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Smart Specialisation Strategy (RIS3) East Netherlands 2021-2027

Versie 1.0



Preface

Our provinces are committed to strong and innovative entrepreneurs and powerful SMEs. It's important to know your strong points and where the best opportunities lie. The Regional Innovation Strategy in front of you details where the innovative capacity of our regional economy lies and outlines a clear course for the period up to and including 2027.

In East Netherlands we are working towards a smart and clean economy. We are building on the basis that was realized in the previous RIS period. Starting from the strength of East Netherlands innovations (Agro&Food, Health, HighTech Systems and Materials, Energy & Environmental Technology) established in that period, in the coming years we will create the link with the big social challenges of our time such as the energy transition and circular economy. This will result in exciting crossovers that will form the core of the new innovation strategy.

The big transitions not only ask the attention of us all but are also an economic opportunity we can make use of to strengthen our competitive position as East Netherlands Region. This will be the challenge in the coming years. We can achieve this by smart cooperation and being optimally in line with European and government policy. This RS3 offers the required tools.

The RIS3 has been developed within the framework of the new ERDF period 2021-2027 and constitutes an important basis for the new Operational Programme ERDF, our economic policies and the review & update of our programme The Strength of East ('Kracht van Oost'). This strategy has been drawn up after extensive consultations with many stakeholders: businesses, knowledge institutes, authorities, etc. As we consider it important that the RS3 remains a dynamic document, we will regularly update this strategy together with our stakeholders.

We have every confidence that through this document and the new ERDF programme we can offer the East Netherlands economy a strong boost as from 2021.

on behalf of the Provincial Executive

C. van der Wal

Regional Minister of Gelderland



on behalf of the Provincial Executive

Y.J. van Hijum

Regional Minister of Overijssel



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Introduction

Why a Smart Specialisation Strategy?

A smart specialisation strategy (RIS3) is a substantiated prioritisation for investments in innovation in a certain Region. This strategy clarifies the strengths of and the opportunities for the knowledge economy and innovations within the Region. The RIS3 creates the relationship with entrepreneurial activities and available infrastructure, and points out where the critical mass is located in the Region. Such a strategy therefore outlines the opportunities for specialisations on the basis of the Region's potential. In this way, the Region is challenged to make choices and to only invest in competitive advantages instead of stimulating all innovations that originate from the Region. However, this does not imply that other innovations from the Region are not welcome. It does mean that the Region makes choices based on its innovation strategy to only invest in those specialisations that offer a competitive advantage and a future for the Region.

The RIS3 is a requirement for all European Regions that want to make use of the European Fund for Regional Development (ERDF) in the period 2021-2027. The strategy is a dynamic so-called 'living' document that will be adjusted in the coming years in line with changes in social and economic circumstances that influence the challenges to and developments within the innovation ecosystem.

The ERDF distinguishes between 3 NUTS levels: East Netherlands is a so-called NUTS1 Region consisting of the Province of Overijssel and the Province of Gelderland. To prevent confusion with the term 'region' which is regularly used within both provinces for NUTS3 areas (Achterhoek, Twente etc.) we will refer to these as 'provincial regions'. When we refer to East Netherlands as a NUTS3 Region, it will have a capital R for reasons of clarity.

Build on the previous strategy and the strengths of East Netherlands

This document is not the first smart specialisation strategy for East Netherlands. In September 2013, the first edition of the strategy was published.¹ The current strategy builds on this first edition. The 2013 strategy noted that East Netherlands at the time invested in the triple helix model and that the first investments in clustering were being realized. At the time, however, it appeared that critical mass among others things turned out to be a challenge in specific themes just as innovation activities across the board. It was concluded that the Region had taken up a middle position with regard to a lot of themes. It was decided that the strategy would specifically invest in four themes i.e. Agro & Food, Health, HighTech Systems & Materials (HTSM) and Energy & Environmental Technology including biobased economy (EMT). In the past years, investments have been made in all four themes and specialisations have arisen in respect of specific components.

The previous strategy has contributed to giving direction to investments to reinforce and expand the innovation ecosystem of East Netherlands. Through knowledge parks, Valleys, instruments of East Netherlands Development Agency Oost NL and partnerships such as BOOST and Energy and Environmental Technology-cluster Stichting KIEMT, the ecosystem is becoming more accessible and is supported more effectively. As is clear from Chapter 1 of the strategy, these investments are starting to pay off and clustering has really materialized, certainly on local and regional levels. The choices in this strategy, therefore, build on these specialisations and further zoom in on the crossovers between the specialisations with which East Netherlands distinguishes itself.

A strategy in times of mission-driven innovation policy and transitions

Whereas, the previous strategy was drawn up immediately after the economic crisis, this strategy is written in times of economic prosperity with warnings for the coming slump. This setting also influences the choices and the direction of the current strategy. The current challenges and expectations for the

¹ https://www.op-oost.eu/bestanden/Documenten/OP-Oost/Over_OP-Oost/S3%20Oost-Nederland.pdf

coming years are that the rapidly developing technological innovations will increasingly gain a foothold in society and that the social relevance of innovations is therefore becoming more and more important.

On a geological scale, the world is reaching the limits of its growth. This increases the climate crisis, the biodiversity crisis, the pressure on drinking water supplies and agricultural areas as well as the related migration streams. In addition, we also see other social challenges, for example in the area of healthcare costs and the organisation of care, the demand for technical skills and the growing displacement of low-skilled labour by automation. On the other hand, there is a growing offer of technological, social and organisational innovations such as the circular economy, the share economy, digitalisation, robotisation, sustainable energy, and smart and saline agriculture.

Mission-driven innovation is committed to the successful deployment of new ideas to solve the big and urgent problems that threaten our way of life. That is why through mission-driven innovation policy² the innovation potential of East Netherlands is connected to social challenges in the same way as this is effected in Dutch and European innovation policy.

At the same time, the businesses that are important to the innovative capacity of East Netherlands are challenged by economic transitions. The term ‘transition’ is used for many aspects in current society. Within the economy, it concerns changes in the ways that raw materials are being used, how products and services are produced and delivered, where they are realized, and for and by whom they are used (as is further detailed in Chapter 2). These economic transitions require the application of innovations in order to remain competitive. Both the missions and transitions constitute an important context to which specialisations of East Netherlands have to respond.

Direction of the strategy

This strategy focuses on strengthening the innovation ecosystem and to specialise in three crossovers that originate from the four themes of the previous strategy and represent the innovative power of East Netherlands. In this manner, East Netherlands can consolidate its position as ‘strong innovator’ within Europe and possibly strengthen it.

To reinforce the existing innovation ecosystem, we are committed to:

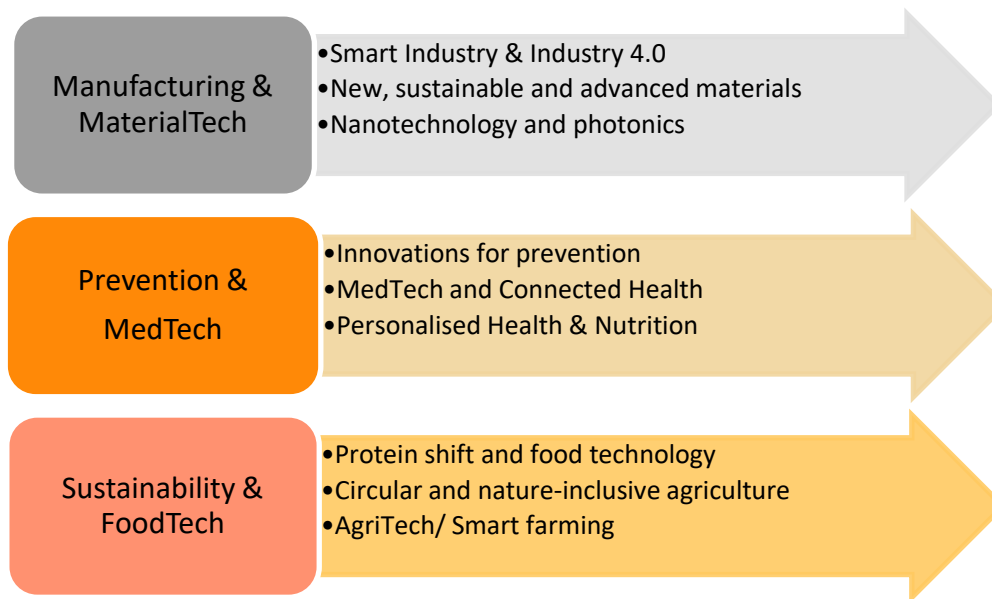
- Bundle the strengths in East Netherlands at the level of the Region (focus & mass);
- Invest in incremental and radical innovations that are essential to the economy and that will be the eye-catchers of East Netherlands;
- Invest in maintaining strong and competitive SMEs and develop new opportunities via start-ups and scale-ups (the existing and the new economy);
- Tie in with social missions and economic transitions that create the context for innovations to be successful;
- Facilitate a comprehensive innovation approach with a central position for the business case;
- Involve figureheads in connecting actors and activities to arrive at a constant interaction so that innovations do not stagnate by issues of the day;
- Innovate with and for the residents of East Netherlands;

Chapter 4 will discuss in more detail why and how the innovation ecosystem is strengthened in this way.

The strength of East Netherlands lies in the synergy between the different expertise areas (i.e. crossovers) in which technology is linked to societal challenges. The possibility to bundle expertise through these crossovers makes the Region unique.

These crossovers and the opportunities for innovation include:

² <http://www.mejudice.nl/artikelen/detail/missiegedreven-innovatiebeleid-twee-vliegen-in-een-klap>



The three chosen crossovers represent the capacity for innovation of East Netherlands and contribute to social missions and economic transitions, as explained in Chapter 5, 6 and 7. The potential of these crossovers has already been proven. In each of these crossover areas, an East Netherlands innovation was nominated and/or selected as National Icon - a prestigious Dutch award for innovations. They are judged on being ground-breaking innovations in which the Netherlands is or can become international leader.³

The choice for the crossovers and the areas within those crossovers with logical opportunities for distinctive East Netherlands innovations, are the result of an extensive desk study of the strengths and challenges of East Netherlands, interviews with stakeholders and several strategy sessions with stakeholders and interested parties of innovations in East Netherlands (see Appendices A and B).

Overview

The strategy starts with an outline of the existing innovative capacity of East Netherlands; from businesses, knowledge institutes, the authorities and the public (Chapter 1). Consequently, the challenges for East Netherlands are considered within the context of the social challenges and missions, and economic transitions (Chapter 2). These two chapters lead to an analysis of the strengths, weaknesses, opportunities and threats of the East Netherlands Region (Chapter 3). Chapter 4 states the strategy to strengthen the East Netherlands innovation ecosystem. The following three chapters (5-7) discuss the specialisations in more detail per crossover. And finally, Chapter 8 outlines how the strategy is kept up-to-date. Appendix A reflects the way in which the strategy has been realized and states the names of the persons that were consulted. The list with consulted sources is included in Appendix B and additional data for Chapter 1 can be found in Appendix C.

³ <https://www.nationaleiconen.nl/>

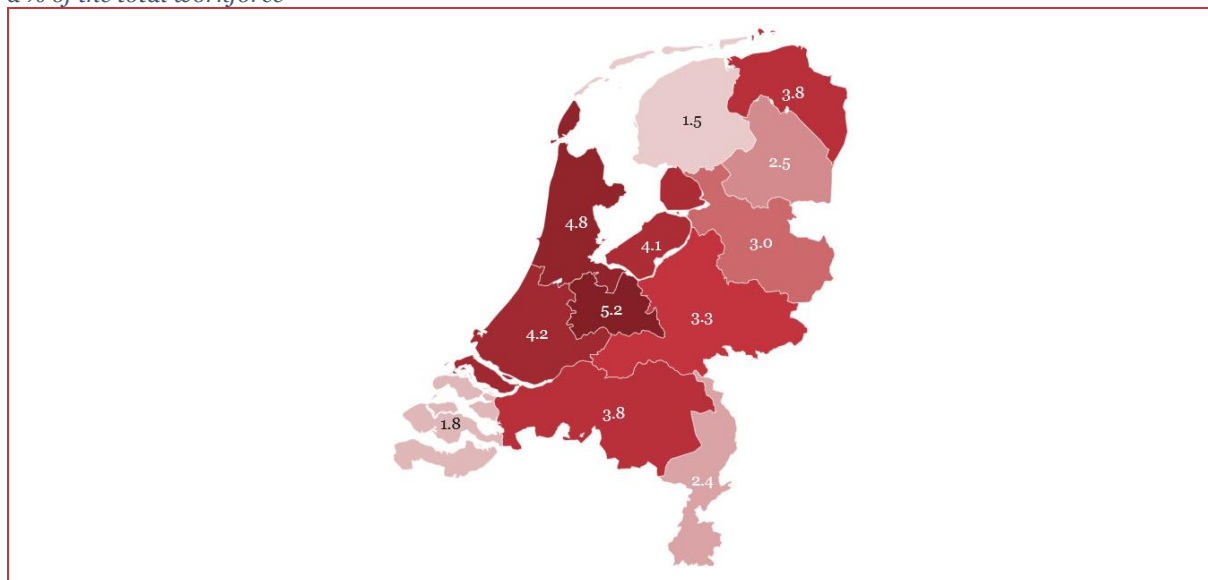
1 The regional innovation system in motion

Innovation can be defined as the successful introduction and implementation of better or improved products, services, processes or models and therefore extends far beyond the invention phase. Innovations stimulate the growth of the economy because they can contribute to an expansion of economic activities and can make the processes that are required for this, more efficient. A healthy innovation climate is therefore essential for a stable and strong economy. **When innovations have sufficient mass and clustering power, they can make a Region distinctive or contribute to keeping up with general market developments.**

As innovative country, the Netherlands scores high in multiple international rankings. Among others because of the good collaboration between businesses, knowledge institutes and authorities, businesses that sell knowledge, the level of education, the quality of infrastructure (including IT), public investments and income from patents.⁴ According to the European Innovation Scoreboard, **the Netherlands is even an innovation leader in Europe**, and in 2019 takes up the fourth position after Sweden, Finland and Denmark. **With this ranking, the Netherlands has realized the largest growth in terms of innovation since 2011 compared to the other EU-countries.** It is the bundled forces of the four different Dutch Regions that ensure this high valuation of innovation in the Netherlands, in which each individual Region has its own specialisations and distinctive strengths.

The East Netherlands Region makes an important contribution to innovation in the Netherlands. The East Netherlands Region consists of the Provinces of Gelderland & Overijssel, and borders on all three other Dutch Regions as well as Germany, which makes it the most central Region of the Netherlands. Some 3.2 million people (one fifth of the Dutch population) live in East Netherlands (2018). Ranked on the basis of working population employed in the technological and knowledge-intensive sector, **the East Netherlands Region takes up the middle position in the Netherlands**; after the provinces in the West of the Netherlands, Noord-Brabant and Groningen (see Figure 1).

Figure 1 Part of the working population employed in the technological and knowledge-intensive sector in 2018 as a % of the total workforce



Eurostat 2019⁵

⁴ For example, the European Innovation Scoreboard, Global Competitiveness Report, Global Innovation Index

⁵ https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=htec_emp_reg2&lang=en

Compared to other European Regions, the East Netherlands Region performs above-average on economic and innovation indicators. The Regional Competitiveness Index of 2019 shows that Gelderland scores 86.4 out of 100 and Overijssel 81.69 (which makes them respectively the 20th and 32nd most competitive Regions within the EU). For both provinces, comparable Regions have been identified, which are mostly the same for both, i.e.:

- In Germany: Berlin and surroundings, Koblenz and Arnsberg
- In Sweden: East, Central and South Sweden
- In Denmark: North Jutland
- In Austria: Carinthia
- In the United Kingdom: Hampshire & Isle of Wight
- In Italy: Liguria

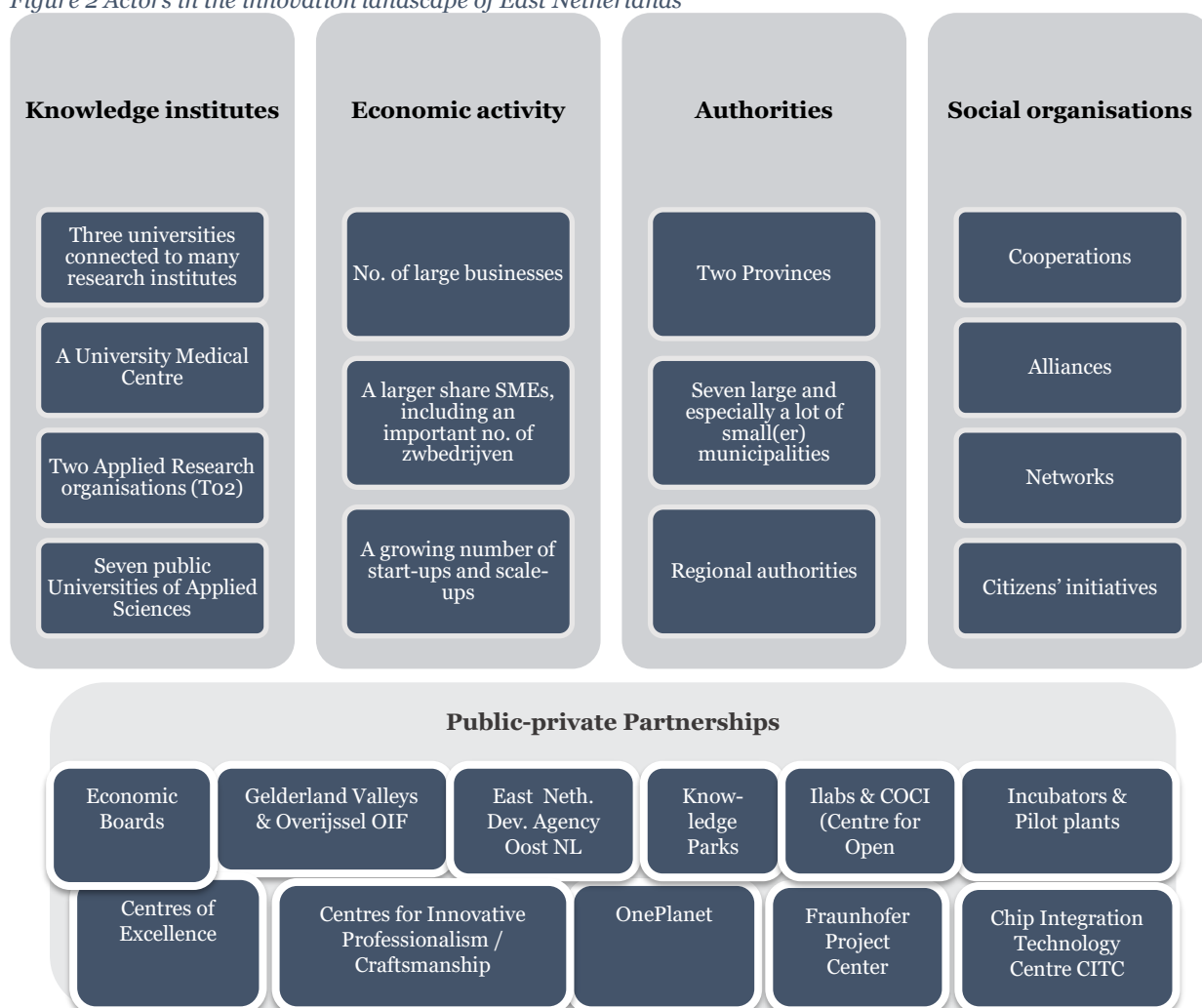
With respect to other European Regions, both provinces score above-average on all indicators and do especially well on the indicators: institutions, macro-economic stability, primary education and technological 'readiness' (and for Gelderland specifically on infrastructure).

East Netherlands is also recognised as '**strong innovator**' according to the Regional Innovation Scoreboard 2019. Both provinces also have a higher GDP per resident for 2017 than the European average, even though growth between 2013-2017 fell below the European average. **The scoreboard shows that both provinces score above the European average on many indicators for innovation but on the other hand a little below the Dutch average.** Both Gelderland and Overijssel score high on higher education, lifelong learning, innovative partnerships between small and medium-sized businesses (SMEs), scientific publications and scientific partnerships between businesses and knowledge institutes. In addition, Overijssel also scores high on investments from the business community for research and development whereas Gelderland shows a high score on investments from the public sector in R&D. Focus areas for innovation⁶ in both provinces mainly concern intellectual property (patent applications), corporate innovation and sales on new markets.

The East Netherlands Region accommodates a broad range of players that jointly contribute to the innovation climate. The strong ties of these organisations with the Region and their mutual cooperation create opportunities for innovation in East Netherlands. **This chapter briefly considers the developments and characteristics per type of actor that make the innovative capacity of East Netherlands distinctive from others.** This existing innovation infrastructure forms the basis on which the strategy for the 2021-2027 time frame can be built as described in the Chapters 4 up to and including 8. The stated organisations in this chapter are important examples but they are certainly not the only actors that contribute to innovation in East Netherlands.

⁶ Elements in which the East Netherlands Region scores below the European average

Figure 2 Actors in the innovation landscape of East Netherlands



1.1 The economic innovative power in East Netherlands: Innovation from businesses

The capacity for innovation in the economy of a Region is mainly determined by the specific economic sectors in which the Region is predominantly active and that will therefore represent its strengths. Just as in the rest of the Netherlands,⁷ the five biggest economic sectors in East Netherlands in terms of number of branches, are **the services industry, trade, (health)care, other services and the construction industry**. In terms of number of jobs (employment), the first three are the same and the last two are replaced by **industry and education**. This is mainly due to the fact that the construction industry and other services mostly consist of one-man businesses (self-employed workers without employees). In comparison with the rest of the Netherlands, the following aspects stand out (are different from the average):

- Agriculture is characterised by micro/small businesses (<10).
- There are a lot of small and medium-sized businesses (SMEs) in the industrial sector including fairly large enterprises.
- The care sector has a wide range of employers in terms of size; we find both very large organisations and micro businesses in the sector.

⁷ The construction industry and trade are somewhat more represented than in the rest of the Netherlands while services (business, financial and other) and IT are less strongly represented. Data based on Statistics Netherlands (CBS) / Netherlands Employment Register LISA.

