AGRIFOOD SECTOR

AN IN-DEPTH OVERVIEW OF THE AGRIFOOD SECTOR IN BRABANT

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Colophon

Brabant, the Netherlands – Industry analysis of the AgriFood industry /
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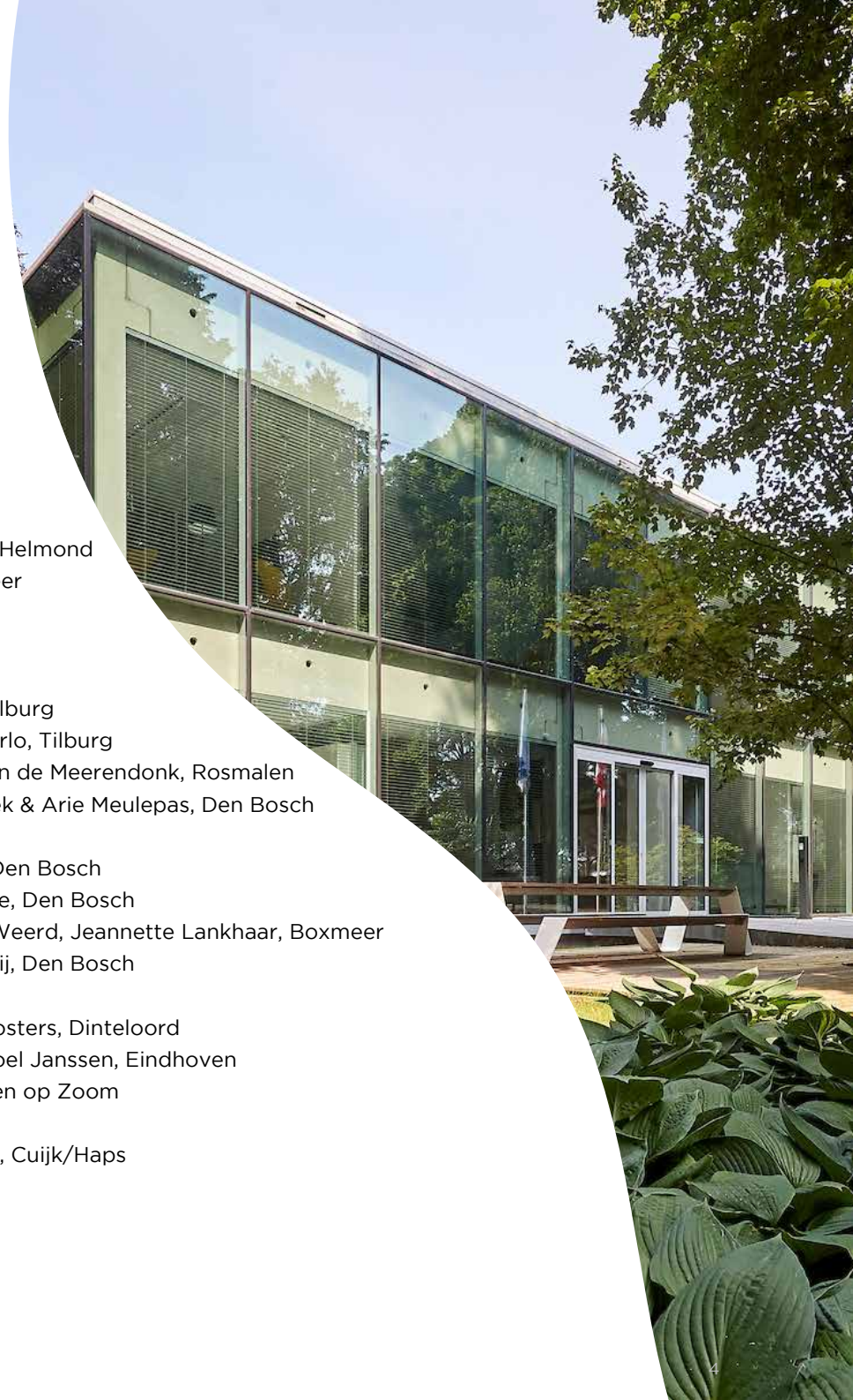
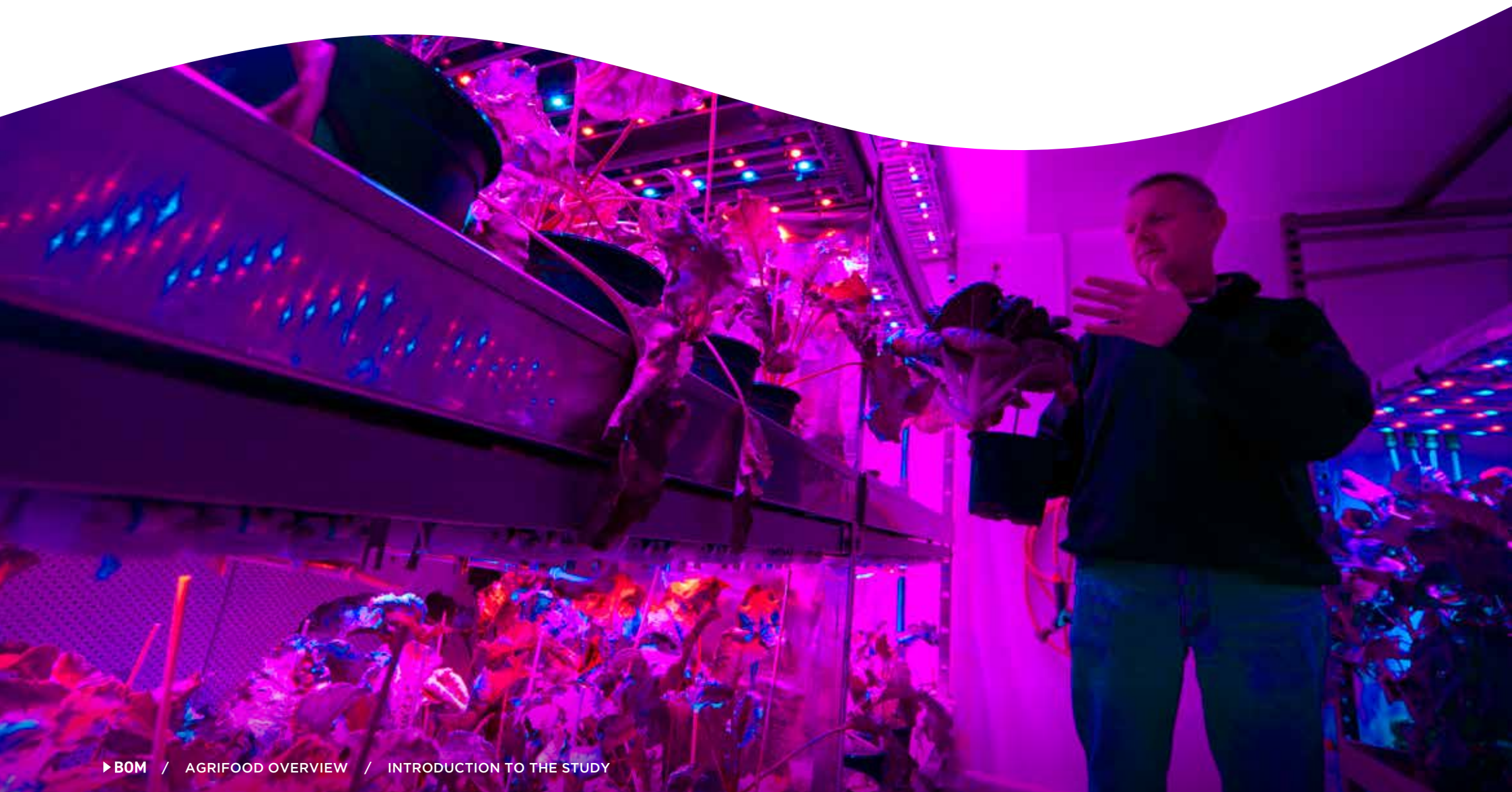
Maan identity. design. content. - Ulvenhout



