecosystem to ensure that equipment processes run smoothly at a top level. This is reflected in the Smart Industry field labs in the South (including MultiMaterial 3D Printing, Advanced Manufacturing Logistics, Fieldlab Robotics) and the presence of knowledge institutes such as JADS. The South also occupies a leading position in Artificial Intelligence (AI), as can be seen with the EAISI, the AI institute at TU Eindhoven.
- **Photonics:** The South has developed a strong ecosystem in this area for 10-15 years, with initiatives such as PhotonDelta and Solliance. Photonics is very promising for energy saving in data centres/hardware.
- **Advanced materials:** (including thin film, organic). In the South, the Brightlands Materials Center (Chemelot Campus, Geleen)[10] plays a vital role in developing advanced materials.
- **Life Science & Biotech:** The South is influential in life sciences, with the Brightlands Maastricht Health Campus (BL-MHC) focusing on innovation in Healthcare & Life Sciences and the Expertise Centre for Care and Technology (EIZT)[11], in which the Zuyd University of Applied Sciences and local SMEs work on applying Life Sciences in innovative care. The life sciences & health cluster in Brabant with Pivot Park, TU Eindhoven, Care Innovation Center West-Brabant, and Smarter Living also focuses on developing and implementing new healthcare solutions.
- **Chemical technology**: The South has a strong chemical sector, concentrated around Chemelot, DOW Terneuzen, and the port of Moerdijk. Substantial investments are being made here in research and development; initiatives include the Brightlands Chemelot campus (Geleen), the Biobased Delta cluster, and the Green Chemistry Campus.
- **Nanotechnology**: This is an essential technology both for major industrial players such as ASML and NXP and for the ecosystems of SMEs that have formed around them. Knowledge development in the South occurs in the Holst Centre and TU Eindhoven, among other places.

Sample project:
Prevention and early diagnosis through sensor technology
Earlier detection of diseases is possible through smart and affordable sensor technology, using integrated photonics.
In this way, health problems can be discovered at an early stage.



Although the South's knowledge position in key enabling technologies is noteworthy, this in itself is not unique. Thanks to the combination of strong and innovative SMEs and a collaborative culture and infrastructure, South Netherlands' distinguishing strength lies in its ability to apply key enabling technologies and achieve economically viable innovations.

The application possibilities of these technologies are almost infinite. There are many opportunities to achieve breakthroughs within each of the five social transitions. Figure 2.3 shows an illustrative matrix with possible opportunities for South Netherlands to apply key enabling technologies in each transition. Combinations of technologies are often needed to arrive at innovative solutions. Within South Netherlands, there are good prospects in electric mobility, for example, using combinations of digital technologies/AI, advanced materials, and chemical technology.

Figure 2.3: Indicative matrix with possible opportunities for South Netherlands to apply key enabling technologies in each transition

	Energy	Climate	Raw materials	Agriculture	Health
Digital Technology /ADMA[12]	Self-managing and self-learning management systems (Artificial Intelligence & Robotics) Digital security				
	Smart grids Electrolysers for Power2Molecule Electric mobility	Climate control Water and soil management	3D printing / additive production Advanced maintenance	Precision agriculture	Personalised / precision medicine Medtech / imaging Robotisation Remote surgery
Photonics	Energy storage Solar cells Energy saving hardware/data centres				
Advanced Materials	Renewable energy (e.g. coatings/composite wind turbines)	Climate-resistant materials	Circular economy / materials	Ingredients	Micro-reactors Lab-on-a-chip Nanomedicine
Chemical Technology	Carbon Capture Electrification, Power2Molecule		Bio-economy / agriculture Recycling / circular agriculture		
Nanotech and Electronics	Energy storage (efficient solar cells, batteries, accumulators)		Treatment of ground / wastewater / residual flows	Seed breeding	
Life Sciences / Biotech	Biosensors / chips to identify toxic substances Bio-materials and bioplastics			GMO superfoods / lab foods	

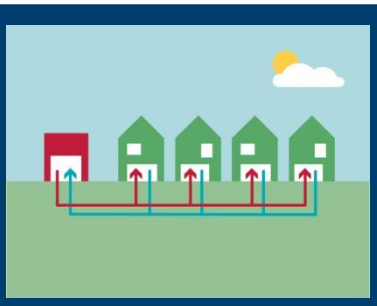
2.3 *Strength of the South: potential contribution towards the five social transitions*

The analysis shows that South Netherlands has the capacity to innovate, thanks to its strong technological knowledge position, innovative SMEs, strong partnerships and campuses, and a collaborative culture. This is important, because innovation is at the heart of the region's future earning capacity. The specific characteristics of South Netherlands also lead to specific opportunities within each of the social transitions.

Energy transition

The South has unique competencies to achieve and accelerate the energy transition in its own region and beyond. First, its strong position in intelligent measurement and control systems (sensor technologies, artificial intelligence, smart grids, and so on) catches the eye. This is essential for a reliable and safe energy system. But equally important is the region's ability to increase support for renewable energy and to match supply and demand of energy locally. The South leads the way in area-based cooperative partnerships between businesses and/or the general public. The learning experiences from this can form the basis of an export model.

Sample project:
Living lab for next-generation heating networks
Properly matching energy supply and demand is essential for the energy transition. Innovation in smart grid management to better match heat harvesting and heat/cold demand can thus significantly contribute towards the energy transition. The technology is applied in the existing living environment through a living lab.



Converting and storing energy is also crucial for the energy transition. The Energy Storage Alliance (ESA) uses three different routes: (1) storage in molecules, (2) metal fuels and forms of hydrocarbons, and (3) heat storage in different materials. South Netherlands has the necessary expertise in this field. In province of Limburg, for example, considerable expertise has been built up, originally from the European supported mine water project, in harvesting and using residual heat for heating and cooling. Process management and the intelligent matching of supply and demand play a crucial role in this regard. Parties on the Brightlands Chemelot campus are also working on new energy conversion and storing systems. South Netherlands' strong position in battery technology also offers opportunities. DIFFER – the Dutch Institute for Fundamental Energy Research – is one of the main knowledge carriers in the South in the field of energy.

Alongside conversion and storage, the capacity to produce sustainable energy is also necessary for the energy transition. The South has specific strengths and proven experience in this area. The province of Zeeland, for example, will play an important role in offshore wind, offering opportunities to produce green hydrogen (produced from renewable energy) and boosting innovation in production and maintenance. And research and demonstration of tidal energy occurs in the Tidal Technology Center Grevelingendam (TTC-GD). An interesting crossover to the agricultural transition lies in desalinating water based on energy surpluses in sunny weather and strong winds. Solliance (a partnership of TNO, ECN, and Belgian Imec) works with academic and industrial partners on thin-film solar cells. Lastly, there are also opportunities to make South Netherlands' strong automotive industry more sustainable.

Raw-materials transition
South Netherlands occupies a strong position in chemistry and materials technology and has a robust agricultural sector. Biobased materials are therefore logically an important focal point in the intended raw-material transition. Companies and knowledge are clustered on and around the Brightlands Campuses Chemelot and Greenport Venlo, and the Smart Delta Resources in Zeeland. And groundbreaking innovations are occurring on the Green Chemistry Campus (Bergen op Zoom), ranging from extracting bioaromatics from vegetable waste to producing sweet wrappers from potato residues. South Netherlands also has enormous innovative potential for the transition to a smart industry with minimal use of raw materials and maximum product lifespan. The region owes this to its knowledge and expertise in digital, chemical, manufacturing technologies, and advanced materials. Within the international top clusters (Agriculture & Food, Chemistry, HTSM) and the manufacturing industry, among others, there is a constant search for applications of this knowledge. Examples include carbon capture and utilisation (capture and industrial application of CO_2) by chemical technology, and extraction of waste streams from wastewater. The South also occupies a strong position in the recycling and upcycling of plastics and applications for bioplastics. Lastly, there are several initiatives in South Netherlands in circular construction and design. Through circular redesign, the South can make a significant contribution towards the ambition to make the Netherlands 100% circular by 2050.

Sample project: Re-design and Re-use
Much electronic equipment contains scarce or toxic raw materials, which preferably should not end up on the waste heap. New product designs that facilitate the repair, replacement, and reuse of components, reduce e-waste and increase the circular share in the economy.

Climate transition
Climate transition has been formulated as one of the policy spearheads in the charcoal sketch. Under this flag, RIS3 focuses on innovation aimed at climate adaptation. In the RIS3, the mitigation component of climate change will be given a place in the energy and raw-materials transition. As for climate adaptation, South Netherlands can make a difference, partly because of its strong position in digital technologies such as measurement and control technology and sensor technologies. These contribute towards smart management of water and soil quality, water shortages, flooding, heat stress, and more. The province of Zeeland, for example, is influential in water and delta technology with knowledge centres such as NIOZ and Zeeland University of Applied Sciences. And there is a concentration of knowledge in Province of Noord-Brabant and other areas about advanced (e.g. thin film) and climate-resilient materials (e.g. biobased water permeable pavements).
Technology offers only part of the solution. The climate transition also requires new forms of collaboration, for instance between water boards and SMEs. In province of Limburg, for example, collaboration is taking shape between the water board and business owners around climate adaptation and heat stress. And collaboration between machine manufacturers, agricultural companies, and knowledge institutes towards precision agriculture also offers starting points that can reduce soil depletion, soil compaction, and mineral leaching. This collaboration is already occurring around Brightlands Campus Greenport Venlo, the HAS and HZ living lab Schouwen-Duiveland, and pilot strip-farming projects in the province of Noord-Brabant, and is just as relevant to the climate transition as the agricultural transition. Briefly put, the South has the technological knowledge and cooperation culture to become climate adaptive itself and create successful export products.

Sample project:
Desalination combined with wind energy
Seawater can be desalinated through reverse osmosis (when seawater is pressed through membranes under osmotic pressure drinking and irrigation water. The project aims to use wind energ combination with reverse osmosis. Wind energy is used for the reverse osmosis process and additional electricity can be generated.

Agriculture & food transition
The strength of South Netherlands' agricultural sector lies in its robust position as a production area, the large processing and distribution chains, the network of technological knowledge and 'common sense' surrounding it, and its global leading position as an exporter. The sector in the South is also highly organised, with partnerships such as Agrifood Capital, Greenport Venlo (including Brightlands Campus), Food Delta Zeeland, the HAS, Zeeland University of Applied Sciences, and the sector organisation ZLTO. In addition, the region has many initiatives that contribute towards and support bottom-up innovations such as Boerschappen, Herenboeren, and other similar initiatives in South Netherlands. This enables the region to innovate in the agricultural and food chain like no other.
Producing non-animal proteins, limiting nutrient loss, and reducing environmental impact (including nitrogen and greenhouse gas emissions) are vital for the global food supply and local environment. Closing chains at a regional level and arriving at different earning models is also important. This challenge fits in well with existing strengths within the South. For example, Zeeland University of

Applied Sciences works with companies in a joint research centre on food, water, and energy. This illustrates how different transitions in the agrifood sector come together.
And the technological knowledge base of the South and its collaborative culture can also make a difference in the agriculture and food transition. A good example of this is the company Pixelfarming, which gathers knowledge about big data, software, robotisation, sustainable mobility, and agriculture to achieve sustainable and circular agricultural production.
Further down the chain, the combination of technological knowledge, innovative business owners, and collaboration also lead to innovations. For example, around Greenport Venlo and in various private initiatives in Brabant (e.g. Van Rijsingen Green), ingredients are being separated and/or upgraded from vegetable products. And the Waste Factory in Veghel is an example of where production, logistics, and marketing are combined as strengths. This shows there is already fertile ground for chain collaboration in the South, which is particularly crucial in the food chain.

Health transition
In the transition towards a more efficient care system in which people grow older in a healthier and happier way, South Netherlands' potential lies, among other things, in combining technology and collaboration. The Brabant medtech cluster, for example, is a lively ecosystem of knowledge parties such as TU Eindhoven and Holst Centre, large companies such as Philips Healthcare, innovative SMEs, and the public sector. In an open-innovation system, they achieve commercially viable innovations with global impact, such as e-health applications, evidence-based sensing, and disease detection through nanotech and photonic applications. The knowledge position and collaborative culture are also strong elsewhere in the South, In Oss, for example, the legacy of Organon can be seen in the dozens of Life Science companies in Pivot Park. And in the province of Limburg, the Brightlands Maastricht Health Campus focuses on developing knowledge from the Maastricht UMC+ and Maastricht University, focusing on regenerative medicine among other areas. Collaborating with the chemical and materials cluster (e.g. Chemelot Campus) and the data cluster (Smart Service Campus) also creates market opportunities here. Another relevant angle is prevention and innovation in care, in which both care providers and new coalitions with care users ensure innovation and breakthroughs. Parties in South Netherlands are experimenting with this and can market and export their experiences in this area. Examples include Zorgcoöperatie Zeeland, which aims to strengthen the self-organising capacity of the general public through innovative forms of collaboration. The South has also built up a considerable track record in projects focusing on the broader social context of the general public, increasing participation and involving SMEs, care organisations, and insurers. Examples include the action centre Limburg Positief Gezond, the Brainport Healthy Living Lab, and the Care Innovation Center in Roosendaal. Lastly, innovation in healthcare is also about breaking down financial and other barriers. Healthcare providers, companies, patients, and the general public are working in the South on various European and other projects, such as the SEAS2GROW project that focuses on product innovation for the elderly.

2.4 *Conclusion on 'Strength of the South' and the vision of the RIS3*

The analysis shows that the South has top clusters, innovative SMEs, knowledge institutions, strong and increasingly influential campuses, and a network of triple-helix organisations. The region also has technological strength (including key enabling technologies) and an entrepreneurial and collaborative culture. This, combined with a good business and residential climate, makes for a strong innovation system. SMEs are successfully involved in innovation processes more so than in other regions. The analysis and the 'Entrepreneurial Discovery Process' for this RIS have also shown that there are many leads for innovation in the South within the transitions.

Vision of RIS3 South Netherlands 2021-2027

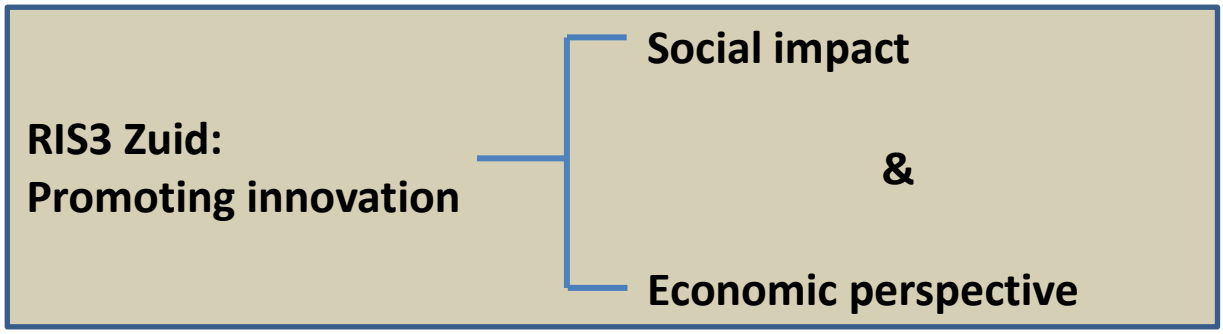
The main opportunity this RIS responds to is the international character of the transitions and the related international market opportunities. The combination of a strong, versatile, innovative, and internationally oriented business community, including SMEs, with the transitions and related international markets is what this RIS is all about. Devising new solutions to the major challenges facing Europe and the rest of the world. And simultaneously showing that these new solutions work in the South, connecting them interregionally in value chains, and thus accelerating progress within the transitions, both in South Netherlands and internationally. Demonstrating that solutions work means that many intended projects will include application-oriented components in the form of pilot projects, demonstration plants, or living labs, so that the intended potential social impact in the transitions and the economic feasibility can be demonstrated in practice. Because progress in the transitions depends not only on technological innovation, but also on the future-ready employability of the working population, there will be scope in the regional European programmes for new forms of collaboration ('organisational innovation'), a broadening of target groups, and attention to skills development. The strategy (Chapter 3) fleshes this out.

The theme of the South Netherlands RIS3 largely mirrors that of other regions, but its uniqueness lies in exploiting the strength of the innovation system and actually creating (designing and producing products and services) and implementing new solutions.

3 South Netherlands' innovation strategy

3.1 *Promoting innovation with economic perspective and social impact*

South Netherlands focuses on promoting innovation aimed at both strengthening the economy and making a clear contribution towards social transitions.



Economic perspective

As in the current EU Programming Period, the RIS focuses on promoting innovation with economic impact. As a rule, projects eligible for support do not yet have a conclusive business case; this is precisely a reason for awarding a grant. An unprofitable entity can be financed as long as there is a demonstrable prospect of a viable business case. To this end, a project may demonstrate innovation on a larger scale, for example, to eliminate technological risks, bring new parties together, increase consumer support and awareness, or remove legal barriers. We include mechanisms to monitor this in the programmes.

It is further essential that the economic effect of promoting innovation is also felt in South Netherlands. So, this is about innovations that:

- are developed and scaled up by players in the South and based on the strength of the South
- contribute towards strengthening the national and international competitiveness and export position of the region
- strengthen economic cohesion throughout South Netherlands through collaboration between parties from different sub-regions in the South, which complement each other's knowledge and expertise
- The focus on South Netherlands is not intended as a restriction. The RIS also aims at interregional cooperation with complementary parties for knowledge exchange and technology to strengthen interregional value chains, thus contributing to strengthening the economy within and across regional and national borders.

Social impact

In the shorter or foreseeable longer term, using regional European funds must ensure social impact: a demonstrable contribution towards the transitions that are urgent in the South, nationally, and internationally. Although the regional European funds in South Netherlands are substantial in absolute terms, they account in relative terms for only a small proportion of the total public and private funds used for the transitions. In other words, we do not intend to finance the transitions from the regional EU funds, but will look for projects with a strong objective-fund relationship within the transitions. This can be done in several ways; the first chapter of Part II contains solution paths and sample projects for each transition. To illustrate, here are several examples of innovations with social impact:

- **Energy transition**: for example, innovations that generate renewable energy more efficiently (e.g. breakthrough in floating solar energy) or provide a reliable and safe energy system (e.g. local energy cooperatives that store energy locally in electric cars)

- **Raw-material transition:** for example, innovative projects that ensure circular use of raw materials (e.g. circular design of buildings or 'built to recycle') or that capture and upgrade CO_2 (marketing of carbon capture and usage applications)
- **Climate transition:** for example, a project that combines sustainable water and soil management through digital technologies (sensor, drones, AI) and new forms of collaboration
- **Agricultural transition:** for example, a project that increases protein efficiency (e.g. alternative crops such as aquaculture) or reduces the environmental impact of agriculture (use of strip farming and increasing consumer support and understanding)
- **Health Transition:** for example, a project to enable the general public to live longer and healthier at home, through the use of technological tools (e-health) and innovative civic cooperatives

Sample project: Innovative weed control

Chemical crop protection agents are used to control weeds in agriculture, even though this can have an adverse effect on people, nature, and the environment. By working together with various links in the chain (breeders, robot and other technology, strip farming), we can combat weeds in an environmentally friendly way. Consumers can be involved in this, increasing their willingness to pay more if necessary.

Within each of the five social transitions, an industrial transition is also happening. After all, it is industrial companies that help shape the transitions – by bringing promising innovations to the market – and have to undergo them themselves, for example by greening their own energy supply or making the production process circular. Because the RIS3 promotes social transitions and includes SMEs as one of its main target groups, it also supports South Netherlands' industrial transition as such. The RIS3 thus meets RIS3 criterion 6 (Actions to promote industrial transition must be included)[13] As described, South Netherlands has a favourable baseline position thanks to leading companies in international clusters and a broad knowledge base in key enabling technologies.