The strength of the East Netherlands Region differs strongly per provincial region; both between the provinces and within them, there are big differences in respect of focus. Agriculture is for example most strongly represented in the Achterhoek, Southwest Gelderland and Southwest Overijssel, industry in Twente and the Achterhoek; (health)care in Arnhem/Nijmegen and Southwest Overijssel, services in Arnhem/Nijmegen, the Veluwe and Southwest Overijssel and the construction industry is relatively strong in the Veluwe.

Although small (family) businesses are an important part of the economy, the share of **larger SMEs is substantially larger than on average in the Netherlands**. This is clear from the fact that businesses with more than 100 employees, provide 37% of the jobs in the East Netherlands Region, while the average in the Netherlands is lower than 20%. **These bigger SMEs in East Netherlands are mainly present in industry, public utility companies, logistics, financial services, authorities, education and care**. Large multinationals, however, are only present to a lesser degree in East Netherlands. Appendix C offers more detailed information per sector.

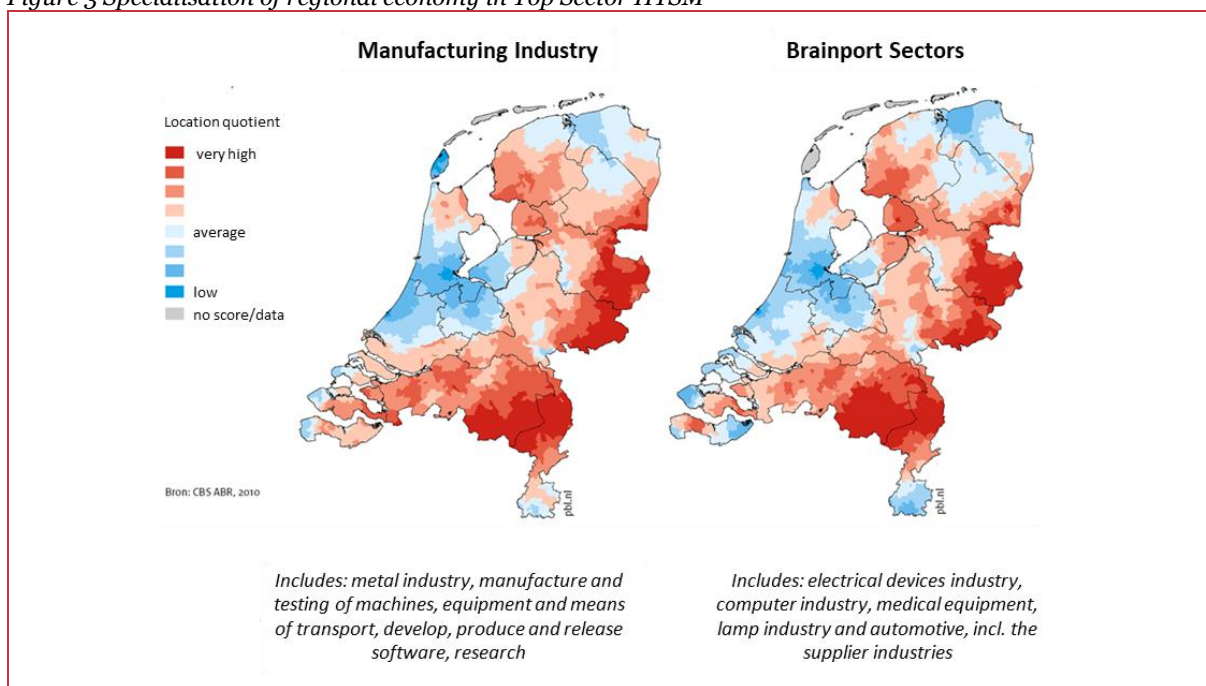
In the Netherlands, SMEs in the industry generally have strong regional links with big companies through supply chains. Remarkable however is the fact that the provincial regions with a large industrial presence in East Netherlands such as the Achterhoek and Southwest Gelderland, are also the regions without large enterprises. **The industrial SMEs in East Netherlands are mostly linked to large businesses outside the Region**, especially from North Brabant and the Ruhr area/Düsseldorf. These areas are important export partners for East Netherlands just as the Provinces of South Holland and Limburg as well as Asia, the United States and elsewhere in Europe (depending on the industrial sector).

For these big companies, East Netherlands enterprises are apparently distinctive and interesting enough in terms of their specialism to maintain them in their value chain. This international cooperation offers opportunities for growth and access to other networks and innovations outside the East Netherlands Region on the one hand but on the other hand also presents a challenge to maintain this position without being physically nearby. In order to be able to achieve this, it is important for the business community but also for the East Netherlands Region itself to remain aware of the dependency of its innovation policy in these provincial regions.

The ERDF programme 2014-2020 paid attention to strengthening the cooperation between (among others) the SMEs and the big businesses in East Netherlands by an arrangement for cluster and network reinforcement. Some big companies made use of it and they are increasingly cooperating with SMEs in the Region such as Thales, Topicus and Demcon for example.

It is also clear from an analysis by the Netherlands Environmental Assessment Agency PBL that the regional economy in the eastern part of Overijssel (particularly Twente) and Gelderland (particularly the Achterhoek) is strongly specialised in the area of (sophisticated) manufacturing industry. This makes East Netherlands in addition to Noord-Brabant, the key driver behind the manufacturing industry/HTSM of the Netherlands as illustrated in Figure 3. Cooperation between the three provinces in these areas is self-evident.

Figure 3 Specialisation of regional economy in Top Sector HTSM⁸



Source: adapted on the basis of PBL Netherlands Environmental Assessment Agency, 2014

Innovations from businesses

Data from the Promotion of Research and Development Act WBSO shows that **the businesses in both provinces of East Netherlands score above-average in research and development funds (R&D/ S&O)** compared to businesses in other Dutch provinces, which is an important indicator of their capacity for innovation.⁹ Twente and Arnhem-Nijmegen are frontrunners in these innovation efforts by the business community, followed by the Veluwe. On the basis of the number of established R&D investments, Twente was the fourth most important area in the Netherlands in 2014. At the time, Arnhem/Nijmegen was the third most important area on the basis of the expenditures for research and development funds (R&D, in euro). It is unlikely that these positions have changed materially.¹⁰

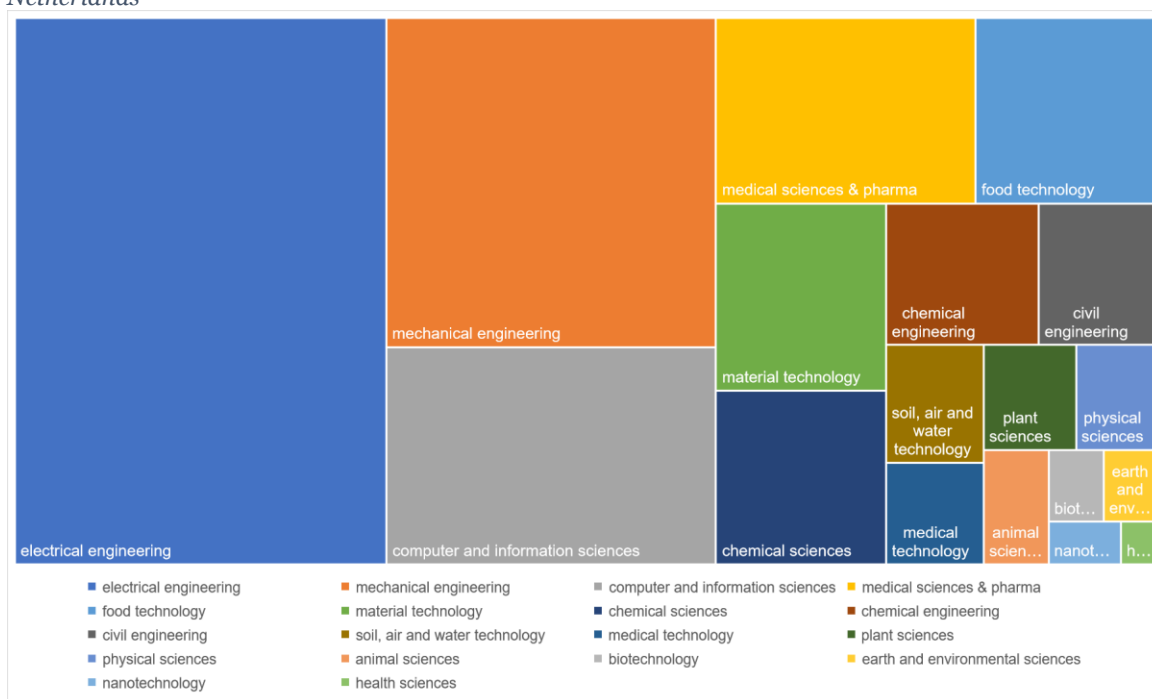
Innovations for which tax measures from the Promotion of Research and Development Act WBSO have been applied in the East Netherlands economy, have largely remained the same with respect to technology between 2014 and 2018 to as is illustrated in figure 2.

⁸Although these data have become fairly outdated by now, it doesn't seem likely that the presented picture has shown extreme changes in the past 10 years (after the economic crisis). The latter in view of the fact that the stated provinces already have a strong technological profile and that the economic activity is partly centred around knowledge institutes in the Region.

⁹ On the basis of Netherlands Enterprise Agency RvO data for 2018 specifically provided for this strategy.

¹⁰ Netherlands Enterprise Agency RvO (2016) Capacity for innovation in Gelderland and Overijssel; results of a Regio Scan in the Provinces of Gelderland and Overijssel; at the time that this document was drawn up there was only data available for the provincial regions in East Netherlands and presently there is no more recent information to arrive at a comparison with other Dutch Regions. It is clear however from the data for Twente and Arnhem/Nijmegen of 2018, that they still show remarkably high R&D investments compared to the other provincial regions of East Netherlands.

Figure 4 R&D expenditures by businesses on wages+ miscellaneous costs/expenditures in 2018 in East Netherlands^{11 12}



In the area of electrical engineering, East Netherlands makes an exceptionally strong contribution to the Dutch capacity for innovation. Electrical engineering is the fourth largest S&O investment area of businesses in the whole of the Netherlands, of which nearly half (48%) originates from East Netherlands. In terms of the numbers of enterprises involved in this technology, East Netherlands scores a little above the Dutch average. The majority of these investments originates from large enterprises SMEs (100+ employees) in East Netherlands.

Businesses in East Netherlands also invest a lot of R&D in mechanical engineering and computer & information sciences. These technologies are essential for the challenges that are facing the business community in the Netherlands such as the digitalisation (also see ‘Economic Transitions’ in Chapter 2). Comparable with the trend in the whole of Netherlands, it is mainly the small enterprises (10-49 employees) that make investments in computer and information sciences, while the investments of the big companies of East Netherlands largely concern mechanical engineering. Although these two technological areas are showing high investments by East Netherlands businesses, the expenditures are below the Dutch average.¹³ This means that East Netherlands businesses make significant investments in these technologies but this does not set them apart from other Dutch Regions.

Technology areas in which East Netherlands businesses as a whole invest more compared to enterprises from other Dutch Regions, are electrical engineering, physical sciences, earth and environmental sciences, nanotechnology and animal sciences.¹⁴ Investments in nanotechnology, and earth and environmental technology are relatively small in view of the total amount

¹¹ On the basis of Netherlands Enterprise Agency RvO data for 2018 specifically provided for this strategy.

¹² Netherlands Enterprise Agency RvO (2016) Capacity for innovation in Gelderland and Overijssel; results of a Regio Scan in the Provinces of Gelderland and Overijssel

¹³ On the basis of Netherlands Enterprise Agency RvO data for 2018 specifically provided for this strategy. In 2018, businesses in the Netherlands as a whole have invested the most R&D expenditures in the following order: mechanical engineering, computer and information sciences, electrical engineering, chemical sciences and engineering, medical sciences and pharma, plant sciences, medical technology.

¹⁴ On the basis of Netherlands Enterprise Agency RvO data for 2018 specifically provided for this strategy.

(businesses in East Netherlands spend less than 10 million on R&D in these technologies), but they are important for the Dutch innovativeness in these areas.

Businesses also work on European research and development projects in international consortia. Since 2014, 43 businesses have received an amount higher than €1 million through the European Horizon2020 funds (see Appendix C). The 10 companies that have received the largest amount (all of them more than 3 million) are:

- DNV GL in Arnhem aimed at electricity and renewable energy sources
- BTG Biomass Technology in Enschede aimed at smart technology for biomass processing
- Lionix International in Enschede aimed at microsystems (photonics, chips, etc.)
- BDR Thermea in Apeldoorn, aimed at sustainable heating devices and elements
- Roessingh in Enschede aimed at mobility technology (rehabilitation)
- Engie Energie in Zwolle¹⁵ aimed at the conversion of a coal fire plant for biomass processing
- Hygear in Arnhem aimed at (bio)hydrogen for industrial manufacturing applications
- Solmates in Enschede aimed at photonics
- Wärtsilä in Zwolle aimed at sustainable engines for ships and motorbikes
- Khondrion in Nijmegen aimed at medical innovations

These projects tie in well with the social challenges and economic transitions concerning smart, healthy and sustainable and as such with the priorities of the European Union and for the expenditures of innovation funds (also see Chapter 2). However they cannot be translated one-on-one into specialisations of the Region; **to realize momentum in a Region separate projects are not sufficient, there has to be a form of clustering.** Authorities in Eastern Netherlands are very much aware of this and they have intensively invested in such clusters in recent years (see section 1.3).

The involvement of businesses in the East Netherlands Region with European projects underlines that the Region can rely on an important international corporate network with respect to its innovation strategy. In a number of these projects the involvement of the regional knowledge institutes is evident. The width of innovations from the economy, both on the basis of the Promotion of Research and Development Act WBSO and Horizon2020 data, **shows the diversity and innovation that the East Netherlands Region has to offer through its businesses especially in technological innovations and particularly in healthcare, HTSM and the manufacturing industry.**

The 'new economy': start-ups and scale-ups in the East Netherlands Region

According to TechLeap (previously Start Up Delta) which attempts to stimulate the start-up economy at a national level and maintains data on the progress, **there are between 700-750 start-ups and scale-ups in the East Netherlands Region.**¹⁶ These numbers are substantially higher than in North Netherlands (248) and substantially lower than in West Netherlands (5500+). A large part of the start-ups in the Netherlands is located in Amsterdam. Nijmegen is also an important location for start-ups; the city ranks number nine with regard to the number of jobs generated by start-ups (around 2000 jobs).¹⁷ **The number of start-ups and scale-ups in East Netherlands is comparable to the figures in the Province of North Brabant.** In terms of venture capital as well, the East Netherlands Region as a whole is comparable with North Brabant with 84.5 million euro in venture capital (compared to 86.2 million euro in North Brabant).

¹⁵The actual project is located in Rotterdam

¹⁶ <https://finder.startupdelta.org/dashboard> more precise data about the number of start-ups and scale-ups in the Region is difficult to verify especially as a result of the various definitions that are applied and the range of indicators that is used.

¹⁷ <https://blog.dealroom.co/wp-content/uploads/2019/09/Netherlands-Employment-Report-vFINAL.pdf?msID=a33ae4bf-7667-4ef4-9bac-c62352d59ecb>

These start-ups and scale-ups in the Region are mainly but not exclusively located around the universities and universities of applied sciences. Especially around Enschede, Arnhem/Nijmegen, Wageningen, Hengelo and Zwolle we see clusters of start-ups. According to TechLeap, the Region also has a so-called ‘unicorn’ i.e. Experia in Nijmegen, specialised in semiconductors for (mainly) the automotive industry. Unicorns are start-ups valued at €1 billion or more. Whether Nexperia can still be qualified as start-up remains to be seen as it is a split-off of NXP-semiconductors.¹⁸

Other important scale-ups for the East Netherlands Region in Overijssel are for example Eastern Enterprise, Topicus, Demcon, SciSports, Micronit Microfluidics, Opra Turbines (21 scale-ups in total according to TechLeap). In Gelderland these include Avantium Technologies, Reasult, SolarNow, GXSoftware, Yeast and Mircleos (23 in total). These scale-ups offer mostly high-technology solutions and/or digital innovations and especially offer b2b services & products and in some cases also business-2-customer services and products. Therefore these successes are mainly linked to investments in IT and information technologies including artificial intelligence (AI).

The innovations the start-ups aim at, are strongly linked to the profile of the knowledge institutes in the East Netherlands Region and range from medical innovations and, specific HTSM-solutions for subsectors within the manufacturing industry to digital solutions for a wide group of businesses.

1.2 Innovation from knowledge institutes

East Netherlands has a wide group of **knowledge institutes that jointly offer a broad knowledge base for innovation in the East Netherlands Region.** There are three universities of which one has a University Medical Centre, various research institutes including two Applied Research Organisations (To2), seven public Universities of Applied Sciences (UAS), and several public-private partnerships in which this knowledge is valorised.

Universities in the Region

The East Netherlands universities create a wide field of knowledge which is internationally recognised. The various specialisations of the universities are strongly reflected in the smart specialisation strategy of 2013. The role of these knowledge institutes in the East Netherlands Region has become an integral part of innovation policy.

- **Wageningen University and Research Centre (WUR)** aims at the development of knowledge of nutrition and food production, living environment and health, lifestyle and living conditions. WUR is a combination of university (Wageningen University) and nine research institutes (Wageningen Research).
- **Radboud University (RU)** in Nijmegen is a general broad university, which in addition to social and beta sciences is known for its strong University Medical Centre **Radboud UMC**.
- **University of Twente (UT)** in Enschede focuses on hightech and applications thereof in society.

The research fields of these knowledge institutes are exceptionally relevant for the social challenges of today and the coming years (see Chapter 2), which is reflected in the growing popularity of the institutes. It remains a point of attention to embed this knowledge in the East Netherlands Region and especially in respect of attracting and retaining talent and translating knowledge into economic activity in the Region.

East Netherlands universities score high on international rankings. All three universities are among the top 500 best universities in rankings such as the ‘Times Higher Education World University Rankings’¹⁹,

¹⁸ <https://www.nrc.nl/nieuws/2017/02/09/de-chips-van-nexperia-niet-zo-sexy-wel-winstgevend-6607980-a1545149>

¹⁹ <https://www.timeshighereducation.com/world-university-rankings>

QS Top Universities²⁰ and Centre for Science and Technology Studies (CWTS) Leiden Ranking²¹ (see appendix C for the specific positions of the universities per ranking). Within its specialisation area ‘Life & Earth sciences’, WUR scores exceptionally well and ranks among the top 10 worldwide.

The academic network of East Netherlands does not stop at the borders of the Region. **The international partnerships from these institutes and the growing recognition for the knowledge from the Region play an important part in innovation in the East Netherlands Region.** In the European Knowledge and Innovation Communities, the East Netherlands knowledge institutes are among others represented in EIT Climate-KIC and EIT Digital and they cooperate with KIC InnoEnergy.²² International networks are also important to gain access to European innovation funds. The successful applications in the European Horizon programme show that the cities and the environment in which these knowledge institutes are situated, are important hotspots for Horizon in the Netherlands, as indicated in Appendix C (the focus areas of these relationships strongly vary between the knowledge institutes).²³

And the figures from the Horizon programme indeed show that from all organisations in the Region, the universities have been especially successful in applying funding for European research and innovation projects (based on data of 2014-2019). Jointly they have attracted almost 400 million euro to the East Netherlands Region: ²⁴

- Wageningen University & Research has worked on 312 projects in total in the area of plants animals and earth with a total project scope of more than 160 million euro.
- Radboud University and Radboud UMC: 188 projects especially aimed at research of the body and more specifically brains, conditions and the combination with technology span in total nearly 143 million euro.
- University of Twente cooperated in 129 projects on issues concerning digitalisation and robotics for nearly 95 million euro.

Compared to the businesses from the Region that cooperate in innovation projects within Horizon2020, there is a clear overlap in the areas in which UT develops knowledge and to some extent also RUMC. WUR has overlap to a lesser extent in terms of knowledge areas with the businesses within Horizon2020.

The cooperation between universities and the regional economy varies per knowledge area and per university. The universities look for a structurally better deployment of the knowledge and innovations in the regional economy and in the past years they have made a conscious effort in respect of their valorisation task. By means of incubators and cooperation with the Universities of Applied Sciences such as Novel-T, StartLife, Novio Tech Campus, Mercator Launch, all three universities try to have wider and improved applications of the results of research and the knowledge & ideas of both students and researchers within the Region. These efforts have certainly paid off, with successful businesses as result. The number of start-ups in the East Netherlands Region related to the universities has increased but the results of the next step from start-up to scale-up are still lagging behind.²⁵ Despite

²⁰ <https://www.topuniversities.com/qs-world-university-rankings>

²¹ <https://www.leidenranking.com/>

²² WUR, Cleantech Regio, Startlife in Climate-KIC and UT in EIT Digital, NRG in Arnhem is also involved in EIT RawMaterials as project partner. In view of the expertise of the knowledge institutes, it is remarkable that the East Netherlands Region is not represented in EIT Food, EIT Health and EIT InnoEnergy. There is no hub for these networks in East Netherlands while they do exist in other Dutch Regions. On the other hand there is a good cooperation with InnoEnergy concerning start-ups and scale-ups via project ‘Generation E’ and EnergyScaleUp in Arnhem.

²³Through the CORDIS datalab, a network analysis of the international connections per organisation can be accessed. <https://cordis.europa.eu/datalab/datalab.php>

²⁴ Based on data from the Community Research and Development Information Service CORDIS data consulted on 20-06-2019 <https://data.europa.eu/euodp/en/data/dataset/cordisH2020projects>

²⁵According to available data of Start Up Juncture, in 2018 only 6 of the 80 start-ups in the Netherlands that secured more than 1 million in investments, were established in East Netherlands, i.e.: Xenikos, Mimetas, Screenpoint Medical, Stapp.In, MindAffect and Travelbags.

the efforts of innovation brokers, connections between the universities and established SMEs are difficult to realize.