1. INTRODUCTION TO THE STUDY



AgriFood sector in Brabant
An in-depth overview

Dear Reader,

We are the Brabant Development Agency (BOM) and we are proud to present to you our new in-depth review of the Agrifood industry in Brabant.

The goal of this review is to provide you with a detailed overview of the Agrifood industry in Brabant, including the strengths and opportunities the region has to offer. In 2018, the Brabant AgriFood industry was made up of 13,912 businesses directly employing 81,160 people. That means the province's AgriFood share stands at 15.7% of businesses and 17.3% of the total number of jobs in the Netherlands. Also, one of the strengths of Brabant is the distinctive and constructive model of cooperation. In short, building partnerships in the region is a quick and fluid process – faster than anywhere else. Individuals and companies wanting to join the club and make a contribution will quickly and easily reap the rewards.

So who are we? We are the Brabant Development Agency. Based in Tilburg, our BOM Foreign Investments & International Trade department assists new and existing foreign companies to make optimal use of the opportunities offered by Brabant as a business location. We also provide hands-on support to companies based in Brabant that are growing their business abroad.

We hope you will enjoy reading this in-depth review, and if you would like to know more about what Brabant has to offer, then please feel free to reach out to us!

With kind regards,
Sandra van den Poll

Project Manager, Agrifood
svandenpoll@bom.nl

Introduction

This review is a sequel to the first AgriFood overview created for and by BOM Foreign Investment & Trade in 2015, which was authored by Marcel van der Westerlaken (VDW Research), Henry de Vaan (Fanion Research) and Ben Engel (BOM). The review aims to provide a comprehensive overview of the AgriFood (AF) industry in Brabant. Our target audience is primarily current and potential investors in and/or innovation partners for the industry in Brabant, but also includes policy-makers, industry organisations and media representatives with an interest in the industry who would like to learn more.

The review is based on desk research, extensive data-analysis, stakeholder interviews and interviews with industry specialists as well as intensive teamwork between the authors and representatives of BOM and its key partner organisations in Brabant.

The report contains Brabant-specific facts and figures but is written with the clear understanding that the AgriFood industry is a global one where regional and even national borders are of little importance. This is why the report focuses in its entirety on the province of Brabant embedded in a wider national perspective of the Netherlands operating on a world market.

Our overview is laced with profiles of inspiring regional and national actors in the AgriFood industry and it also contains information on international trends and developments.

The review aims to give the reader an accurate picture of what Brabant has to offer. While we have strived to make it as complete and accurate as possible, we would like to hear readers' comments and thoughts, which will prove valuable for future editions. We hope that this review will both provide valuable insights and prove to be an entertaining read.

We would like to acknowledge and thank all our contributors for the input they provided. We would not have been able to accomplish our task without them.

Ben Engel, Engel – Een Heldere Blik
Henry de Vaan, Fanion Onderzoek & Advies

2. INTRODUCTION TO BRABANT, THE NETHERLANDS

A. What has Brabant got to offer?

The Dutch province of Noord-Brabant is located in the southern part of the Netherlands, strategically situated between Amsterdam Schiphol Airport, Europe's leading seaport in Rotterdam, the Port of Antwerp, Brussels and the major German economic heartland of the Rhine-Ruhr region. Brabant covers an area of 5,082 km2, making it the second largest province in the Netherlands, and is home to some 2.5 million people spread across 62 municipalities.