In the various regional programmes and calls for each programme, we put our intended kind of social impact into operation (examples in the box below). These may be innovations that contribute directly towards the intended impact, or where it can be made clear that these innovations will eventually contribute to it. These should preferably also be innovations with an international perspective. In other words, innovations that are also relevant outside South Netherlands and have the prospect of being rolled out internationally as an export product from the South.

Examples of social impact

A non-exhaustive list of examples of desired social impact has been formulated here to help structure ideas:

- CO_2 reduction
- Higher proportion/volume of renewable energy in production and/or consumption
- Availability of fresh water
- Increased biodiversity
- Higher proportion of biobased materials in building production
- Less plastic waste
- Higher proportion of food parcels produced regionally
- Reduction of food miles
- Reduction of nitrogen deposition
- Above-average increase in life expectancy
- Decrease in health inequalities in healthy years of life

Experimenting with true cost accounting
Although many innovative projects have a potentially positive social impact, they are not economically viable because they have to compete with a business-as-usual approach and adverse externalities. This means that costs are passed on to society or other parties. Examples in the food chain include adverse effects on a local scale (such as the environmental impact of fertilisers and pesticides, soil degradation, and water pollution) and on a global scale (such as CO_2 emissions from the production of animal feed and transport). By applying true cost accounting (TCA), the hidden costs are internalised so innovations become economically feasible. South Netherlands is investigating the options of creating scope for TCA within its innovation promotion policy.

3.2 *New forms of collaboration and broadening to end users*

Second, South Netherlands is making the strategic choice to focus on new forms of collaboration and broader coalitions. Just as in the previous RIS, we start from the strength within and between the national and international top clusters in the South. For the next EU Programming Period, we also see many opportunities for regional and interregional collaboration on innovations, within and between sectors at the interface of the key enabling technologies, as outlined in Chapter 2. Examples are the application of Artificial Intelligence in agriculture and horticulture and Life Sciences & Health ('precision medicine') or chemical technologies such as bioprocessing in chemistry with biomass from agriculture. Besides technological innovation, we are also focusing on new forms of collaboration and broadening of target groups, in which end users are given a more prominent role. This involves:

- **More prominent role for SMEs and commitment to accessibility and simplification**. While large enterprises know how to find their way to European funds, SMEs are also crucial in bringing innovations to market. After all, thanks to their entrepreneurship, it is SME owners who are often able to convert knowledge and innovation into profitable business models and then introduce them on a regional, national, and international scale. SMEs are thus given a prominent role in the RIS3 and are one of the main target groups in the regional European programmes. Not only established businesses, but also innovative newcomers (start-ups and scale-ups) form the target group. Strengthening cooperation between knowledge institutions and SMEs is also essential to achieve greater development of knowledge. In the regional programmes, we aim to simplify the regulatory environment and reduce the administrative burden on SMEs (see text box).
- **Place for civil society organisations and civic cooperatives.** We foresee that social institutions and civic groups will be given a more prominent role. This can be achieved, for example, through projects with consumers or consumer organisations to increase support for sustainable food production, projects in which civic groups produce sustainable energy with each other and with companies, or through innovative local care cooperatives that ensure people remain active and healthy for longer.
- **Attracting role for intermediaries: regional development corporations, triple-helix organisations, cluster organisations, and campuses.** These intermediaries act as a bridge between knowledge institutions and SMEs and can, for example, drive or participate in projects based on their own role and responsibility.
- **Shifting role of knowledge institutions**. Academic universities and universities of applied sciences remain essential for innovation, and SME institutions also come into the picture here. Within the regional EU programmes, we foresee a shift towards more applied knowledge development: more entrepreneurship (e.g. through spin-offs/start-ups), more cooperation with SMEs, knowledge development with an economic perspective, and innovation with a demonstrable society impact. Fundamental knowledge development, including in key enabling technologies, remains important, but is mainly financed by national and thematic EU funds. The further development of key

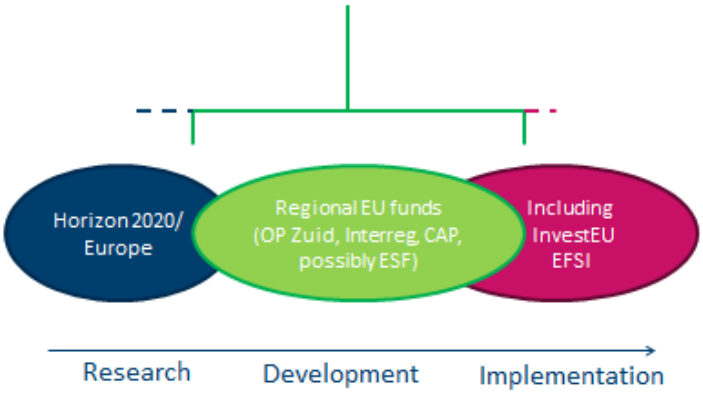
enabling technologies could also be given a place within the EU regional funds, if the link to the transitions and – over time, possibly – the intended impact can be made clear.
- **Innovative methods of collaboration**, e.g. co-creation with business owners, authorities, knowledge institutions, and residents around complex issues, innovative governance with scope for experimentation in laws and regulations, or innovative peer-to-peer platforms.

Focus on SMEs calls for accessibility and simplification
Compared to the current EU Programming Period, this RIS puts even more emphasis on a greater role for SMEs. In practice, however, participating in European programmes is still accompanied by a relatively high administrative burden and procedures perceived as opaque and slow. Focusing on SMEs implies a commitment to accessibility and simplification. The European Commission has announced far-reaching simplifications. In South Netherlands, the aim is to implement these simplifications and not have SMEs become snowed under by our own additional regional or national requirements. Genuine simplification to give SMEs more opportunities, that is the commitment.

3.3 *Focus on demonstration and pre-market launch (TRL 6-9 and SRL 3-7)*

Through the regional European programmes, South Netherlands is focusing even more firmly on innovation that reaches the market and thus has a social impact. The region does this based on the observation that innovations have not been sufficiently capitalised on so far, even though this is needed to increase the social return on innovations. Beside the focus on the five central transitions in the RIS3, the focus on innovations with a **higher TRL** (technology readiness level) must also ensure this. Specifically, the RIS3 focuses on innovations with a TRL from 6 to 9: therefore, projects that demonstrate innovative technologies and forms of collaboration in their relevant environment (TRL 6), integrate them into their operational environment (TRL 7), make them work properly in their real environment (TRL 8), and take the final steps towards market launch (TRL 9). TRL 9 can be eligible for co-financing only as the last step in a project that also covers lower TRLs. In the regional funds, we provide scope for setting up **living labs**, **pilots**, **trial production**, and **first roll-outs** where technological innovations are demonstrated and tested in practice.

By choosing projects with TRL 6-9, the regional EU programmes complement other European and national innovation funds in the next EU Programming Period. Part 2, Chapter 2 fleshes out how the RIS3 relates to other innovation promotion funds. Lastly, we note that the focus on TRLs is indicative; there may be reasons to support a project that also includes research activities (TRL 5 or lower), or that is already moving towards implementation. **Value-creation projects** are therefore also possible, provided there is also insight into their social impact within the transitions. The further development of key enabling technology in itself, without sufficient insight into social impact, obviously remains significant because of the region's longer-term earning capacity and is also in line with this RIS3. However, this is not the focus of EU regional funds, but is seen as the domain of Horizon Europe and other thematic programmes. Central government funds, including research funding through NWO, are also relevant here.



Whereas the TRL indicates the development phase of a new technology, the **SRL**[14] (societal readiness level) expresses the extent to which a new technology, approach, or form of collaboration is ready to be integrated into society. This is determined by aspects such as social acceptance, familiarity, and awareness. An innovation with a low SRL is unlikely to be applied on a large scale, even if this is technologically possible. The interaction between behaviour and technology is crucial when it comes to transition challenges. The behavioural component is therefore an important framework condition for innovation (also see promising perspective of Smart Industry).

Although there is no hard boundary, South Netherlands will indicatively focus on projects with an SRL of between 3 ('first testing phase of solutions with relevant stakeholders') and 7 ('refining the solution and, if necessary, retesting it in the relevant environment and with relevant stakeholders'). A project can explicitly aim to increase the SRL, for example by focusing on awareness and acceptance of an innovation.

Smart Industry: Focus on intertwining behaviour and technology
In the multidisciplinary field of Smart Industry and Artificial Intelligence, South Netherlands is uniquely placed to facilitate man and machine reinforcing each other.
The man-machine interaction underpins the possible success of these technologies.
By focusing on intertwining behaviour and technology, greater added value can be achieved than with digital technologies without that intertwining.
Several examples of this already exist in the South's top clusters.
First concepts are visible in the health sector within the framework of the VIBE project.
And there are other examples in the maintenance (Campione) and logistics (DALI and living lab autonomous transport) sectors throughout South Netherlands.

Digitalisation as an important enabler
Besides the broad innovation scope of this RIS, we emphasise the importance of digitalisation as an enabler for innovation. Digitalisation, as a cross-cutting development within all social transitions, can bring about breakthroughs by making technological applications and other forms of collaboration and organisation possible. In the regional programmes, South Netherlands therefore provides scope for digital innovations within the transitions. Annex 2 (page 60, specifically) examines the opportunities associated with digitalisation in the transitions.

Creative industry
Renewal and innovation often require combining knowledge, skills, and bringing together different people and perspectives. Social transitions also require social awareness and support. Design and creative industry can play an important role in this regard. As the KIA for Creative Industry states, the strength of creative professionals is that they 'broadly collaborate from a cultural and social perspective,

but also from an economic value, on interventions that create support for change'. The creative industry designs both the process (articulating the need, vision and strategy, co-creation) and the intervention itself (the system, desired behaviour, value, and form).

In South Netherlands, the creative industry is well-represented by strong players such as IMPACT, Kunstloc Brabant, Dutch Design Foundation, and CLICK NL. Educational institutions such as Design Academy Eindhoven and the Maastricht Academy for Arts and Design (Mafad) are also located in the South, while the Breda University of Applied Sciences, for example, focuses on imagineering.

3.4 *Focus on skills development and future-ready employability of the working population as a prerequisite for transition*

For each of the transitions, it is essential that the working population in South Netherlands has the right knowledge and – above all – skills. Recent advice from the Social and Economic Council shows that enormous investments are needed in training, attracting people, and guiding them from job to job, to achieve national and climate targets.[15] Other transitions also require investment in skills development and future-ready employability across the board (from senior secondary vocational to university level education) and for all generations. Technical competences and 21st century skills are the keywords here.

Educational institutions primarily invest in skills development at all levels, in triple-helix partnerships and through provincial and regional education, labour market, and economic affairs policies. This RIS3 sets the agenda for these programmes. We also provide scope in the regional European programmes for skills development within innovative projects aimed at social and economic impact. Examples include creating learning workplaces in SMEs or including practical space in living labs. INTERREG projects can also help remove hard and soft barriers to cross-border work (e.g. recognition of qualifications, social insurance, language differences), if this contributes towards transitions.
In-work training can moreover be supported to a limited extent only by regional European programmes. This could be done within programmes of the European Social Fund, but in the Netherlands are aimed mainly at people who are currently unemployed. South Netherlands is making efforts to also be able to use ESF funds for this RIS.

3.5 *Putting RIS3 into operation in EU funds and increasing synergy with the European commitment in the South*

The South Netherlands is first putting its smart specialisation strategy into operation in the regional European funds that it is partly shaping itself. The RIS3 serves as the basis for the South's new Operational Programme (OP), the CAP Innovation Programme as part of the National Strategic Plan (NSP) for agriculture, the Interreg A funds (Netherlands-Flanders, Netherlands-Germany), the Maritime and Fisheries Fund (EMFF, for Zeeland) and the MIT (SME Instrument for the Top Sectors). The South's strategic choices in this RIS3 give direction to how these funds are shaped in practice (obviously in consultation with regions, Flanders, Germany, central government and the European Commission). The Interreg A funds offer both the opportunity to capitalise on cross-border opportunities (in terms of innovation, economic cooperation, social cohesion, etc.) and to tackle cross-border barriers. Examples include hard factors in social security, taxation, healthcare (including insurance) and soft factors such as language and culture[16]

Numerous opportunities also exist for South Netherlands to use the resources from the thematic EU funds for social transitions and innovations in that area. This RIS3 aims to inspire the parties in the South when determining how to use the thematic innovation and other funds such as Horizon Europe, Digital Europe, LIFE+, CEF2 and the possible former 'Component 5' in the ERDF context. There are also opportunities for commercial upscaling of innovations and structural investments. These include the

EFSI (‘Juncker Fund’, for structural investments in research, infrastructure, and sustainability that strengthen the economy), EIB financing (European Investment Bank in SME projects, among others), InvestEU (new programme aimed at market investments in sustainable infrastructure, research and innovation, SMEs and more), and InvestNL (which from 2020 offers risk capital, guarantees, and financing programmes for societal issues). Also see Part II (Deepening), Chapter 2.

3.6 *Open-minded innovation: cooperation with parties at home and abroad*

Another important element of the strategy is to innovate 'with an open mind', looking beyond the borders of South Netherlands, by entering into, strengthening, and making the most of partnerships with partners at home and abroad.

By linking parties within the society transitions, we create added value for product development and process design in the innovation process. Our ambition is to create this added value across South Netherlands' borders and to seek cooperation with complementary partners in the rest of the Netherlands and Europe. Along with these partners, we create projects in keeping with South Netherlands' established priorities and create more synergy between public and private investments on an interregional basis. In this way, South Netherlands contributes towards developing interregional value chains and thus to strengthening the economy within the region and beyond.

Strategic interregional cooperation and long-lasting connections between regional ecosystems in and outside South Netherlands increase the South's competitiveness and resilience. In this interregional perspective, various opportunities for South Netherlands are promoted in industrial innovation, key enabling technologies and demonstrating and upscaling innovation. This can contribute both towards breakthroughs in the transitions and to strengthening the innovation chain in South Netherlands as a whole.

3.7 *Monitoring and RIS3 as a dynamic document*

The South's challenge is for the RIS3 to be a dynamic and adaptive document, and the South also wants to gain and offer insight into the social impact of the RIS. We achieve this through:

- Qualitative monitoring and use of evaluations
- Quantitative monitoring of the RIS based on:
  - Innovation indicators in all regions
  - Relatedness model
  - Social impact
  - Efficient use of funds

Qualitative monitoring and use of evaluations

When drawing up the RIS, we paid close attention to the entrepreneurial discovery process (also see 1.3 and Annex 4). The working method and contacts built up during this process are used to periodically update the RIS. Periodically (every two years), the region will give the monitoring group of the RIS process a role in keeping the strategy up to date/dynamic, partly based on quantitative progress and partly based on qualitative input from stakeholders.

South Netherlands is known as a region in which significant consultation and dialogue occurs between the various economic players. The new partnership of the eight triple-helix regions in South Netherlands and the provinces of Zeeland, Noord-Brabant and Limburg – ENZuid – will put the messages from the economic field into practice. This partnership thus acquires a role in keeping the RIS up to date. The RIS will periodically be on the agenda of this partnership's management-level meetings.

The design of the RIS's governance explicitly accounts for the above stakeholders and gives them a role in periodically reviewing the RIS. Messages from these bodies will lead to the RIS being adapted, where necessary.

Using evaluations

Ongoing and new European innovation promotion programmes are all subject to periodic evaluation. National KIAs will also be subject to evaluation in due course. South Netherlands intends to include these evaluations in the two-yearly update of the RIS.

Quantitative monitoring
Quantitative monitoring is built up from several sources. Although public sources will be consulted, explicit attention will also be paid to a more scientific approach based on the desire to measure impact and assess which international connections can be made.

Innovation indicators in all regions
In cooperation with the other three regions, it was agreed in the previous EU Programming Period that Statistics Netherlands (Economy Businesses sector) would monitor the RIS3 Strategies. This has been shaped by measuring these indicators regionally for each top sector:

- Private R&D expenditure
- Private R&D expenditure by SMEs
- Innovative companies: technological innovation
- Innovative companies: non-technological innovation
- Innovative expenditure
- Innovative companies: collaboration with University
- Innovative companies: collaboration with research institute

The basis of these indicators form the national monitor for Top Sectors. The regional measurement occurs every two years. The reporting years are 2020 and every subsequent two years. This is an historical series that started in 2014.

This set may be supplemented with 'traditional' innovation-output indicators such as the number of patents and licences. This will be determined in consultation with the other regions and the European Commission.

Relatedness model
Besides continuing the monitor used in the previous EU Programming Period, a more specific monitor based on the relatedness model will be set up under the supervision of Professor Boschma. Among other things, this model is suitable for searching internationally for and validating complementary competencies. A baseline measurement will be produced in the first half of 2020, providing an up-to-date and dynamic picture. These data will later be processed in the update of this RIS3 document, which validates the specialisations. This monitor is then repeated every two years.

To judge the South's current competencies and their complexity, we want to use this relatedness model as a monitor tool for the RIS3. For this purpose, we visualise the South's diversification potential based on relativity and complexity (Balland et al. 2018).

This method enables us to measure two types of competencies:
a) technological diversification potential, using the OECD REGPAT patent data set 2012-2017
b) sectoral diversification potential, using the LISA database for sectors 2013-2018

For each of these diversification potentials, we can also indicate the European regions in which complementary competencies exist.

This makes it possible to identify the diversification opportunities for specific new economic activities in the South by gaining access to complementary competencies in other regions where the South does not have them itself. In this way, we can determine which regions in Europe have the required

competencies for each potential new activity in the South, and thus identify which regions could be strategic partners for the South to develop this new economic activity.

Social impact
In the regional European programmes, we put the intended social impact of the projects into operation. We monitor progress on these impact indicators. This also serves as a basis for dialogue with stakeholders and adjusting the strategy, where necessary.
A monitor on which the impact of the RIS can be measured will be developed in the spring of 2020. Indicators, which are specified for this purpose, will be added to the RIS at a later stage.

Use of funds
A final quantitative input when implementing the regional European programmes is to monitor whether South Netherlands is spending the funds in line with the RIS3's objectives. These include indicators such as the share of financing in favour of SME owners, the TRL of projects, and a balanced regional distribution of funds. Meanwhile, a first monitor has been developed to monitor European funds in relation to objectives. This monitor can be expanded and refined based on the strategy in this RIS.

Governance
Besides monitoring, the European Commission also attaches great importance to the governance the RIS is subject to in the region. The last RIS came firmly under the governance of OPZuid. That line will be continued.

The three southern provinces each determine the RIS separately. As the managing authority of OPZuid, the province of Noord-Brabant will formally bear responsibility for its implementation. Within its responsibility, there will be a periodic meeting with the provinces of Zeeland and Limburg. The Preparatory Group as formed for the RIS is the appropriate body for this purpose.

To organise input from the field and keep the RIS dynamic, there will be regular consultations with ENZuid and coordination with other stakeholders, such as companies, regional development companies, knowledge institutions, and so on. Stimulus programme management plays an important role in organising this input. By implementing the various economic programmes, Stimulus collects many messages from the market. Stimulus makes proposals on this basis to keep the RIS up to date. It is mandated for this purpose by the managing authority. Stimulus is sufficiently equipped for this task and has the necessary competencies.

The RIS3 is adopted in the Provincial Executives of the three provinces, which are mandated for this purpose. The strategy does not have to be adopted at Provincial Council level.
The Provincial Executive of Noord-Brabant mandates the Preparatory Group to adjust the strategy based on the ongoing entrepreneurial discovery process. Major changes will be resubmitted to the Provincial Executives.