Research institutes and Applied Research Organisations (To2) in East Netherlands

Several research institutes are located in and around the universities, often set up from the university (as departments e.g.) and sometimes in cooperation with other knowledge institutes, as for example the **Fraunhofer Project Center** in Enschede (since 2017). Not all institutes are established from the universities, some have opted for the close location to be able to enter into a partnership with the University as for example the **Max Planck Instituut** for psycholinguistics in Nijmegen (since 1980). In some cases, the regional authorities and/or the regional business community were involved, for example in attracting IMEC to Wageningen and Nijmegen to form **OnePlanet** since 2019. In addition, based on its expertise in physics, Radboud University is also a partner in the partnership of the **National Institute for Subatomic Physics NIKHEF** in Amsterdam.²⁶

Next to the research institutes around the universities, **MARIN** is also an important knowledge organisation in the East Netherlands Region. Maritime Research Institute Netherlands MARIN is one of the six Applied Research Organisations (TO2) in the Netherlands (Wageningen Research, part of WUR, is also a TO2). MARIN focuses on clean, safe and smart ships and a sustainable use of the oceans. Through the European Horizon programme, MARIN has already received more than €8 million through 11 projects to work on innovation issues for waterways and shipping. MARIN operates mainly across regional boundaries, particularly with specialised businesses, the Dutch Ministry of Defence and Netherlands Organization for Applied Scientific Research TNO, and to a lesser extent in the regional economy (as the Region does not border on the sea and there is little shipbuilding).

Universities of Applied Sciences (HBO) and Secondary Vocational Education (MBO)

In the East Netherlands Region, the large group of publicly funded Universities of Applied Sciences play an important role in the innovation system:

- HAN – Arnhem and Nijmegen (33,000 students) – broad UAS;
- Saxion UAS - Enschede, Deventer and Apeldoorn (26,000 students) – broad UAS;
- NHL Stenden – Zwolle, Leeuwarden, Emmen, Groningen (24,000 students) – broad UAS;
- Windesheim - Zwolle (20,000 students) – broad UAS;
- UAS Hall Larenstein – Velp (GL) and Leeuwarden (4,200 students) - aimed at agriculture and food;
- Christian UAS Ede (4,200 students) – religion, social, care, IT;
- ArtEZ – Enschede, Arnhem and Zwolle (,3000 students) – culture.

In addition, there are a number of important private education institutes accredited by Accreditation Organisation of the Netherlands and Flanders NVAO that offer accredited UAS programmes such as the UAS Tio in Hengelo, Wittenborg UAS in Apeldoorn, UAS VIAA in Zwolle, AERES UAS in Wageningen, Iselinge UAS in Doetinchem.

UASs supply a large part of the young professionals in e.g. technical aspects, food sustainability and health needed to enable businesses to grow. UASs offer a platform for businesses to come into contact with talented students by making internships a obligatory part of the curriculum. Their success in supplying (future) employees for the East Netherlands Region is reflected in their high score for these indicators according to the international ranking of universities and UASs, which among other things measures regional embedding.²⁷

²⁶ The expertise in physics and astronomy of the East Netherlands Region is also reflected in the advisory body of Netherlands Institute for Space Research in Utrecht SRON .

²⁷ Insofar as available via <https://www.umultirank.org/study-at/>

In the area of the Horizon funds they have logically played a less large role than the businesses and universities in the past programme periods. Saxion, HAN and UAS Hall Larenstein took part in six Horizon projects resulting in an investment of around €1.5 million euro in East Netherlands through the UASs. As Horizon funds were especially targeted to the early TRL levels, the big difference between the UASs and universities in this respect is not surprising. In the programme period 2014-2020 (particularly) the larger UASs also participated in some ERDF projects just as the universities.

The UASs offer room to develop products on a higher technology readiness level (TRL) and as such function as **an important link between lab research and the application of innovations in practice**. This for example materializes in the partnerships of the Centres for Expertise (CoE) where, together with lecturers, the connection is made between education, research and the business community with respect to social challenges. The first Centres in the Netherlands started out in 2011. In 2019, East Netherlands accommodates a large share of these partnerships. i.e. 16 of the 39 in the whole of the Netherlands. This high density of cooperation in the East Netherlands Region underlines the importance of the UASs as binding factor with the regional business community of East Netherlands. They work on smart technologies, sustainability and health themes.²⁸

Subsequently, there are intermediate vocational institutes throughout the East Netherlands Region. These Intermediate Vocational Institutes (MBO) in the Region are among other things specialised in agri/food and technical aspects and are an important factor in the development of the employment potential. This way they offer the large share of SMEs options to expand their activities. East Netherlands also has 56 public-private partnerships with Intermediate Vocational Institutes on themes of construction, care, logistics, mobility, technology (general and specific e.g. for food), sustainability and more. A number of these so-called Centres for Innovative Professionalism / Craftsmanship (CIV), represent a similar cooperation as the CoE in the UASs but this time between Intermediate Vocational Institutes and enterprises. East Netherlands has CIVs in place on themes of Agri&Food, Polymers, Coatings and Composites, Green, and Nature and Living Environment.

1.3 Regional Authorities and Public-Private Cooperation

The Provinces of Gelderland and Overijssel cooperate in many areas to support and drive the regional economy. The policy documents of the past period, including the accepted mission agreements from 2019 show that **both provinces consider innovation an important investment in view of the added value for the economy and the residents of East Netherlands**. Both provinces see opportunities for the East Netherlands Region in the application of technology; by making businesses more effective and efficient and by improving the living environment and health. The authorities also have strong views about innovation policy as realized on a national level in 2019 (see chapter 2) and this will undoubtedly be implemented in this policy period.

The provinces are committed to a facilitating, connecting and challenging role. They facilitate innovations by means of financial support through e.g. ERDF and East Netherlands Development Agency Oost NL; by bringing businesses and knowledge institutes together in networks, jointly via BOOST for Smart Industry, in Overijssel by the Open Innovation Facilities, but also through the innovation brokers from Regional Technology Centre Gelderland. And more recently in Gelderland through the Chip Integration Technology Centre CITC on Novio Tech Campus and OnePlanet. They challenge by making choices in their policy and by applying them in tendering procedures for example.

Next to the provinces, the municipalities also play a part in supporting innovations in the East Netherlands Region by facilitating partnership agreements and making smart use of available locations. **The Region is characterised by seven large and many smaller municipalities**. Nijmegen, Ede, Arnhem and Apeldoorn are the largest municipalities in Gelderland, and Zwolle, Enschede and Deventer are the biggest in Overijssel. These seven large municipalities all have more than 100,000

²⁸ Centres in East Netherlands among other things focus on nature and living environment, energy technology, cleantech, making the animal production sector more sustainable, develop and apply sustainable materials and manufacturing processes in fashion and design, industrial robots, AI and data science, cheap technology, the HTSM sector, biotechnology, rehabilitation care, sports and physical talent, education and IT.

inhabitants, but none of them more than 200,000 people. Partly as a result of this, there is no single local economy that claims a dominant specialisation of the Region. Instead, various specialisations have arisen especially around the larger municipalities that are strongly embedded in the local economy and the nearest knowledge institutes. **As a result there are several specialisations in East Netherlands, facilitated on a local level by local, regional and provincial authorities.**

Gelderland for example has multiple Valleys, linked to specific sectors: Food (Food Valley region, between Ede, Barneveld, Nijkerk, Wageningen and Veenendaal), Health (Arnhem Nijmegen area), Legal (Arnhem Nijmegen, Zutphen region) where various activities are bundled on the basis of Triple Helix cooperation. The energy transition and circular economy in East Netherlands is also accelerated by the cluster organisation KIEMT²⁹, just as via CIRCLES and on the Knowledge Parks IPKW in Arnhem and Innofase in Duiven. The Polymer Science Park in Zwolle focuses on innovations concerning materials, and Deventer, Apeldoorn and the surrounding municipalities are working on a CleanTech Region. Enschede has Space53 and a Knowledge Park with connections with tech centres from the Twente University area for entrepreneurs.

Support for start-ups has also increased strongly in the East Netherlands Region in the past years by both public and private parties and **is increasingly in sync with each other.** Both provinces have Start-up in Residence programmes in place; Gelderland offers the Start and Growth Accelerator via Oost NL and the Gelderland Valorises! programme (since 2011), EMTRadar operates in the programme from KIEMT (since 2009) and there are various incubators including Mercator Launch and Rockstart in Nijmegen. Around Enschede, the city where one of the best known start-ups of the Netherlands was born (Booking.com), set up Start-up Twente for example in 2018, consisting of the already active Ceespot, Novel-T, Saxion Centre for Entrepreneurship, EntrepreneurLab of Regional Training Centre ROC Twente: and office accommodation Spinnerij Oosterveld. These examples of partnerships demonstrate that there is not just isolated support for entrepreneurs but that in the past years the steps in the chain (with the required support) were realized on the basis of programmes. These kinds of partnerships are also emerging elsewhere in the Region.

Start-ups are often associated with knowledge institutes and they also play an important role in the East Netherlands ecosystem. WUR for example has offered support to start-ups via StartLife since 2011 and RU since 2013 via Novio Tech. Support for start-ups is not limited to areas around universities, however; in East Netherlands we see the same support around Universities of Applied Sciences. UT is for example working together with Saxion via their partnership in Novel-T. There are also developments in regional and urban areas. In Deventer, the Gasfabriek has been active since 2015 and in Zwolle the number of support organisations is increasing, such as Start-up region Zwolle from Kennispoort Zwolle (since 2017), Region Zwolle Incubator (since 2014) and the private LaunchLab (since 2016). Within the CleanTech Region, start-ups have been supported since 2017 through the StartUp accelerator programme of CleanTech Center. These are merely a few examples that show that support for start-ups has really taken off in East Netherlands in the past years.

The chemistry sector offers specific support to young researchers via iLabs and Centres for Open Chemical Innovation (COICs). An iLab is a research facility where student-entrepreneurs can further develop their innovations with the help of experts. As soon as these innovations can be scaled up for market access, they will receive further support in the COCI. Five of the 19 locations are situated in East Netherlands, i.e. iLabs in Enschede, Nijmegen, Wageningen and Zwolle and a COCI on the S/Park in Deventer.

Support for the start-up ecosystem has therefore shown considerable improvement in the past 10 years, also between the provinces and across borders. The increasing cooperation between the support organisations, services and activities should result in a more resilient system in which people with good ideas can find proper support in the Region from concept to proof-or-concept and from market launch to expanding business. This will stimulate them to remain in the East Netherlands Region, contribute to the entrepreneurial culture and to create jobs among other things. **To what**

²⁹ Office in Arnhem with services for the whole of East Netherlands

extent the Region actually succeeds (and better than in the past) to develop start-ups and to preserve them for the Region is still unclear at this time as many support actions started relatively recently. Preserving businesses not only requires support in the start phase of the enterprise but also a strong ecosystem; and therefore also sufficient relevant businesses in the value chain to keep the Region attractive to retain businesses in their growth phases.

Next to the provinces and municipalities, a number of provincial regions also have Economic Boards committed to stimulating the economy, as is the case in Twente, Arnhem/Nijmegen and Zwolle.

This means that innovation is actively supported on all levels: local, provincial regional and on the level of the East Netherlands Region. The examples stated in this strategy are just a few illustrations of these activities.

In the past years, the public and private organisations that are involved in the European Framework Programmes, especially Horizon2020 projects, have jointly examined in which areas they are distinctive with (sufficient) cohesion. This has led to the formulation of two flagships, i.e. ‘concepts for healthy living’ and ‘smart and sustainable industries’ to act vigorously in respect of the future European Framework Programmes (Horizon Europe, Digital Europe, InvestEU funds) following from the Regional Innovation Strategy for the East Netherlands Region and to improve the connection between the knowledge institutes and economic activity in the process. Through the profiling programme Th!nk East Netherlands³⁰ the regional partners present these specialisations towards Europe and (potential) international cooperation partners, especially for Horizon Europe but also for Digital Europe and InvestEU. For the new Digital Europe programme, a European Digital Innovation Hub is being developed, based on Smart Industry Hub BOOST and the other existing Digital Innovation Hubs.

1.4 Innovation from the public

The cooperation in which businesses, knowledge institutes and authorities somewhat act outside their classic roles and cooperate with each other, has been called the Triple Helix since the nineties. In the past decades regional innovation systems have therefore been strengthened by public-private partnerships. This is also the case in East Netherlands as is clear from section 1.3.

One important player that is missing from the Triple Helix however, is the public - both as innovators and users of innovations. In the past decades, citizens have increasingly claimed a clear role in innovation. New digital technologies are a playground for innovation for all. Just think of 3D-printing and apps, and crowd-funding platforms make it possible for citizens to invest in innovation, also with a limited budget. By the change in the labour market, citizens innovate as self-employed workers without employees and students more and more often establish start-ups on the basis of innovative ideas. Social innovation is another increasing trend in which citizens and communities play an important role in organising, developing and implementing solutions for social challenges. And finally, citizens also increasingly participate within the framework of citizen science. In East Netherlands for example the recently started TOPFIT Citizenlab.

In view of these developments and the social challenges that face East Netherlands, we therefore now speak of a ‘Quadruple Helix’. Not only businesses, knowledge institutes and authorities are jointly working on innovation, but the public explicitly joins in. Especially when it concerns innovation for social challenges or missions, public involvement is of importance. This involvement can concern interested individuals but also representatives of social groups (such as youth/elderly, patients, persons with an impairment), districts (think of sustainability or cohesion initiatives) or communities (for example for facilities and quality of life in villages).

In East Netherlands, citizens are very much involved in innovations. With respect to themes such as care, the energy transition, the environment and (agricultural) nature (management), art & culture and general quality of life, there are powerful civic networks that jointly organise activities.

³⁰ <https://thinkeast.nl/>

2 The world in motion

It is clear from the previous chapter that the regional innovativeness is strongly interrelated between businesses and knowledge institutes through international networks. These partnerships strengthen the innovation ecosystem and are increasingly entered into by the actors in European Regions. International developments have had a considerable impact on the regional innovations of East Netherlands. The two most important current shifts that impact regional innovation are international developments: 1) social challenges that tip government policy towards implementing more mission-driven policies and 2) transitions in the economy that change the way work and related processes are organised in such a way that a strong need arises for innovations in the space these developments create. This chapter offers a concise description of these developments.

2.1 Social challenges and mission-driven innovation policy

2.1.1 Social challenges

The coming decades will be characterized by extensive and accelerating developments. From a societal perspective, we are reaching the limits in the areas of healthcare costs, the demand for technical skills and the growing displacement of low-skilled labour by automation. As a result of the increasing knowledge and prosperity we are also challenged to deal with the ageing population and the appropriate care while at the same time demand for personalised care is growing. On a geological scale we are reaching the limits of growth: in this respect we mention the climate crisis, the biodiversity crisis, the pressure on drinking water supplies and agricultural areas as well as the related migration streams.

On the other hand there is a growing offer of technological, social and organisational innovations such as the share economy, digitalisation, robotisation, sustainable energy, and smart and saline agriculture. Mission-driven innovation is committed to the successful deployment of new ideas to solve the big and urgent problems that threaten our way of life.

These challenges were also recognised by the United Nations and have prompted a worldwide agreement in the 2015 Summit in which 17 sustainable development goals (SDGs) were determined that must be achieved before 2030. These goals focus on the biggest social challenges we are facing now, both in developed and developing countries. In the Netherlands, alliances are being developed per goal that will jointly draw up and implement action plans. East Netherlands parties are also involved in this effort and in any case concerning goal 2 (end hunger), goal 4 (quality education), goal 7, (affordable and clean energy) and goal 15 (life on land).³¹ In view of the specialisations of East Netherlands, it is probable that multiple organisations from the East Netherlands Region will join this and other alliances.

2.1.2 Mission-driven innovation policy

In the previous smart specialisation strategy, the top sectors were regarded as an important national framework for the economy. This national framework has been adjusted in the past years whereby the top sectors have organised themselves in such a way that they contribute to national missions. These missions exceed individual sectors and Ministries, and their aim is to prioritise longer-term social challenges in innovation policy.

This is an important shift in the way in which innovation policy is organised in the Netherlands and this also has an impact on East Netherlands. The main frameworks of Dutch policy innovation may be differentiated in 'generic' and 'governing' policy. The main generic instruments of the Dutch authorities concerning innovation are administrated government-wide by the Netherlands Enterprise Agency RvO and the Netherlands Organization for Scientific Research NWO. The following table lists the most important instruments for generic and governing policy-making for innovation at a national level.

³¹ <https://www.sdg-nederland.nl/sdg-alliances/>

Table 1 Instruments of generic and governing national innovation policy

Generic policy	Governing policy
<ul style="list-style-type: none"> • Tax instruments: Promotion of Research and Development Act WBSO & Innovation bracket • Entrepreneurship support RVO: e.g. Innovation Stimulation Regions and Top Sectors MIT, Investment Preparation Studies DHI, Innovation Credit Scheme, SME Credit Guarantee Scheme BMKB, Early Stage Financing VFF, etc. • Second funding flow for knowledge institutes, TO2-policy 	<ul style="list-style-type: none"> • Top Sectors policy <ul style="list-style-type: none"> – Knowledge & Innovation Agenda – Mission-driven top sectors – Investments in Key Technologies (in preparation) – Top Consortia for knowledge and innovation (TKIs) • Targeted innovation subsidies: Demonstration Energy and Climate Innovation DEI, Socially Responsible Procurement MVI, Sustainable Shipping Subsidy SDS • Targeted contribution European instruments: Eurostars, Eureka, Joint Integrative Projects JIPs • National Science Agenda

In the past years, a trend of a relatively stronger control policy has emerged while generic instruments on the other hand have increasingly come under pressure³². Previously, the Netherlands generally implemented a very generic policy with relatively little control compared to other European countries³³. The new policy control specifically focuses on social challenges (‘missions’) in which also a larger participation is important (see e.g. the National Science Agenda) and technologies. Although policy aimed at (top) sectors is still nominally steering, the connections between the sectors and horizontal approaches (e.g. through missions or technologies) are still the key elements. In conclusion, we see an important trend that research and innovation continue to internationalise; an increasing number of businesses operate their R&D activities outside the Netherlands. Although the government also supports joint internationalisation & innovation through a range of instruments (e.g. with Eureka, Investment Preparation Studies DHI, etc.) this still concerns relatively limited volumes and there is no coordinating strategic framework, contrary to Flanders for example³⁴, although the cabinet indicated in 2018 that this is being developed³⁵.

The new *top sectors- and innovation policy* and its missions were announced in April 2019. Four main themes were defined in which the missions were mapped and key technologies identified that are required to realize the social challenges.

Table 2 Mission-driven top sector and innovation policy

Main theme	Mission	Ministries involved
Energy transition and sustainability	<ul style="list-style-type: none"> • Reduce the national greenhouse gas emissions by 49% in 2030, towards 95% by 2050 as compared to 1990. A fully CO₂-free electricity system by 2050 • A CO₂-free built-up area by 2050 • In 2050, raw materials, products and processes in the industry will be net climate-neutral and for at least 80% circular • Emission-free mobility for people and goods by 2050 • In 2050, the system of agriculture and nature will be net climate-neutral • A sustainably powered fully circular economy by 2050 	Ministry of Economic Affairs & Climate Ministry of Infrastructure & Water Management
Agriculture/water/food	<ul style="list-style-type: none"> • In 2030, the use of raw and auxiliary materials in agriculture and horticulture will have been substantially reduced and all end- and residual products will be capitalized as much as possible. The emissions of polluting and eutrophication substances into ground and surface water 	Ministry of Agriculture, Nature and Food Quality

³²Netherlands Bureau for Economic Policy Analysis CPB (2018) R&D more data-driven: access data part of innovation policy

³³ Rathenau Institute (2017) Fact Sheet Innovation Policy

³⁴ Flemish Board for Science and Innovation (2011) Strategic Vision of the internationalisation of the Flemish Science and Innovation Policy

³⁵ <https://zoek.officielebekendmakingen.nl/kst-33009-62.html>

Main theme	Mission	Ministries involved
	<p>will have been reduced to practically zero. Ecological conditions and processes will be the starting point for food production as a result of which biodiversity will be restored and the agriculture will become more resilient.</p> <ul style="list-style-type: none"> • In 2050, the system of agriculture and nature will be net climate-neutral. • The Netherlands will be climate-proof and water robust by 2050. • In 2030, we will produce and consume healthy, safe and sustainable food and chain partners including farmers will receive a fair price for their products. • With respect to maritime waters in 2030, and for inland waters (rivers, lakes and foreshores) in 2050, there will be a balance between ecological carrying capacity and water management (water safety, fresh water supply and water quality) on the one hand and the challenges for renewable energy, food, fishing and other economic activities on the other hand. • Netherlands is and will be the best protected and liveable delta in the world, also after 2100 by timely taking future-proof integrated measures against controllable costs. 	<p>Ministry of Infrastructure & Water Management Ministry of Health, Welfare and Sport.</p>
<p>Health and care</p>	<ul style="list-style-type: none"> • In 2014, the burden of disease as a result of an unhealthy lifestyle and unhealthy living environment will have decreased by 30%. • In 2030, healthcare will be organised 50% more (or more often) in the own living environment (instead of in health facilities) in combination with the network around people. • In 2030, the share of people with a chronic condition or lifelong impairment that can participate in society in line with their wishes and capacity, will have increased by 25%. • In 2030, the quality of life of people suffering from dementia will have increased by 25%. 	<p>Ministry of Health, Welfare and Sport. Ministry of Social Affairs and Employment</p>
<p>Safety</p>	<ul style="list-style-type: none"> • In 2030, the visibility of illegal activities and money flows will have increased to such an extent that organised-crime will have become risky and less profitable. • In 2035, the Netherlands will have a navy that is ready for the future. It will protect the Dutch values and prosperity, and will provide secure access to international waters. It can respond to unpredictable and unimaginable developments in terms of threats and technology, and will be effective, efficient and flexible in fulfilling its missions. • In 2030, the Netherlands will have operational space travel capacity to be deployed for defence and safety. Space travel capacity in this definition comprises both satellites, infrastructure on the ground and information processing. • The Netherlands will be able to safely capitalize on the economic and social opportunities of digitalisation. By committing to the development of cybersecurity knowledge and innovation, the Netherlands strives to be in the top 10 of both the Global Cyber Security Index and the National Cyber Security Index within 5 years. • In 2030, the armed forces will fully operate in a network with other services and will use integrated new technologies such as unmanned systems, electromagnetic spectrum and social media as a result of which we can complete the decision loop faster and better than our opponents. • In order to increase our joint innovations, a permanent dense innovation network must be created that will match supply and demand in order to implement short-cycle successful innovations. Stimulating innovations on the basis of (key) technology will lead to applications in civil domains and the use of solutions by civil organisations. • In 2030, security organisations will collect newer and better data and with the help of smarter analyses, the right interventions will take place avoiding any surprises. 	<p>Ministry of Justice and Security Ministry of Defence</p>

Main theme	Mission	Ministries involved
	<ul style="list-style-type: none"> The profession of security professional will be in the top 10 of the most attractive professions in the Netherlands by 2030. 	