- From a geographic perspective, Brabant offers easy access to 170 million Europeans within a 500 km (310 m) radius. Physical and telecommunication infrastructure are best-in-class when it comes to establishing head office, marketing and sales, R&D, manufacturing and/or logistics operations.

- In terms of costs, the Netherlands has a company-friendly tax structure when compared to most other European countries.

- Research, product and process development and manufacturing are part of Brabant's DNA. Ranging from primary production in agriculture and the food industry to the manufacture of semi-finished products all the way through to OEM manufacturing for the most complex electronic, biopharmaceutical, nutraceutical and IT products and equipment, all of these activities can be found in the region in abundance.

- The well-developed industrial and knowledge networks or 'ecosystems' in the High Tech Systems, Logistics, Life Sciences & Health, AgriFood, Chemicals and Aerospace industries offer opportunities for joint ventures at a very high level. Cross-industry partnerships in the region are a given.

Source: BOM, Info & Graphics

B. Brabant's main benefits

The province of Brabant offers both the business-friendly environment of the Netherlands and also has a number of favourable geographical benefits:

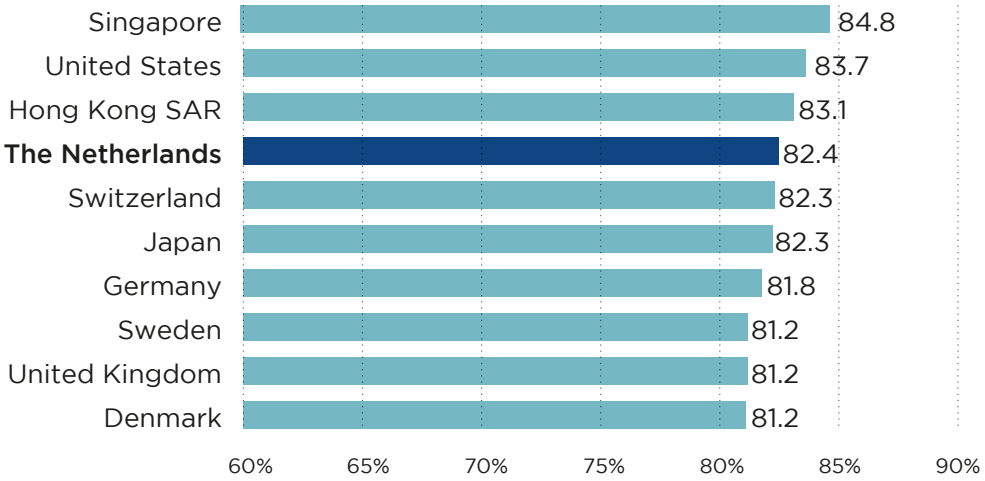
The Netherlands as a whole and Brabant offer:

- an attractive tax climate, including personal and corporate income tax and value-added tax (VAT)
- a stable economic, political and social climate
- competitive labor costs

Brabant is particularly strategically well-located in Europe because:

- it is centrally located in north-western Europe
- it is easily accessible
- it has excellent infrastructure

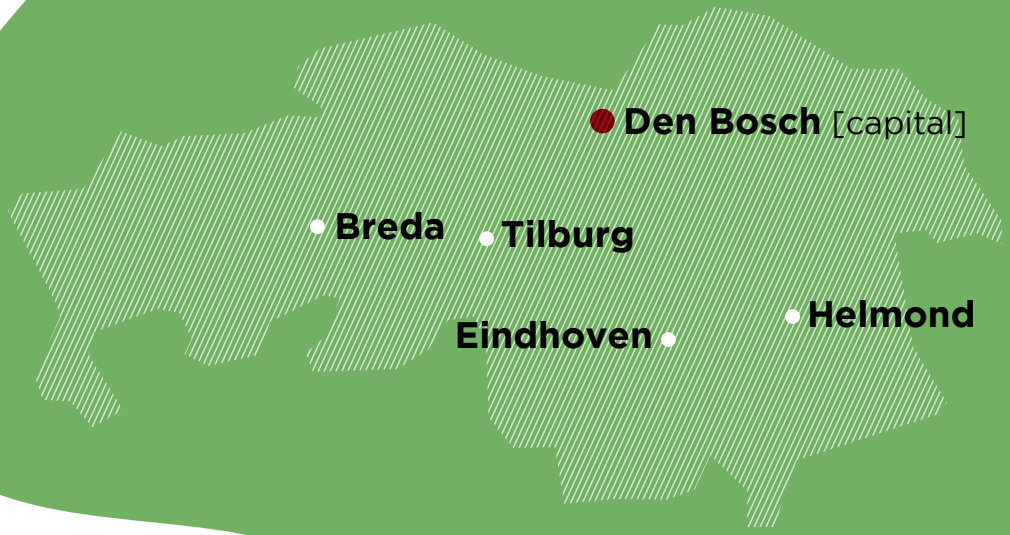
As a whole, time and time again, the Netherlands – with Brabant as its innovative heart – has proven to be a very competitive economy on a global scale!



THE NETHERLANDS, ONE OF THE WORLD'S MOST COMPETITIVE ECONOMIES (WORLD ECONOMIC FORUM (2019) – THE GLOBAL COMPETITIVENESS REPORT 2019

C. Brabant's main cities

Covering 5,000 square kilometres (2,000 square miles), almost 15% (2.5 million inhabitants) of the Dutch population lives in Brabant. The capital of Brabant is Den Bosch, while its largest city is Eindhoven followed by the cities of Tilburg, Breda, Den Bosch and Helmond.



D. Brabant: industry, science and innovation

Brabant is a productive, highly industrialised and knowledge-intensive province in the Netherlands and as such provides attractive opportunities to companies looking for (partnerships in) industrial innovation and/or state-of-the-art manufacturing.