3.8 *RIS3 promotes innovation and strengthens the innovation system of the South as a whole*

Lastly, we note that the new RIS3 not only contributes towards innovation with economic and social impact, but also strengthens the innovation system in South Netherlands as a whole. This fulfils the fifth fulfilment criteria that apply to the RIS3 ('actions to improve the regional innovation system'). It has already been observed that the existing innovation system of South Netherlands – with its influential SMEs, knowledge institutions, authorities, triple-helix organisations, and development companies – is strong. As such, there is no need to build a regional innovation system; however, the innovation system is improved, in particular by increasing its impact (social return):

- The existing quadruple-helix parties (triple-helix plus civic cooperatives/civil society organisations) are encouraged to collaborate even more in bringing innovations to market. It is only by achieving profitable business models that innovation really can be widely implemented. This put SMEs in a better position to bring innovation to the market.
- The focus on 'innovation with an open mind', with strong cross-border connections, strengthens the innovation chain and ensures that knowledge from outside is applied in the South and vice versa.
- Improved governance and the continuous EDP also strengthen the innovation system. In this way, the South is better able to capitalise on relevant trends, developments, challenges, and market opportunities in the period 2021-2027.

Part II:

Deepening strategy

Opportunities for each transition and links to EU funds

1 Deepening strategy for each transition

1.1 *Energy transition*

Clarification of the energy transition challenge
Within the energy transition, we distinguish between two tasks:

1. **Higher share of renewable energy** in the energy mix. This task consists of:
- Reducing energy consumption through energy savings and redesign.
- Renewable energy. Both at sea and on land, the challenge is to scale up conventional techniques (wind, solar) further and to develop new techniques and make them profitable (e.g. floating solar energy, tidal energy, geothermal energy).
- Built environment. The transition to natural gas-free homes goes hand in hand with the search for sustainable heat (solar heating, aquathermal, geothermal, bioenergy). Energy savings, including through the use of biobased materials, a more efficient design, and a more efficient building process, are an important way to increase the share of renewable energy. Integrating sustainable generation in the built environment (use of façades and large-scale roofs) is also a focal point that requires not only technical but also organisational innovations.
- Within the industry, there is a major challenge to save energy, including through more efficient production, exchange of residual heat, and by closing raw-material chains.
- The challenge is also great in the field of mobility. A sustainable mobility system requires alternative fuels, both for passenger cars and heavier vehicles.
- At the interface of the energy and agriculture transition, the transition to climate-neutral food production is decisive for achieving CO_2 targets. And in the horticultural sector, the transition to gas-free and sustainably heated greenhouses is a major task.

2. **Reliable and safe energy system**. A reliable and safe energy system is a condition for achieving the energy transition and overcoming the aforementioned challenges within it. The IKIA refers to a 'robust and socially acceptable' energy system that is hybrid in the medium term (2030) and sustainable in the long term (2050). Investments in innovative conversion and storage techniques (e.g. battery technologies, accumulators, green hydrogen), in digitalisation, and in organisational innovations are essential here.

Promising solution paths within the energy transition
There are opportunities in the South for improving and scaling up conventional sustainable techniques (wind and solar, and by extension also green hydrogen, for example) that are readily available, and techniques that are still being developed. The programmes support innovation if it has substantial energy potential and also offers opportunities outside South Netherlands. Specific priorities for the South are the built environment, mobility and transport, and energy savings in industry, particularly digital monitoring and control of the energy system. The programming specifies that projects with the potential for a higher share of energy generation (upscaling potential) will be given preference. Synergy with the other transitions is also seen as a plus point.

In the energy transition, non-technological solution paths can also form the basis of economically feasible and exportable business models. Examples include:

- Projects that increase public support. Implementing the energy transition can be accelerated by allowing the general public and businesses to benefit more directly from production. Pilot projects that show innovation in this regard score higher. The mobilisation of new target groups – for example, a business park approach or a civic collective – is also well-received.
- Projects that contribute towards skills development. Problem-based learning research[17] shows that the energy transition is leading to a need for more and different types of workers. New jobs will certainly be created in plant engineering and construction, for example, where there is already a

shortage. And learning workplaces can be set up in living labs or at SMEs as part of innovation projects.

- Projects that experiment with laws and regulations. These include pilot projects that use an area-oriented approach 'outside the network manager' to arrive at more sustainable and cost-effective approaches (than when this is done through the network or its management).

Energy transition and non-fossil raw materials in 'large' chemistry: important, but regional EU programmes continue to focus on collaboration through SMEs

South Netherlands is home to three of the six major national chemical clusters: the Canal Zone, Moerdijk, and Chemelot. These chemical clusters are interconnected with pipelines, which also branch out into the Flemish hubs (Port of Antwerp and along the Albert Canal) and the Ruhr Valley. This chemistry is based mainly on fossil sources and energy. Although large enterprises dominate this capital-intensive industry, several SMEs are also associated with it. For the economy of South Netherlands and the energy and raw-materials transition, it is vital that this major chemical industry can make the transition to other sources of raw materials (e.g. biobased) and run on renewable energy. Prof. Hans Mommaas (PBL Director) pointed this out in an interesting analysis performed for this RIS. Of course, the large enterprises are also working hard on this and can rely on Horizon (now 2020/soon Europe) for innovation. For the transition to non-fossil business models, SMEs related to the 'large' chemical industry can apply to the regional European programmes.

The cross-border dimension of the pipeline network is of interest within CEF2, the European infrastructure programme, and for smaller pilot projects perhaps in INTERREG. The more modest regional European programmes, which this RIS primarily concerns, focus mainly on SMEs.

Sample projects - opportunities

	Main dimensions of the transition	
	Getting the right energy mix of the functions	**Secure and safe supply: feasible, affordable, flexible, and reliable**
Economic competencies and opportunities	Renewable energy at sea and on land: conventional techniques are better and cheaper; roll out new techniques further. Attention to physical integration and support.	New methods of collaboration and joint decision-making
	Built environment: natural gas-free, renewable heat sources, linking of systems	Flexible multi-commodity system, supply and demand balanced by demand-side management, AI, smart grids, smart and low-cost storage/conversion (battery technologies, green hydrogen, molecules, metal, physical, thermal).
	Industry: efficient production, sustainable heat, raw-material transition interfaces	Making large-scale, industrial energy issues sustainable and hybrid
	Mobility: electric, energy-efficient combustion, change behaviour/mobility system	
	Agriculture: sustainable greenhouses, food efficiency	

Strong parties and promising partnerships[3]

South Netherlands has strong knowledge institutions, companies, private initiatives, and partnerships that can shape the energy transition:

- In the province of Zeeland, the energy transition is high on the agenda of authorities and the business community. For example, multinationals such as DOW Benelux, Zeeland Refinery, and the Flemish EngieElectrabel work together within the Smart Delta Resources on energy and raw-materials reduction through industrial symbiosis. This results in innovative energy-saving projects, such as the exchange of residual heat between Lamb Weston/Meijer (potato processor) and Wiskerke Unions (onion producer). The province of Zeeland is also a promising location for generating energy at sea. This concerns more than just wind energy; one interesting project is the Tidal Technology Center Grevelingendam (TTC-GD), for research, development, and demonstration of tidal energy.
- The province of Limburg is also strongly committed to stimulating the energy transition. This occurs within LEKTA (Limburg Energy and Climate Transition Approach), an alliance of residents, companies, organisations, and authorities. Using mine water and other sources of residual heat as a basis for sustainable energy (for example to heat and cool buildings, homes, and offices) is a specific Limburg opportunity. Opportunities also exist at the interface with raw-material transition. For example, parties on the Brightlands Chemelot campus are working on initiatives to make the chemical industry more sustainable and develop new energy conversion and storing systems.
- With its Energy Agenda, the province of Noord-Brabant is working to make the province more sustainable, specifically in industry, transport, buildings, and agriculture. For example, it supports the Solliance initiative (partnership of TNO, ECN, the Belgian Imec, and academic and industrial partners focused on thin-film solar energy). Opportunities for making the Automotive industry, with its prominent presence in Brabant, more sustainable are also promising given the crossovers with the high-tech industry. In relation to this, Brabant occupies a strong position in battery technologies. The province is also organisationally strong. Various platforms and partnerships support companies and private initiatives in the energy transition, such as the Energiewerkplaats, BOM Renewable Energy, and Stichting Brabant geeft Energie (BgE).

1.2 *Raw-materials transition*

Clarification of the raw-material transition challenge

The raw-materials transition arises from the finite nature of and uncertainty about the availability of raw materials and the adverse effect of using fossil raw materials on the climate and the environment. Within the transition, we distinguish three tasks:

1. **Biobased economy**. The first task concerns the transition to a low CO_2 economy and industry based on biobased, non-fossil raw materials. This concentrates mainly on finding economically and functionally competitive alternatives for raw materials and chemical building blocks, for example through biorefinery of agricultural and organic base and residual flows into raw materials for a new application on a sufficiently large scale. Developing widely applicable applications for the end market and using biobased materials are also important.
2. **Circular economy.** The second central task is to reduce waste and residual flows through the circular use of raw materials. This goes far beyond recycling and reusing end products. Providing services, design, extending the lifespan of products and materials, and upgrading all add more value and contribute towards reducing CO_2 emissions.
3. **Smart industry:** The third task is to use fewer raw materials and resources in the manufacturing industry and to extend the lifespan of products through smart production processes (for example, additive and advanced manufacturing techniques, smart maintenance).

[3] The examples come mainly from the Entrepreneurial Discovery Process, are intended to be illustrative, and are not exhaustive

Promising solution paths within the raw-material transition

To achieve the transition to biobased raw materials, fewer raw materials, and circular use, the South sees opportunities in demonstration and other projects relating to the built environment and digitalisation:

- **Built environment as a lever**, because that is where all transitions essentially come together (energy efficient and low carbon, climate resistant and water-robust, circular and biobased, healthy, including air quality)
- **Digital solutions** that contribute, among other things, to optimising supply-chain management and reverse logistics, customised products and services without production errors (advanced manufacturing, 3D printing), monitoring of product quality, use, and wear (smart maintenance), detecting losses and emissions, analysing and managing production processes (self-learning systems via AI and IoT), and sustainable crossovers that close industrial cycles (through better insight into material flows) and facilitate circular material use (e.g. material passports in construction).[18]
- Opportunities for economically viable innovations in **plastic recycling and applying bioplastics** also exist in South Netherlands. Applying knowledge in the materials and chemicals cluster in the province of Limburg and the Biobased Delta in the provinces Noord-Brabant and Zeeland, for example, is promising.

In the raw-materials transition, non-technological solution paths can also form the basis of economically feasible and exportable business models. Examples include:

- Projects that contribute towards feasible earning models. It is difficult to achieve feasible earning models within the current 'fossil' system: there is too great a price difference between biobased raw materials and conventional fossil raw materials. This requires supra-regional investments and steering at national and even EU level (e.g. through European emission trading / ETS and Innovation Fund, Horizon Europe, and InvestEU, and introducing national CO_2 taxation and extending the Stimulation of Sustainable Energy (SDE) scheme to materials).
- Projects that increase public support. Setting up new field labs and scaling up existing test set-ups in biorefinery and biomaterials, e-waste mining, circular construction, and high-tech systems. Developing large-scale and market-oriented biobased cycles from biomass to end product: after all, stimulating the circular and biobased economy is more a question of organisation and logistics of such cycles than of developing technology.
- Projects that contribute towards skills development. There is a great need for innovative research projects and specialists, from IT consultants who develop sensors to the technicians who maintain the machines. Circularity is not yet a permanent part of education and training programmes; this requires pilot projects for extra education, internship, and work experience through collaboration between education and SMEs/industry[19] The existing talent programmes within the top sectors of Energy and Chemistry for higher professional education and academic students can serve as an example.

Sample projects – opportunities

	Main dimensions of the transition		
	Biobased raw materials	**Circular economy**	**Raw-material and resource efficiency**
Economic competencies and opportunities	Biorefining from biomass to raw material	Circular design	Additive and advanced manufacturing (3D printing, robotisation, IoT, etc.)
	Functional/smart biomaterials	To a circular built-up environment	Smart maintenance and services (sensors, drones, etc.)
	Application of agricultural/organic biomass Packaging/moulds Dyes/coatings	Circular materials for manufacturing: **metals**, plastics, bioplastics, batteries. Recycling technology (mechanical and chemical)	High-tech systems for industrial symbiosis and circular production

	Construction and infrastructure (concrete, asphalt, insulation, etc.) Feed and soil improver		
		Using industrial residual streams as raw materials (water, heat, CO, CO_2, hydrogen, etc.) CO_2 storage and conversion to raw material (CCS/CCU)	
	Circular & biobased fertiliser use		

Strong parties and promising partnerships[4]

- Biobased Delta cluster, with a strong business network, the Green Chemistry Campus, and application centres that can help entrepreneurs scale up their innovation in biobased materials and/or the circular economy. Together with major food and other players (COSUN, SuikerUnie, Cargill, etc.).
- In this context, Biorizon is an important programme for developing and adapting bioaromatics in the chemical industry (with European recognition as a KET).
- SeaBioComp as development of biomaterials suitable for aqueous conditions.
- BioTreatCenter focuses on biorefining agricultural residues into new raw materials (grass, manure, etc.)
- SmartDeltaResources: industrial collaboration in the port area of Terneuzen-Ghent, converting and exchanging industrial residues into raw materials.
- Field Labs around smart use of raw materials Campione 2.0, Spark, MultiM3D, Flexible Manufacturing, Development Center for Maintenance of Composites, Robotics.

1.3 *Climate transition*

Clarification of the climate transition challenge

Climate transition focuses on climate adaptation and not on climate mitigation (this is reflected in energy and raw-materials transition). We distinguish between tasks in the following themes:

1. **Water**: safety (flood protection), water security (including groundwater level, sustainable water use, and water storage), and water quality (drinking and industrial water).
2. **Soil quality**, and preventing salinisation, impoverishment, desiccation, and erosion.
3. **Air quality:** the task of improving air quality (e.g. less nitrogen, particulate matter) lies both in measures at the source (sustainable mobility, smart industry, etc.) and in clean-tech solutions to purify the air.
4. **Heat stress**: this theme occurs primarily in large cities.

Promising solution paths within the climate transition

The South is committed to climate adaptation with the emphasis on integrated water and soil management. At the heart of this integrated water and soil management is detailed and large-scale data collection and processing, for example via sensors, drones, and AI. On this basis, derived services around analysis and translating this to management in practice can be provided. Relevant techniques and developments include sophisticated high-tech devices, machinery, installations, management systems for water storage and peak precipitation, thermal water buffer[20], water purification and reuse of residual water (by industry)[21], desalination (linked to offshore wind farms), infiltration and drainage (on a regional scale), integration of BIM and GIS tools for infrastructure design to obtain better insight into

[4] The examples come mainly from the Entrepreneurial Discovery Process, are intended to be illustrative, and are not exhaustive

the water system/cycle[22], biobased water- permeable paving and green roofs in the built-up environment.

In the climate transition, non-technological solution paths can also form the basis of economically feasible and exportable business models. Examples include:

- Projects that contribute towards feasible earning models. New earning models are conceivable based on ecosystem services. Examples include water storage by farmers, paid for this service by the government or by other farmers in need of water for using their water surplus. Climate-adaptive procurement by the government with circularity as a condition helps[23].
- Projects that contribute towards skills development. Firstly by making new technology usable and effective, and secondly by teaching people in the sectors how to work with it. The efforts should preferably tie in with ongoing projects such as the Human Capital programme of the Water & Maritime Top Sector[24], the Green Pact for agriculture, horticulture, and the living environment, the Technology Pact, and others.

Sample projects – opportunities

<table>
<tr><th rowspan="2">Economic competencies and opportunities</th><th colspan="4">Main dimensions of the transition</th><th></th></tr>
<tr><th>Sea level / high tide</th><th>Extreme weather (drought / precipitation)</th><th>Soil quality</th><th>Water quality</th><th>Air quality</th></tr>
<tr><td rowspan="2">Clean-tech / environmental technology</td><td colspan="5">Measuring and management systems for industry and consumers (sensors, AI, etc.)</td></tr>
<tr><td colspan="2">Climate-resilient construction</td><td>Physical-ecological / landscape management</td><td>Water purification and reuse</td><td>Air purification and quality management (industry, mobility, housing)</td></tr>
</table>

Note: Because of possible technological crossovers and spillovers concerning water and soil management systems, this diagram also includes air quality.

Strong parties and promising partnerships[5]

- In digitalisation and high-tech applications[25], the South occupies a strong position in water and delta technology (Campus Zeeland), in high-tech systems and key enabling technologies in digital technology and advanced manufacturing, photonics, and nanotech[26] (with Brabant leading the way).
- The South also has strong knowledge centres including NIOZ, TU Eindhoven, TNO, Zeeland, Avans University of Applied Sciences, Zuyd University of Applied Sciences, CoE BBE, and Fontys University of Applied Sciences
- And the region has active cooperation between the province, water boards, water sector, and other relevant sectors such as agriculture, industry, and construction[27].
- Because of this mix of available technology and high-tech applications, knowledge poles, and companies[28], there is potential to roll out and scale up innovations.

1.4 *Agriculture and food transition*

Clarification of the agriculture and food transition challenge

In agriculture and food transition, work is being done towards a food system that pays adequate attention to people and the environment, human rights, animal welfare, and health. The RIS3 focuses on these elements:

- Healthy and safe food
- Agriculture in balance with the environment (e.g. circular agriculture)
- Preventing waste, using/adding value to residual flows
- Alternative crops for ingredients and biobased raw materials

[5] The examples come mainly from the Entrepreneurial Discovery Process, are intended to be illustrative, and are not exhaustive

- Protein transition, the substitution of products of/with animal protein by vegetable and other proteins

Promising solution paths within the agriculture and food transition

In terms of the intended impact, the agriculture and food transition overlaps largely with the other transitions. This is why South Netherlands gives priority to initiatives that contribute towards multiple transitions:

- For **agriculture/food & energy**, examples include projects that:
  - stimulate energy-efficient and/or non-fossil food production and processing
  - ensure CO_2 sequestration (in the soil, but also in biobased materials through CCU)
- **For agriculture/food and raw materials**, this includes innovations that:
  - help to reduce food waste (through technologies such as sensors, behavioural, and system changes)
  - prevent the downgrading of residual flows
  - increase food and protein efficiency (e.g. alternative crops such as aquaculture)
  - reduce the use of fertilizers and nutrients
  - contribute towards the transition to a biobased economy (e.g. fibres for biomaterials, raw materials for chemical applications, etc.)
- At the interface of **agriculture/food and climate**, conceivable projects include those that:
  - make the agricultural sector more climate adaptive
  - through how agricultural businesses contribute towards climate adaptation (e.g. through innovative water and soil management).
- For **agriculture/food and health**, initiatives include those that:
  - contribute to prevention (e.g. reducing the use of harmful pesticides, increasing the supply of healthy food to reduce the risk of chronic diseases)
  - use innovations in product characteristic taste, firstly to make food production and consumption more sustainable, tastier, and healthier, and secondly to make better use of commercial opportunities
  - contribute to personalisation (personalised diet)
  - have curative applications (e.g. biobased raw materials for the pharmaceutical industry)
- Projects that contribute towards specific tasks in the **agricultural transition** are also possible:
  - transition to a food system that takes greater account of animal welfare
  - transition to a food system in which the position and welfare of food-chain employees improves worldwide
  - transition to more **transparency** throughout the system

In the agriculture and food transition, non-technological solution paths can also form the basis of economically feasible and exportable business models. Examples include:

- Projects that contribute towards feasible earning models. It is precisely in the agriculture and food transition that we see true cost accounting as a promising mechanism for steering more towards ecological and social impact (see barrier removal). In the Operational Programme, we see this as a principle to be fleshed out to also make innovations in agriculture economically profitable. An example would be a pilot project in which the ecological footprint of production is factored into the price.
- Projects that increase public support. Focus on aligning with the wishes and behaviour of the consumer as the end user in the chain. Promoting cooperation with the general public, civic groups, and cooperatives. Increasing transparency in the chain (traceability).
- Projects that contribute towards skills development. The shortage of technically and practically trained personnel in the agrifood sector calls for solutions in which educational institutions, business owners, and authorities work together. The commitment must be to improve the image of the

sector, outline career prospects, and recruit across borders. Automation in the sector is also happening quickly; this requires projects aimed at continuous training and retraining.