By acknowledging the social importance of innovation right from the concept stage, it has become more important to get a clear picture of how innovation(s) should tie in with the current dynamics in society. In addition to a technology readiness level (TRL), a societal readiness level (SRL) has also been the topic of discussion in recent years; in other words the extent to which society can actually accept the innovation. Although no European or Dutch standards have been accepted for this SRL, defining the SRLs is being developed on several levels through social, political, economic and ethical draft issues. **East Netherlands is exceptionally well-positioned to contribute to these developments** as the Region already has innovations on many social themes.

Therefore, East Netherlands has the knowledge and expertise to contribute to all four main themes and to invest in specific missions. In some missions, players in East Netherlands have already reached an advanced level concerning technological and social innovations as e.g. prevention in healthcare, organising care in the home situation as well as food and agricultural issues. On other issues the Region should minimally go along and structure the economic activities in such a manner that they do not obstruct the missions.

The East Netherlands Region faces the challenge of these national missions to, on the one hand **focus its investments on the strengths in the Region** that fit these challenges and on the other hand to go along with developments and possibly attract innovations to the Region. For this strategy it is therefore important to distinguish between:

- Fields of interest for innovations; these are themes for which innovations need to be created but that have not materialized so far.
- Individual innovation successes; these concern successful innovations from the Region that are not connected to the broader developments in the knowledge clusters or economic forces that are important to the Region but hard to predict and therefore not appropriate for a strategy;
- Clustered innovation successes; these are innovation successes that originate from partnerships within groups of businesses and/or with knowledge institutes centred around expertise that is typical of the Region and that produce multiple innovation activities.

Eventually, these three are also interconnected; where there's a will, there's a way (and a plan), and after a first innovation, others may follow. It is of importance that the strategy makes good use of clusters that are already visible within the Region and therefore to especially strive for these themes and missions. This will not only offer the Region a specific focus but eventually also create the required mass to generate impact. That is why it was decided in this RIS3 to focus on strengthening existing customers and to integrate them even more to offer solutions for the societal challenges that match the expertise of the Region optimally (see Chapter 4 up to and including 7).

Missions from Europe

The European Commission has also increasingly moved forward in recent years to make its work recognisable to the general public and to make better choices. For example in the Europe2020 strategy in which it tries to make Europe 'smarter, more sustainable and inclusive' as well as the 10 Juncker priorities as a structure for the European activities. Within Horizon2020, 'societal challenges' have also been defined to which the innovation projects should contribute.

The details of Horizon Europe programmes (the 2021-2027 programme, the successor of H2020) and ERDF 2021-2027 are not yet fully known. It is clear that the mission-driven approach of Europe will be continued and even extended. The programme will for example be subdivided into three pillars, i.e.

Open Science, Open Innovation en Global Challenges and Industrial Competitiveness. These Global Challenges are health, an inclusive and safe society, digital and industry, climate, energy and mobility and, food and natural raw materials. In addition, five areas were chosen for Horizon Europe in which missions are being defined at this time. These 5 areas are:

- Climate adaptation, including social transformation
- Cancer
- Healthy oceans, seas, coastal and inland waters
- Climate-neutral and smart cities
- Soil health and food

The missions for these areas are being developed by mission boards including experts from the whole of Europe. East Netherlands is represented in the final theme by Professor Bouma of WUR.

2.2 Transitions for businesses

Changes in society also have an effect on the economy. We see a number of transitions in the current economy that will drastically change the way we work, organise and produce. For the innovation strategy it is important to follow these transitions. On the one hand, **they offer opportunities for regional innovations for which a business case must still be drawn up** and on the other hand **these transitions threaten the competitive power of the businesses that currently form the heart of the knowledge economy**, certainly if they do not develop or attract and apply the right innovations in time.

Five transversal international economic transitions (so cross-sectoral and cross-regional) that also create a challenge for our Region, are:

- **The Energy and Raw Materials Transition** (what it is made of). The shift in the use of traditional energy sources, raw materials and materials to (more) sustainable options. This transition comprises the concepts of low-carbon economy, sustainability and circular economy.
- **Digitisation and Robotisation** (how is it made) - the shift of business processes to further automation through the use of advanced digital and robotised solutions. This transition comprises automations, Artificial Intelligence, the Internet of Things and Cyber Security.
- **Servitisation** (how is it delivered/supplied) - the shift within the value chain where customers can be offered higher added value through product-service combinations than mere products. This transition particularly takes place in the manufacturing industry but also via the platform economy for example.
- **Internationalisation** (where is it delivered/supplied) - the shift in the work field in which involved actors become active on new markets across borders, which are organised differently than their domestic markets. This step is made by start-ups that have developed into scale-ups but also by the mature companies that see new opportunities in another economy.
- **Social Innovation** (for whom and by whom is it used) the shift in approaches and solutions to better meet the social needs of certain types of groups or society. This concerns both the development of the innovation as putting it on the market and continuing its market presence.

In the East Netherlands Region there are activities and developments for all these transitions in the economy, in knowledge institutes and through government policy which all offer opportunities for strengthening the capacity for innovation of the Region. In respect of the energy and raw materials transition, various circular agendas are worked on and there already is a circular atlas of Gelderland, there is the cleantech region, a large number of big Horizon2020 projects have been awarded to businesses in this theme and there are developments in various sectors to produce and supply more sustainably. Sustainability ranks high on the policy agendas. The food theme also offers clear opportunities for the Region through the protein transition to connect innovations to the energy and raw materials transition. Similar opportunities can be found concerning the other transitions; in the

area of robotisation and digitalisation we see regional activities that (may) make an important contribution to the innovative capacity of the Region: from the start-up activities around Enschede to the digitalisation of health products and services. The strong presence of the manufacturing industry in the Region also offers room for experiments with servitisation. The international networks of both the knowledge institutes and the business community can be deployed to enhance and expand the internationalisation activities. Through Go4Export, businesses can also receive support to make the step to activities abroad.³⁶

Although the East Netherlands Region is well positioned to create opportunities from these transitions, this requires informed and deliberate actions: for this transition does not only take place in East Netherlands. While there are developments in this Region, the other Dutch and European Regions are also working on the same transitions. They as well are fully committed to innovations to take the lead in these transitions.

Responding to and tying in with international transitions offers major opportunities for the economy of East Netherlands - certainly in the long term - and is also necessary to maintain the competitive position of the Region. These transitions offer opportunities for entrepreneurs by increased efficiency, improved insight into the future wishes of customers, by an improved organisation of business processes, improved conditions for employees and citizens, and by effectively enlarging markets.

For the established business, tying in with such transitions in many cases involves the active application of existing technologies/methods within the context of their activities, transforming internal processes and in some cases even adjusting their business model. Such changes are an essential link in the innovation process **and may pose a great challenge for enterprises.** The implementation of the innovations can have a significant impact on existing business operations and in the long-term they can determine the success of the local economy.

East Netherlands has made better progress with certain transitions than with others. For example a fairly large number of entrepreneurs from the Region rank in the Ch.o.C. Innovation Top 100 by a strong commitment to sustainability³⁷, the SMEs from the Region are known for their extensive export activities³⁸ and businesses in East Netherlands have a higher score in digitalisation than the national average³⁹. The Region also has specific attention for the development of new business models such as servitisation, gamification and the application of blockchain. Various studies show that **the established business community is seeing opportunities but experiences obstacles to actively take up such transitions** despite the large number of opportunities.^{39,40} It remains a challenge for many enterprises to make concrete steps particularly because cashing in on eventual innovation and competition advantages, is still not easy.

For these transitions to have maximum benefits, businesses must have a clear eye as to which transitions are most important to them and when they need to actively step up their efforts in this respect. This would seem to state the obvious but it turns out that many enterprises take insufficient account of these transitions - even when other businesses are already reaping the benefits. **It is necessary therefore that the transitions are given the proper priority.** This requires a certain level of honesty about the position of the business; not all enterprises benefit from a leading position within each transition.⁴¹ It is essential however not to tie in too late with the transitions as the risk exists of losing the competitive advantage.

³⁶ <https://go4export.nl/nl>

³⁷ Gelderlandvaloriseert, (2015), “East Netherlands scores with sustainability and innovation in Innovation Top 100”, site: <https://www.gelderlandvaloriseert.nl/oost-nederland-scoort-met-duurzaamheid-in-innovatie-top-100/>

³⁸ Statistics Netherlands (CBS), (2014), “All provinces contribute to goods export”

³⁹ Erasmus Centre for Business Innovation, (2018), “Baseline Measurement Digitalisation and Social Innovation Gelderland and Overijssel”

⁴⁰ Dialogic, (2018), “Strategic exploration digitalisation Gelderland”

⁴¹ Freese, C., Dekker, R., Kool, L., Dekker, F. & Est, R. van (2018). Robotisation and automation on the Work Floor - business choices in technological innovations. The Hague: Rathenau Institute

The biggest bottlenecks that must be overcome, are:

1. Urgency

It is essential that the established business community makes a timely assessment of the urgency of transitions. The priority of the transitions will have to be determined for the company to remain a relevant player within the value chain in the long term. Insight into future wishes of customers, staff and the society should be guiding principles in this respect.

2. Knowledge and expertise (to develop strategies & implement the choices)

Knowledge and expertise are required to effectively join the transitions. It mainly concerns the active application of knowledge and expertise in the enterprise. In many cases, this knowledge and expertise is not available in the current workforce. When the knowledge and expertise cannot be acquired directly through education and training, third parties will have to be called in. This is also part of the major human capital issues of East Netherlands.

3. Available means (financial and in terms of staffing)

In many cases there are insufficient means available to actively start working on transitions. In order to make real steps forward, a substantial investment is required which will have to generate a return in the longer term. This means there are less means available for active business processes.

4. Flexibility

As the transitions can have a major impact on business processes, personnel and the business model, flexibility is required at the level of management as well as at the level of the employees.⁴²

Many businesses are able to independently take significant steps to incorporate the transition: big companies have the means and small business are often more agile and flexible. **For mature SMEs - characteristic for the Region - this can be a lot more difficult as they rely more strongly on further developed business processes in their daily run of affairs.** For these enterprises it is a challenge to free up the financial means but also especially staff for long-term developments such as these transitions. In the long-term, this may lead to a risk of clinging too fiercely to proven approaches and work methods.

It is of importance for the East Netherlands Region to include the development of these transitions in the Region in the general economic and innovation strategy. In this respect a **distinction needs to be made between innovations *from* the Region and innovations *for* the region.**

The smart specialisation strategy specifically aims at the former: innovations that (may) result from the Region for which a strong business case is developed. These innovations may also be applied in the regional economy but this is not a strict requirement (for example technology for setting up seaweed farms).

At the same time the regional economy also needs innovations to stay up-to-date and not lose its competitive strength. Not all of these innovations need to originate from the Region. What's more, it would **undermine the strength of the Region if it were trying to be frontrunner in all innovations** and spread out its innovation efforts too much.

⁴² Change management literature may be consulted.

3 Opportunities and challenges

The choice of the priorities for the current RIS is based on the Region's strengths and opportunities, taking challenges and weaknesses into account. The SWOT analysis compares the strengths and weaknesses of the Region (internal characteristics) with its opportunities and threats (characteristics of the environment). The confrontation of in- and external characteristics enables the identification of future issues that are of importance for the strategy of the Region.

This SWOT is the result of an analysis of the state of affairs in the Region, interviews with regional experts and strategy sessions with representatives of the provinces, business community and knowledge institutes.

The following has been taken into account in this analysis:

Internal factors and environmental factors: the distinction between an internal or external factor is determined by the possibility of the actors in the Region to influence them. If they do have this option, it concerns an internal factor.

Intentions blur pure analysis: intentions are entirely different from practice. As a result certain elements may be underexposed. Weaknesses are sometimes stated as opportunities for example when bad quality is regarded as an opportunity for improvement. As this strategy must remain relevant for at least the coming 10 years, we have strongly linked intentions to the actual infrastructure, commitments and conditions of organisations as well as available means before labelling it as an opportunity.

Value judgements make wording issues more difficult: no value judgements were awarded to the different elements in the matrix because in a later stage they will make it more difficult to precisely formulate the issues at hand. Examples of value judgements are: good, better, beautiful, great, tasty, fantastic, bad, little, low, fierce, etc.

Wording in too general terms: a threat phrased as 'increasing European regulatory framework' is too general. We have attempted to be as specific as possible; so also in terms of which regulations influence the strategy.

Underexposed strengths and opportunities: people tend to identify weaknesses and threats more quickly, which make the list with strengths and opportunities seem relatively limited. To prevent this, we have paid extra attention to the successes and opportunities including small successes that may still grow.

3.1 Strengths of the Region

- Geographically the Region has a favourable location, with direct connections with the three other Regions and Germany; it is above sea level and has sufficient fertile soil and the physical space for the required infrastructure.
- The economy mainly consists of a broad range of SMEs, including an above-average share of big SMEs. This diversity ensures that the East Netherlands economy does not depend on a single business or sector and that it is also developing via various networks, creating opportunities for unique crossovers.
- The Region accommodates internationally acknowledged institutes that offer a broad knowledge base; partnerships and crossovers are starting to take off as e.g. with TopFit but also with regard to support for start-ups and enterprises.
- The knowledge institutes and the SMEs have access to international networks through various routes.
- Both the knowledge institutes and the SMEs offer substantial expertise that is relevant for the societal challenges; from (nature-inclusive) agriculture and protein transition, the shift to more personalised care to clean sustainable processes and materials for a circular economy.

- Vocational education has strong regional ties and a wide offer of a relevant training for the activities in the regional economy; it is also strongly involved in local clusters and initiatives.
- The self-organising capacity is a clear strength of the Region: parties manage to find each other on local and regional levels, are prepared to think and work together and are easily connected within the established networks. This has resulted in many different initiatives with (potential for) innovation. A number of these initiatives are especially distinctive or at least have the potential to become so.
- The innovation ecosystem has grown strongly in the past years and has seen serious investments which has led to a strong potential support for innovations.
- The Region attracts large numbers of mid-career professionals on the basis of its location and attractive residential climate and living environment.
- The actors in the Region succeed in tying in well with value chains that often cross regional borders, and the regional authorities have put targeted policies in place.

3.2 Weaknesses of the Region

- The identity in the Region is not perceived as ‘East Netherlands’ but is mostly local or derived from a specific region within the province (Twente, Achterhoek, etc.). It is logical that customers and economic boards will be created at the perceived identity level. On a local level they contribute to cohesion and innovation activities. Their success in transcending the geographical location is limited however. This leads to tensions between and within the provinces concerning certain themes.
- At the present time, there is a shortage of technicians in East Netherlands.
- The scarcity specifically concerns software companies and IT experts needed for the digital issues in the Region.
- The big companies present are mostly connected in value chains outside East Netherlands and play a limited role in the Region’s innovation ecosystem. As a result they cannot act as drivers in the way that big companies do in other Regions.
- The economy includes a large group of well-established SMEs with limited growth ambitions. If they innovate insufficiently, their competitive position will deteriorate.
- Although the means and activities for start-ups have increased in the past years and are now more strongly focused on clustering, the ecosystem still insufficiently stimulates and supports the continued growth of start-ups into scale-ups.
- Other means for the innovation ecosystem are not always easy to find and use for entrepreneurs. The reconciliation between supply and demand has room for improvement.
- The Region finds it difficult to retain students after they graduate.
- The knowledge activities in East Netherlands are very wide and not necessarily linked to local identities. The relationship between the knowledge institutes and the regional economy is not used optimally; valorisation activities have increased but there is certainly room to improve the ties between knowledge institutes and regional businesses.
- The Region is only occasionally used as launching customer and opportunities are missed to retain innovations within the Region.
- The strong international connection in the Region is usually fragmented and dependent on 1-on-1 contacts.
- Innovation activities that successfully emerge from the chain are limited.

3.3 Opportunities for the Region

- Several transitions are changing the established social and economic order as explained in Chapter 2. A lot of the knowledge and economy in the Region concerns these transitions.

- The market needs crossovers between the regional specialisations and therefore space to join forces also in areas linked to the transitions.
- There are strong international players in the direct vicinity of the Region that may be used with respect to innovation; the nearby Regions in the Netherlands, Belgium and Germany generally have high scores on innovation indicators.
- Strategic international regional partnerships are emerging and are very well accepted by the EU, especially Regions that may reinforce each other to jointly upscale (as Manunet for example and the Vanguard Initiative).
- By the increasing shortage on the property market in the Amsterdam-Rotterdam conurbation Randstad, the number of highly educated people with relevant profiles for the East Netherlands economy who are looking for housing work and nature outside the Randstad, is on the rise.

3.4 Threats for the Region

- The importance of regional profiling has increased; more and more Regions are currently engaged in framing themselves as internationally competitive.
- The international businesses with strong ties in the Region are influenced by and also co-dependent on priorities that are determined outside the Region. When these priorities change, businesses must be able to continue to meet the demands and expectations from partners in the value chain.
- On an international level, economic competition increasingly takes place around knowledge, and big international players (from China and the US for example) are actually buying up innovations. This makes intellectual property rights increasingly important, just as the protection of knowledge that has not yet been laid down in patents.
- Just as within the Region there is an international shortage of specific technicians which gives both the ‘war for talent’ and the solutions to organise work in a different way an international dimension.
- Support for the process ‘from-knowledge-to-start-up-to-scale-ups’ has increased internationally in the past years and various Regions have stronger ecosystems for this purpose than East Netherlands.
- Staying on track requires joining the earlier mentioned transitions. The transitions change the way in which the economy is organised as well as the products and services from this economy; in other words the Region is challenged on both levels. The required changes within these transitions are developing at different levels and are in different stages (from concept to application).
- There is no clear business case as yet for a number of social transitions partly because it is not clear who is or should be the customer (e.g. individual, hospital or authority for healthy ageing, food transition, self-care, etc). Through the absence of the business case it is not lucrative for businesses and therefore the transitions do not or only take place slowly.
- East Netherlands has strong neighbouring Regions that compete with regard to the same challenges (knowledge workers, transitions, specialisations).

4 Our ambition for 2027: Capitalize on crossovers throughout the chain

East Netherlands has an above average development of knowledge and expertise. Although there is already a considerable amount of R&D, there are still clear possibilities to strengthen this development. The connection between the knowledge base and the regional economy must be reinforced for example. And where this is already the case, the strength can be developed more on the level of East Netherlands instead of on a local or provincial regional level.

Especially stronger partnerships between knowledge institutes and the business community can contribute to the valorisation of ideas and knowledge from East Netherlands. Innovation issues come with interactions that do not fit within existing structures, do not connect with existing KPIs or that exceed the function profiles of the involved individuals. That is why communication and coordination between players must be improved. **It is essential in this respect that various players start to speak each other's 'language'**: the usual jargon that policy and knowledge institutes use, is often not recognised by the business community; enterprises often find it difficult to find the right person because they have broad questions and proposals that do not fit the specific task of staff within knowledge institutes. **The challenge for East Netherlands is to jointly tackle innovation issues beyond chains and provincial regions.** Only then the possible synergy within East Netherlands will be used optimally, enabling strategic choices in terms of the knowledge and expertise in other Regions.

4.1 Strengthening the innovation ecosystem

To enhance the existing innovation ecosystem, this strategy focuses on:

- Bundle the strengths in East Netherlands at the level of the Region (focus & mass);
- Invest in incremental and radical innovations that are essential to the economy and that will be the eye-catchers of East Netherlands;
- Invest in maintaining strong and competitive SMEs and develop new opportunities via start-ups and scale-ups (the existing and the new economy);
- Tie in with social missions and economic transitions that create the context for innovations to be successful;
- Facilitate a comprehensive innovation approach with a central position for the business case;
- Involve figureheads in connecting actors and activities to arrive at a constant interaction so that innovations do not stagnate by issues of the day;
- Innovate with and for the residents of East Netherlands.

The following paragraphs outline why and how we will implement our commitments.

4.1.1 Focus and mass

The strength of East Netherlands especially results from cooperation between individuals, organisations and (cluster) initiatives on regional and local level. East Netherlands is not known for its very big players nor for its strong *branding*: compared with other areas the profile is less explicit. Despite this modesty, the players in East Netherlands do have a strong sense of pride. They are proud of the own innovations, proud of the own knowledge, proud of the own technologies, proud of everything that is achieved locally. **At the level of the East Netherlands Region, however, the sense of pride is experienced less; it is felt more dearly at the level of the provincial regions and even cities:** in Twente, Arnhem or the Achterhoek for example. And this is not surprising as remarkable specialisations have been developed there. These offer insufficient mass however.

The synergy between core players in East Netherlands, the strategic cooperation with other Regions and the level on which East Netherlands can profile itself towards other Regions, determine its capacity for innovation. In the broader perspective of the Netherlands and the international community, it is

essential that players within East Netherlands cooperate. Neighbouring areas of East Netherlands are also strongly developed such as the Ruhr area, South Netherlands and the Amsterdam-Rotterdam conurbation Randstad. In view of the international character of the economy, many sectors also target the European or even global markets; here as well it is important to join forces to secure a strong position.