In fact, Brabant is the most intensive region in the Netherlands when it comes to R&D and one of the most innovative regions in Europe, as aptly illustrated by the following three facts:

1. **30% of all industrial R&D in the Netherlands is undertaken in Brabant**
2. **50% of all European patent applications from the Netherlands are generated in Brabant**
3. **Brabant holds fifth place in Europe for regions with the highest number of patent applications**

Source: BOM, Info & Graphics

With over 34,000 people engaged in R&D activities, Brabant can provide the required brainpower thanks to its bright people and numerous research and educational institutes. Geographical clustering results in ready partnerships between businesses, universities and public research institutions. Cooperative R&D results in a mutual bolstering of strengths and inspiration and involves sharing technological know-how, expensive research facilities and being a part of national and European technology programmes. This distinctive collaborative research style is the secret to significantly advancing R&D and innovation activities.

E. Facts and figures

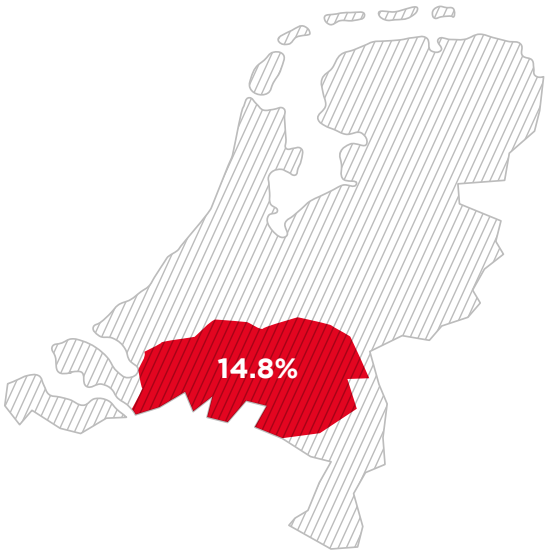
DEMOGRAPHICS

Population as of 01-01-2019
Brabant 2,544,806 14.8%
The Netherlands 17,282,163 100%

Population growth in 2018
Brabant 0.65%
The Netherlands 0.59%

Population density per km²
Brabant 416
The Netherlands 513

Non-Dutch nationals 2019
Brabant 151,254 5.9%
The Netherlands 1,110,859 6.4%



Age groups

	The Netherlands	Brabant
0 - 14	16.1%	15.5%
15 - 64	65.1%	64.9%
65+	18.9%	19.7%
Total	100%	100%

Source: Statistics Netherlands, Eurostat, LISA, BOM, Province of Brabant

THE ECONOMY

GDP for 2018 (in euros x1000, market prices)
Brabant 116,090,000 15%
The Netherlands 774,039,000 100%

Economic growth 2018
Brabant 3.0%
The Netherlands 2.6%

Total own R&D spend as a % of GDP 2017
Brabant 3.06%
The Netherlands 1.98%

Companies
Brabant 231,990 14.2%
The Netherlands 1,630,070 100%

Jobs
Brabant 1,297,560 15%
The Netherlands 8,651,830 100%

Foreign companies 2019
Number of companies in Brabant 1,660
Brabant workforce 119,870

Industrial property
Total available in January 2019 (ha) 1,790
Immediately available in January 2019 (ha) 790

3. INDUSTRY OVERVIEW

A. Definition

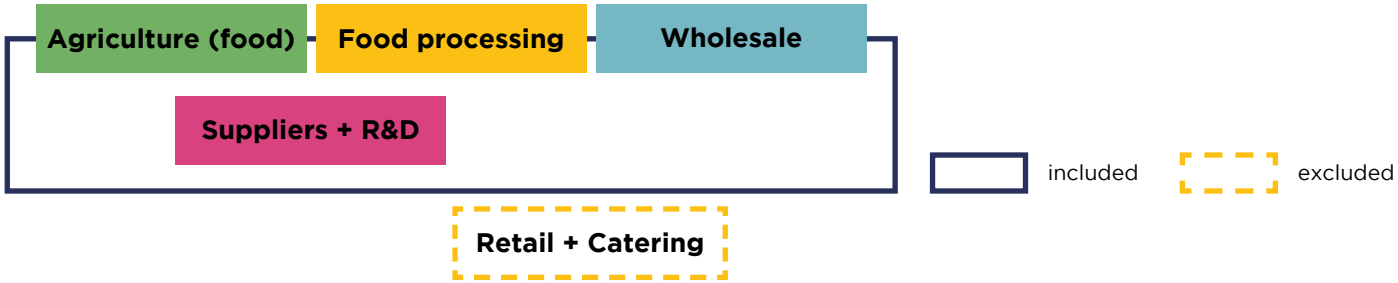
Our review is based on the definition of the AgriFood Priority Industry as outlined by Statistics Netherlands (CBS). Companies in the retail and hospitality industry are excluded. The following four subsectors are used for AgriFood.

1. Primary industry (food production – agriculture, livestock, seeds and animal genetics)
2. Food processing
3. Wholesale
4. Suppliers and R&D

These subsectors, in turn, comprise of 85 branches as defined by Statistics Netherlands (CBS).

The diagram illustrates the subsectors that are included in and respectively excluded from the tables in this review.