Sample projects – opportunities

	Main dimensions of the transition			
	Healthy and safe food	**Agriculture in balance with the environment**	**Preventing waste, using/adding value to residual flows**	**Alternative crops**
Economic competencies and opportunities	Involving the consumer earlier in the chain to increase acceptance and market viability.			
	Safe and sustainable production and processing	Reducing the use of fertilisers and nutrients	Preventing the downgrading of residual flows	Aquaculture, saline culture (seaweed, glasswort, etc.), insects, and so on
	Healthy food, easy choice and appreciated	Cyclic agriculture		Organic fodder (e.g. from sugar beets, etc.)
	Protein transition	Adapting to changing circumstances (e.g. saline crops and drought-resistant varieties)	Innovative market concepts (e.g. 'family fruit')	Pharmaceutical (probiotics from rhubarb)
		Water management		Chemical applications (colourants from tomatoes, algae, blueberries, etc.)
	Smart farming / precision farming			Soil improver / disinfectant (grass, seaweed, beets, etc.)
				Fibres, etc. for biomaterials (e.g. hemp insulation)
	Aiming for innovations that involve three or more links in the chain			

Strong parties and promising partnerships[6]

- A characteristic feature of South Netherlands is that regional leaders are represented within all links in the food chain. The agrifood sector is also highly organised, with partnerships such as Agrifood Capital, Greenport Venlo (including Brightlands Campus), Food Delta Zeeland, and the sector organisation ZLTO. We focus on projects relating to several links in the food chain, to increase the success rate and impact of innovations. Examples include collaboration between the breeder, the farmer, and the food processor, or between the food processor, the retailer, and consumer groups.
- Cross-sectoral collaboration also has potential to apply the relevant knowledge in the South to key enabling and other technologies in the agricultural sector. Thanks to its strong position in various key enabling technologies, the South has many opportunities within the agriculture and food transition. Applications include precision agriculture (by means of digital technology/ADMA, photonics, advanced materials), transition to bioeconomy, circular agriculture (application of chemical technology) and seed breeding (Nanotech, electronics).

[6] The examples come mainly from the Entrepreneurial Discovery Process, are intended to be illustrative, and are not exhaustive

1.5 *Health transition*

Clarification of the health transition challenge

The health transition focuses on a transition to a more efficient care system where people grow older in a healthier and happier way. The transition is partly necessary because of the increasing pressure on the care system caused by an ageing population (less labour supply, greater demand for care). We use the Netherlands Organisation for Applied Scientific Research's P4 principle as a framework for the South Netherlands health transition, and distinguish four tasks within this:

1. **Prediction**. The first task is to better predict health risks.
2. **Prevention**. Considerable health gains can still be achieved with prevention. A healthy lifestyle protects us from psychological and social problems, loneliness, and addictions.
3. **Personalisation**. Personalisation is about tailoring medical treatments to a patient's individual profile.
4. **Participation** means that people start to participate in and contribute towards their own care. The patient takes their care into their own hands and acts accordingly.

Besides this P4, there is still a considerable challenge in curative and regenerative medicine, by which quality of life and life expectancy can also be positively influenced. The P4 principle and curative medicine can also complement each other. Personalisation, for example, is a theme that is also gaining momentum in curative medicine.

Promising solution paths within the health transition

South Netherlands is committed to transitioning to a more efficient care system where people grow older, healthier, and happier thanks to a healthy lifestyle and living environment, widely available care, and care in their own living environment. The South focuses specifically on initiatives that contribute towards the specific tasks of prediction, prevention, personalisation, and participation in healthcare, and:

- **Prediction** refers to predicting the health risks of individuals or certain groups. These risks can be better predicted based on information about genetics, molecular biomarkers, stress, and social factors. Knowledge of artificial intelligence and other modelling techniques is needed to use big data. This requires cooperation between the healthcare sector and parties operating in ICT and data science. Protection of privacy is a priority in this regard.
- Considerable health gains can be made through **prevention**. Challenges include a healthy environment, stimulating healthy eating, a healthy lifestyle and social environment, and preventive screening. A healthy lifestyle protects us from psychological and social problems, loneliness, and addictions.
- **Personalised** care considers genetic, physical, psychological, social, and other factors, increasing the effectiveness of care and reducing undesirable side effects. The associated working method is called personalised medicine, also known as precision medicine.
- **Participation** and care in one's own living environment is an essential strategy to guarantee the availability of care. People are participating more in and contributing towards their own care. Technologies such as e-health applications, wearables, home automation, and robotics can assist with remote consultations and diagnoses, self-medication, and staying active longer. Participation

also has a social side. Social innovations can ensure that the formal and informal support systems are mobilised in good time.

In the health transition, non-technological solution paths can also form the basis of economically feasible and exportable business models. Examples include:

- Projects that contribute towards feasible earning models. Innovations such as cell therapy and personalised medical devices are expensive. Switching to affordable, large-scale production of individual therapies, such as cell therapy, can be a solution for this.
- Innovative forms of financing to launch expensive care innovations, such as new medicines and cell or other therapies on the market faster, can also help.
- Projects that increase public support. More will be demanded from informal carers and from patients themselves. Technologies and innovations such as e-health applications, home automation, and robotics can facilitate informal care and self-care. Besides more traditional forms of informal care, we can also think of cohabitation concepts in which the elderly or people with a minor need for care help and keep each other active, supported by care professionals.
- Projects that contribute towards skills development. Care is one of the sectors where labour market shortages are most pressing. To take advantage of cross-border opportunities, it is necessary to remove border barriers for healthcare professionals (e.g. recognition of qualifications, social security) and for patients (including conditions for healthcare insurers), either permanently or temporarily, through more scope for experimentation. The health transition also requires current and new curricula and other ways of training, for example with regard to using Virtual Reality and taking advantage of the opportunities of e-health.
- Projects that experiment with laws and regulations. Privacy legislation is often a barrier to collecting and analysing large amounts of data. Innovative methods, such as the personal health train (PHT) and other methods (developed in the public-private partnership DTL or Dutch Techcenter for Life Sciences) can help overcome these barriers.

Sample projects – opportunities

	Main dimensions of the transition			
	Prediction	**Prevention**	**Personalisation**	**Participation**
Economic competencies and social opportunities	Predicting risks with smart data, AI, and modelling techniques	Stimulating a healthy diet (in cooperation with the food industry)	Personalised/Precision medicine based on FAIR big data and innovations like organoids.	Remote care (consultations, diagnosis, medication) in the patient's living environment with e-health, domotics
	Safe and ethical learning of personal data (e.g. personal health train)	Promoting healthy and active lifestyles, with an eye for social context	E-health applications for customised care approaches	Collaboration with the logistics/installation sector for widely available care
		Cleaner environment, less toxic materials (including in raw-material transition)		Social innovations and innovative co-habitation and social care concepts
		Measuring: Evidence-Based Sensing, detection with nanotech and photonics (in conjunction with HTSM, med-tech)		
	Regenerative medicine			
	Removing barriers to the exchange of medical staff and patients			

Strong parties and promising partnerships[7]

- South Netherlands has world market leaders in medical and sensor technology, innovative SMEs in Life Science & Health, leading knowledge institutions, committed social institutions, and many local initiatives that can work together on tasks contributing toward the health transition. At Pivot Park in Oss, for instance, dozens of companies are active in Life Science, particularly in pharmaceuticals, and the TU Eindhoven is working on innovations with immunotechnology. And the Brightlands Maastricht Health Campus (BL-MHC) is making impressive innovations happen in Healthcare & Life Sciences and in the field of care.
- Specifically, South Netherlands occupies a strong position in key enabling technologies such as photonics and advanced materials. This offers opportunities to accelerate the health transition. For example, integrated photonics can be used to create a wide variety of sensors that are accurate, small, and inexpensive and can be used for prevention and early diagnostics outside of hospitals. Developments in advanced materials, such as micro-reactors, facilitate the production of more sustainable and cheaper medicines.
- South Netherlands is also strong in regenerative medicine: Maastricht University and Eindhoven University of Technology are working on this in collaboration with KU Leuven. Both significant large companies (Medtronic, Lonza) and SMEs (Neuroplast, Cimaas, Triplemed, Xilloc) are active in the field of regenerative medicine.
- Projects aimed at the broader social context and increasing participation in society also contribute towards a healthy lifestyle. Examples include the action centre Limburg Positief Gezond, the Academic Workshops of Tranzo (Tilburg University), the Brainport Healthy Living Lab, and the Care Innovation Center in Roosendaal.

[7] The examples come mainly from the Entrepreneurial Discovery Process, are intended to be illustrative, and are not exhaustive

2 Overview of EU funds and opportunities for South Netherlands

2.1 *New EU Programming Period: focus on simplifying the funds*

RIS3 is the key to synergy between the European programmes and synergy is becoming the focus more than ever for converting the RIS3 into concrete projects. The EU is supporting this with a series of simplifications[29].

- For example, a single rule book makes it easier to combine ERDF and ESF+ and grants and financial instruments (with a view to attracting private investment) within a single project
- Member States can voluntarily choose to transfer up to 5% of their Structural Fund resources to the new Invest EU fund, thus gaining access to the EU budget guarantee for investing in innovation, ERDF/Interreg digital networks, and the non-fossil economy
- It is also possible to transfer up to 5% of funds between funds to finance a specific project.
- Lastly, the ERDF and ESF+ can be used jointly (up to 10%) to finance all or part of a project within the context of the 'Investment in growth and jobs' objective.

The RIS3 of South Netherlands, in particular, which provides for a prominent role for SMEs and a broadening of target groups, requires a commitment to accessibility and simplification. This is taken into account when fleshing out the Operational Programme and the other European regional funds.

2.2 *Overview of European innovation funds*

Without going into the specific programmes in detail, we can identify the relevant European innovation-oriented funds with their focus on and application to the transitions[30] here (see Figure 1):

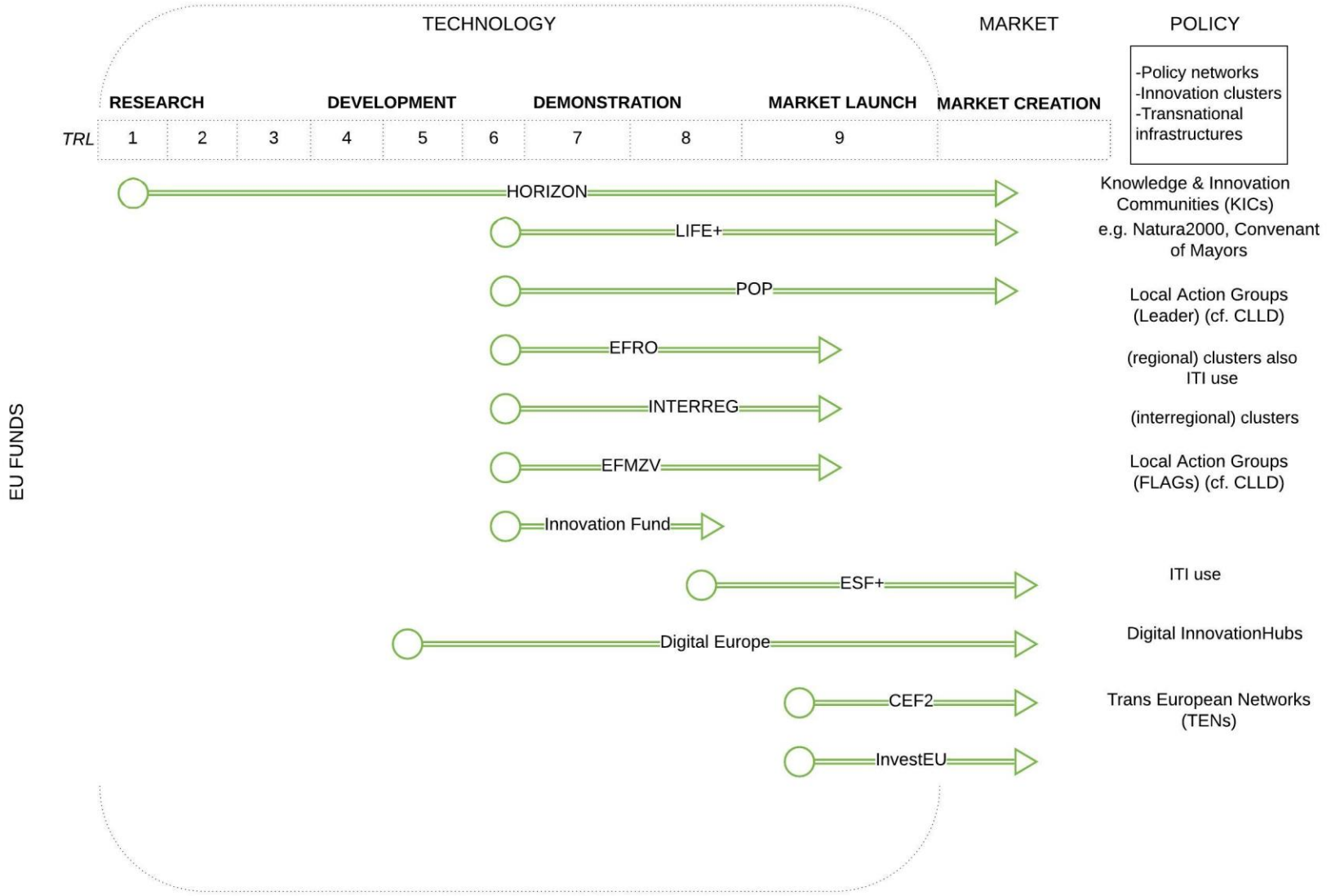
- **Regional development: ERDF and Interreg**
  - Focus: strategic objective of 'smarter Europe' (innovation, digitalisation, economic transformation, and support to SMEs) and 'greener Europe' (energy transition, renewable energy, and the fight against climate change):
    - ERDF (OPZuid): regional importance and economic transformation of existing knowledge and technology, based on the RIS3
    - Interreg: cross-border and transnational capacity building and removal of border barriers
    - Also a new interregional innovation programme, based on shared RIS3 priorities, including big data, the circular economy, and advanced manufacturing (positioning within regional policy programmes is still under negotiation within the EC-Council-EP trilogue)
  - Application: all transitions and themes transecting transitions ('enablers') such as the labour market, skills, and social/chain innovation (in conjunction with ESF+), as well as digitalisation and KETs.
- **European Social Fund+ (ESF+)[31]:**
  - Focus: inclusion, education, and training (life-long development), skills (particularly digital skills) and work, and health
  - Application: Health transition and labour market enablers, skills (including digital skills), and social/chain innovation .
- **Rural Development Programme (EAFRD/CAP Innovation Programme)[32]**:
  - Focus: roll-out of proven innovations and digitalisation within the agrifood sector
  - Application: Agriculture and Food Transition, also interfaces with other transitions (raw materials, energy, health, and climate as regards water and soil management), enabler skills, and digitalisation
- **Maritime and Fisheries Fund** (EMFF) – specifically for the province of Zeeland
  - Focus: transforming coastal communities to a low-carbon and climate-resilient, blue economy
  - Application: Agriculture & Food, also interfaces with other transitions (raw materials, energy, health, and climate as regards water and soil management), enabler skills, and digitalisation

- **Horizon Europe**
  - Focus: European excellence in mission-driven research and ground-breaking, market-creating innovation within European partnerships and in synergy with other funds (as mentioned here).
  - Application: all transitions and horizontal themes (enablers)
- **Digital Europe**
  - Focus: digital transformation via supercomputers, AI, cybersecurity, advanced digital skills, and large-scale application of digital technology in all sectors of the economy and society, including networking via Digital Innovation Hubs
  - Application: enabler digitalisation
- **Connecting Europe Facility (CEF2)**
  - Focus: creation of Trans European Networks (TEN), 'core network' (the digital TEN is particularly important here). Through ERDF investments in an 'extensive network'.
  - Application: enabler digitalisation
- **LIFE+**
  - Focus: supporting demonstration of environmental and climate techniques and good practices
  - Application: Energy transition (initiatives on energy efficiency and small-scale renewable energy sources), Raw materials (circular economy), and Climate transition (climate adaptation, water quality), as well as interfaces with Agriculture & Food transition (energy, circular economy, and climate adaptation), and Health transition (water and air quality)
- **InvestEU**[33]
  - Focus: market-based investment in sustainable infrastructure (including renewable energy, digital connectivity, circular economy, and water); research innovation and digitalisation (e.g. added-value research and innovation, digitalisation of industry, and AI); small enterprises (access to financing for SMEs and small mid-caps); social investment and skills (including social innovation and health care)
  - Application: all transitions and enablers.
- **Innovation Fund**[34]
  - Focus: demonstration of low-carbon technologies and processes in energy-intensive sectors
  - Application: Energy transition

TRL levels at which these funds are used (see Figure 2)

Horizon Europe is the only European fund covering the full TRL spectrum (from TRL 1 – basic research to TRL 9 - market launch)[35] Funds such as ERDF and Interreg are used not so much as an instrument for research and innovation actions, such as Horizon Europe, but to build research and innovation capacity and apply existing knowledge and technology relevant to the region. From this perspective, they focus primarily on projects starting from TRL 6 – prototype demonstration in test environment. This is a shift from the previous EU Programming Period, where projects were funded from TRL 3 – Proof of Concept. Techniques can also be tested and demonstrated within the standard actions of LIFE+. The same applies to the CAP Innovation Programme and EMFF, which are important for the roll-out of technology and applications. This is also the case for CEF2, which aims to use the most advanced technologies (created under Horizon Europe and other funds) for TENs. InvestEU is a market-based funding instrument, complementary to all the other funds mentioned above.

The figure on the next page indicatively shows the TRLs on which the funds focus.



Explanation:
- Note: Single Market and Erasmus+ are not included in this overview as they are not prioritised under RIS3. Also no new mechanism for tackling border barriers, if relevant to the labour market in a cross-border context.
- Abbreviations: 'CEF2' stands for Connecting Europe Facility; 'CLLD' for Community Led Local Development; 'ITI' for Integrated Territorial Investments (managing funds such as ERDF and ESF+ together).
- TRL 1 refers to Basic research; 2 Applied research; 3 Proof of Concept; 4 Prototype implementation and testing; 5 Prototype validation; 6 Prototype demonstration in test environment; 7 Prototype demonstration in operational environment; 8 Product/service is complete and operational; 9 Market launch of product/service
- Research (TRL 1-3), development (TRL 4-6), demonstration (TRL 7-8), and market launch (TRL 9+) refer to the innovation phases (linked to TRL).
- Horizon Europe, Innovation Fund, Invest EUR, Digital Europe, CEF2, LIFE+ are managed centrally by EU institutions and agencies; ERDF, RDP, ESF+, EMFF have shared or decentralised management (DC) with Member States or regions; in the case of Interreg, it is a mix, depending on the specific sub-programme – cross-border/transnationally shared and interregionally central
- Digital Europe and CEF2, used to invest in infrastructure, help create the framework conditions for implementation (market launch and creation). The same applies to ESF+ for skills and

2.3 *Linking EU funds to social transitions and enablers*

There are numerous options for using European funds on social transitions and the enablers (key enabling technologies, digitalisation and labour market/skills development). The link between funds and transitions/enablers is shown indicatively in the figure below.

Single Market (including SME services through Europe Enterprise Network – SME financing through InvestEU, also consumer protection and statistics) and Erasmus+ (higher education cooperation) are not included. Neither do we refer here to the new mechanism to tackle border barriers (relevant to the labour market in view of border location) nor to the programme to support structural reforms (relating to national policies, where applicable).