The strength of East Netherlands is therefore still insufficient at the level of the entire Region. Steps are being made to realize better connections between the specialisations. For example through Topfit, a strong partnership at Regional level, the provinces invest in cross-provincial activities through Oost NL, in partnerships such as Th!nk East Netherlands and BOOST and possibly ultimately also via OnePlanet. To increase the clout of East Netherlands it will have to make **further investments in shared interests by connecting the specialisations of the regions in East Netherlands with each other to create cluster strength.**

4.1.2 Strength from incremental and radical innovations

East Netherlands ranks in all innovation statistics as a powerful average achiever. The **SMEs** in the Region are strongly **focused on exports**. The innovation efforts within the established SMEs are mostly demand-driven; they originate from interactions with customers or suppliers. The deployed knowledge does not originate from fundamental or scientific research, **it concerns incremental innovations aimed at efficiency, quality improvements in the form of reliability, effectiveness or ease of use for example.** Incremental innovations therefore usually improve existing products, services or processes. These innovations contribute to the missions and transitions (also see Chapter 2).

In addition, the Region has knowledge institutes that develop leading knowledge. This knowledge to a large extent concerns (possibly) new solutions that may lead to new products, services and processes. **This puts the knowledge institutes closer to radical innovations and they are less strongly attached to the current product and service offer of the SMEs,** with the exception of the UASs.

Invest in both and connect these strengths to ensure innovation throughout the chain and create a strong and sustainable innovation ecosystem.

4.1.3 Invest in the existing and the new economy

Established SMEs are and will remain the heart of the economy of East Netherlands. They represent the major part of turnover, patents and employment, maintain strong international relations and drive innovations. **East Netherlands will continue to invest in this group in order to maintain the competitive strength during the transitions.**

In the past years, East Netherlands has also invested via various routes in stimulating a new economy through start-ups, and with considerable success. **It is now important to consolidate these investments and to continue to stimulate the start-up ecosystem.** For start-ups create new opportunities for the knowledge economy. To put start-ups on the right track from idea to market, various forms of support are possible. A lot of this support is already available within the Region but not everywhere, not for everybody and certainly not in a coherent structure. A strong start-up ecosystem is important to make sure that innovations do not stagnate and that promising start-ups grow into scale-ups of which there are only a few strong examples within East Netherlands.

4.1.4 Join transitions and missions

The innovative SMEs of East Netherlands have the potential to contribute to both the societal challenges and the economic transitions. The strength of the SMEs is enhanced by tying in with these changes (see Chapter 2). This way, the SMEs can maintain their earning potential and even expand it. **In addition, strong SMEs are important for absorbing and exploiting sophisticated knowledge. They must be able to dedicate the required capacity for this.** For many businesses it is a challenge to proactively respond to global transitions as the daily course of affairs often has the upper hand. And yet,

in view of the connections with the value chain outside the Region, it is important to take early steps within the transitions to be prepared for future wishes of customers in this way.

In addition, the provinces of the East Netherlands Region have indicated that they want to apply mission-driven innovation policy in line with the Dutch and European missions (see Chapter 2). This offers an opportunity for the business community of East Netherlands. For the strengths of East Netherlands are very socially relevant such as in the area of care, nutrition and food, cleaner and more sustainable technologies. **In this respect, it is the challenge for the Region to not want to join all developments but to become frontrunner in those specialisations in which economic activity and knowledge reinforce each other.**

4.1.5 An integrated innovation approach

It is important to have attention for all aspects **(inventor, implementor, user, supporter) of the innovation ecosystem and that it is based on a business case (revenue model)** to successfully develop and implement innovations. A business case comes with elements such as a clear market opportunity, a risk assessment, a financial framework, planning, clearly defined roles and responsibilities and mutual agreements about impact and proceeds. This requires a strong form of demand-driven operations in innovation support. In addition, the innovations must be able to actually land in society. Attention for the social relevance therefore needs to become the standard so that all those involved in innovations are cooperating to realize actual applications.

As innovations are new by definition, the current system will often not be prepared or structured for the introduction of the innovation. This among other things requires availability and/or education of personnel, available additional services, and adjusting legislation and regulations. **These matters must be taken up from the business case, otherwise the innovation will stagnate. Initiators from the business community, the knowledge institutes, the authorities and the end-users – who do not stop at obstacles but overcome them - are essential in this respect.** Cooperation comes first and requires the involvement of all actors as well as a shared objective.

While cooperation is important within East Netherlands, it may well be that some issues must be taken up with players from outside the Region, for example the *launching customer* (businesses in East Netherlands often act as a supplier) or with required knowledge that is already available in other areas. By means of a good internal cooperation, the East Netherlands profile will become stronger and partnerships outside the Region can be entered into strategically. The clearly to be communicated profile for East Netherlands is important as partners across borders also need to have a clear view of what East Netherlands has to offer them, as for example through Th!nk East Netherlands for Horizon Europe among others. This way, East Netherlands can both aim at the capacity within the Region and make use of the strengths of others.

4.1.6 Connect through figureheads

Despite the fact that innovation is strongly connected to technology, it can only be realized by people. The initiators of innovation projects, the entrepreneurs in businesses, the knowledge bearers of knowledge institutes, the representatives of the authorities and – not to be forgotten – the end-users are the ones that jointly develop innovations for the Region.

In order to gain innovation success as East Netherlands, figureheads are needed that together create an innovation culture in which innovation ambitions are stimulated, partnerships are pro-actively sought and opportunities are capitalized in the economy. Especially when developed knowledge is connected to the established business community, and innovative start-ups and scale-ups evolve into strong private players, the Region will reap the benefits from its investments in the innovation ecosystem.

In the current playing field, especially representatives of knowledge institutes, authorities and supportive organisations play a major part in drawing up targets, strategic and further plans for the innovation ecosystem. The business community is not so much present at the table. Where in other areas, the business community often centres around major players, these are far less present in East Netherlands. The involvement of the SMEs therefore poses an explicit challenge in view of the diversity

of players and the - on the whole - less organised character. It is on the one hand a challenge to involve multiple players but it is also a challenge to increase the trust between the SMEs to make it possible for them to speak with one voice. It is essential to involve this group of enterprises as they are at the base of employment economic activity within the Region. New enterprises - start-ups - also belong to this group albeit that the ambition level of course plays a major part. Partners in the Region must be able to enter into a dialogue with each other to jointly define the business case.

Who will be the best choice to act as figurehead will depend on the innovation and the parties involved. It is clear however that a figurehead must embrace the business case of the innovation. At the same time, a shared vision about the business case is of importance to coordinate the commitment of all players involved. Office space to involve parties to fulfil this role is essential for East Netherlands.

4.1.7 For and with the people from East Netherlands:

Innovation means change. On updating this RIS3, we saw one recurrent theme, i.e. **it's the people that will have to do it. The Human Capital theme is very much alive in East Netherlands in 2019**, on the one hand because there are shortages in terms of specialists (particularly technical) and on the other hand as there are still (relatively few but still an important factor) unemployed in the Region. The economic crisis of 2008-2011 had a long aftermath in East Netherlands affecting businesses in construction, industry and agriculture for example for quite some time. It also influenced the composition of the employment market and led to an increase in self-employed workers without employees. In addition, the transition around digitalisation and robotisation involves an automation process in which human work is becoming obsolete in some situations. At the same time innovation creates opportunities for jobs (certainly when businesses are growing and new ones are established) mainly for new tasks within existing jobs that involve new technologies.

As a result, East Netherlands is facing the important challenge to both support enterprises in attracting specialists and to retrain existing employees or give them extra training and find good positions for those who have or will lose their jobs because of the transitions. **Businesses that see changes generated by transitions, will have a bigger chance of retraining employees or giving them extra training, and to deal with new work processes and technologies.**

East Netherlands is not alone in this; all Regions experience a form of shortage of specialists. That is why already a lot of national campaigns have been started to deal with the shortages on the employment market as for example TechniekPact, the Top sectors and sector organisations. Also within East Netherlands itself, solutions are sought at both regional and local level. In further investments in innovations this challenge must remain in the foreground. **Attention to the human capital aspect is essential to make the innovation system flourish.**

4.2 Capitalize on crossovers

In the past years, the Netherlands has worked hard to distinguish itself in various themes. There are opportunities both in the field of distinctive innovations with which the Region can profile itself, especially social missions and in the area of innovations through which East Netherlands can keep up with general market developments. **Innovations the Region can use to profile itself, combine the knowledge and economy of the Region; these concern innovations that are mostly new at a national or even global level and that contribute to social missions and economic transitions.** Innovations through which the Region can keep up, are determined by large-scale international transitions; in many cases these are innovations that influence the operations and processes within organisations.

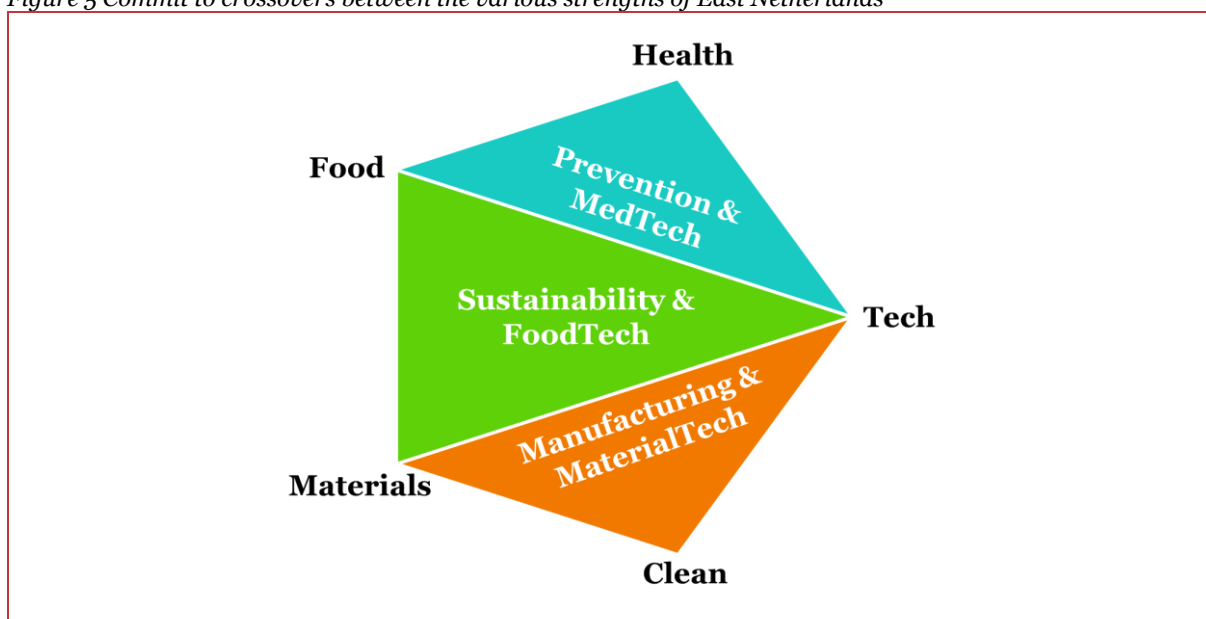
4.2.1 Identity by diversity

Ambitions for distinctive innovations will have to be very much in line with the specialisms of East Netherlands and will have to be connected on the basis of clear targets. As is clear from the SWOT analysis, the Netherlands has a large diversity in expertise spread out over various sectors, regions and chain players. **The challenge is to not invest a little in everything; but to make real choices so that a leading position in certain developments is actually possible.** This means not

committing to a specific topic of theme. The strength of East Netherlands lies in the synergy between the different expertise areas **in which technology is linked to societal challenges. The possibility to bundle expertise through these crossovers makes the Region unique.**

Figure 5 shows the three main crossover areas of East Netherlands, i.e.: **Prevention & MedTech**, **Sustainability & FoodTech** and **Manufacturing & MaterialTech**. These crossovers are formed between the expertise in the Region in the areas of *Health, Food, Clean, Materials* and *Tech*, which correspond with the main partnership forms, knowledge hubs and Valleys in East Netherlands. The fact that this represents the strength of the Region has also been implicitly acknowledged by the Ministry of Economic Affairs and Climate Policy; in all three crossovers, East Netherlands has at least one (finalist for the) National Icon.⁴³

Figure 5 Commit to crossovers between the various strengths of East Netherlands

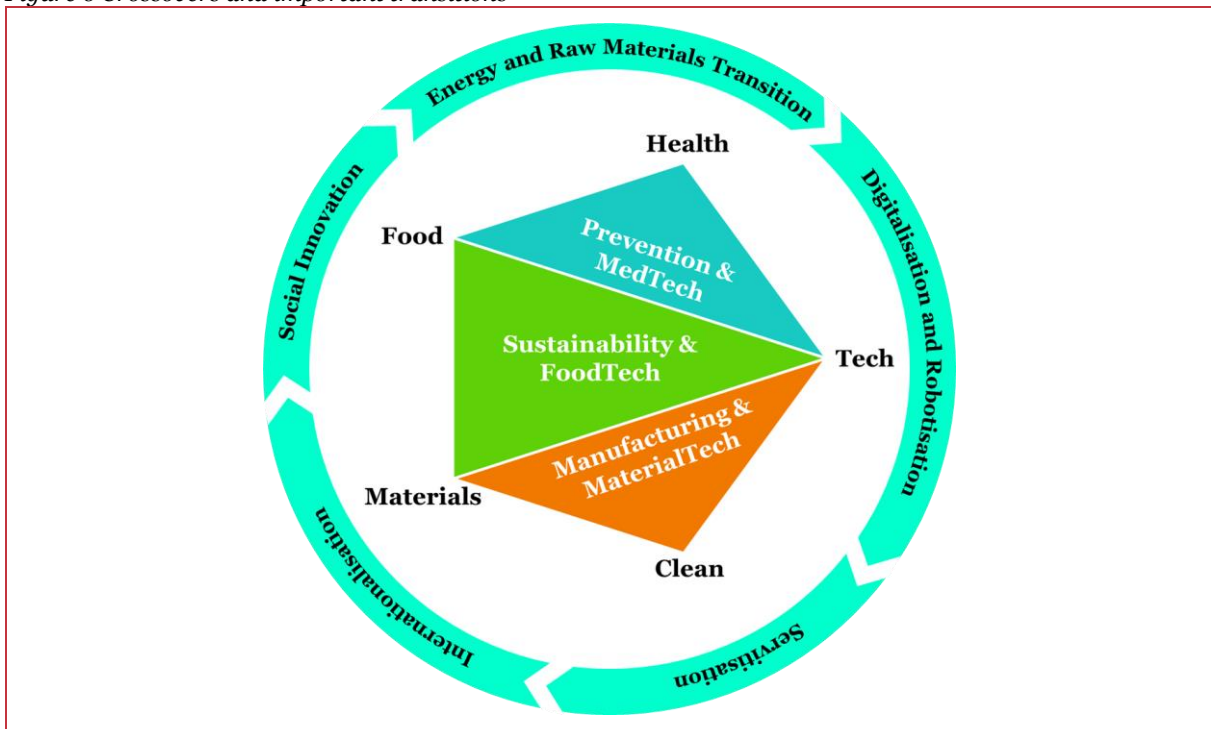


Technopolis Group, 2020

From talks with players from the Region it strongly emerges that they want to strive for and see the biggest opportunities in tackling the social challenges and transitions that we have to deal with as society. The stated crossovers offer an excellent starting point for this as the social challenges and transitions mostly have strong multidisciplinary needs (see figure 5).

⁴³ <https://www.nationaleiconen.nl/>

Figure 6 Crossovers and important transitions



Technopolis Group, 2020

The business community, the knowledge institutes and the authorities need to structurally and sustainably work together to capitalize on innovations within these crossovers. **This means that successful activities must be embedded in the regional business community and also be rolled out supralocally/supraregionally and be included in the East Netherlands ecosystem.** In addition, the authorities in East Netherlands may be deployed as launching customer which will also attract (inter)national attention to innovations from the Region and/or launching customers may be jointly identified elsewhere in a more structured manner.

5 Our strength: Manufacturing & MaterialTech

The crossover Manufacturing & MaterialTech ties in with the strength of East Netherlands in the area of technology and materials and the growing ambitions and activities concerning a clean and circular manufacturing industry. **Both Gelderland and Overijssel are traditionally strong in the manufacturing industry** (including the processing industry). At this time, the percentage of people employed in this sector in both provinces is higher than the Dutch average.⁴⁴



The provinces find each other in the **technological challenges** that face the manufacturing industry in the coming decade, i.e. the earlier mentioned **energy and raw materials transition** and the transition of **digitalisation and robotisation**. Within the plans of Th!nk East Netherlands, the latter transition is also recognised as **Smart Industry** and **Digital Industry**; internationally these innovations are often also placed within the **Industry 4.0 and Circular Economy** concept. Both aspects are covered by the flagship “Smart and Sustainable Industries” of the East Netherlands innovation profile (which among other things has been developed for profiling for the European Horizon Europe programme). The circular economy is broader than just the manufacturing industry but it is especially within this sector that there are challenging innovation issues for which East Netherlands is strongly positioned to respond. In conclusion, East Netherlands plays an important role for the manufacturing industry in the Netherlands. East Netherlands parties have co-signed the National Raw Materials Agreement in which materials and the manufacturing industry have formulated two spearhead transitions.⁴⁵

Through Smart Industry, processes and business models of the manufacturing industry will change and there are opportunities for more sustainable and efficient use of materials. By placing sensors, applying the Internet of Things and the automation of processes, new opportunities arise to maintain the competitive advantage of the manufacturing industry in the Netherlands as well. **This mostly concerns process innovations** by means of new technology; **both the application of these innovations and selling the innovation create important opportunities for the region.**

Also in terms of product innovations, the Region has a competitive advantage. **Especially in the area of material technology, East Netherlands is a strong player**, for example in the area of plastics, textile, composites and nanotechnology. This strength also offers opportunities for the development and application of lighter materials, reusable or biodegradable materials, functional materials (mechanical, electronic and photonic) and energy materials (to generate transport and store energy).

5.1 Photographs of our ecosystem

East Netherlands has many players in the area of Manufacturing & MaterialTech. Only the business community in Sunderland has already more than 9,000 businesses and in Overijssel nearly 5,000 businesses that are active in the (manufacturing) industry.⁴⁶ **The greater part of manufacturing industry in East Netherlands concerns SMEs, including some small start-ups knowledge institutes:** some 53% of the industrial businesses in East Netherlands employ more than 100 persons.⁴⁷ Examples of these businesses within this crossover are: Demcon, Lionix, Thales, IJssel Technologie, NXP, Sensata, Micronit, Bronkhorst, Norma, Van Raam, Solmates, Aebi Schmidt, AWL, DSM, Wärtsilä and Nouryon.

⁴⁴ Statistics Netherlands (CBS)-data: 13.8% in Overijssel, 11.3% in Gelderland and 9.9% on average in the Netherlands.

⁴⁵ <https://www.rijksoverheid.nl/onderwerpen/circulaire-economie/nederland-circulair-in-2050>

⁴⁶ Statistics Netherlands (CBS) data 2019.

⁴⁷ Netherlands Employment Register LISA data 2018.

This crossover ties in with the knowledge and expertise of various knowledge and education institutes in East Netherlands, which do research and supply well-trained staff for the manufacturing industry. At a scientific level, this concerns all three universities - in Enschede, Wageningen and Nijmegen Especially, UT has developed a strong ecosystem around material technology (incl. Mesa+/Nanolab and Elastomor Competence Center) and hightech for the industry (e.g. Fraunhofer Project Centre). RU and the WUR can also contribute to the manufacturing industry and material technology through their physical and technical expertise departments, albeit to a lesser extent. At the level of universities of applied sciences, we mention Saxion (Smart Industry, TechForFuture), Windesheim (lectorates Plastics Technology and Industrial Automation & Robotics) and HAN (Knowledge Centre Technology & Society and Centre Multiple Value Creation) aimed at the industry, materials science and circular economy with their lectorates and education. There are also various intermediate vocational schools (MBO) in East Netherlands that train young technicians for the industry, such as Regional Training Centre (ROC) Twente, Graafschap College, ROC Nijmegen, Aventus, Rijn IJssel and ROC Rivier, also in cooperation with enterprises (as mentioned in section 1.2 CIV). There are 10 Digital Innovation Hubs (DIHs) active in East Netherlands, the most of which in the field of Industry 4.0., such as BOOST Smart Industry Hub. The objective of these hubs is making digitalisation knowledge and expertise easily available for SMEs.

Next to these players, there is a wide range of public-private partnerships in the East Netherlands ecosystem. It consists of campuses, such as NovioTech Campus, Knowledge and S/park, but also of networks, e.g. BOOST for Smart Industry and AMMON for advanced materials and production technology, the regional CleanTech region and CIRCLES for the circular economy. And within this crossover, East Netherlands also disposes of a number of open innovation facilities and fieldlabs, such as High-Tech Factory and CITC (Chip Integration Technology Centre (nano/microtechnology), Space53 (drones), CAPELLA (smart maintenance), The Garden (cyber security), Smart Welding Factor, Smart Bending Factor, Fieldlab Industrial Robotics, TValley and LEO (robotics), ThermoPlastic composites Research Centre TPRC, Polymer Science Park, TPAC and GreenPac/iLab (composites and plastics), Open Innovation Center Advanced Materials OICAM (materials), LAC (lasers) and Open innovation Centre for Textile Recycling Texperium (textile), Fieldlab Circular Packaging, Knowledge Centre Paper and Cardboard and the hotspots Arnhem and Twente within the Dutch Circular Textile Valley. All in all, there are many activities in the area of Manufacturing & MaterialTech in East Netherlands.

5.2 From knowledge to economy

From a social perspective there is the clear desire for cleaner and more sustainable production by the manufacturing industry. By also investing in making the manufacturing industry smarter, the sector will remain competitive enough to continue to establish itself in the Netherlands and contribute to economic growth.

This crossover also has a strong link with the economy in East Netherlands. The (manufacturing) industry is an important sector in Overijssel and Gelderland. This is also acknowledged in ‘The strength of East Netherlands’ (2017), ‘Innovation Profile East Netherlands Region’ (2016) and ‘The strength of the Gelderland Manufacturing industry’ (2017).