COMPOSITION OF THE AGRIFOOD INDUSTRY IN THIS REVIEW



Source: Vestigingenregister provincie North-Brabant and LISA

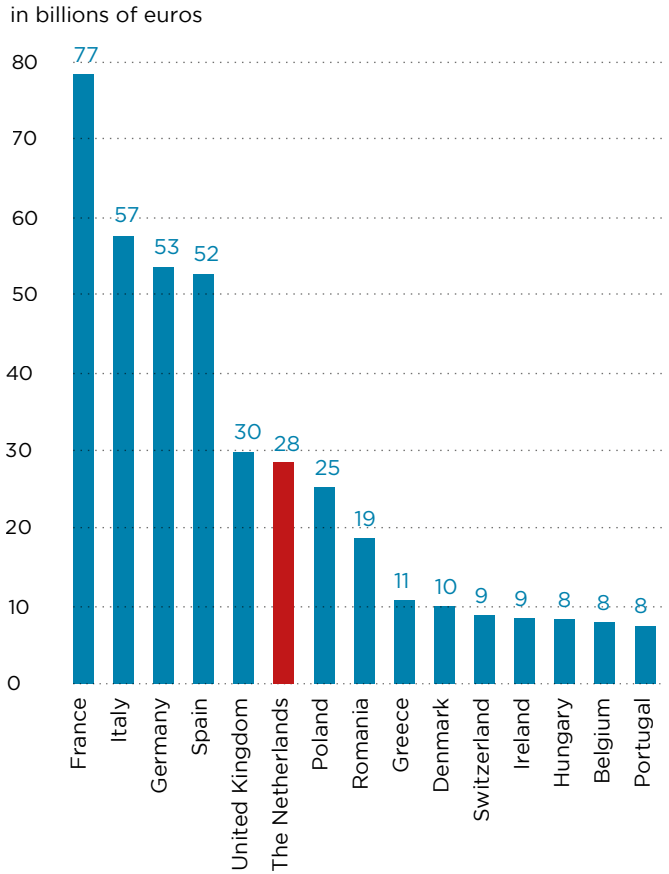
B. The Dutch AgriFood industry from an international perspective

The Dutch agricultural industry had a total production value of €28 billion in 2018, making the Netherlands the sixth largest agricultural producer in Europe.

Under the definition employed in our review, the Priority Industry of AgriFood was valued at €87.5 billion and provided added value of €19.3 billion in 2018. Between 2010 and 2018 the value of AgriFood in the Netherlands grew by 30%, while the worth of the food industry as a whole grew faster (by 37.7%) than primary agricultural production (7.8 %).

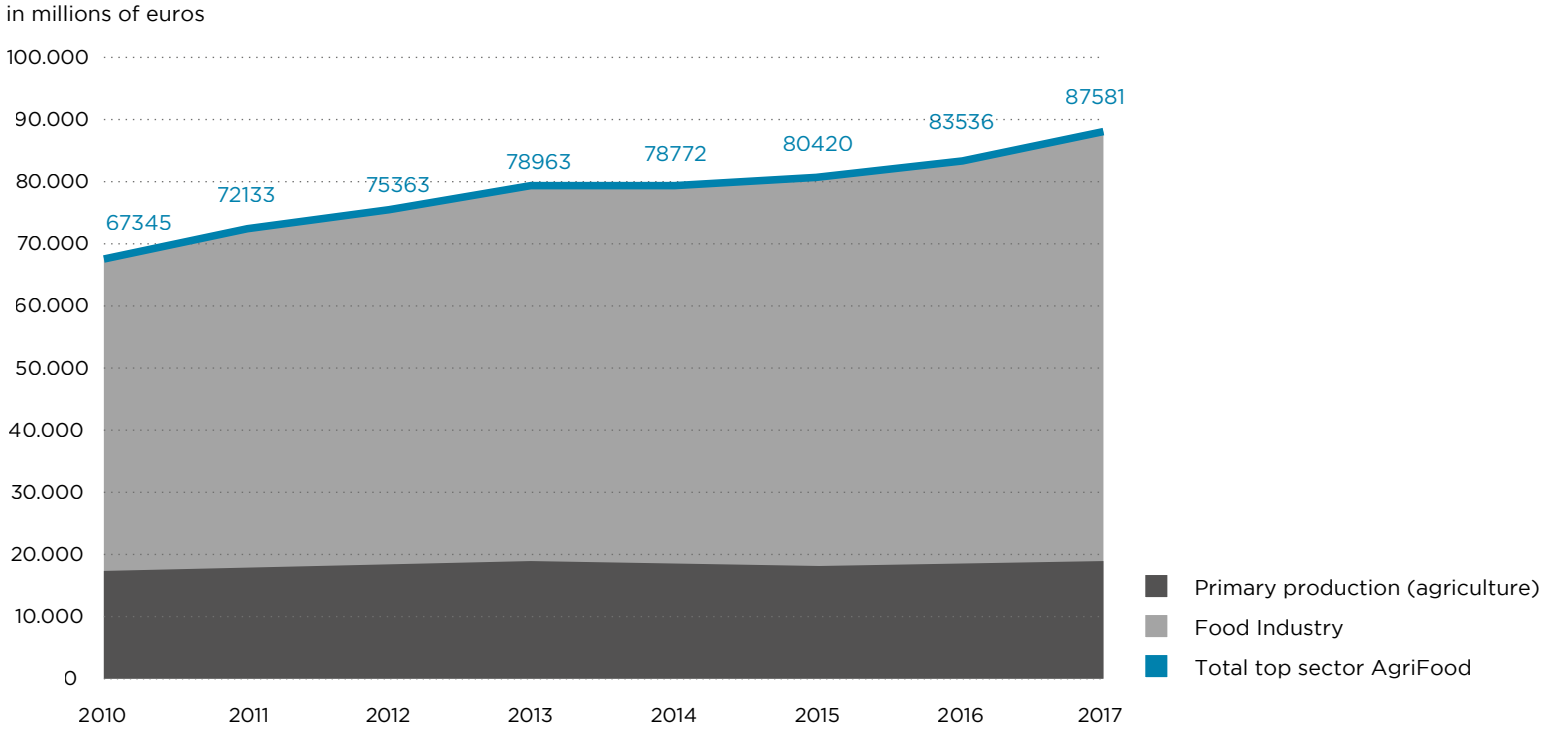
Dutch agricultural and food products exports (approximately €100 billion/$112 billion in 2018) are even greater than Dutch production levels, because the Netherlands – being the gateway to Europe that it is – is also an important global hub for the import and throughput of agricultural and food products to the European Union. This makes the Netherlands the second largest exporter of agricultural products in the world, after the US.