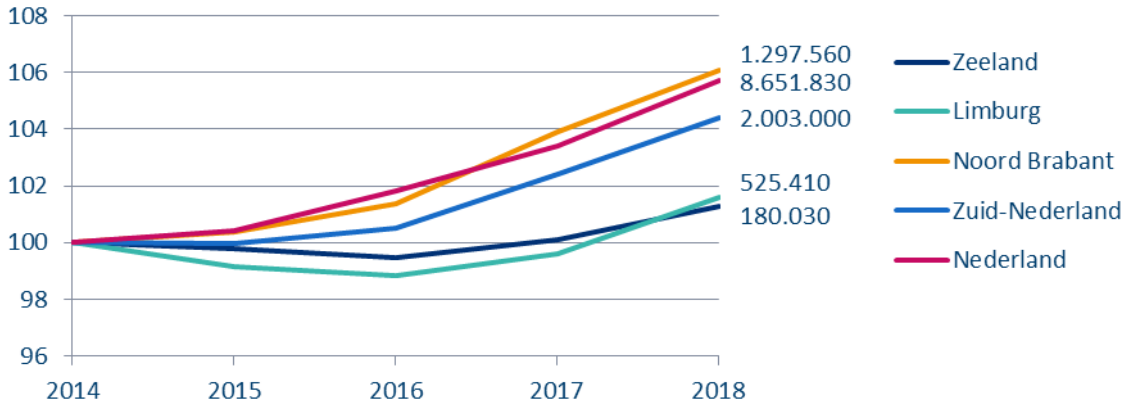
Supplementary report

Annex 1: Economic context and innovative strength in South Netherlands

The South Netherlands economy has developed favourably in recent years. GRP (gross regional product) has developed favourably in South Netherlands as a whole and in the individual provinces. Between 2010 and 2018, GRP grew by 25% in South Netherlands. Since 2014, the economy has been growing everywhere at least as fast as the average for the Netherlands. The Limburg economy has shown the strongest upward trend in recent years.

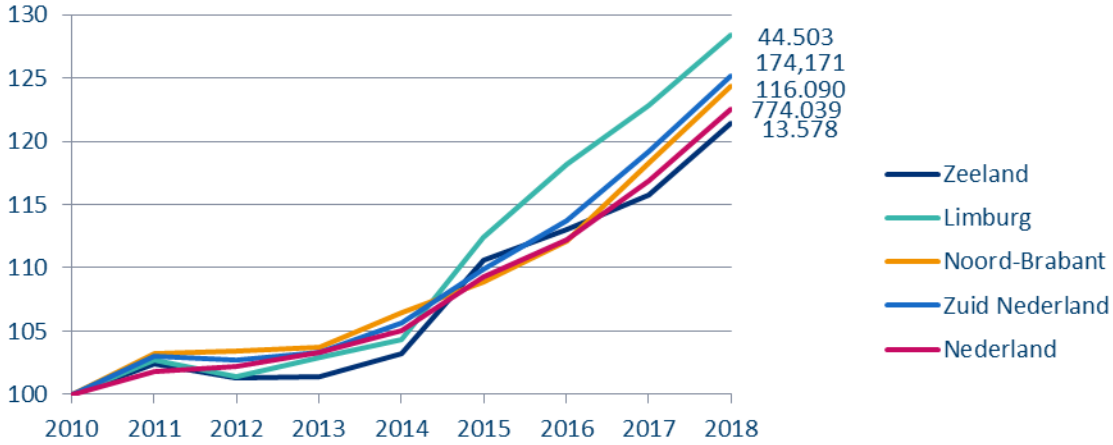
Employment has increased, especially since 2016. Between 2016 and 2018, employment in South Netherlands grew by 3.9%. This is comparable to the Netherlands average (3.8%). The rate of employment growth varies from region to region. In recent years, growth has been concentrated in the province of Noord-Brabant. From among the top sectors in the South, the Agriculture & Food, Logistics, and HTSM sectors are seeing the greatest growth in job numbers. After several years of contraction, employment in Life Sciences & Health and Chemistry is also picking up again.

Figure 2: Evolution of total employment in South Netherlands 2014-2018 (indices; the total number of jobs in 2018 for the region concerned is shown on the right)



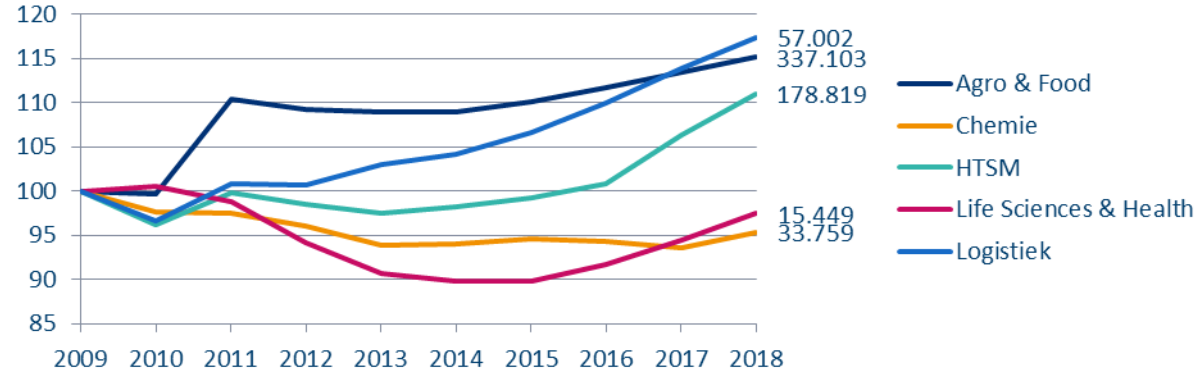
Source: LISA, 2018

Figure 3: Development of the gross regional product of South Netherlands 2010-2018 (indices; the total GRP per region is shown in millions of euros on the right)*



Source: Statistics Netherlands, 2019

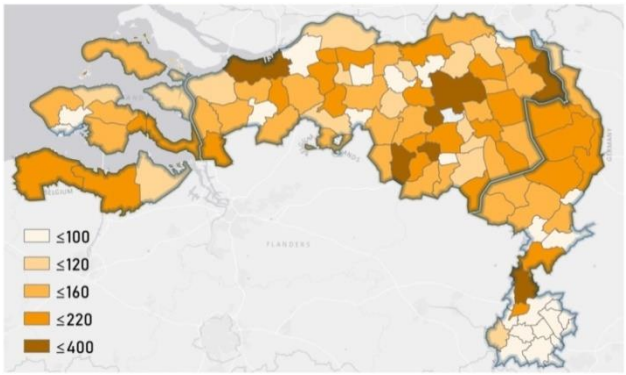
Figure 4: Development of employment in top sectors of the South 2009-2018 (indices; the total for 2018 is shown on the right).



Source: LISA, 2018

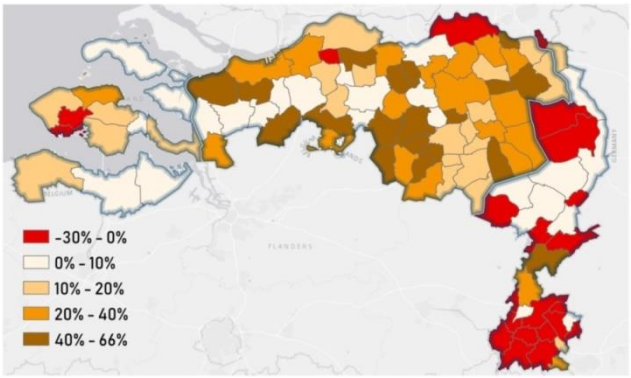
** figures for 2017 and 2018 are provisional data*

Figure 5: Number of jobs in top sectors per 1,000 residents



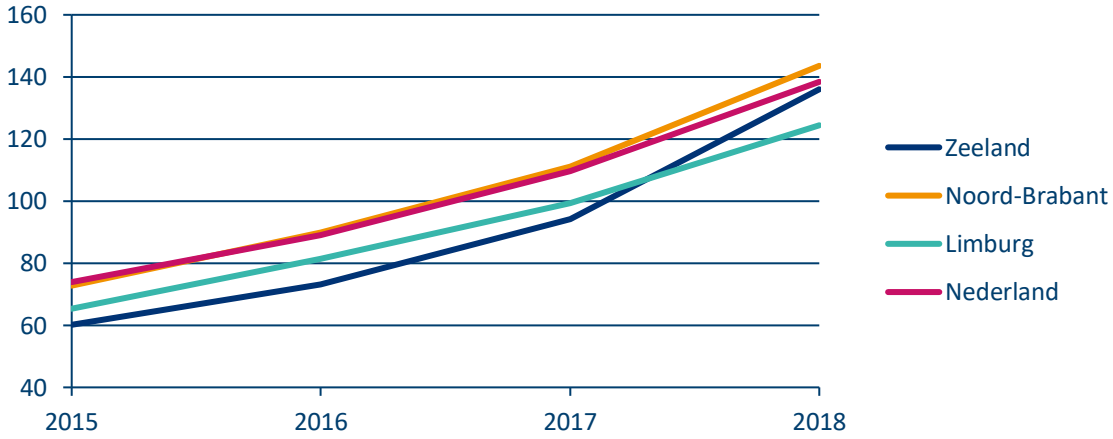
Source: LISA, 2018 and Statistics Netherlands, 2019

Figure 6: Number of jobs in the five top sectors (2009-2018)



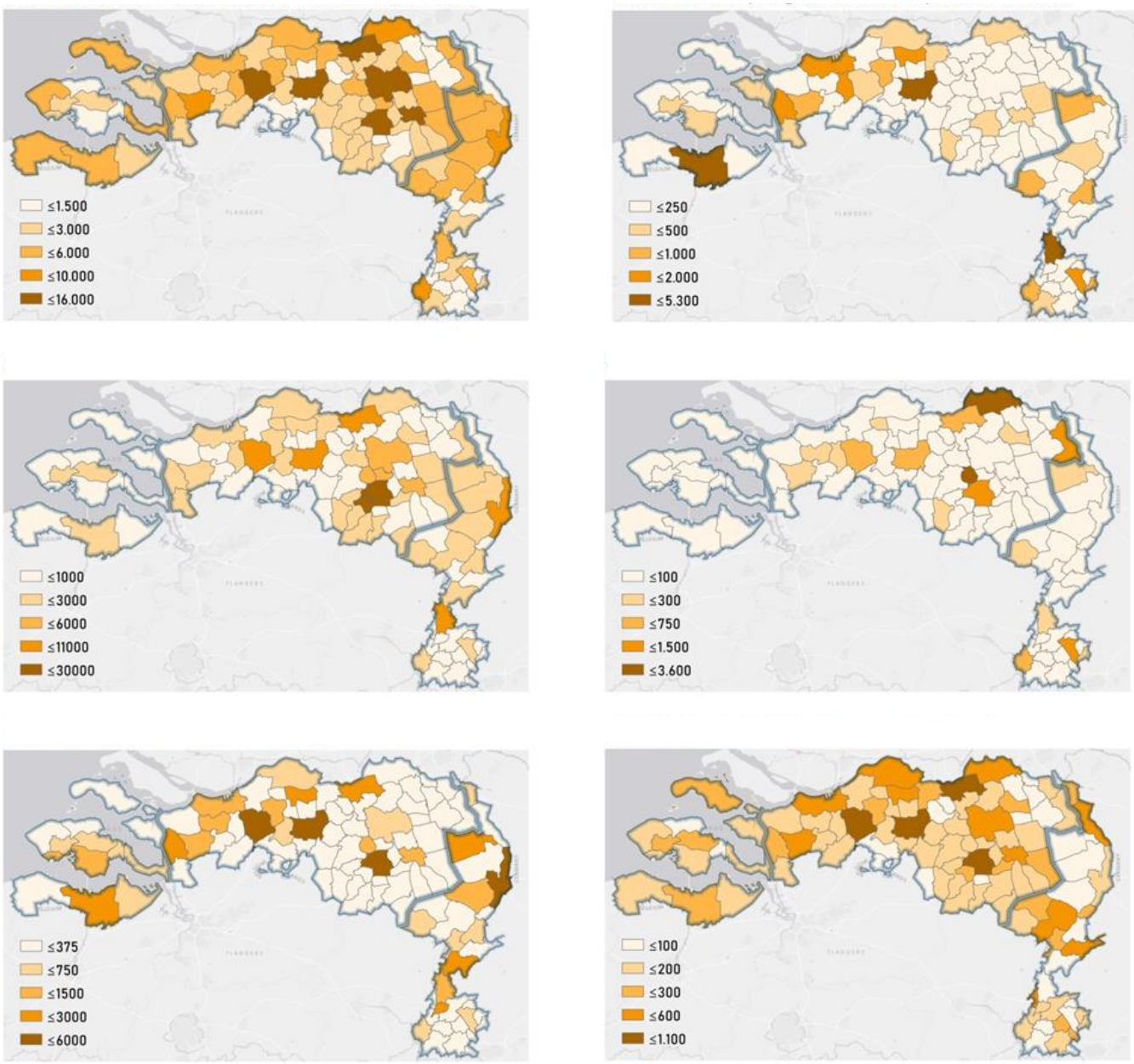
Source: LISA, 2018

Figure 7: Number of vacancies per 10,000 inhabitants



Source: Statistics Netherlands, 2019

Figure 8: Number of jobs per municipality in top sectors



Source: LISA, 2018

An analysis of innovation indicators shows that South Netherlands has an innovative and competitive economy in both a national and European context. This is evident because:

- **South Netherlands has a highly innovative corporate fabric**, according to the European Regional Innovation Scoreboard (see Table 1). The picture for the three provinces is also much more balanced than the traditional R&D indicators. Compared to the Netherlands as a whole, the region has a high proportion of companies involved in innovation (developing new products/services) and participating in technological innovation projects. This applies to all provinces[36].
- **The region is very competitive from an international perspective.** The Regional Innovation Score also shows that all provinces in the South are above-average innovators. Province of Zeeland is classified as 'strong'; province of Limburg and province of Noord-Brabant as 'leader'. And the

Regional Competitiveness Index shows a similar picture. All provinces of South Netherlands are above-average for competitiveness in Europe, with Province of Noord-Brabant leading the way.

Table 1: Score of the South Netherlands provinces compared to the EU (=100) on Regional Innovation Scoreboard (2019)

Indicator	Zeeland	Noord-Brabant	Limburg
Design applications	36.54	141.25	118.29
EPO patent applications	72.10	220.74	158.79
Employment in medium and high-tech manufacturing & knowledge-intensive services	101.82	120.98	92.70
Innovation index	90.41	135.15	123.73
Innovative SMEs collaborating with others	131.17	124.69	123.22
Lifelong learning	144.55	171.29	162.38
Marketing or organisational innovators	64.92	66.45	64.03
Most-cited publications	116.31	125.41	127.79
Non-R&D innovation expenditures	70.82	72.40	70.72
Population with tertiary education	61.18	131.65	120.25
Product or process innovators	101.61	103.85	100.88
Public-private co-publications	64.46	200.18	139.67
R&D expenditure business sector	89.02	157.21	117.38
R&D expenditure public sector	27.11	76.93	103.94
SMEs innovating in-house	90.71	90.71	90.71
Sales of new-to-market and new-to-firm innovations	101.91	102.11	100.02
Scientific co-publications	77.00	123.18	188.85
Trademark applications	90.70	174.68	121.97

Source: Regional Innovation Scoreboard, 2019

The analysis of knowledge parties and partnerships also reveals the image of a region that invests heavily in innovation, is strong in knowledge development, and has a strong corporate fabric that can market and scale up innovations. We summarise the picture as follows:

- **South Netherlands has a strong knowledge base and internationally leading knowledge institutions.**
    - The region has a diverse offering of universities (e.g. Eindhoven University of Technology, Tilburg University, Maastricht University) where basic and applied research occurs within varied fields of humanities, natural sciences, and social sciences. With the Roosevelt Academy, the province of Zeeland offers a specific academic institute.
    - The region also hosts a large number of universities of applied sciences, which contribute towards applying and developing knowledge in all kinds of fields of work and study. Examples include Zeeland University of Applied Sciences, Avans University of Applied Sciences, HAS, NLDA, BUAS, Fontys University of Applied Sciences, Design Academy

Eindhoven and Zuyd University of Applied Sciences. Senior secondary vocational institutions and regional training centres are increasingly working on continuous curricular strands.
    - Regional knowledge institutes are working on developing, upgrading, and upscaling knowledge across the entire spectrum of South Netherlands' top sectors and in all key enabling technologies.

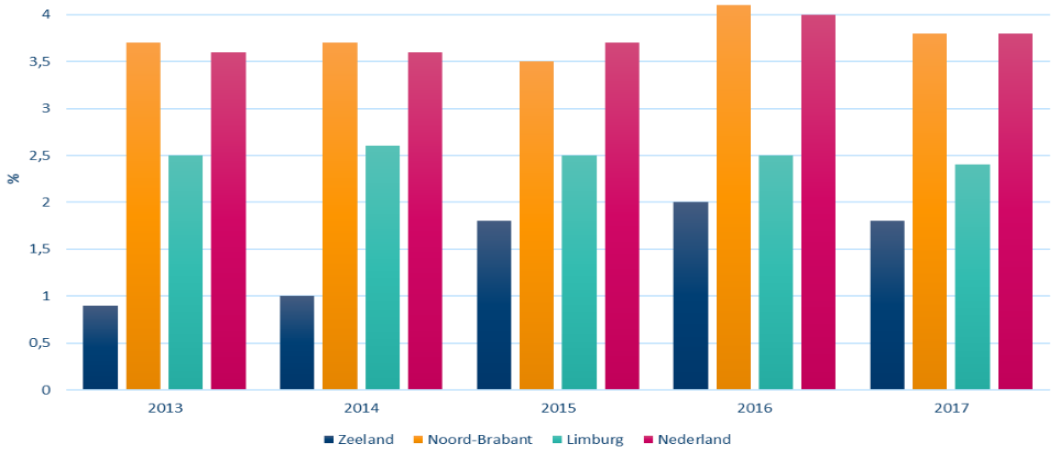
- **The region has a strong innovation infrastructure.** The knowledge and skills in the South find their way through various channels to the business community, social institutions, cooperatives, and other parties who can apply and bring the knowledge to market.
    - Various triple-helix network organisations operate at regional and subregional level. These organisations stimulate economic development with a regional and/or sectoral focus and, to this end, promote collaboration between knowledge institutions, authorities, and the business community. Relevant organisations include Midpoint Brabant, Economic Board West Brabant, REWIN, AgriFood Capital, Brainport Eindhoven and Brainport Development, Greenport Venlo, ESZL (South Limburg Economic Partnership), Keyport 2020, Crossroads Limburg, and Economic Board Zeeland. The various regional development companies, such as LIOF, BOM, and Impuls Zeeland, are also an important link in the innovation and funding system. Additional development companies exist at sub-regional level.
    - South Netherlands also has influential campuses, where knowledge institutions, companies, and other research organisations physically come together and work on innovation in all kinds of sectors. Impressive campuses include the Pivot Parkactief in pharmaceutical science, Green Chemistry Campus in the biobased economy, Automotive Campus, Campus Zeeland and the Brightlands campuses in Limburg in the Life Sciences & Health, Chemistry, Agriculture & Food, and ICT sectors.
    - Strong companies operate in the top sectors of South Netherlands. These are both well-known, internationally leading companies (e.g. Dow Benelux, Lamb-Weston, Yara Sluiskil, ASML, various Philips divisions, DAF, VDL-Nedcar, DSM, Sabic, etc.) and emerging companies ('unusual suspects', such as Lightyear, Blue Rock Logistics, Ecovat, Vanrijssingen, and Hemcell).