To bring knowledge through innovation to the society and economy, projects need to relate to challenges in the business community. Market pull and involvement of the business community are a must. Bringing together parties throughout East Netherlands constitutes a valuable contribution preferably by also involving suppliers and customers. Knowledge and education institutes can contribute by applied research, the transfer of knowledge, making facilities available and strengthening human capital. As the shortage of qualified staff is one of the challenges within this crossover. Add to this that existing personnel is increasingly challenged to more and more combine technical and social skills - which once again underlines the importance and necessity of lifelong learning.

Students that can be placed with businesses for internships, work experience or to work on their thesis, are often made aware of the bottlenecks of the enterprises. The knowledge that they gain in this respect can serve as feedback to the knowledge institutes and be used for further relevant follow-up research. This is already regularly the case among UAS students and they also regularly visit businesses. The transition back required for knowledge development is already taking place little by little through innovation hubs, electorates and internships but still needs perfecting as well as facilitation through universities.

Innovation within this crossover mainly **concerns new products and processes**. New materials - both as products and as raw materials - may also play a role in this. In order to secure the connection with the economy, new materials need to be developed together with businesses for specific application in innovative products or processes.

Within the crossover Manufacturing & MaterialTech there is room for innovation in the following areas:

- **Smart Industry and Industry 4.0:** modernising the (manufacturing) industry by further automation of production through robotisation and digitalisation. Production processes make use of smart machines that communicate with each other digitally. New business models are examined for the manufacturing industry made possible by smart industry. Chain cooperation is important in this respect as well as specific digital technologies such as 5G, AI, chip and communication technology. This then concerns new business models as well as new products with new services.
- **New, sustainable and advanced materials⁴⁸:** the development and application of new materials, products and processes, and testing them in prototypes and pilots. This may concern lighter materials, more sustainable materials or functional materials. This will lead to innovative products. As well as recycling technologies in the area of water, plastics, packaging and mattresses for improvements in existing products. It also includes materials for the storage, transport and generation of energy. Think of Photo Voltaic, superconductor cables and batteries.
- **Nanotechnology and photonics:** East Netherlands has strong competencies in the area of nanotechnology and especially photonics is emerging from the field of research. Both technologies are key technologies with various possible applications (products and processes) in a broad range of sectors. The further developments of these technologies and their applications offer new economic opportunities. In this context, partnerships with businesses and UASs are important to valorise research with the knowledge institutes.

The latter area is explored to a lesser extent at this time and offers opportunities to maintain and strengthen the future position of East Netherlands in the field of hightech manufacturing industry. It also offers the possibility to valorise the knowledge towards interested companies.

5.3 View of the future

This crossover is highly relevant for the **digitalisation and robotisation** transitions and **the energy and raw materials transition** and extending the mere sale of products to offering services (or **servitisation**). By investing in this crossover now, the East Netherlands industry will remain up-to-date in 2030 and even be frontrunner in specific niches. Both product and process innovations that may be sold outside the Region and enabling businesses in East Netherlands to develop in line within the transitions, will create opportunities. In this crossover, the role of the Region as launching customer is very evident. In addition, the crossover, through smart industry offers room for the further development of services within the manufacturing industry and as such within the servitisation transition to drive innovations in the way the products are supplied. This is not an automatic process and it often has an impact on the value chain and the business model of the organisation. As such it also offers opportunities for possible connections and reinforcements in the value chain of the Region.

⁴⁸In this area there are two finalists for the National Icon, i.e. Leadax and Oxycom Fresh Air
<https://www.rvo.nl/onderwerpen/innovatief-ondernemen/nationale-iconen>

With the crossover Manufacturing & MaterialTech, East Netherlands can strengthen its industry to capitalize its position in material technology and make the industry future-proof within the framework of smart and sustainable industry.

However there are conditions for these innovations. One of the main thresholds in the Region in this respect at this time is the shortage of sufficient specialised people. The employment market in the Netherlands has been showing a shortage of technicians for a number of years. This also holds good for East Netherlands. In addition, technicians are increasingly required to dispose of a range of social skills while non-technical professions more and more need to understand technical concepts and terms. To ensure a strong innovation in Manufacturing & MaterialTech in the future, it is important to take human capital into consideration now.

5.4 Across the borders of the Region.

The Manufacturing & MaterialTech crossover ties in with national policy. It has overlap with the HTSM Top Sector and with many key technologies that have been defined in the renewed mission-driven Top Sector policy (including engineering and manufacturing technology as well as advanced materials). This creates a good connection with the national innovation and businesses policy.

This crossover also allows for very clear connections with the missions defined for the Netherlands, as indicated in the following table.

Table 3 Relation between the crossover and national missions

Mission	Contribute to this objective	And possibly also to these objectives
Energy and sustainability	<ul style="list-style-type: none"> In 2050, raw materials, products and processes in the industry will be net climate-neutral and at least 80% circular A sustainably powered fully circular economy by 2050 	<ul style="list-style-type: none"> A Co2-free built-up area by 2050 Emission-free mobility for people and goods by 2050
Agriculture, water and food		<ul style="list-style-type: none"> In 2050, the system of agriculture and nature will be net climate-neutral.
Safety		<ul style="list-style-type: none"> In 2030, the Netherlands will have operational space travel capacity to be deployed for defence and safety. Space travel capacity in this definition comprises both satellites, infrastructure on the ground and information processing. In 2030, the armed forces will fully operate in a network with other services and will use integrated new technologies such as unmanned systems, electromagnetic spectrum and social media as a result of which we can complete the decision loop faster and better than our opponents.

Within this crossover it is also expected that a strong focus and important contributions are made to **the development of key technologies**: from sensors, Artificial Intelligence, cyber security, data intelligence and robotics to photonics and nanotechnology.

Thanks to the connection with the top sectors and the knowledge and innovation agendas a link with the Netherlands Organization for Scientific Research NWO is also secured in which especially the activities of the Applied and Technical Sciences (TTW) are relevant. Internationally, there is a strong connection with the second pillar of Horizon Europe, specifically the Digital and Industry cluster. The foreseen European partnerships on Key Digital Technologies en Innovative SMEs also tie in with this cross-over.

Apart from East Netherlands, other Regions are also active in this crossover. South Netherlands and especially North Brabant, also have attention for the themes within this crossover. The difference being that they focus more on big companies. West Netherlands as well and especially South Holland, has quite a lot of manufacturing industry and the themes within this crossover are also relevant there. This area also shows a higher concentration of businesses with data specialists programmes and other IT-specialists that may contribute to the shortages in this field within the Region. This offers opportunities for cooperation in the area of innovation. Across the border in Germany in North Rhine-Westphalia for example, there is also a lot of attention for Industry 4.0 and sustainable materials. Here is well there are opportunities for cooperation not in the least because it already is an important sales market.

6 Our strength: Prevention & MedTech

The crossover Prevention & MedTech combines the themes of Health, Food and Tech in East Netherlands. **This crossover connects Overijssel and Gelderland concerning a shared challenge in the area of prevention and combines the strengths from both provinces in the area of healthy nutrition, medical technology, diagnostics and treatment.**



The strengths of both provinces are reflected in this crossover which makes it logical to join forces and cooperate. **Together they cover all three expert competences that play a role in prevention**, as is acknowledged in the impact programme TopFit, which is supported by both provinces and the reason why knowledge parties from both provinces are working on it.⁴⁹ **Also in the field of MedTech, the shared strengths in Tech en Health meet.** The combination of these strengths in a single Region is unique and this makes this crossover an appropriate specialisation for East Netherlands.

6.1 Photographs of our ecosystem

Care is an important sector in East Netherlands. More than 11% of the organisations that are active in East Netherlands, are working in the care sector; this concerns more than 21,500 organisations in Gelderland and over 10,500 organisations in Overijssel, jointly with nearly 279,000 jobs.⁵⁰ More than half of the organisations that operate in this sector are large organisations with more than 100 employees. Especially in the provincial regions of Arnhem/Nijmegen, followed by the Achterhoek and South-west Overijssel, we find many care organisations. Examples of care organisations (including in the private sector) in East Netherlands are Quirem Medical, Khondrion, Astra Zenica, SPL Medical, Radboudumc, various non-academic hospitals, Roessingh R&D and Sint Maartenskliniek; a number of enterprises also aim at the health of animals such as GD and VKON.

Next to care, this crossover has a relationship with healthy nutrition, especially within a context of prevention and more specifically the combination of food and exercise. In this area there is also a lot of economic activity in East Netherlands, and especially Gelderland – and more specifically the Food Valley region – has a lot of organisations that operate in the food sector. Examples of businesses in food in East Netherlands are Friesland Campina, Unilever Foods Innovation Centre, Kraft Heinz, Johma, GreenFood50 and NutriLeads. Concerning food and exercise, Sports Centre Papendal and Sint Maartenskliniek produce innovations for example via the ‘Eat2Move’ project.

This crossover also ties in with the knowledge and expertise of various knowledge and education institutes in East Netherlands. **RU, WUR, UT and RUMC all dispose of good knowledge to contribute to prevention and medical technology from various angles.** WUR mainly focuses on healthy nutrition, RU and RUMC are mainly involved in medicine, diagnostics and therapies, whereas UT focuses on medical technology. The Region is also strong in robotisation in healthcare (with hubs such as DIH-HERO, one of the Health Digital Innovation Hubs and the TechMed Innovation Hub). **The UASs also play an important role in expertise and training for care and health**, such as Saxion (research Health & Wellbeing), Windesheim (e.g. lectorates Exercise, Health and Wellbeing and IT-innovations in care) CHE and HA) (Knowledge Centre sustainable care and lectorate Nutrition and Health). There are also various intermediate vocational schools in East Netherlands that train students for the care sector such as ROC Twente, Aventus, Graafschap College, Rijn IJssel, ROC Nijmegen and ROC Rivier

In this crossover we also see a number of public-private partnerships that operate in the East Netherlands ecosystem. This concerns programmes such as TopFit, which now aims at prevention to increase the quality of life in East Netherlands, OnePlanet launched in 2019, which also has attention

⁴⁹ Zie: <http://www.topfit.life/>

⁵⁰ Netherlands Employment Register LISA data 2018.

for prevention, and C.I.A.L.E., which a focus on nutrition, health and IT. In addition, East Netherlands has Novio Tech Campus, for medtech and life sciences, Papendal for sports and exercise, and TechMed Centre for medical technology. There are also various customers and networks, such as Health Valley, Food Valley and i3B (IT for Brain, Body & Behaviour). Then there are open innovation facilities and field labs in this crossover. We mention Health Innovation Park, Nutrition in healthcare Alliance, Digital Health Centre, Fieldlab Primary Care, Fieldlab Care for the Disabled, Fieldlab Rehabilitation Fieldlab Secondary Care. In conclusion there are some incubators and accelerators in this crossover: Rockstart Digital Health and BRISKR.

6.2 From knowledge to economy

From a society perspective there is a clear demand for solutions to lower healthcare costs, enable people to live healthy longer and improve the quality of life of people with chronic disorders. This demand is not only apparent within the Netherlands but in the whole of Europe. As such it offers an opportunity for the business community to respond. **Enabling knowledge from knowledge institutes to land with the business community is an important precondition within this context.** Partnerships between the business community and knowledge institutes is essential but care organisations, healthcare professionals and even patients/customers need to be involved for a proper demand articulation, practical applicability and tests. Within this framework, TopFit mentions a 'citizen lab for prevention', which is also emphasised in the recently published knowledge and innovation agenda for healthcare.

With respect to prevention, there is a social business case but it is a lot harder to draw up an economic business case. As prevention is desirable from a social perspective it is important that authorities act as funder or launching customer for such innovations. This requires cooperation between the business community and knowledge institutes.

Innovation in this crossover primarily relates to products (especially in MedTech) or services (e.g. digital). This may concern innovations for diagnostics, self-management, nutrition or prevention or on the other hand treatment programmes or therapies. The changes that can be generated from this crossover for healthcare also require that current personnel will be able to handle these and will have the proper skills.

Within the Manufacturing & MaterialTech crossover there is room for innovation in the following areas:

- **Innovations for prevention:** these include innovations that contribute to the prevention of illnesses and that reduce the burden of disease and in this way increase health (and the experience of health) so that the costs of healthcare for society go down. This applies e.g. to nutrition, (grassroots) sports and exercise, and may also be social innovations. However, there must be the prospect of a customer for the innovation as it is in this respect that the business case poses a challenge. This may be realized by cooperating with a potential customer right from the development phase. There are already some successful examples of social innovations in East Netherlands.
- **MedTech and Connected Health⁵¹:** these include technological innovations for early diagnostics, medical treatment and care, including remote digital applications (software and hardware). This may concern medical and care robotics for example, medical sensors/actuators (chips), eHealth and drug delivery systems.
- **Personalised healthcare & nutrition:** these include innovations in care and nutrition customised to the individual wishes, needs and circumstances of people to improve their health or healing process. In this context, partnerships with businesses and/or hospitals and UASs are important to valorise research knowledge in practice.

⁵¹ Within this crossover a National Icon has been awarded
<https://www.nationaleiconen.nl/actueel/nieuws/2019/september/23/kabinet-benoemt-inreda-diabetic-ioniqa-en-hiber-tot-nationale-iconen>

The latter area is still being explored to a lesser extent at this time and offers opportunities to maintain and strengthen the future position of East Netherlands in the field of nutrition and health also towards interested businesses.

6.3 View of the future

With the crossover Prevention & MedTech, East Netherlands has the potential to on the one hand reinforce its economy and business community in the areas of Health, Food and Tech and on the other hand contribute to a societal challenge concerning health and healthy ageing.

By committing to a specific niche that combines the strength of both provinces, **East Netherlands may acquire a strong position in prevention and medical technology.** This requires cooperation between knowledge institutes, businesses, including healthcare insurers, hospitals and care providers, patients and citizens.

Within this crossover, there are also clear connections with the transitions; not only **robotisation & digitalisation** and **servitisation** but also **social innovation**. Here as well, different organisational forms and innovation with a social objective are important (just as in in the other crossovers). Organising in a different manner comes down to involving more stakeholders than is the case with technological innovation. And the fact that prevention often requires behavioural changes and different ways to deal with the illness. In this area there are clear opportunities for innovations that are not (purely) technological but for which it can be made plausible that regional SMEs will benefit.

This crossover has to contribute to the fact that in 2030 East Netherlands will have developed in the area of prevention, medical technology and social innovation and will be cooperating more. This should ensure that **the regional business community will have tied in with the digitalisation and robotisation transition, which is also taking place in healthcare.**

Human capital is also a focus area in care; there are personnel shortages throughout the Netherlands.⁵² The increasing population requires more care personnel and innovative solutions in order to be able to offer good-quality care. This may partly be technology. **In this respect it is important that current and future care personnel can work with new technology and has been prepared for it.** Especially digital skills but also competencies to function in new organisational forms are essential for the social innovations that are particularly important in these crossovers.

6.4 Across the borders of the Region.

The Prevention & MedTech crossover ties in with national policy. It has overlap with the Life Sciences & Health (LSH) Top Sector and with many key technologies that have been defined in the renewed mission-driven Top Sector policy (particularly life science technology and digital technologies).

This crossover offers important opportunities as well to contribute to the Dutch missions.

Table 4 Relation between the crossover and national missions

Mission	Contribute to this objective	And possibly also to these objectives
Agriculture, water and food		<ul style="list-style-type: none"> In 2030, we will produce and consume healthy, safe and sustainable food and chain partners including farmers will receive a fair price for their products.

⁵² Statistics Netherlands (CBS) (2019), Dashboard Employment Market Care and Wellbeing: <https://dashboards.cbs.nl/v1/AZWDashboard/>.

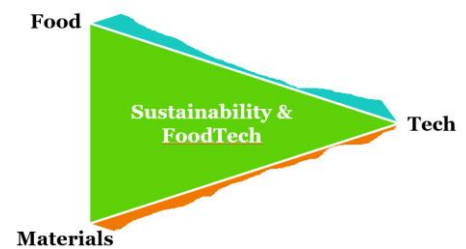
Mission	Contribute to this objective	And possibly also to these objectives
Health and care	<ul style="list-style-type: none"> • In 2014, the burden of disease as a result of an unhealthy lifestyle and unhealthy living environment will have decreased by 30%. • In 2030, healthcare will be organised 50% more (or more often) in the own living environment (instead of in health facilities) in combination with the network around people. 	<ul style="list-style-type: none"> • In 2030, the share of people with a chronic condition or lifelong impairment that can participate in society in line with their wishes and capacity, will have increased by 25%. • In 2030, the quality of life of people suffering from dementia will have increased by 25%.

Thanks to the connection with the top sectors, missions and the knowledge and innovation agendas, a link with the Netherlands Organization for Scientific Research NWO is also secured in which especially the activities of the Applied and Technical Sciences (TTW) are relevant. There is also a strong connection with the Netherlands Organisation for Health Research and Development Zonmw and the crossover may be regarded as additional to the National Prevention Agreement which in itself has no focus on innovation. Internationally, there is a strong connection with the second pillar of Horizon Europe, specifically the Health cluster. The foreseen European partnership Innovative Health Initiative also ties in with this cross-over.

With this crossover, East Netherlands is distinctive while at the same time there are areas of overlap with strengths in South and North Netherlands. In the area of medical technology, North Brabant also has quite a lot of expertise, particularly in the Brainport area with the activities of Philips and the Holst Centre. In Groningen, Healthy Ageing has been the focus for a longer period (including Healthy Lifestyle and MedTech) and prevention also plays a part in this. With the current focus, LSH is not generally targeted as a result of which the competition with West Netherlands is less prominent. **Within this crossover, the distinction with other Regions particularly concerns food, the broad cooperation from different competencies (medical, technical, biological) and organisations.**

7 Our strength: Sustainability & FoodTech

In the Provinces of Gelderland and Overijssel there is a lot of activity concerning **sustainability**. The joint forces of the Region are **particularly strong in the field of sustainable food technology which results from specialisations around technology, agriculture & nutrition and biological materials & raw materials (biobased materials)**. By cooperating at the interface of the specialisations, East Netherlands is creating distinctive economic opportunities for the Region.



There are already various partnerships within the provinces in which researchers, authorities and entrepreneurs work together on innovative propositions and especially in the Food Valley region. Through the Protein Cluster (in the protein transition domain) and the CleanTech Region, the provinces also share ambitions and activities. With respect to food technology, however, cooperation between the provinces is sought to a lesser extent while they actually compliment each other quite well in this area.

7.1 Photographs of our ecosystem

In the area of Sustainability & FoodTech, Wageningen University & Research and University of Twente are important sources of knowledge that can complement each other very well in this field. WUR has a prominent international position in the area of Food and (biobased) Materials. In their research within 4TU context with programmes as ‘High Tech to Feed the World’, they are also looking for the combination with technical innovations and sustainability. They are for example engaged in a lot of research and innovation in the field of AgroFood Robotics, precision agriculture and circular agriculture⁵³. This makes them an important driver for developments in the circular economy concerning biobased materials. They also manage the Digital Innovation Hub (DIH) AgRoboFood. University of Twente mainly focuses on technological developments that can be applied in different sectors.

In addition, HAN also disposes of relevant knowledge through their Bachelor programme Food & Business and research concerning Smart Business. In this respect, smart business models are looked into at the interface of sustainable economy, digitalisation and robotisation⁵⁴. ArtEx also focuses on Food Design.

In conclusion, there are a large number of bigger businesses in East Netherlands with lots of activities in innovation. Fresland Campina, KraftHeinz, Unilever and KeyGene for example have large R&D centres in East Netherlands⁵⁵ and companies such as BTG Biomass Technology, Engie Energie, Hygear have attracted a lot of research funds through Horizon2020. East Netherlands also accommodates big international machine manufacturers for the agro and food sector, such as Pas Reform, Moba FTNON and Koninklijke Reesink. In addition, major animal feed companies AgriFirm, ForFarmers and De Heus are established in East Netherlands.

We already see various customers and partnerships at the interface between Food, Tech and Materials.

- Technology- and innovation centre **OnePlanet** is a partnership between Radboud University, Radboudumc, Wageningen University & Research and IMEC the Netherlands. OnePlanet aims at the crossovers between smart technology, nutrition and health. Including research projects in agricultural technology as precision production for example sensors, robots, Artificial Intelligence, big data and digital connectivity for a agriculture will be researched. Connecting these activities with

⁵³ <https://www.wur.nl/nl/Dossiers.htm>

⁵⁴ <https://www.han.nl/onderzoek/kennismaken/business-development-and-co-creation/lectoraat/smart-business/>

⁵⁵ Agrifood 2030, second progress report. https:// Gelderland.notubiz.nl/document/7806782/1/PD_-_Bijlage_Agrifood_2030_tweede_tussenrapportage_%28PS2019-566%29

the other initiatives in East Netherlands, including the actors in the CleanTech Region, UT, HAN and businesses that operate in these themes, will enhance the success of OnePlanet.

- **FlexCRAFT** (Cognitive Robots for Flexible Agro Food Technology), lead by WUR, focuses on robots in the agrofood sector. Businesses in the Region such as Leo Robotics en Demcon, have joined.
- **'Twente Groeit' (Twente Grows) is a public-private partnership** between the agrifood and technology sectors in the Twente area. The initiative brings the various sectors together to discuss the potential of collateral benefits.

Although there already are various partnerships and the connection between research, enterprises and authorities is already often sought, these partnerships often take place on a provincial regional level within Overijssel or Gelderland. Apart from CleanTech Region and the Protein Cluster, partnerships that bundle the strengths of Gelderland and Overijssel are seen to little although there are opportunities for crossovers.

7.2 From knowledge to economy

From a social perspective there is the clear desire for solutions for food scarcity and sustainable & climate-proof food supply.

East Netherlands already has a lot of knowledge in the area of Sustainability & FoodTech. **To use this knowledge within the Region for economic growth, there must also be a sales market for it and innovations must be applied in local SMEs.**

Gelderland has a large agrifood sector with more than 100 food-related organisations in and around **Food Valley. It is also clear that this sector is growing in value and in number of jobs. In AgriFood 2030, the target was set to belong to the top of the world with Food Valley in terms of economic activity and valorisation in this area.** The Province of Gelderland wants to attract new SMEs, NGOs and knowledge institutes to the province and create sustainable employment in the agrifood sector and related sectors⁵⁶.