VALUE OF AGRICULTURAL PRODUCTION (BASIC PRICES), 2018, TOP 15 EUROPEAN COUNTRIES



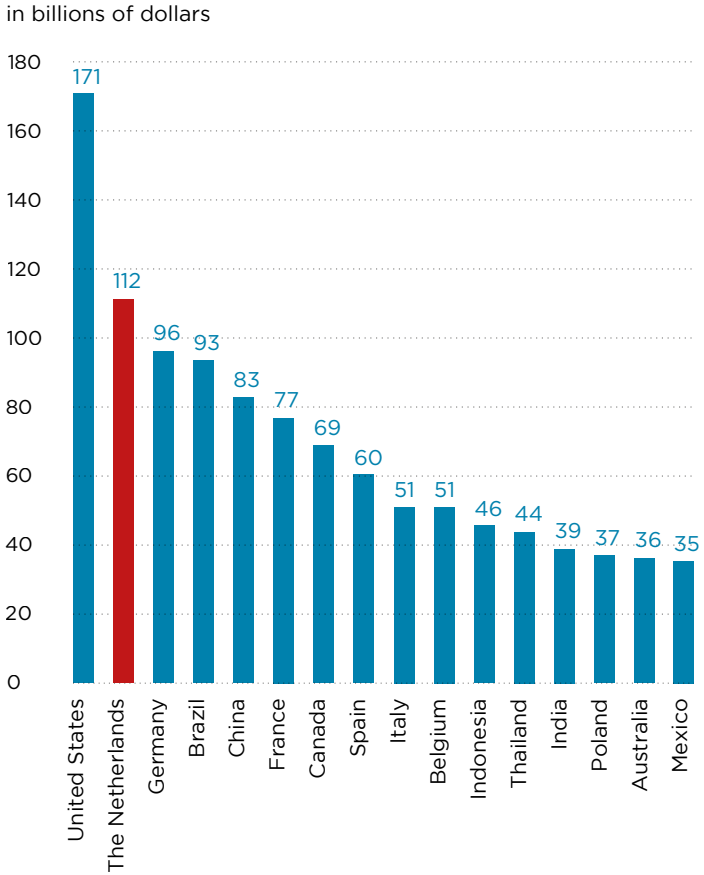
Source: Eurostat, 2019, adapted by Fanion Onderzoek & Advies

RISE IN VALUE (BASIC PRICES) OF THE AGRIFOOD PRIORITY INDUSTRY (PRIMARY PRODUCTION AND FOOD INDUSTRY), 2010 - 2017

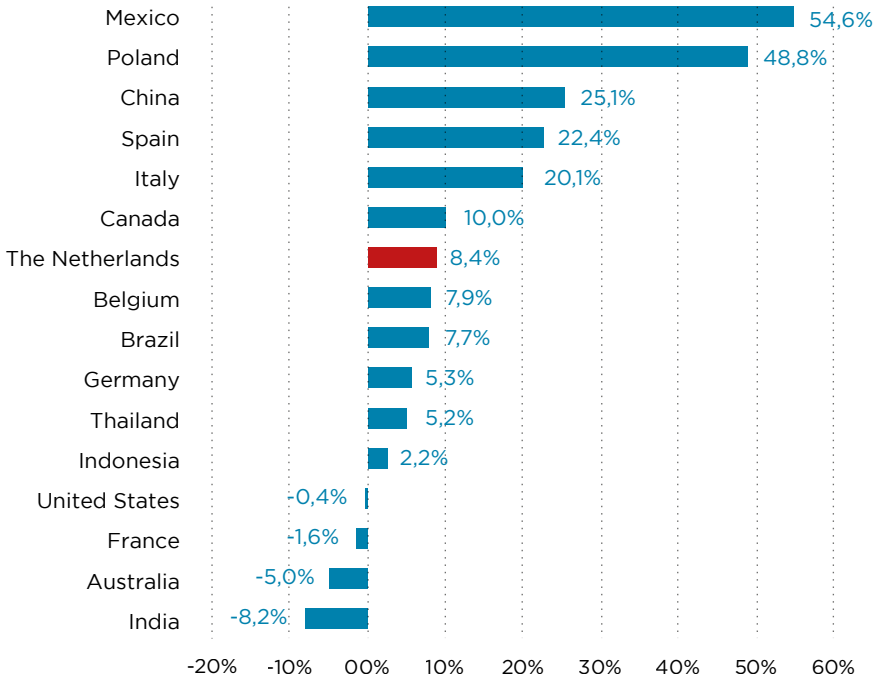


Source: Monitor Topsectoren 2018, CBS, 2019, adapted by Fanion Onderzoek & Advies

TOP 15 COUNTRIES WORLDWIDE FOR AGRICULTURAL PRODUCT EXPORTS PER YEAR, 2018 (IN BILLIONS OF DOLLARS)



RISE IN EXPORT VALUE OF AGRICULTURAL PRODUCTS, FOR THE TOP 15 COUNTRIES, 2012-2018



Source: WTO, adapted by Fanion Onderzoek & Advies

C. The Brabant AgriFood industry

In 2018, the Brabant AgriFood industry was made up of 13,912 businesses directly employing 81,160 people. That means the province's AgriFood share stands at 15.7% of businesses and 17.3% of the total number of jobs in the Netherlands. To put this in perspective, 14.7% of the country's population lives in Brabant and 15% of all jobs and all businesses can be found in Brabant, which demonstrates that AgriFood has a strong presence in Brabant.