*Table 2: Top 10 largest companies in top sectors by province**

Zeeland	Limburg	Noord-Brabant
Cargill	Océ	ASML
COROOS Conserven	VDL-Nedcar	Bosch Transmission Technolog.
Dow Benelux	DSM	DAF Trucks
ENGIE Services	Sabic	Marel Stork Poultry Processing
Lamb-Weston/Meijer	Medtronic	MSD
McCain Foods Holland		Philips Health Care
Verbrugge Zeeland Terminals		Philips Consumer Lifestyle
Sligro DC Kapelle		Philips Electronics Nederland
Yara Sluiskil		Vanderlande Industries
Zeeland Refinery		WSD Groep

** for the provinces of Zeeland and Noord-Brabant, data are based on LISA data from 2018. No data at individual company level are available for the province of Limburg, data are based on RIS3 South Netherlands 2014-2020.*

Figure 9: Employment in high-tech sectors: % development 2013-2017 per province and the Netherlands as a whole



Source: Eurostat, 2018

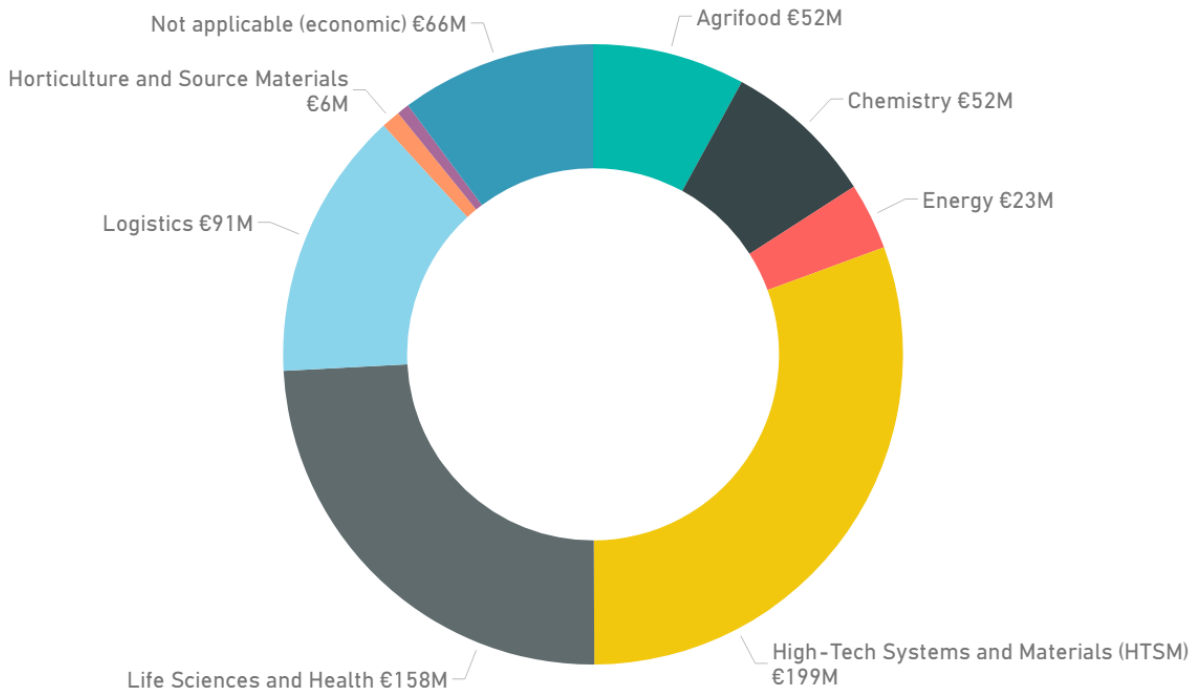
Given its strategic location between the Randstad, the Flemish Diamond, and the Ruhr Valley, and the character of South Netherlands, cross-border collaboration is an unmistakable part of the region's DNA. Besides obvious links with West Netherlands (including the port of Rotterdam, knowledge institutions such as Delft University of Technology, Leiden University, knowledge institutions, and businesses in the Amsterdam Metropolitan Area and the Utrecht Metropolitan Area) and East Netherlands (including knowledge institutions such as the Wageningen University & Research, Radboud University, and the University of Twente, universities of applied sciences and businesses in East Netherlands), this also involves cross-border collaboration. Examples include:

- TTR-ELAt (Top Technology Region/Eindhoven-Leuven-Aachen triangle, including triple-helix organisations in Maastricht, Hasselt, and Liège).
- The Kennis-As (collaboration between Limburg knowledge institutes and universities of Liège, Hasselt, and Aachen, financed by the province of Limburg).
- In the province of Zeeland, HZ University of Applied Sciences and the University of Ghent work together on programmes in water, agriculture, and nutrition.
- Numerous innovation projects financed through the cross-border Interreg programmes Flanders-Netherlands, Euregio Meuse-Rhine, and Netherlands-Germany.
- In chemistry, for example, Maastricht University and RWTH Aachen University collaborate in the Aachen-Maastricht Institute for Biobased Materials (AMIBM), a research hotspot at Chemelot. Partners from the business community, including DSM and Sabic, are also involved.
- The Biorizon Shared Research Center**,** a Dutch-Flemish collaboration (TNO/VITO) with a special focus on developing bioaromatics for chemical applications and the ambition to assume a leading global position.
- In health, the UMC cooperates with medical centres in Aachen and Liège.
- In HTSM, for example, there is collaboration in South Netherlands within Solliance, a partnership for research into next-generation, thin-film solar cells, including at TU Eindhoven. UHasselt, TNO, and Imec collaborate on this with affiliate market parties from various European countries.
- The sector organisation ZLTO cooperates with various international organisations in agriculture and food and also initiates various European projects.

Within a European context, parties in South Netherlands collaborate on innovative solutions to social challenges in all kinds of projects and settings. The following picture emerges from an analysis of EU funds[37]made available in South Netherlands:

- In the current EU Programming Period up to and including March 2019, around €1 billion in EU grants has been awarded in total to organisations in South Netherlands, divided over some 5,000 projects.
- It is clear that Horizon 2020 makes up the greatest share of European grants to be awarded in South Netherlands. 45% of European funding comes from Horizon. Besides H2020, CEF (11%), ESF (8%), EAFRD (8%), and OPZuid (6%) are also important programmes.
- Of the top sectors, HTSM and Life Sciences & Health, in particular, know how to find their way to EU funds (jointly accounting for more than 50% of EU funds). The Logistics, Chemistry, and Agriculture & Food sectors are also well represented.
- Major applicants in South Netherlands are mostly knowledge institutions (e.g. TU Eindhoven, Maastricht University), large companies and governments.
- European funds are concentrated in the regions of the South-East Brabant and South Limburg, where the two largest universities in South Netherlands are located. Measured in euros per inhabitant, the South Netherlands provinces receive relatively few EU grants: Zeeland occupies sixth place of all provinces, Limburg seventh, and Noord-Brabant ninth. In relative terms, the province of Zeeland scores well.
- Intensive collaboration around innovation is also occurring in an interregional context. The Vanguard Initiative, a partnership of 30 European regions aimed at a 'smart' strengthening of European manufacturing (Smart Industries) and accelerated introduction of product-market combinations from demonstrations and pilot projects, deserves a special mention here. HTSM, Chemistry, Life Sciences & Health, Biobased, Maintenance, and Logistics are focused on from the South[38] This initiative has also inspired the proposal to finance the creation of interregional innovation ecosystems through a separate programme within Interreg: the Interreg 'component 5'.

Figure 10: Share of each top sector in euros (above) and share of programmes by euros (below)



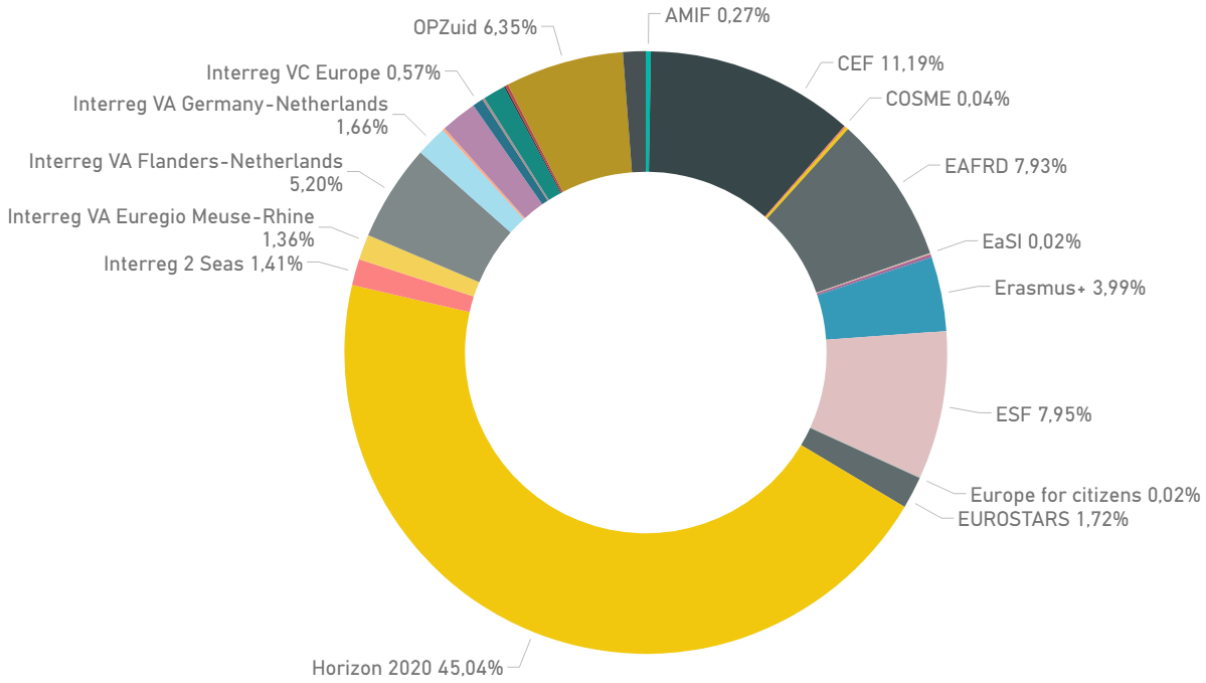
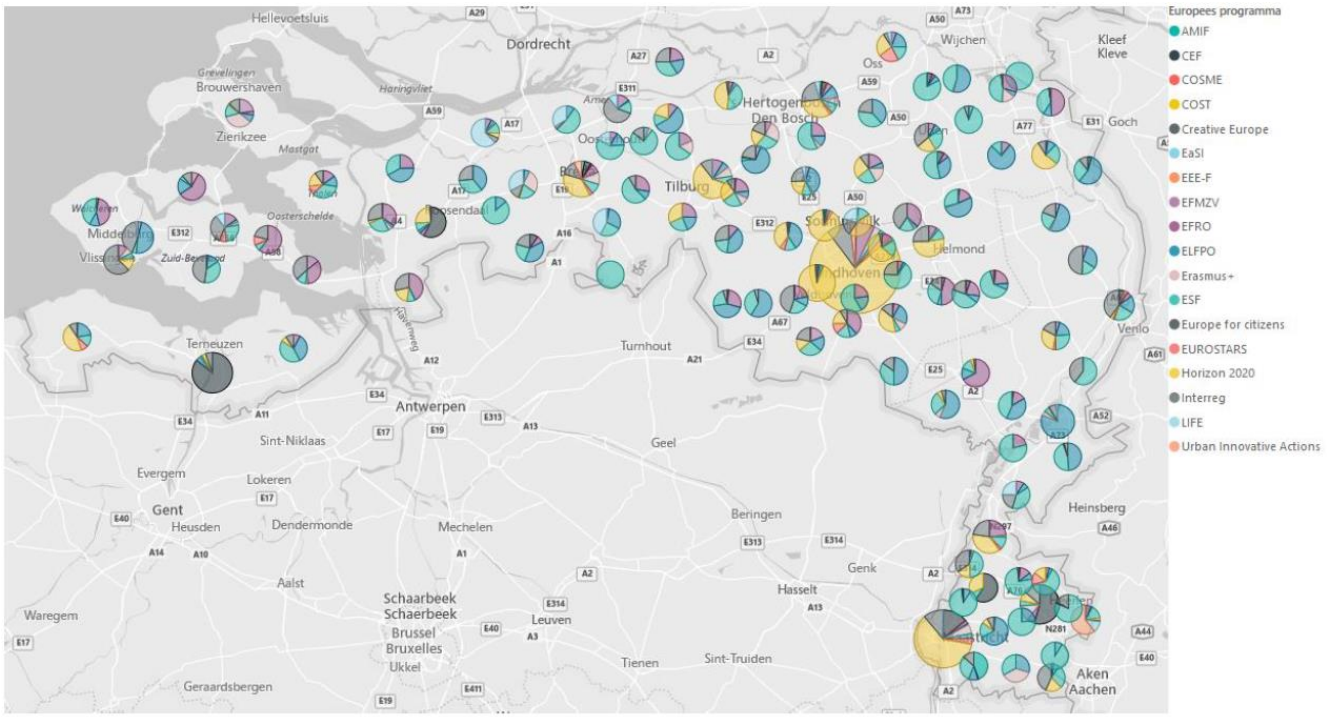


Figure 12: EU funding of each South Netherlands municipality by the European programme in euros



Source: Periodieke inventarisatie Europese euro's (Periodic assessment of European euros), March 2019

Table 3: Three largest applicants per province

Organisation	Province	Number of projects	Grant
HZ University of Applied Sciences Foundation	Zeeland	20	€4,349,925
Municipality of Middelburg	Zeeland	16	€3,954,553
Dow Benelux B.V.	Zeeland	9	€2,654,245
Maastricht University	Limburg	167	€73,922,693
Zuyd University of Applied Sciences Foundation	Limburg	30	€6,006,346
Province of Limburg	Limburg	16	€35,605,348
Eindhoven University of Technology	Noord-Brabant	249	€120,490,000
Tilburg University	Noord-Brabant	41	€24,147,148
ZLTO	Noord-Brabant	38	€7,581,098

Source: Periodieke inventarisatie Europese euro's (Periodic assessment of European euros), March 2019

Annex 2: Analysing the strength of the South: expertise within KETs in South Netherlands

1. *Role and definition of Key Enabling Technologies (KETs)*

Today, Key Enabling Technologies take centre stage in European and national innovation policies and are considered crucial to breakthrough innovations and industrial transformation. Over the coming years, substantial investments will be made in developing and applying key enabling technologies in a wide range of sectors. Besides the thematic KIAs, the government has also drawn up a more horizontal KIA for key enabling technologies. KETs includes four technology areas:

- Photonics and lighting technologies such as integrated photonics
- Nanotechnologies such as nanomaterials
- Quantum technologies such as quantum computing
- High-tech with five subcategories:
    - Digital technologies such as artificial intelligence, security, and process control
    - Advanced materials such as thin film and coatings
    - Chemical technologies such as catalytic process technology;
    - Life science technologies such as industrial biotechnology
    - Engineering and manufacturing technologies such as robotics

As the Netherlands occupies a strong international position in several of these technologies, key enabling technologies also occupy an important place in the RIS3.

2. *Key enabling technologies in South Netherlands – strengths and opportunities*

The European KETs observatory[39] shows that the Netherlands performs very strongly in photonics and advanced manufacturing technologies (ADMA). The South dominates in several patents for almost all KETs (mainly due to large companies and the high-tech ecosystem in and around Eindhoven). The region has a big lead over the rest of the Netherlands in photonics and advanced manufacturing (ADMA) in particular, and is able to capitalise on this strong R&D position in production. The region is also strong in micro- and nanoelectronics, albeit mostly in patents and less so in production. The South is also strong in advanced materials and nanotechnology (with the province of Limburg as the second region in the Netherlands for materials).

Digital technology & advanced manufacturing

As outlined in Chapter 2, we interpret digitalisation in the RIS more broadly than what is understood by digital technologies in the context of KETs. For example, advanced sensors also use principles from photonics and lighting technology, nanotechnology, and development and manufacturing technology. We distinguish opportunities in South Netherlands based on these aspects:

- **Measuring**: sensor technology is developing rapidly, and is the first step in analysing data and predicting trends. Sensor applications (preferably also combining, analysing, and predicting data) offer opportunities in industry, care, the built environment, and at home.
- **Analysing**: the amount of digital information being created and stored is growing exponentially, and devices are increasingly able to communicate with each other online (Internet of Things). This creates big data: large, unstructured, and rapidly growing datasets that can be used to learn from, predict, and improve action.
- **Predicting**: through machine learning and deep learning, computers and machines learn to develop and continuously improve models based on big data. This offers interesting application

possibilities in healthcare (e.g. scans that learn to better recognise medical abnormalities), industry (e.g. predictability of maintenance or replacement), and more.

- **Deciding**: Decision Support Systems (DSS) can help make complex decisions in healthcare, agriculture, industrial mobility, and other areas. Visualisation can also help with decision making; in **virtual reality** the computer generates images, which are shown across the real world in augmented reality.
- **Acting:** automation and robotisation increase labour productivity and change the demand for labour. Production and processing operations are also becoming increasingly accurate. Besides economic benefits, this can also result in environmental gains (e.g. less waste, reduced use of pesticides, fewer CO_2 emissions, etc.). For the South, the link to the manufacturing industry/advanced manufacturing (ADMA) is certainly important, where digital technology and AI are converted into new production technology and systems, such as those based on robotics, the Internet of Things, and 3D printing.
  Digitalisation also changes production chains. It gives rise to chain integration and opportunities for the sub-economy. Through innovative subplatforms, businesses and individuals can trade goods, space, knowledge, energy, mobility, logistics, healthcare, money, and services by buying, selling, renting, lending, borrowing, giving, exchanging, or sharing[40].

Given its strong position, the South is represented in the 40 **Smart Industry Field Labs** set up under the national Smart Industry agenda '18-'21 (aimed at demonstration in the context of market launch). In the South itself, 11 field labs are active, namely Fieldlab MultiMaterial 3D Printing (Eindhoven)[41]; Smart Connected Supplier Network (Eindhoven)[4243]; Flexible Manufacturing (Eindhoven); High Tech Software Competence Center (Eindhoven)[44]; Advanced Manufacturing Logistics (Eindhoven)[45] ; CAMPIONE – advanced maintenance in process chemistry (Gilze Rijen)[46]; Precision Farming Laboratory (Reusel)[47]; Composites Maintenance and Repair in Aviation (Hoogerheide, Aviolanda-Woensdrecht)[48]; Fieldlab Robotics (Roermond)[49]; SPARK – Ultra Personalised Products and Services (Den Bosch); Fieldlab Zephyros - advanced maintenance in offshore wind energy (Breda)[5051].
Investments are being made through the regional development companies to convert the work in the Field Labs into digital entrepreneurship and start-ups[52]. The region is a leading partner in the cross-regional thematic **S3 platform on 'High Performance Production through 3D-Printing'**[53], and a participant in 'Efficient and Sustainable Manufacturing'[54].
Lastly, South Netherlands can play an important role in the theme of digital security. Parties with expertise in this area meet at the **Brightlands Smart Services campus** in Heerlen[55], and the national cyber resilience centre was recently launched at the Brainport Industry Campus.