In Overijssel as well, the agro & food sector is also important for the economy and employment. This sector provides 15% of employment, 10% of the income and is responsible for 70% of the land use in Overijssel. **The province is working on making the sector more sustainable and sees many new developments (such as antibiotics reduction, precision agriculture and soil fertility and health of man & animal) to respond to.**⁵⁷

By using the knowledge in the area of Sustainability & FoodTech in the agro & food sector, the economic position of East Netherlands can be reinforced. Various stakeholders play a role in this and a number of them have already started to act on it.

From private enterprises and the universities, start-ups are supported in which the knowledge of the universities is used to set up businesses and let them develop. Next to Novel-T in Enschede, from WUR and East Netherlands Development Agency Oost NL, StartLife has been initiated with the objective Growing Food & AgriTech start-ups into leading enterprises. StartLife has already supported more than 250 start-ups that jointly have created more than 1,200 jobs and attracted M€96 in funding.⁵⁸ There are also various fieldlabs and testing grounds where innovations can be tested. There is The Green East e.g., for the circular economic future of the agri and food business; the Poultry Innovation Lab, with a poultry house and a business centre for training, research and knowledge transfer; and IDC Randwijk, for innovations in the food sector.

In conclusion, enterprises in the Region are also working together, for example in the area of sensor technology. Thales Nederland and NXP for example have set up a partnership with SMEs in East

⁵⁶ Agrifood 2030: https://gelderland.notubiz.nl/document/7806782/1/PD_-_Bijlage_AgriFood_2030_tweede_tussenrapportage_%28PS2019-566%29

⁵⁷ <http://www.overijssel.nl/thema's/economie/innovatie/agro-food/>

⁵⁸ <https://start-life.nl/startups/> (consulted on 05-08-2019)

Netherlands to further develop sensor technology and make it accessible for mass application to be applied in various sectors including the agrofood sector.

Stakeholders in Eastern Netherlands did indicate that the cooperation can and must be stepped up. Agrifood2030 also states that there is still a lot of unused potential for partnerships and cooperation. It is expected that there are even more opportunities for the Region by connecting the specialisms in the areas of Food, Tech and (Biobased) Materials more and securing a stronger position in the crossovers between these areas.

Within the crossover, there is room in the following areas:

- **Protein transition and food technology**⁵⁹: Combining and making better use of (biobased) materials will lead to new opportunities for healthier and more sustainable food. East Netherlands has already built up a strong market around food technology and this is expanded into the application of knowledge for a more sustainable use of proteins; such as plant-based proteins and aquaculture (algae and weeds) but also cultured meat and insect protein as well as food wastage.
- **Circular and nature-inclusive agriculture** Dutch agriculture is very efficient, and partly as a result, has a high burden on the environment. Circular and nature-inclusive of agriculture may ensure that the present agriculture will strengthen the local ecology while at the same time producing a good yield. The transfer from a linear to a circular system is slowly gaining ground. In the circular system, all biomass is used optimally so that the omission of hazardous substances is as low as possible without any waste. Food that people do not consume for example, may be used as animal feed. By the production of the required biomass, new possibilities also arise for agri- and aquaculture. They also offer biobased materials a better functionality, e.g. lower oxygen permeability in food packaging. These developments have the potential to improve water quality in the Region. By committing and innovating, East Netherlands may maintain its leading position in agriculture and horticulture, and contribute to sustainable soil and water.
- **AgroTech/ Smart farming**: There are many developments at the interface of Agrofood en HighTech. As East Netherlands has a lot of expertise in both themes, there are a large number of opportunities for the Region. This crossover is often labelled as AgriTech or smart farming. We are talking about the use of technical innovations such as robots, drones and sensors for the Agrofood sector. With the arrival of IMEC and the set-up of OnePlanet the first steps are already underway. As societal challenges such as soil depletion, biodiversity and climate change are becoming increasingly urgent and receive more and more attention, it is to be expected that the role of AgriTech will only grow in the future

7.3 View of the future

The demand for food and energy will continue to grow and innovations are playing an important part because this growth will at the same time have to be realized in a sustainable manner. This crossover makes an important connection between the **energy and raw materials transition** and between **digitalisation and robotisation**. The role of consumers is crucial with regard to acceptance and their willingness to pay for the costs of new products. Behavioural sciences will therefore have to be deployed to understand consumer choices and to support the connectivity with the consumer.

Expectations are that the sectors can and will show further growth. For East Netherlands, there are a lot of opportunities in this area because of the broad knowledge base in Food, Tech en Biobased materials and the Region already has a lot of activity in the agro and food sector.

7.4 Across the borders of the Region.

The Sustainability & FoodTech cross-over ties in with national policy. It has overlap with the Agri & Food and Life Sciences & Health (LSH) Top Sectors and with many key technologies that have been

⁵⁹ Within this crossover a National Icon has been awarded <https://www.nationaleiconen.nl/bekroonde-nationale-iconen/hybride-aardappel>

defined in the renewed mission-driven Top Sector policy. This creates a good connection with national innovation and businesses policies.

This crossover offers important opportunities and contribute to the Dutch missions.

Table 5 Relation between the crossover and national missions

Mission	Contribute to this objective	And possibly also to these objectives
Energy & Sustainability	<ul style="list-style-type: none"> In 2050, the system of agriculture and nature will be net climate-neutral A sustainably powered fully circular economy by 2050 	<ul style="list-style-type: none"> Reduce the national greenhouse gas emissions by 49% in 2030, towards 95% by 2050 as compared to 1990.
Agriculture, water and food	<ul style="list-style-type: none"> In 2030, the use of raw and auxiliary materials in agriculture and horticulture will have been substantially reduced and all finished and residual products will be capitalized as much as possible. The emissions of polluting and eutrophication substances into ground and surface water will have been reduced to practically zero. Ecological conditions and processes will be the starting point for food production as a result of which biodiversity will be restored and the agriculture will become more resilient. In 2050, the system of agriculture and nature will be net climate-neutral. In 2030, we will produce and consume healthy, safe and sustainable food and chain partners including farmers will receive a fair price for their products. 	<ul style="list-style-type: none"> With respect to maritime waters in 2030, and for inland waters (rivers, lakes and foreshores) in 2050, there will be a balance between ecological carrying capacity and water management (water safety, fresh water supply and water quality) on the one hand and the challenges for renewable energy, food, fishing and other economic activities on the other hand.
Health and care		<ul style="list-style-type: none"> In 2014, the burden of disease as a result of an unhealthy lifestyle and unhealthy living environment will have decreased by 30%. In 2030, the share of people with a chronic condition or lifelong impairment that can participate in society in line with their wishes and capacity, will have increased by 25%.

The Netherlands is not the only Region to focus on the above stated themes but it is also well-positioned to become or remain an important player in these themes. Of course the partnerships and cooperation with other Regions should remain in sight. The Provinces of North Brabant, Limburg and South Holland also have knowledge and innovation in the area of FoodTech and therefore a cooperation with FoodTech Brainport, Brightlands and Greenports seems obvious.

8 Monitoring RIS3 as a dynamic document.

East Netherlands is committed to making the RIS3 a dynamic and adaptive document. We will do so by:

1. • qualitative monitoring through a continuous dialogue with regional stakeholders.
2. • quantitative monitoring based on:
 - i) Innovation indicators in all Regions
 - ii) Relatedness model
 - iii) Effective expenditure of means.

8.1 Qualitative Monitoring

During the process of drawing up this strategy a lot of attention was given to the entrepreneurial discovery process: we have closely involved the stakeholders of East Netherlands through various stakeholder meetings and we have set up a Reflection group (Spiegelgroep) to reflect on the concepts of the RIS3. The Reflection group was a good presentation of the so-called Quadruple Helix in East Netherlands (authorities, education and knowledge institutes, civil society organisations and the business community). To keep the RIS3 up-to-date we will keep the Reflection group involved by periodically (for example every two years) giving them a role in redefining and/or adjusting parts of the strategy. Based on the quantitative progress and the qualitative input from the members, the Reflection group will be asked to deliver an opinion.

8.2 Quantitative Monitoring

The quantitative monitoring consists of a number of sources. We will consult public sources but will also have additional scientific research carried out by the University of Utrecht. Each of the four Regions of the Netherlands, in mutual consultation, have commissioned the University of Utrecht thereto.

In addition, we are developing a suitable set of indicators to monitor RIS3.

8.2.1 Innovation indicators in all regions

In cooperation with the other three Regions, it was decided in the previous programme period that Statistics Netherlands CBS (Economy Businesses sector) will provide monitoring of the RIS3 Strategies. This is structured by measuring the following indicators reasonably and per top sector.

- Private R&D expenditures.
- Private R&D expenditures SME.
- Innovative businesses: technological innovation.
- Innovative businesses: non-technological innovation.
- Innovative expenditures.
- Innovative businesses: cooperation with University.

- Innovative businesses: cooperation with research institute.

The national monitor Top Sectors will be the basis for these indicators. Regional measurements will take place on a two-year basis. The reporting years are 2020 and biannually from then onwards. This concerns a historical series started in 2014.

8.2.2 *Relatedness model*

Next to continuing the monitor that was used in the previous programme period, supervised by Professor dr. Boschma (University of Utrecht), a specific monitor will be set up on the basis of the 'relatedness model'. Together with the three other Regions, East Netherlands has agreed to deploy this model for RIS3 monitoring.

The objective is to identify where the Region has specific potential to renew and expand the existing knowledge and technology structure.

The relatedness model presents a picture of the diversification potential of a Region: the potential of the business community in that Region to develop new sophisticated, complex economic activities that connect with existing competencies within the Region. This potential depends both on the specific level of relatedness of the new activities to existing economic activities and the level of complexity of the new economic activities. The model identifies the level of relatedness and complexity just as internationally complimentary competences (Hidalgo C.A. et al. (2018)).

The relatedness model measures two types of competencies:

(a) technological diversification potential, by means of the OECD REGPAT data set of patents;

(b) sectoral diversification potential by means of the Netherlands Employment Register LISA database.

For each of these diversification potentials it can be indicated exactly which European Regions offer complimentary competencies.

In the first six months of 2020, a baseline measurement will be completed with which the monitor can present an up-to-date and dynamic picture. The data will be processed in an update of this RIS3 document in a later stage. Consequently, the monitoring process will be repeated periodically.

8.2.3 *Effective expenditure of means*

A final quantitative input is monitoring whether East Netherlands spends the means in line with the objectives of the RIS3 in the implementation of the regional European programmes. Think of indicators such as the share of the financing in favour of SMEs, the TRL of projects and a balanced regional spread of funds. In the meantime, the first monitor has been developed that monitors the European means with respect to targets. This monitor may be expanded and tightened based on the strategy in this RIS3.

8.3 Governance

Next to monitoring, the European Commission also attaches a lot of value to the governance through which the RIS3 is implemented in the Region. The two provinces of East Netherlands are the owners of the RIS3 but the execution responsibility (the managing organisation) will be in the hands of the Managing Authority East Netherlands, in effect one of the two provinces.

By giving the Reflection group an explicit role, input from the field is secured, ensuring maintaining the dynamic aspect of the RIS3. Based on the quantitative progress and based on the qualitative input from the members, the Reflection group will provide advice. Where necessary the RIS3 will be adjusted. These alterations will be implemented after decisions by the Provincial Executives of Overijssel and Gelderland. The MA East Netherlands will manage this continuous process.

With this governance layout of the RIS3, we structure the entrepreneurial discovery process, with an explicit role for the stakeholders in East Netherlands.

Bijlage A Accountability

A.1 The way this regional innovate innovation strategy has been drawn up.

Commissioned by the Province of Gelderland and the Province of Overijssel, this strategy has been developed by Technopolis B.V. with advice of ERAC B.V. in the time frame May - December 2019. The strategy has been realized through an analysis of documents (studies, policy documents and news items), interviews with persons with knowledge of the developments in East Netherlands from a broad perspective, workshops with stakeholders and meetings with policymakers from the provinces, the Government and the European Commission.

Overview of workshops and meetings:

- Workshop with policy staff of the provinces, 17 June 2019
- Event with policy staff of the provinces and the preparation group (project leaders provinces and Sander Figeo on behalf of the Ministry of Economic Affairs and Climate), 2 July 2019
- Meeting with coordinators, The Ministry of Economic Affairs and Climate and representatives of the Top sectors about ERDF and the Knowledge and Innovation Agendas, 18 June 2019
- Meeting during administrative consultations with Thi!nk East Netherlands, 25 June 2019
- Workshop with broad group of stakeholders, 9 July 2019
- Meeting with the Reflection group, 2 September 2019
- Workshop with businesses and employer representatives, 3 September 2019
- Workshop with broad group of stakeholders, 3 September 2019

A.2 List of interviewed persons

- Ben Dankbaar, Professor Emeritus Professor BA Radboud University
- Maarten van Gils, Lector Smart Business UAS HAN
- Rob Hamer, Vice-President Agrifood External Affairs Unilever
- Roger van Hoesel, Managing Director FoodValley
- Trudy Huisman, Chairperson Economic Board of Region Zwolle Board
- Wilma van Ingen, Director-Administrator housing cooperative Domijn
- Jan Jonker, Professor Strategy Radboud University
- Han Leemhuis, Investment Manager Wadkinko
- Alex Oostvogel, Chairperson Supervisory Board Holding company Fondsen Overijssel
- Marius Prins, CEO Oost NL
- Dennis Schipper, Managing Director Demcon
- Els Sweeney-Bindels, Head European Investment Bank Group Office Amsterdam
- René Wolfkamp, Director Wadinko
- Richard Black, Director Holding company Fondsen Overijssel
- Thi!nk East Netherlands (written, joint response to interview questions)

A.3 Members of the Reflection group

Table 6 Overview members of the Reflection group

Representative of	First name	Last name
Gelderland cities	Adriaan	Hellemans
Overijssel cities	Toon	Bom
Gelderland Universities	Gerlinde	van Vilsteren
Overijssel University	Rolf	Vermeij
UAS Gelderland	Han	ten Berge
UAS Overijssel	Dave	Blank
Confederation of Netherlands Industry and Employers VNO-NCW & SMEs East Netherlands	Christian Cees	Lorist de Boer
Province of Gelderland	Anko Jan Francien	Knoops
Province of Overijssel	Joost Dominique	Kuijper Cremers - Meijnders
Countryside association Landschap Overijssel	Matthijs	Nijboer
Th!nk East Netherlands	Karolien	de Bruine

A.4 List of persons involved in workshops

Table SEQ Tabel * ARABIC 7 Overview of persons involved in workshops

First name	Last name	Organisation
Wim	Bens	Kennis DC Logistiek
Han	ten Berge	Partnership Gld valoriseert
Ed	den Besten	SME Deventer
Ton	Beune	Techniekpact
Renze	Blokland	FME
Margriet	Bouma	Metaalunie

First name	Last name	Organisation
Jacob	Brobbel	Hollander Techniek
Marcia	Brouwer-Ilbrink	Province of Overijssel
Guido	Bruinsma	Gamelab Oost
Robin	Burghard	BOOST
Marieke	Dijkstra	Province of Gelderland
Pieter	Dillingh	East Netherlands Development Agency Oost NL
Jeroen	van den Eijnde	ArteZ
Piet	van Erp	Water Board Vechtstromen
Helmy	van Erp	Ministry of Economic Affairs
Martijn	Gerritsen	Radboud UMC
Kristian	Göeken	Demcon
Kees	de Gooijer	Food & Nutrition Delta
Lars	de Groot	Demcon
Magda	Hage	HIP
Victor	Haze	Health Valley
Wimjan	van der Heijden	Water Board DOD
Adriaan	Hellemans	Municipality of Apeldoorn
Gerry	Hemink	Innofood
Janneke	Hoedemaekers	UT
Arie	Hooimeijer	Knowledge Centre Paper and Cardboard
Willem	Huntink	Gelderland circulair
Alexander	Jansen	TFF/ Windesdheim
Anneliene	Jonker	Techmed Centre / CMI/UT
Leontien	Kalverda	University of Twente
Jouke	Karddus	East Netherlands Development Agency Oost NL

First name	Last name	Organisation
Sjoerd	Keijser	FME
Martijn	Kerssen	East Netherlands Development Agency Oost NL
Luc	Kikkert	Stichting KIEMT
Jellard	Koers	Supplacon
Roy	Kolkman	Novel-T
Wouter	van Kooten	Garage2020
Rene	Koster	Box NV Private Incubator
Jeroen	van de Lagemaat	TalentIT Twente /NDIX
Theo	Lam	Gezondheidsdienst voor Dieren
Bart	van Leerdam	Kennispoort Regio Zwolle
Mark	Leeuw	S/PARK (chemie) / Oost NL
Bernadette	Lohuis	UAS Saxion
Mirjam	Luizink	Roessingh
Irna	van der Molen	Twente University
Matthijs	Nijboer	NMO
Margot	Nijkamp	Open innovation academy
Rob	Oostermeijer	Confederation of Netherlands Industry and Employers VNO-NCW
Barry	Peet	BCS / CITC
Lucien	Perizonius	VMO, Zwolle board
Kees	Pieters	Province of Gelderland
Wouter	van Ree	AKOS
Maarten	Reimersma	Municipality of Ede
Herman	Schoorlemmer	Wageningen Plant Research
Ivo	Schrijer	UAS Arnhem Nijmegen
Rien	Slingerland	IJssel Technologie

First name	Last name	Organisation
Sander	Snellink	UAS Saxion
Toine	Straatman	Metaalunie
Gerard	Taat	Province of Gelderland
Margie	Topp	UAS Windesheim
Martin	Verbeek	Mineral Valley Twente
Biba	Visnkicki	Fraunhofer Project Center
Michiel	Vreriks	VKON & Platform Natuurlijke Veehouderij & Animal Health Delta
Floor	van der Watering	East Netherlands Development Agency Oost NL
Han	de Wit	Tauw/ Board Reg. Tech. Centres
Tienke	van der Werf	Chambers of Commerce
Aljona	Wertheim-Davygora	Social and Economic Council Overijssel
Erik	Wolkotte	Technologie & zorgacademie
Myriam	Zetten	Province of Gelderland

Bijlage B Consulted Sources

B.1 Reports and articles

- CPB (2018) R&D meer datagedreven: toegangdata onderdeel innovatiebeleid
- Dealroom.co, Techleap.NL, CBRE (2019) Startups: Job growth engine in the Netherlands, The Dutch tech ecosystem and its impact on employment
- Dialogic, (2018), *Strategische verkenning digitalisering Gelderland*, Utrecht
- Erasmus Centre for Business Innovation, (2018), *Nulmeting Digitalisering en Sociale Innovatie Gelderland en Overijssel*, Rotterdam
- Erasmus Centre for Business Innovation (2017) *Nulmeting innovatiemonitor Gelderland en Overijssel*, Rotterdam
- Freese, C., Dekker, R., Kool, L., Dekker, F. & Est, R. van (2018). Robotisation and automation on the Work Floor - business choices in technological innovations. The Hague: Rathenau Institute
- Imec International, Radboudumc, Wageningen Research, “One Planet: A health and food research center waar hoogwaardige technologie medische wetenschap en agro-food expertise elkaar vinden voor innovaties die direct toepasbaar zijn”, februari 2019.
- Matthijs Janssen, Marko Hekkert, Koen Frenken, “Missiegedreven innovatiebeleid: Twee vliegen in één klap?”, Me Judice, 25 september 2019.
- Mariana Mazzacuto, Gregor Semieniuk, “Public Financing of Innovation: New Questions, Oxford Review of Economic Policy, Volume 33, Number 1, 2017, pp 24-48
- Hidalgo C.A. et al. (2018) The Principle of Relatedness. In: Morales A., Gershenson C., Braha D., Minai A., Bar-Yam Y. (eds) *Unifying Themes in Complex Systems IX*. ICCS 2018. Springer Proceedings in Complexity. Springer, Cham
- Panteia (2013) *Intellectueel eigendom Overijssel: Octrooien, merken en modellen in Overijssel*, Zoetermeer
- PBL (2017) *Stedelijke regio's als motoren van economische groei: wat kan beleid doen?* Den Haag
- PBL (2014) *Topsectoren en regio's: de relatie tussen vestigingsplaatsfactoren en de concentratie van de topsectoren*, Den Haag
- Provincie Gelderland (2019) *AgriFood 2030: het programma voor een wereldleidend agrifood ecosysteem, tweede voortgangsrapportage*.
- Provincie Gelderland (2018) Statenbrief ‘Bijdrage aan het CITC- Innovatiecentrum voor chiptechnologie’, 25 september 2018, Arnhem
- Provincie Gelderland (2017) Provinciale werkgelegenheidsenquête Gelderland: eerste uitkomsten werkgelegenheidsonderzoek 2017, Arnhem.
- Provincie Gelderland (2016) *Werken aan de economie van de toekomst: circulair, innovatief en internationaal*, Arnhem
- Provincie Gelderland (2016) Statenbrief ‘de groeiversneller’, 13 december 2016, Arnhem
- Provincie Gelderland en provincie Overijssel (2019) “Valorisatieaanbod KIA Oost Nederland”, versie 3.0 140 mei 2019
- Provincie Gelderland en provincie Overijssel (2019) “Inbreng Regio Oost NL KIA Gezondheid en Zorg
- Provincie Gelderland en provincie Overijssel (2013) *Slimme specialisatiestrategie Oost-Nederland 2013*
- Provincie Overijssel (2019) *Circulair Bouwen: Een transitieagenda voor Overijssel*, Zwolle.