BUSINESSES AND JOBS IN BRABANT AND THE NETHERLANDS IN THE AGRIFOOD PRIORITY INDUSTRY, 2018

AgriFood	Number of businesses	Number of jobs
Brabant	13,912	81,160
The Netherlands	88,470	468,700
share	**15.7%**	**17.3%**

Under the Priority Industry definition of AgriFood, the sector comprises four subsectors: the primary sector (plants and livestock), food processing, wholesale, and other (suppliers, R&D). The final subsector, 'other (suppliers, R&D)', is made up of companies supplying products, equipment and R&D-services only to the AgriFood industry, or where the industry at least makes up the vast majority of their business. Some Brabant-based companies that fall under this category are Marel Poultry (poultry processing equipment), GEA Food Solutions (food processing and packaging equipment), Ploeger Constructie (agricultural machinery) and Ferm-o-Feed (fertilisers).

The AgriFood definition does not include a subsector that is closely connected to the industry and is highly advanced in Brabant – the high tech sector, particularly those companies involved in *AgTech*, or agricultural technology, and *FoodTech*. AgTech companies develop and manufacture agricultural machinery while FoodTech companies specialise in food processing technology. Further information on this category, numbering almost 100 companies and employing over 6,500 professionals in Brabant, can be found in the chapter *AgriFood high tech manufacturing*.

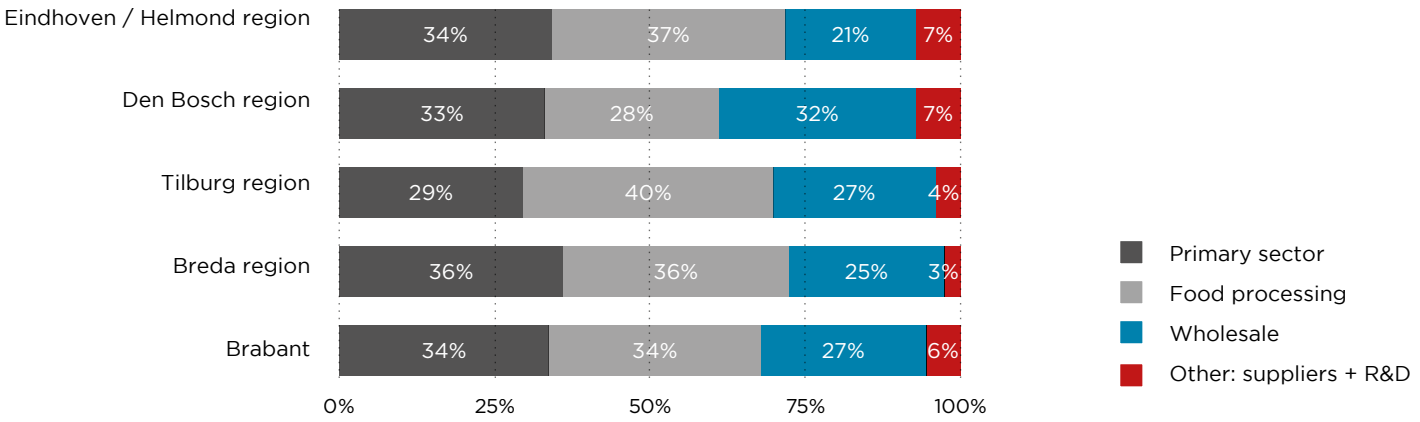
Most jobs in Brabant's AgriFood industry are in food processing, which accounts for 34.4% of jobs, closely followed by the primary sector (33.5%), with wholesale at 26.5% and 'other' at 5.6%.

The Den Bosch region (northeast Brabant) is home to the largest AgriFood cluster with 4,610 businesses and 27,780 jobs, followed by the Eindhoven/Helmond region with 4,200 businesses/branches and 23,900 jobs.

The make-up of the industry differs per region. Primary sector and food processing businesses are strongly represented in the Breda region (west Brabant), the food processing industry is the largest subsector in the Tilburg region (central Brabant), the Eindhoven/Helmond region (southeast Brabant) in turn focuses on primary sector and other activities (suppliers and R&D) and in the Den Bosch region (northeast Brabant) wholesale is by far the largest subsector with a share of 40% of the total number of AgriFood jobs.