Photonics
By means of optical sensors, image technology, and optomechatronics, photonics make an indispensable contribution to the AI-driven systems described above, and are therefore inextricably linked to the advanced manufacturing industry. The South has built up a strong ecosystem in this area over the past 10-15 years, and thus plays an important role in the National Photonics Agenda 2018, drawn up in part by **PhotonDelta**, the most important cluster organisation in this field, based in Eindhoven[56]. With ASML already a central company, this cluster also includes a multitude of SMEs operating in various niche markets[57]. Scaling up testing and production is the challenge here. Important R&D-oriented collaborations, in which photonics plays a role, are also active in the region, such as **Holst Centre** (TNO, TU Eindhoven, Imec), focusing on free-form lighting, signalling, and sensors, virtual reality displays, and imaging equipment for large surfaces, and **Solliance** (TU Eindhoven, TNO, Imec), focusing on research into the design, prototyping, and production of solar cells. Initiatives and companies of South Netherlands are also active in European partnerships or networks, such as Photonics21 or EPIC. The South is also a leading partner in the cross-regional thematic **S3 platform on Photonics Integrated Circuits** (PICs)[58]. And PhotonDelta is active at

European level as a Digital Innovation Hub (important in the context of the Digital Europe programme)[59].

Advanced Materials

Advanced materials also play an important role in ADMA, e.g. 3D printing / additive manufacturing. Nationally, the High-Tech Materials roadmap is embedded in the HTSM Top Sector, for applications in energy, climate-resilient materials, healthcare, mobility, and safety.

In the South, the **Brightlands Materials Center** (Chemelot Campus, Geleen)[60] plays an important role in developing and upgrading advanced materials, focusing on polymeric materials (plastics), with applications in sustainable buildings, additive manufacturing, and lightweight Automotive. Other relevant development and collaboration initiatives include DPI Polymer Research Platform (Eindhoven)[61]; pre-competitive industrial materials development; Solliance in the specific field of solar-energy materials such as thin films; Dutch Institute for Fundamental Energy Research (DIFFER) Eindhoven[62]. The patent applications in this domain mainly come from the large companies DSM, NXP, Philips, ASML, and from players such as Sabic, Océ/Canon, BASF, Sabic, Dow, and Panalytical.

Chemical Technology

Chemical technology plays an essential role in making the economy more sustainable, firstly by making chemical conversion processes more energy efficient, and secondly by creating more sustainable and recyclable products (biobased, circular, post-fossil economy).

The South has a strong chemical sector, concentrated around Chemelot, DOW/BASF Terneuzen, and the port of Moerdijk. Substantial R&D investments are being made in these hubs to achieve the above objectives, and in some areas are even European pioneers. The most relevant initiatives in this context include **Brightlands Chemelot campus** (Geleen) that combines research facilities for sustainable chemistry (DSM, Sabic, Arlanxeo) with incubation and business development in new chemistry-based applications and products[63]; the **Biobased Delta cluster** that seeks to capture the entire **biobased** value chain, with an important place for biochemistry (biorefineries - e.g. lignocellulose, bioaromatics)[64]; the **Green Chemistry Campus** (Bergen-Op-Zoom) as a business accelerator for upscaling biobased innovation[65]; and the **Biorizon Shared Research Center** (TNO/VITO) with a special focus on developing bioaromatics for chemical applications and the ambition to assume a leading global position.[66] Within the context of the KETs observatory, bioaromatics has recently been described as a 'promising KETs-based value chain'.[67] From this positioning, the South participates in the cross-regional thematic **S3 platform on the Bio-Economy (non-food biomass)**, focusing on lignocellulose refining and bioaromatics[68]

Nanotechnology and electronics

Nanotechnology is often applied in combination with photonics, life sciences, and chemistry. For example, small accurate sensors combine semiconductor devices (microchips) with microfluidics, nanomaterials, and microreactors. For large industrial players such as **ASML and NXP**, this is essential technology. In this context, nanotechnology also plays an important role in R&D initiatives such as the DPI Polymer Research Platform and the Holst Centre, where the crossover between nanotech, photonics, and advanced materials is made in nanoelectronics and materials. TU Eindhoven is also involved in the 'open' research facility for nanotech research, NanoLabNL.

And the South is a participating partner in the cross-regional thematic **S3 platform on New Nano-Enabled Products** (Printed Electronics & Micro Systems for Bio Analysis).[69]

Life Sciences / Biotechnology

Life sciences relates most directly to the domains of care & health, with industrial biotechnology as an important economic conversion.

The life sciences hub in the South is in South Limburg, including the Brightlands Maastricht Health Campus (BL-MHC), which focuses on innovation in Healthcare & Life Sciences. Based on Maastricht University's top research facilities, ecosystems are being built around imaging, innovative diagnostics, and regenerative and precision medicine.[70] Initiatives such as the Centre of Expertise for

Care and Technology (EIZT)[71] collaborate with Zuyd University of Applied Sciences and local SMEs on applying Life Sciences in innovative care. Examples of the innovative corporate fabric in the South are Lonza/Pharmacell (cell and gene therapy), Medace (biomedical innovation), PT Theragnostic (DNA therapy), Cristal Delivery (nanomedicine), Xillox (personalised implants), Neuroplast (stem-cell therapy), Cimaas (immunotherapy), and Triplemed (aneurysm therapy).

Quantum technology
This technology is still the most under development, its added economic value is still in its infancy in Europe, and Delft represents the most important knowledge centre in the Netherlands. Because it bears little direct relevance to the RIS3, we will not discuss it further here.

3. *Key enabling technologies and the transitions*

In summary, we can say that the South's strengths lie in:

- digital technologies with a strong ecosystem in the South, reflected in the fact that the South is taking the lead in eleven Smart Industry field labs on a national level
- advanced materials (nano, thin film, organic)
- chemical technology, also biobased
- nanotech and industrial biotech

These technological strengths and leading position enable the South to accelerate transitions and achieve economically viable innovations. In the matrix below, we present promising topics for each KET and transition.

	Energy	Climate	Raw materials	Agriculture	Health
Digital technology/ADMA	Self-managing and learning management systems (Artificial Intelligence & Robotics)				
	Smart grids	Climate control Water and soil management	3D printing / additive production Advanced maintenance	Precision agriculture	Personalised / precision medicine Medtech / imaging
Photonics	Energy storage Solar cells				
Advanced Materials	Renewable energy (e.g. coatings / composite wind turbines)	Climate-resistant materials	Circular economy / materials		Micro-reactors Lab-on-a-chip Nanomedicine
Chemical Technology	Carbon Capture Electrification, Power2Gas		Bio-economy / agriculture Recycling / circular agriculture		
Nanotechnology and Electronics	Energy storage (efficient solar cells, batteries, accumulators)		Treatment of ground / wastewater / residual flows	Seed breeding	
Life Sciences / Biotechnology	Biosensors / chips to identify toxic substances Biomaterials			GMO superfoods / lab foods	

Digitalisation as an enabler for social transitions

Specifically with regard to digitalisation, which we define here not only as a key enabling technology but also as a process that transforms economy and society, we now detail each of the transitions:

- **Raw materials:** From the source to reuse, from product development, past the processing industry to reverse logistics, digitalisation can contribute to a more efficient use, exchange, and reuse of resources, raw and other materials through sensors, data analysis, modelling and prediction, automation, AI, and robotisation. This concerns digital solutions that help to optimise supply chain management and logistics, including reverse logistics, and customised products and services (advanced manufacturing, 3D printing), monitor product quality, use, and wear (smart maintenance), detect losses and emissions, and analyse and manage production processes (self-learning systems via AI and IoT). Digitalisation can also contribute to sustainable crossovers in which industrial cycles are closed (through better insight into material flows) and that facilitate circular use of materials (e.g. material passports in construction).
- **Climate adaptation:** Digitalisation is a *conditio sine qua non* to make South Netherlands climate-resilient and 'water-robust'. Sensors and measuring systems help monitor water and soil quality, water shortages, and heat stress, reserves (groundwater), and flooding (rainwater). Data collection and processing can contribute towards risk management, modelling, and forecasting in flood protection, water purification, desalination, sustainable management of freshwater resources, and more.
- **Energy**: Digitalisation also plays an important role within the energy transition. One of the biggest challenges to achieve a different energy system is the safe and secure supply of energy, through smart-grids and smart storage systems. Because of digitalisation, supply and demand can be better matched. Digitalisation also offers more opportunities for decentralised sustainable energy generation subsystems in a smart grid (local energy cooperatives, co-creation). And energy efficiency can be increased. Smart measuring systems enable business processes to be set up ever more efficiently, while ventilation and lighting, for example, can also be optimised.
- **Agriculture and food:** Although parts of the agriculture and food sector are already highly automated, there is still much potential for digitalisation. Digitalisation can be a good facilitator for innovations that contribute towards the transition. This may involve smart sensors and ICT for analysis, data and information collection, and quality control. This helps improve the quality and traceability of our food. Digitalisation can also make the agricultural process itself more efficient and sustainable. For example, robots can take over production tasks, while soil and raw materials are used more efficiently through precision farming and smart farming. And digitalisation can promote sub-initiatives, for instance by bringing farmers and consumers into contact with each other through digital platforms.
- **Health:** Digitalisation, big data, and measuring systems are making it increasingly possible to apply prediction and prevention. Innovations in home automation and remote care are also facilitated by digitalisation. Accordingly, there is a clear link between health transition and digitalisation.

Annex 3: SWOT analysis of South Netherlands

The SWOT analysis below summarises the picture that emerges from evaluating South Netherlands' economy and innovative strength.

SWOT analysis of South Netherlands' innovation system

Strength	Weakness
• Powerful top clusters • Innovative business: high participation and innovation success rate, including in SMEs • Diverse and strong higher education offering • Strong position in key enabling technologies • Cross-regional and cross-border collaboration in innovation • Strong role in several EIT KICs • Strong campuses and environments for knowledge economy • Collaborative culture	• Tight labour market, particularly in technically trained people at all levels • Mass and density compared to international metropolises (and thus appeal for talent) • Availability of risk capital (has improved, but still limited) • International connections (digital, road, rail, water, air, pipelines) • Robustness of infrastructure networks
Opportunities	**Threats**
• Transitions pose international challenges and create markets • Transitions require a combination of knowing and doing • Use of labour potential on other sides of national border	• Fossil, energy-intensive processing industry in chemistry and agrifood • Environmental issues in agriculture relating to the resilience of natural systems (water, soil, emissions) • Acceptance of change transitions

Clarification of SWOT analysis

The strengths have been reviewed in Annexes 1 and 2, but there are also some weaknesses. Particularly in a technologically strong regional economy like the South, the tight labour market for technicians at all levels is a hindrance. And although the South generally has an attractive residential and living environment, it has to compete with more metropolitan areas at home and abroad that have a stronger appeal for talent, while that talent is an increasingly important competitive factor.

When strengths and opportunities are combined, a core idea unfolds behind this RIS: the most important opportunity this RIS responds to is the international character of the transitions and the related international market opportunities. The combination of a strong, versatile, innovative, and internationally oriented business community, including SMEs, with the transitions and related international markets is what this RIS is all about. Devising new solutions to the major challenges facing the world or parts of it. And simultaneously showing that these new solutions work in the

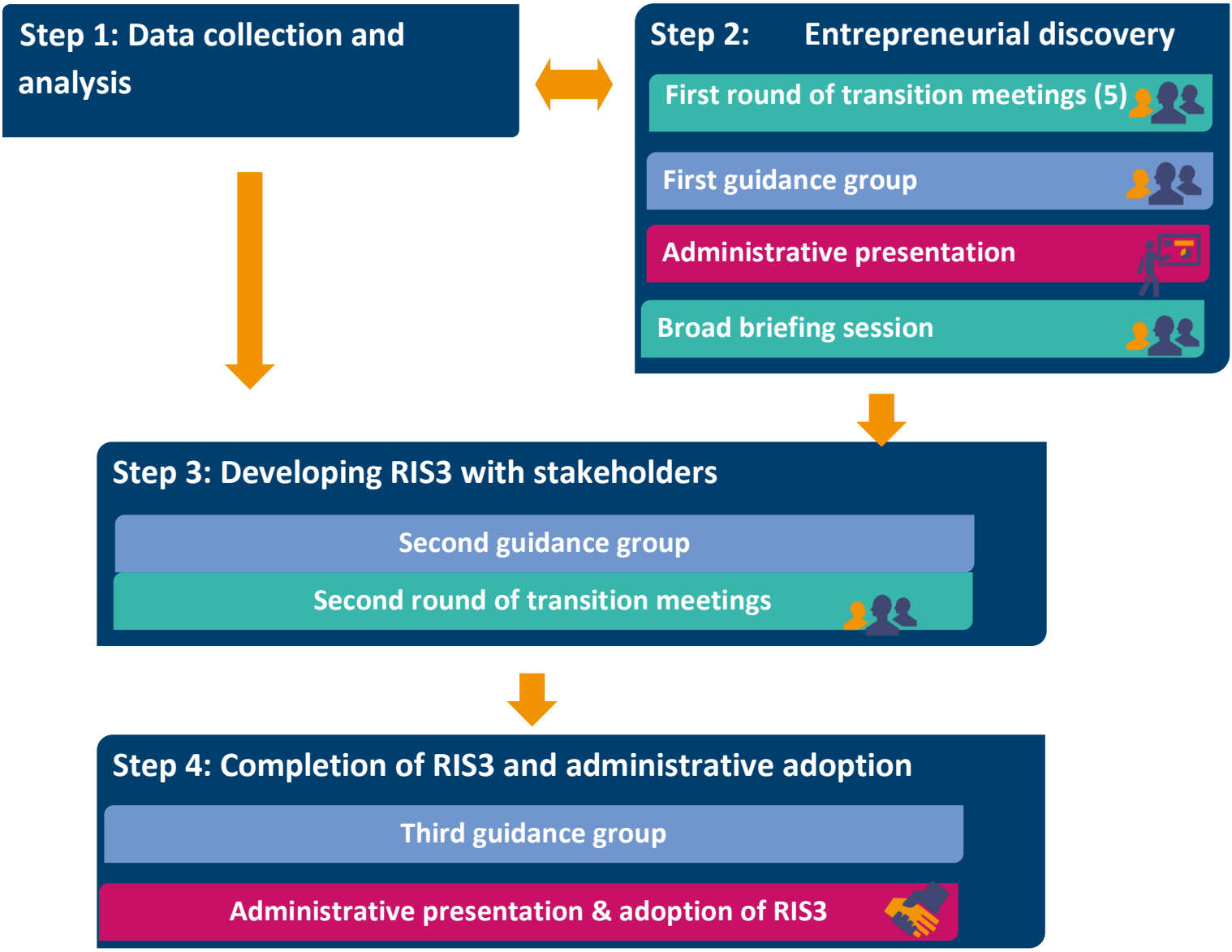
South and thus accelerate progress within the transitions. The culture of collaboration and combining knowing and doing come together in this.

At the same time, there are some threats, which this RIS does not address directly, but which contribute to decisions. For example, the processing industry in the South, in chemistry and agrifood, is energy-intensive and that energy has so far mainly come from fossil sources. The necessary steps with the major players in these clusters fall outside the scope of the specific programmes this RIS is looking at, but are of course extremely relevant for preserving those clusters. The environmental problems in agriculture – besides the current nitrogen debate, issues such as desiccation, soil quality, and other emissions – are another example of this. Meanwhile, it is precisely the transitions that are partly an answer to these threats.

Annex 4: Explanation of the process of producing the RIS3 and an overview of the parties involved

The RIS3 South Netherlands 2021-2027 was developed in an interactive process with regional stakeholders. The figure on the next page sets out the process and approach to producing a new RIS3. Main points:

- In parallel with a process of data collection and analysis (step 1), we held talks with approximately 40 parties in South Netherlands in the **entrepreneurial discovery process** (step 2). These were SMEs (renowned companies and 'unusual suspects', i.e. innovative and fast-growing companies), knowledge institutions, triple-helix organisations, and regional authorities.
- In **two rounds of five 'transition meetings**' (one for each social transition), we collected input on the transition itself and the innovation potential of South Netherlands (round 1), presented the main aspects of the strategy and fleshed them out (round 2).
- In a **broad briefing session** (September 2019), we updated parties with a role in the regional innovation system and gave them the opportunity to make their contribution.
- In **three meetings with the guidance group**, we fine-tuned the outline of the RIS. Academic universities, universities of applied sciences, the business community (employers' and sector organisations), local authorities, and other institutions were represented here. As a result of the '80% version' of the RIS3, we organised an extra meeting with the guidance group on 22 January. Besides clarification of the document, there was also room for comments and discussion. The output of this session was incorporated in this final version.
- As a result of the last guidance group on 22 January, we held an **additional administrative meeting** about the RIS3 with representatives of the B5 (five largest municipalities in Brabant) and triple-helix organisations in South Netherlands. We clarified several issues and have covered the items for attention they raised in this final version. We also shared the main comments in advance by letter.
- In a **meeting with ENZuid**, we discussed the draft version ('80% version') of the RIS3 with triple-helix parties and development companies in the South (8 January). We have incorporated the comments made by the members of ENZuid during the meeting and afterwards by e-mail in this final version.
- And we have meanwhile given the **steering group** (portfolio holders from the three provinces, with Theo Bovens, Commissioner of the King for the province of Limburg (in Dutch: "Gouverneur") an outline of the RIS. The **Provincial Executive** of the three provinces has also been informed separately about the draft version ('80% version') of the RIS3 and given the opportunity to make comments and raise items for attention.
- As the authors, Bureau BUITEN and IDEA Consult supervised the drafting of the RIS3. To this end, they had regular contact with the official **Preparatory Group** (consisting of representatives from the three provinces and the implementing organisation, Stimulus) and produced this final version in a collaborative effort.
- The Preparatory Group has been in regular contact with the other **regions of the Netherlands** and the **Ministry of Economic Affairs and Climate Policy** ('coordinators' meeting'), the **European Commission**, and the **managing authorities in Flanders and North Rhine-Westphalia** about the content of the new RIS3.