- Provincie Overijssel (2019) *Iedereen in Overijssel Doet Mee! Human Capital Onderwijs en arbeidsmarkt 2016-2019*, Zwolle
- Provincie Overijssel (2018) Statenvoorstel “Overijssel Circulair 2050”, 28 augustus 2018, Zwolle
- Rathenau Instituut (2017) Factsheet Innovatiebeleid
- Regioplan, ESD2, IHS, Ruimtelijk Economisch Atelier Tordoir (2017) *De Kracht van Oost-Nederland: Een economisch-geografische analyse*, Amsterdam, Den Haag, Enschede, Nijmegen, Rotterdam en Utrecht versie 18 januari 2017
- RVO (2016) “Innovatiekracht in Gelderland en Overijssel: Resultaten van een Regioscan in de provincies Gelderland en Overijssel, maart 2016, Den Haag
- SER Overijssel (2018) “Verkiezingsprogramma RTV Oost, reflecties van de SER”, 18 december 2018, Zwolle
- Smart Specialisation Platform (2012) *Guide to Research and Innovation Strategies for Smart Specialisations (RIS3)*, Brussels
- Stichting Stad en Regio, Radboud Universiteit en Universiteit Twente (2017) De kracht van de Gelderse maakindustrie
- Technopolis (2018) *Lerende evaluatie OIF in Overijssel*, Amsterdam
- Technopolis (2014) *Verschuivende paradigma’s in het ruimtelijk economisch beleid*, Amsterdam
- Th!nk East (2017) Smart & sustainable industries enabling the future: profileringsagenda Oost-Nederland
- Th!nk East (2017) Concepts for a healthy living: profileringsagenda Oost-Nederland
- Th!nk East (2016) Het innovatieprofiel Landsdeel Oost-Nederland
- Vlaamse Raad voor Wetenschap en Innovatie (2011) Strategische visie op de internationalisering van het Vlaamse wetenschaps- en innovatiebeleid

B.2 Databases en online sources

- CORDIS
 - <https://data.europa.eu/euodp/en/data/dataset/cordisH2o2oprojects>
- CBS
 - <https://dashboards.cbs.nl/v1/AZWDashboard/>
 - All provinces contribute to goods exports <https://www.cbs.nl/nl-nl/achtergrond/2014/09/alle-provincies-dragen-bij-aan-goederenexport--infographic-->
 - Statline: Establishment of businesses, sector, municipality/corop/province/region
 - Statline: Establishment of business, size, legal entity, sector, region
- European Innovation Scoreboard https://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en
- European Regional Competitiveness Index https://ec.europa.eu/regional_policy/en/information/maps/regional_competitiveness/
- Eurostat
 - https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=htec_emp_reg2&lang=en
- Gelderlandvaloriseert, Oost-Nederland scoort met duurzaamheid in innovatie top 100, <https://www.gelderlandvaloriseert.nl/oost-nederland-scoort-met-duurzaamheid-in-innovatie-top-100/>

- Global Competitiveness Report <http://reports.weforum.org/global-competitiveness-report-2019/economy-profiles/#economy=NLD>
- Global Innovation Index <https://www.globalinnovationindex.org/home>
- Go4Export: <https://go4export.nl/nl>
- ING:
 - <https://www.ing.nl/zakelijk/kennis-over-de-economie/jouw-provincie/gelderland/index.html>
 - <https://www.ing.nl/zakelijk/kennis-over-de-economie/jouw-provincie/overijssel/index.html>
- Leiden Ranking: <https://www.leidenranking.com/>
- LISA Database presents the development of number of jobs per sector: <https://www.lisa.nl/data/gratis-data/overzicht-lisa-data-per-provincie>
- Ministry of Economic Affairs and Climate: <https://www.nationaleiconen.nl/>
- QS Ranking: <https://www.topuniversities.com/qs-world-university-rankings>
- Rabobank:
 - <https://economie.rabobank.com/publicaties/2019/mei/economische-verschillen-tussen-nederlandse-provincies/> (2019)
 - <https://economie.rabobank.com/contentassets/4fc4b7f888bc4d5980dd176be506c9c2/rabobank-uu-2017-brede-welvaartsindicator-nederland.pdf>
- RVO - WBSO data analysis supplied by Koen Septer and Gerard Schut
- Start Up Delta/Techleap: <https://finder.startupdelta.org/dashboard>
- Th!nk East Netherlands: <https://thinkeast.nl/>
- Times Ranking: <https://www.timeshighereducation.com/world-university-rankings>
- UmultiRank: <https://www.umultirank.org/study-at/>

B.3 Newspaper articles

- <https://www.nrc.nl/nieuws/2017/02/09/de-chips-van-nexperia-niet-zo-sexy-wel-winstgevend-6607980-a1545149> (2017)
- <https://www.tubantia.nl/overig/meer-werk-in-hightech-in-twente~ab272a45/> (2014)
- <https://www.tubantia.nl/hengelo/marc-hendrikse-benoemd-tot-nieuw-boegbeeld-high-tech-bij-ikt~a686738d/> (2017)
- <https://www.tubantia.nl/zwolle/35-miljoen-voor-innovaties-in-overijssel-en-gelderland~ab977af6/> (2019)
- <https://www.tubantia.nl/enschede/hightech-startups-in-twente-gedijen-in-buurt-branchegenoten~af9efbc7/> (2019)
- <https://www.tubantia.nl/overig/55-miljoen-voor-bedrijven-in-twente~a102311c/> (2015)
- <https://www.tubantia.nl/gerben-kuitert/discriminatie-alleen-hightech-bedrijven-hebben-toegang-tot-overheidskapitaal~a758b8b1/> (2015)
- <https://www.tubantia.nl/enschede/het-bruist-van-vernieuwing-op-de-technology-base-twente~a6c18efe/>
- <https://www.tubantia.nl/zwolle/aalex-haalt-internationale-bedrijven-naar-zwolle~a3b74587/> (2019)
- <https://www.tubantia.nl/almelo/aveleijn-almelo-test-een-app-om-te-leren-tandenpoetsen~a6caaeef/> (2019)

- <https://www.tubantia.nl/zwolle/ziekenhuis-isala-in-zwolle-wil-10-procent-zorg-bij-patienten-thuis-leveren-goedkoper-en-mensen-willen-het-graag~aac27598/> (2019)
- <https://www.tubantia.nl/hengelo/zgt-hengelo-e-health-is-wieden-in-een-oerwoud-van-apps~a670832f/> (2019)
- <https://www.tubantia.nl/haaksbergen/onderneming-uit-haaksbergen-in-race-om-nationale-zorginnovatieprijs~a090aa12/> (2019)
- <https://www.tubantia.nl/enschede/teleurgestelde-ut-professoren-grijpen-naast-eu-miljarden~a6321e43/> (2019)
- <https://www.tubantia.nl/apeldoorn/tientallen-britse-bedrijven-overwegen-verhuizing-naar-oost-nederland-om-brexite~a1c23ac6/> (2018)
- <https://www.tubantia.nl/apeldoorn/bedrijven-buigen-zich-over-afval-als-grondstof-op-de-zwitsal~a71c648e/> (2019)
- <https://www.tubantia.nl/apeldoorn/d66-apeldoorn-aansluiten-op-snel-intercitynetwerk~a3a8c8dd/> (2019)
- <https://www.tubantia.nl/apeldoorn/van-hijum-in-gelderse-schijnwerpers~a13ad3a6/>
- <https://www.gelderlander.nl/economie/nederland-zet-vol-in-op-fotonica~acod8a4d/> (2019)
- <https://www.gelderlander.nl/wageningen/robot-snoeit-buxustruik-bij-wedstrijd-in-wageningen~a1054ee5/> (2019)
- <https://www.gelderlander.nl/wageningen/business-en-science-park-wil-de-allure-van-de-wageningen-campus~a0852b67/> (2019)
- <https://www.gelderlander.nl/neder-betuwe/tekort-aan-bedrijfsgrond-in-neder-betuwe~a5e133c7/> (2019)
- <https://www.gelderlander.nl/wageningen/morgen-al-plek-voor-eerste-15-mensen-van-imec-op-campus-wageningen~aa94c25f/> (2019)
- <https://www.gelderlander.nl/koken-en-eten/deze-sla-wordt-geteeld-in-de-kas-zonder-een-korreltje-aarde~a787c925/> (2019)
- <https://www.gelderlander.nl/wageningen/arthur-mol-over-komst-imec-dit-wordt-het-silicon-valley-van-voedsel-en-landbouw~adf4de30/> (2019)
- <https://www.gelderlander.nl/de-vallei/de-banaan-is-nu-ook-een-wagenings-streekproduct~a7e292d7/> (2018)
- <https://www.gelderlander.nl/cuijk/agrifood-vraagt-rijk-25-miljoen-om-slimmer-te-boeren~a753e93c/> (2018)
- <https://www.gelderlander.nl/wageningen/nieuwbouw-unilever-op-wageningen-campus-bereikt-het-hoogste-punt~a97b7efc/> (2018)
- <https://www.gelderlander.nl/neder-betuwe/laanboomkwekers-gaan-voor-de-toppositie-van-europa~af173c82/> (2018)
- <https://www.gelderlander.nl/arnhem-e-o/nieuwe-bedrijven-in-gelderland-goed-voor-1000-extra-banen~aa83277d/> (2018)
- <https://www.gelderlander.nl/achterhoek/lochem-krijgt-innovatiecentrum-voor-boeren~a86bf859/> (2017)
- <https://www.gelderlander.nl/nijmegen/zo-houden-we-nieuwe-technologie-in-de-zorg-betaalbaar~ae092145/> (2019)
- <https://www.gelderlander.nl/wageningen/groen-licht-voor-oneplanet-provincie-steekt-65-miljoen-in-komst-imec~a2610607/> (2019)

- [https://www.gelderlander.nl/doetinchem/cleantech-wil-voormalige-bieb-doetinchem-kopen~ad2ff77b/\(2017\)](https://www.gelderlander.nl/doetinchem/cleantech-wil-voormalige-bieb-doetinchem-kopen~ad2ff77b/(2017))
- <https://www.rtvoost.nl/nieuws/303412/Twentse-economie-draait-bovengemiddeld> (2019)
- <https://www.rtvoost.nl/nieuws/302709/High-Tech-Twente-in-actie-om-knappe-koppen-voor-regio-te-behouden> (2018)
- <https://www.rtvoost.nl/media/101586/Miljoenen-voor-high-tech-UT> (2018)
- <https://www.rtvoost.nl/nieuws/286966/Miljoenen-liggen-klaar-in-Den-Haag-maar-plannen-uit-de-regio-zijn-er-niet>
- <https://www.rtvoost.nl/nieuws/285415/Provincie-steekt-vijf-miljoen-aan-Europese-landbouwsubsidies-in-agro-food-bedrijven> (2018)
- <https://www.rtvoost.nl/nieuws/277948/Kwaliteitsteam-agro-en-food-moet-landbouw-Overijssel-verder-verduurzamen> (2017)
- <https://www.rtvoost.nl/nieuws/312815/Minister-de-Jonge-over-100-dagen-man-ZGT-Eerder-nadenken-over-zorg-voor-later> (2019)
- <https://www.rtvoost.nl/nieuws/311582/Werk-en-investeringen-Oost-NL-zorgen-komende-jaren-voor-1-200-banen> (2019)
- <https://www.rtvoost.nl/nieuws/307300/Honderden-nieuwe-banen-in-Overijssel-door-bedrijfsvestiging-en-uitbreiding> (2019)
- <https://www.rtvoost.nl/nieuws/311449/OP-Oost-investeert-35-miljoen-in-economie-Overijssel-en-Gelderland>(2019)

Bijlage C Additional data to Chapter 1

Table 7 The economy of East Netherlands in key figures 2018

East	total no. of branches	total no. of jobs	jobs 0 up to & incl. 9	jobs 10 up to & incl. 99	jobs > 100
Agriculture and Fishery	7%	3%	8%	2%	1%
Industry	5%	12%	5%	12%	17%
Public utility companies	0%	1%	0%	1%	2%
Construction sector	10%	6%	9%	7%	3%
Trade	18%	18%	22%	22%	11%
Transport and Storage	2%	5%	2%	4%	7%
Hotel and catering industry	3%	5%	5%	9%	1%
Information and Communication	5%	2%	4%	3%	1%
Financial institutions	1%	1%	1%	1%	2%
Business Services	23%	14%	20%	12%	11%
Authorities	0%	5%	0%	2%	11%
Education	5%	7%	4%	8%	8%
Care	11%	17%	11%	15%	25%
Other services	11%	4%	9%	3%	1%

Data based on Statline, Statistics Netherlands (CBS) and Netherlands Employment Register LISA (2019)

Table 8 International ranking universities East Netherlands

University	Times 2019	QS 2019	CWTS Leiden 2019
Wageningen University & Research	59	125	210 6 Life & Earth Sciences 147 Social Sciences
Radboud University	123	204	125 48 Social Sciences 73 Bio-medical life & health sciences
Twente University	184	172	427 223 Social Sciences 262 Social Sciences 363 Mathematics & Computer

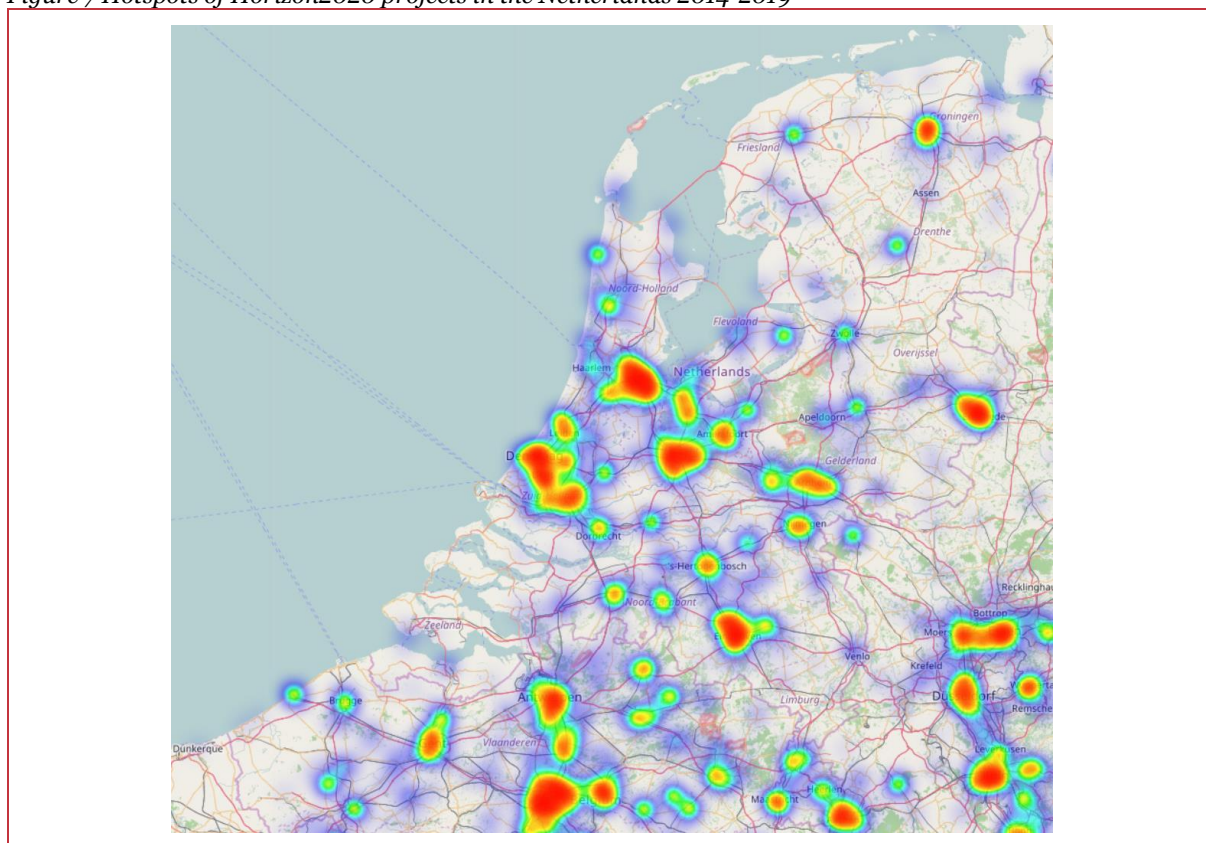
Companies that have participated in Horizon2020 projects and that have received more than 1 million Euro in subsidies.

Table 9 Number of projects and scope Horizon2020 contributions to businesses in East Netherlands higher than €1,000,000

Company name	No. of projects	Total scope
DNV GL NETHERLANDS B.V.	7	€ 9,128,241.68
B.T.G. BIOMASS TECHNOLOGY GROUP BV	14	€ 7,956,610.50
LIONIX INTERNATIONAL BV	12	€ 7,441,230.71
BDR THERMEA GROUP BV	2	€ 6,665,750.00
ROESSINGH RESEARCH AND DEVELOPMENT BV	14	€ 5,891,173.25
ENGIE ENERGIE NEDERLAND NV	1	€ 5,512,218.95
HYGEAR BV	8	€ 4,846,776.13
SOLMATES BV	8	€ 4,381,624.03
Wärtsilä NETHERLANDS B.V.	6	€ 3,847,043.84
HYGEAR TECHNOLOGY AND SERVICES BV	5	€ 3,823,358.00
KHONDRION BV	3	€ 3,254,141.78
NUTRILEADS BV	2	€ 2,762,519.88
STRIJP S ONTWIKKELING BV	1	€ 2,634,748.55
HYET HYDROGEN BV	4	€ 2,372,416.25
4SILENCE BV	1	€ 2,159,500.00
EIJKELKAMP SONICSAMPDRILL BV	3	€ 2,111,250.00
THALES NEDERLAND BV	7	€ 2,070,673.25
PHOENIX BV	6	€ 2,045,818.17
STICHTING EFFOST	9	€ 1,969,674.13
DAMEN DREDGING EQUIPMENT BV	1	€ 1,838,729.44
WATER INSIGHT BV	5	€ 1,827,682.63
TENNET TSO BV	1	€ 1,757,723.94
NEDSTACK FUEL CELL TECHNOLOGY BV	2	€ 1,713,937.50
STICHTING ELAADNL	2	€ 1,695,375.00
DEMCON ADVANCED MECHATRONICS BV	4	€ 1,687,503.37
MICRONIT MICROTECHNOLOGIES BV	5	€ 1,552,547.50
DIAGRAM BV	1	€ 1,378,570.00
BOSCHMAN TECHNOLOGIES BV	5	€ 1,355,284.84

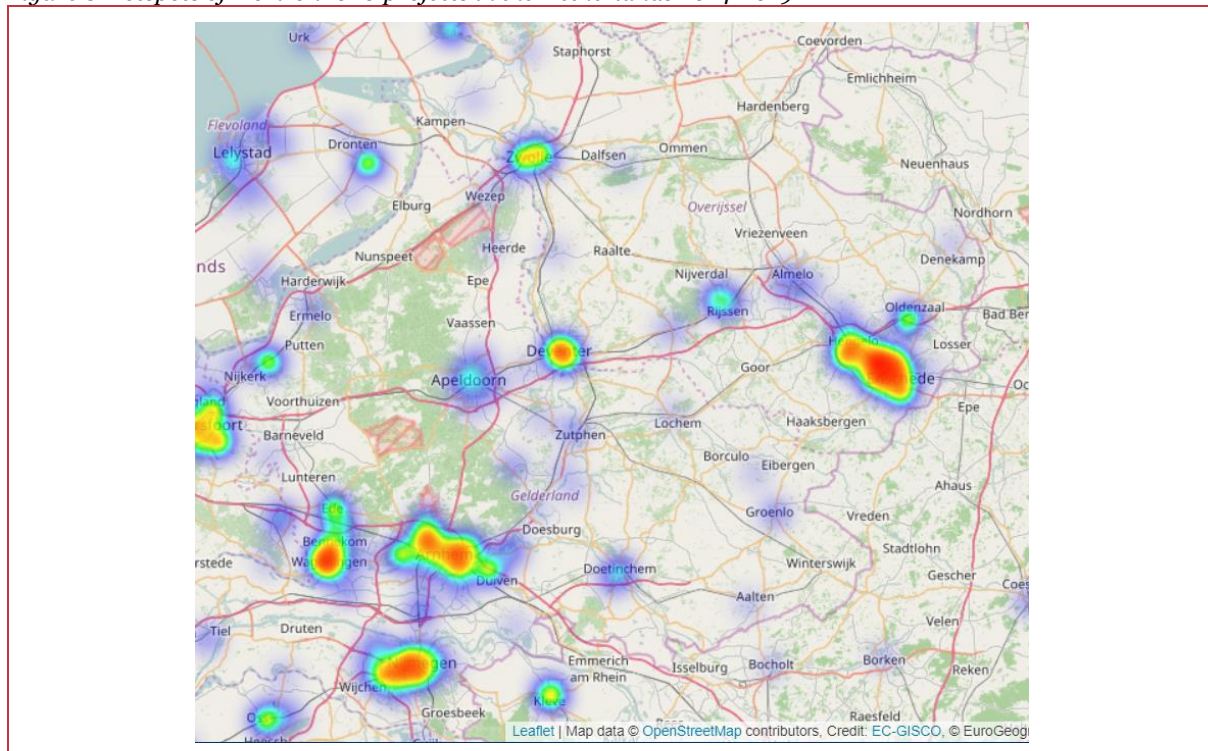
STICHTING ISALA KLINIEKEN	2	€	1,299,101.00
STICHTING KARAKTER	2	€	1,281,972.78
NOLDUS INFORMATION TECHNOLOGY BV	8	€	1,240,151.61
MR COILS BV	4	€	1,231,436.13
DYADIC NEDERLAND BV	3	€	1,204,700.26
GROOT ZEVERT VERGISTING BV	1	€	1,121,977.50
EYE ON AIR BV	2	€	1,120,405.00
ADVANCED PACKAGING CENTER BV	6	€	1,102,954.38
HYSTER-YALE NEDERLAND BV	1	€	1,102,000.00
INNOLUCE BV	3	€	1,096,273.00
BIO-PRODUCT BV	3	€	1,089,361.00
ARTINIS MEDICAL SYSTEMS BV	3	€	1,052,233.92
SINTECS BV	1	€	1,046,273.69
EUROPEAN FORUM OF FARM ANIMAL BREEDERS	6	€	1,042,011.25
TWENTE MEDICAL SYSTEMS INTERNATIONAL B.V.	3	€	1,008,718.03

Figure 7 Hotspots of Horizon2020 projects in the Netherlands 2014-2019



Cordis 2019

Figure 8 Hotspots of Horizon2020 projects in the Netherlands 2014-2019



Cordis 2019