Step 1: Data collection and analysis
Step 2: Entrepreneurial discovery
First round of transition meetings (5)
First guidance group
Administrative presentation
Broad briefing session
Step 3: Developing RIS3 with stakeholders
Second guidance group
Second round of transition meetings
Step 4: Completion of RIS3 and administrative adoption
Third guidance group
Administrative presentation & adoption of RIS3

Overview of stakeholders involved in producing the RIS3

Preparatory group RIS3 2021-2027*

Participants in bi-weekly meetings	
Hans Overbeek	Province of Noord-Brabant (chairman)
Samira Nahari	Province of Noord-Brabant
Pieter Liebregts	Stimulus Programme Management
Marlon Peeters	Stimulus Programme Management
Bart van Sloun	Province of Limburg
Paul Habets	Province of Limburg
Chantal de Schepper	Province of Zeeland
Arnoud Guikema	Province of Zeeland
Participants in bi-weekly meeting at the chairperson's invitation	
Hans de Jong	Ministry of Economic Affairs & Climate Policy
Helmy van Erp	Ministry of Economic Affairs & Climate Policy
Joost Hagens	Bureau BUITEN
Maarten Kruger	Bureau BUITEN
Jos van Heest	Bureau BUITEN
Steven Knotter	IDEA Consult
Björn Koopmans	IDEA Consult
RIS assignment to OPZuid task force 2021-2027	
Tom Schulpen	Province of Noord-Brabant

Guidance group invitees (09-05-2019, 19-09-2019, and 22-01-2020)*

Participant	Organisation
Ton Brandenbarg	Province of Zeeland
Jan Cobbenhagen	Brightlands Campus
Didier Barrois	Brainport Development
Anne Verhaag	Brainport Development
Dick ten Voorde	Economische Impuls Zeeland
Bert de Wit	Industriebank LIOF
Gijs van de Molengraft	Brabantse Ontwikkelings Maatschappij
Joep Brouwers	Brabantse Ontwikkelings Maatschappij
Henk Rosman	REWIN
Dennis van der Pas	Economic Board Zeeland
Gerard van Harten	Dow Chemical
Louise van der Heijden	Delta Platform
Joop Crucq	Maastricht University
Mireille Brinkman	Maastricht University
Clement Goossens	TU/e-Eindhoven University
Jan Lonink	Municipality of Terneuzen
Johan Everaert	Municipality of Terneuzen
Maarten Lenis	Municipality of Venlo
Jos van der Heijden	Municipality of Venlo
Margo Mulder	Municipality of Goes
Jack Mikkers	Municipality of 's -Hertogenbosch
Jan Hoskam	Municipality of 's -Hertogenbosch
John Dane	HZ University of Applied Sciences
Erik Boskamp	Zuyd Hogeschool

Dennis Huurdeman	Zuyd Hogeschool
Lennart Nooij	Avans Hogeschool
Marion Stevens	Avans Hogeschool
Peter Paree	ZLTO
Maja van Putte	ZLTO
Huub Narinx	Limburgse Werkgevers Vereniging
Suat Koetloe	De Unie
Ton Hermanussen	Nederlandse Milieu Federatie
Hans Heijnen	Nederlandse Milieu Federatie
Josette Dijkhuizen	Maastricht School of Management
Florence Bongers-Rijnders	Province of Noord-Brabant
Marlies Veldhuijzen	Province of Noord-Brabant
Gido ten Dolle	Province of Noord-Brabant

Transition meeting invitees for each transition

Energy transition*

Name	Organisation
Jan Roggeband	Province of Noord-Brabant
Gerard de Leede	JADDS
Hans de Neve	TNO
Tessie Hartjes	LightYear
Tom Selten	LightYear
Huib van den Heuvel	Solaredge
Danielle Valkenburg	B5 municipalities Helmond
Susanne Agterbosch	PON
Wim Hazeu	Wonen Limburg
Nicole Rijkens	Pantopicon
Louis Hiddes	Mijnwater BV
Carola Helmendach	Impuls NV
Leo van der Klip	Province of Zeeland
John Jansen	Province of Zeeland
Gijsbrecht Gunter	Yara
Joep Geenen	Province of Limburg
Robert Engelen	Province of Limburg

Raw-materials transition*

Name	Organisation
Waldo Maaskant	Province of Noord-Brabant
Willem Sederel	Biobased Delta
Arnold Stokking	TNO
Eric Lammers	Province of Noord-Brabant
Florence Bongers-Rijnders	Province of Noord-Brabant
Robert Kint	B5 communities Tilburg
Ton Voncken	Bio Treat Center
Eric Appelman	Brightlands Chemelot Campus
Nurhan Abujidi	Hogeschool Zuyd
Harma Albering	Province of Limburg
Kathleen Metz	Prince Kunstofbouw
Goran Milosevic	Prince Kunstofbouw
Richard van Bremen	Province of Zeeland

Anita de Moor	Province of Zeeland
Hans Erkelens	Province of Zeeland

Climate transition*

Name	Organisation
Edwin Wieman	Province of Noord-Brabant
Sas Terpstra	Province of Noord-Brabant
Friso van Abbema	Province of Noord-Brabant
Bas Hoefeijzers	B5 municipalities Breda
Twan Tiebosch	Province of Noord-Brabant
Peter-Paul Huynen	Vereniging Industrie Water
Johan van Mourik	Water platform water
Eric van Griensven	Brabant Water
Martijn Groenendijk	Evides Waterbedrijf
Ton Schuurmans	Enexis
Peter Grispen	Spie
Mark Verheijen	ELC
Rien Huisman	Province of Limburg
Avra Avdic	Cities of Limburg
Robert Engelen	Province of Limburg
Jurate van Wankum	Province of Limburg
Willem den Ouden	Hogeschool Zeeland
Louise van der Heijden	Hogeschool Zeeland
Kees Steur	Province of Zeeland
Niels Elshof	Province of Zeeland

Agriculture transition*

Name	Organisation
Piera Fehres	Province of Noord-Brabant
Elisabeth Koch	Province of Noord-Brabant
Hendrik Hoeksema	ZLTO
Geert Hermans	ZLTO
Maja van Putte	ZLTO
Henri van den Boomen	BAJK
Roel Schutten	Agrifood Capital
Simon Maas	Agrifood Capital
Liesbeth de Theije	AFC
Elies Lemkes	HAS
Jacob de Vlieg	TU/e – Eindhoven University
Bram Derikx	Natuurrijk Limburg
Liesbeth Litjens	Brightlands Campus Greenport Venlo
Wouter de Bruijne	Province of Zeeland
Jos Strobbe	Province of Zeeland
Mariska van Dalen	Lamb Weston Zeeland

Johan Dourleijn	Food Delta Zeeland
Ko Francke	CZAV
Jeroen Rondeel	Blue engineering
Thomas Gijselaers	Province of Limburg
Annemiek Canjels	Province of Limburg
Harold Veugen	Province of Limburg

Health transition*

Name	Organisation
Astrid Kaag	Province of Noord-Brabant
Marc Jansen	BOM
Marielle Swinkels	Smarter futures
Jacoline Plomp	Avance Impact
Pieter de Boer	Province of Noord-Brabant
Edwin Teurlincx	B5 municipalities Den Bosch
Marieke Beekers - Meijer	B5 municipalities Breda
Susanne Agterbosch	PON
Mirjam Smulders	PON
Ida Hellebrekers	Limburgse Werkgevers Vereniging
Falko Houben	Medtronic
Andries de Grip	ROA
Thomas Gelissen	Trendbreuk/ GGD Zuid Limburg
Martijn Rumpen	Province of Limburg
Marga Poulssen	Province of Limburg
Fred Geelen	Municipalities of Limburg
Joyce Vermue	Zorgsaam
Frederique Knoet	Tilburg University
Laura Gottmer	Tilburg University
Rene Boone	Municipality of Goes
Wilma Boonstra	Campus Zeeland/Province of Zeeland
Gerard Olthof	Province of Zeeland
Kristian Coppoolse	Municipality of Goes
Johan Francke	Province of Zeeland
Liesbeth Voets	Province of Zeeland
Eveline de Jong	Z4 Municipalities Vlissingen

Administrative meeting invitees 20 August 2019*

Delegate	Position	Province
Theo Bovens	King's Commissioner	Limburg
Martijn van Gruijthuijsen	deputy Economic Affairs	Noord-Brabant
Andy Dritty	deputy Economic Affairs	Limburg
Joost van den Akker	deputy Economic Affairs	Limburg
Anita Pijpelink	deputy Economic Affairs	Zeeland
Anne-Marie Spierings	deputy Agriculture	Noord-Brabant
Hubert Mackus	deputy Agriculture	Limburg
Jo-Annes de Bat	deputy Agriculture	Zeeland

Consultation partners in the Entrepreneurial Discovery process

Name	Organisation
Bert Kip	Brightlands Chemelot Campus
Cristopher Brewster	Maastricht University
Bert van den Brink	Roosevelt Academy Middelburg
Henk Rosman en Dennis van de Pas	REWIN
Joep Brouwers/ Gijs van de Molengraft	Brabantse Ontwikkelings Maatschappij
Marloes Lenting	Photon Delta
Adri Bout	Seafarm BV
Eric de Ruijsscher en Koos de Groot	Economic Board Zeeland
Jacob van den Borne	Van den Borne Aardappelen BV
Ton Voncken / Peter van Paridon	Bio Treat Center en Grassa
Roel Schutten	Agrifood Capital
Nico Osse	Hemcell
Hans Jeekel	TU/e-Eindhoven University
Cornelis Biesheuvel	Dow Chemical
Boris Colsen	Colsen
Petra Koenders	Green Chemistry Campus
John Dane	HZ University of Applied Sciences
Dick ten Voorde	Economische Impuls Zeeland
Maarten Steinbuch	TU/e–Eindhoven University
Peter Scheijgrond	Tocardo International
Frederike Praasterink	HAS
Bas Kapitein	Midpoint Brabant
Tys van Elk/ Bert de Wit	LIOF
Adwin Martens	WaterstofNet - Automotive campus Helmond
Thomas Cleij	Maastricht University
Tom Selten	Lightyear
Max Aerts	Dens
Ruud van den Bosch	Ecovat
Marcel van Rijssingen en Gerbrand van Veldhuizen	Van Rijssingen
Wouter Stam	Flowid
Christian Janssen	Strategy Unit
Sebastiaan Huntjens	Maastricht University
Louis Hiddes	Mijnwater
Hans de Neve	TNO
Rop Zoetemeyer en Willem Sederel	Biobased delta
Hendrik Hoeksema	ZLTO
Brigitte Drees	Pivot Park Oss
Huub Narinx	LWV
Paul van Nunen	Brainport Development
Marcel de Pender	Coöperatie Slimmer Leven 2020
Olaf Timmermans	HZ University University of Applied Sciences
René Smit	ZorgSaam
Nico van Meeteren	Health Holland
Albert Scherpbier	Maastricht University
Nanne de Vries	Maastricht University

Briefing session 09-09-2019*

All members of the above bodies were invited to the broad briefing session on 9 September 2019, at which they were joined by several other interested parties from South Netherlands.

**Not all invitees attended all the above meetings*

Annex 5: Endnotes

[1] South Netherlands Economic Network, in which triple-helix organisations and development companies from the provinces of Zeeland, Limburg, and Noord-Brabant have been collaborating since January 2020, as a successor to the 'Brainport Network'.
[2] For example, Statistics Netherlands data for 2014 showed that the proportion of turnover from an upgraded product or service at companies (general and for top sectors) in the South was five percentage points higher than the average for the Netherlands (overall 26% compared to 21% and for the top sectors: 29% compared to 24%). See https://www.cbs.nl/nl-nl/maatwerk/2017/12/innovatie-en-r-d-binnen-de-topsectoren-naar-regio-2014
[3] Letter to the Lower House of the Dutch Parliament 33009 no. 70, State Secretary for Economic Affairs and Climate Policy, 26 April 2019: Mission-driven Innovation Policy
[4] See, for example, the relatively low score on indicators in the Innovation Scoreboard on 'Non-R&D innovation expenditure', 'SMEs innovating in-house'
[5] Also see https://www.s3vanguardinitiative.eu/partners/south-netherlands
[6] ERAC, '*Periodieke inventarisatie Europese euro's*' (Periodic assessment of European euros), March 2019
[7] Annex 2 Letter to the Lower House of the Dutch Parliament on the Mission-driven Top Sector and Innovation Policy: Approach to Key Enabling Technologies (26-04-2019), see https://www.rijksoverheid.nl/documenten/publicaties/2019/04/26/aanpak-sleuteltechnologieen
[8] See KIA Key Technologies with MMPIs. The listed Key Enabling Technologies are Chemical Technologies, Digital Technologies, Engineering and Fabrication Technologies, Photonics and Light Technologies, Advanced Materials, Quantum Technologies, Life Science Technologies, and Nanotechnologies. Also see https://www.hollandhightech.nl/kia-sleuteltechnologieen
[9] The analysis was drawn up based on the findings of the Entrepreneurial Discovery Process and the European KETs Observatory, among others.
[10] https://www.brightlandsmaterialscenter.com/
[11] http://www.innovatiesindezorg.eu/
[12] ADMA: Advanced manufacturing technologies
[13] COM(2018 375; Annex IV: Thematic Enabling Conditions applicable to ERDF, ESF+, and the Cohesion Fund. See https://eur-lex.europa.eu/resource.html?uri=cellar:26b02a36-6376-11e8-ab9c-01aa75ed71a1.0003.02/DOC_3&format=PDF
[14] The RIS3 is consistent with the methodology and definitions of the Innovation Fund Denmark, see https://innovationsfonden.dk/sites/default/files/2019-03/society_readiness_levels_-_srl.pdf
[15] Energy transition and employment: Opportunities for a sustainable future (19 April 2019), see https://www.ser.nl/nl/publicaties/energietransitie-en-werkgelegenheid
[16] For a comprehensive overview of cross-border barriers in South Limburg, see, inter alia, the report '*Grensoverschrijdend perspectief Zuid-Limburg*' (Cross-border perspective of the South Limburg) (Bureau BUITEN and Enno the Zuidema Stedenbouw), 2014
[17] PBL Quickscan effecten energietransitie regionale arbeidsmarkt (PBL Quickscan effects of energy transition in the regional labour market), 2018
[18] Cf. KIA for Circular Economy, July 2019
[19] The existing talent programmes within the top sectors of Energy and Chemistry for higher professional education and academic students can serve as an example. See: KIA for Circular Economy, July 2019
[20] For example, Ecovat in Veghel
[21] For example, Fuiji's microbial membrane technology that purifies microplastics , medicines, etc. from residual water that can be used in agriculture
[22] For example, Woonconnect Brabant
[23] As was the case, for example, in the construction of the Venlo town hall; there is also potential in the construction/design of business parks and road construction.
[24] This in conjunction with other ongoing projects such as the Green Pact for agriculture, horticulture, and the living environment, the Technology Pact, etc.: see KIA for Agriculture, Water, and Food, July 2019
[25] Sensors and measuring systems, for example, contribute towards monitoring water and soil quality. Data collection and processing can, for example, contribute towards risk management, modelling, and prediction in flood protection and sustainable land use. Cf. KIA for Agriculture, Water, and Food, July 2019

[26] See KIA for Key Enabling Technologies (KETs) with the MMPI Smart technologies in Agri-Horti-Water-Food (S1), in which the main KETs are digital tech, engineering and fabrication tech, photonics and light tech, nanotech, biotech, and advanced materials.
[27] Collaboration such as on arable farming erosion control in the South Limburg Hill Landscape or the Brabant Water Platform, founded in 2018, whose research has shown that 75 water technology and hydraulic engineering companies operate in Brabant alone (see http://www.microlan.nl/wp-content/uploads/2019/03/flyer_WPB.pdf).
[28] The Waterforce.nl expert network has about 32 independent experts active in South Netherlands.
[29] See https://ec.europa.eu/regional_policy/sources/docgener/factsheet/new_cp/simplification_handbook_nl.pdf
[30] The Single Market programme (which includes integrated advice to SMEs through the Europe Enterprise Network and cooperation on statistics and consumer protection) and Erasmus+ (including exchange and cooperation in higher education) are not included in this list as we do not prioritise them under the RIS3. In the context of the Single Market, funding is provided to SMEs through InvestEU. We also do not discuss the new mechanism for tackling border barriers here, which in itself is interesting given the labour market challenges in a cross-border context based on the border location of the South Netherlands provinces [see COM(2018)373]. Lastly, we pay no attention to the programme in support of structural reforms, which covers national policies where appropriate [see COM(2018)391].
[31] Result of the merger of the existing European Social Fund, the Youth Employment Initiative, the Fund for European Aid to the Most Deprived (FEAD), the EU Programme for Employment and Social Innovation (EaSI), and the EU Health Programme.
[32] Note: At least 30 % of rural development funding reserved specifically for climate and environment-related measures. Also, flexibility to transfer 15% of CAP allocations between direct support and rural development (whose fund also no longer comes under the Structural Funds) and a further 15% for environmental and climate measures without co-financing. Finally, the development of eco-schemes (within the direct aid pillar) for protecting carbonaceous soils (peatlands), nutrient management (less ammonia and nitrogen oxide), alternative cultivation methods (crop rotation instead of crop diversification)
[33] All existing funding programmes (EFSI, instruments within CEF, COSME, InnovFin, EaSi, etc.) under a single roof with one set of rules and procedures and a single point of contact for advice, resulting in a total guarantee of €47,5 billion (including contributions of €9,5 billion from financial partners) expected to mobilise €650 billion of additional investment. Member States have the option of transferring part of their regional development funds to Invest EU for greater leverage.
[34] The EU Emissions Trading System (EU ETS), the world's largest CO_2 pricing system, will provide revenue for the innovation fund from auctioning 450 million emission allowances from 2020 to 2030, as well as any unspent funds from the NER300 programme. Depending on the carbon price, the Fund could amount to around €10 billion.
[35] TRL stands for 'Technology Readiness Level'; we distinguish between these levels:
TRL 1 refers to Basic research / 2 Applied research / 3 Proof of Concept / 4 Prototype implementation and testing / 5 Prototype validation / 6 Prototype demonstration in test environment / 7 Prototype demonstration in operational environment / 8 Product/service is complete and operational / 9 Market launch of product/service
[36] For example, Statistics Netherlands data for 2014 showed that the proportion of turnover from an upgraded product or service at companies (general and for top sectors) in the South was five percentage points higher than the average for the Netherlands (overall 26% compared to 21% and for the top sectors: 29% compared to 24%). See https://www.cbs.nl/nl-nl/maatwerk/2017/12/innovatie-en-r-d-binnen-de-topsectoren-naar-regio-2014
[37] ERAC, '*Periodieke inventarisatie Europese euro's*' (Periodic assessment of European euros), March 2019
[38] Also see https://www.s3vanguardinitiative.eu/partners/south-netherlands
[39] Also see https://ec.europa.eu/growth/tools-databases/kets-tools/sites/default/files/policy/netherlands.pdf
[40] See https://www.sharenl.nl/deeleconomie/
[41] Also see http://amsystemscenter.com/fieldlab-multi-material-3d/
[42] Also see https://www.brainportindustries.com/nl/innovatieprogramma/fieldlab-the-smart-connected-supplier-network
[43] Also see https://www.brainportindustries.com/nl/innovatieprogramma/fieldlab-flexible-manufacturing
[44] Also see https://hightechsoftwarecluster.nl/
[45] Also see https://advancedmanufacturinglogistics.com/

[46] Also see https://www.worldclassmaintenance.com/project/fieldlab-campione/
[47] Also see https://www.pcvpl.nl/nl/479/proeftuin-voor-precisielandbouw-1
[48] Also see https://www.nlr.nl/nieuws/fieldlab-composieten-onderhoud-en-reparatie/
[49] Also see https://www.fieldlabrobotics.org/
[50] Also see https://sparkmakerszone.nl/
[51] Also see https://www.worldclassmaintenance.com/project/fieldlab-zephyros/
[52] For example, through its Business Development Fund, LIOF has provided eight AI-related early-stage funding packages totalling €3.8 million, in accordance with the strategic AI Action Plan. The Eindhoven region is a fairly important centre within the Netherlands with 20-25 active AI start-ups (309 in total) See: https://www.startupdelta.org/press/the-netherlands-could-miss-artificial-intelligence-revolution/
[53] https://s3platform.jrc.ec.europa.eu/high-performance-production-through-3d-printing (Additive-subtractive high precision & high finish production of high-end metals
[54] https://s3platform.jrc.ec.europa.eu/efficient-and-sustainable-manufacturing (Smart and adaptive manufacturing & Digital and virtual factory)
[55] Also see https://www.brightlands.com/brightlands-smart-services-campus
[56] https://www.photondelta.eu/
[57] Examples: Genexis, Satrax, smart photonics, bright photonics, effect photonics (optical 'System-on Chip'), VTEC photonics
[58] https://s3platform.jrc.ec.europa.eu/photonics
[59] https://s3platform.jrc.ec.europa.eu/digital-innovation-hubs-tool/-/dih/1546/view
[60] https://www.brightlandsmaterialscenter.com/
[61] https://www.polymers.nl/
[62] https://www.differ.nl/
[63] https://www.chemelot.nl/home
[64] https://biobaseddelta.nl/
[65] https://www.greenchemistrycampus.com/
[66] Aromatics are essential chemical elements that determine the shape, colour, taste, and odour of chemistry-based products. Although bioaromatics are still in the R&D phase, Biorizon plans to reach TRL 5/6 by 2020, producing 40 tons/year, and move to commercialisation by 2025. See: https://www.biorizon.eu/
[67] https://ec.europa.eu/growth/tools-databases/kets-tools/sites/default/files/documents/analytical_report_nr2_bio_aromatics_final.pdf
[68] https://s3platform.jrc.ec.europa.eu/bio-economy
[69] https://s3platform.jrc.ec.europa.eu/new-nano-enabled-products
[70] https://www.brightlands.com/nl/Maastricht-Health-Campus
[71] http://www.innovatiesindezorg.eu/