Source: Brabant Register of Establishments, adapted by Fanion Onderzoek & Advies

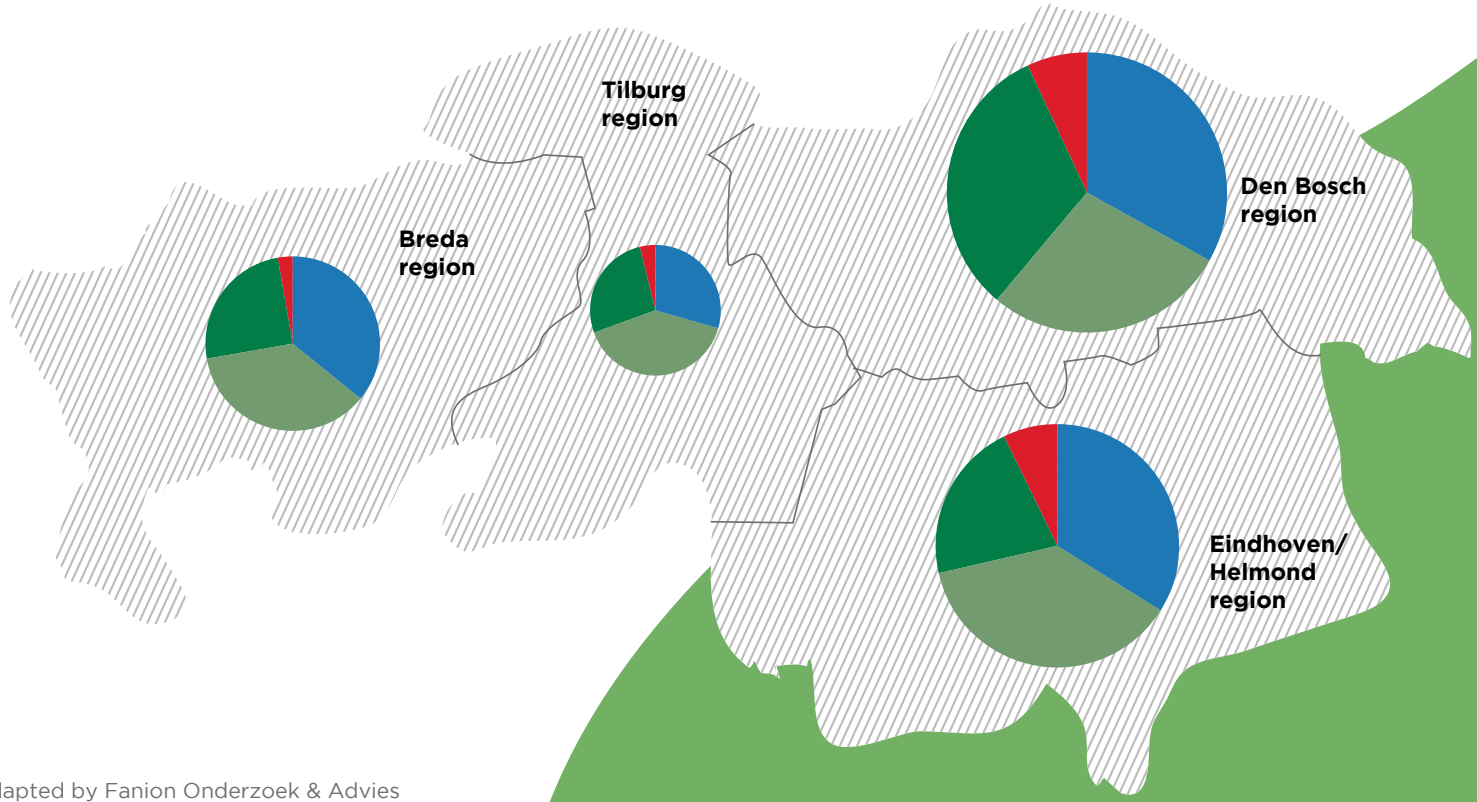
AGRIFOOD SUBSECTORS AND THEIR SHARE OF JOBS, BRABANT AND REGIONS



Source: Brabant Register of Establishments, adapted by Fanion Onderzoek & Advies

NUMBER OF JOBS IN AGRIFOOD BY REGION AND SUBSECTOR

Region	Primary sector	Food processing	Wholesale	Other: suppliers + R&D	Total AgriFood jobs
Breda region	6,150	6,210	4,270	440	17,070
Tilburg region	3,660	4,980	3,290	470	12,400
Den Bosch region	9,220	7,760	8,910	1,890	27,780
Eindhoven/Helmond region	8,160	8,960	5,060	1,720	23,900
Brabant	**27,190**	**27,910**	**21,530**	**4,520**	**81,160**



Source: Brabant Register of Establishments, adapted by Fanion Onderzoek & Advies

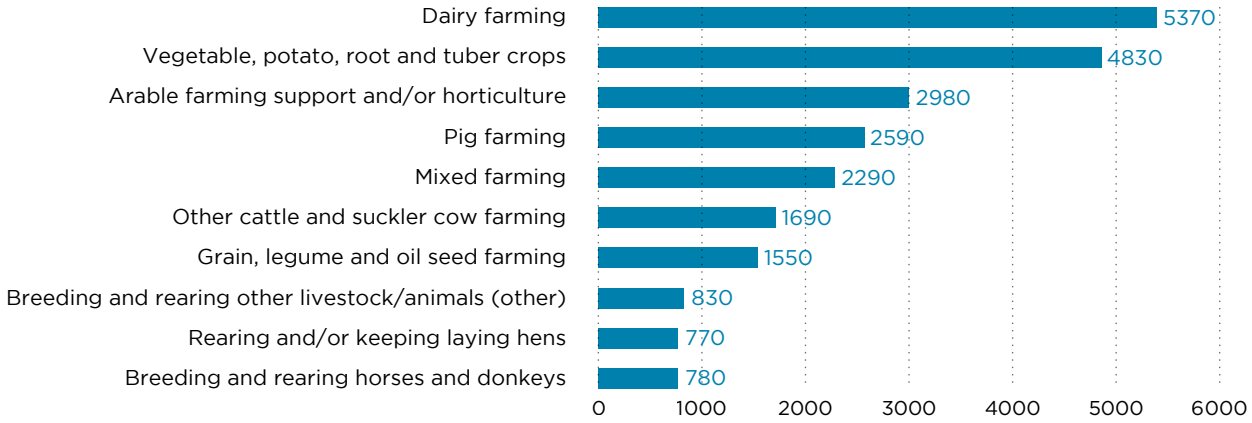
In terms of jobs, the largest branches in the primary sector are dairy farming and vegetable, potato, root and tuber crops, both accounting for around 5,000 jobs.

In food processing, bread and fresh pastry making is a large branch that is spread across Brabant and employs 4,770 people. Other large employers are found in the categories of meat processing (excluding prepared meals), chocolate and sugar confectioneries, prepared meals and snacks and beer (with the province home to AB InBev, Heineken and Bavaria breweries).

Another major industry is the food and beverage processing machinery manufacturing sector, a significant supplier to the food processing industry.

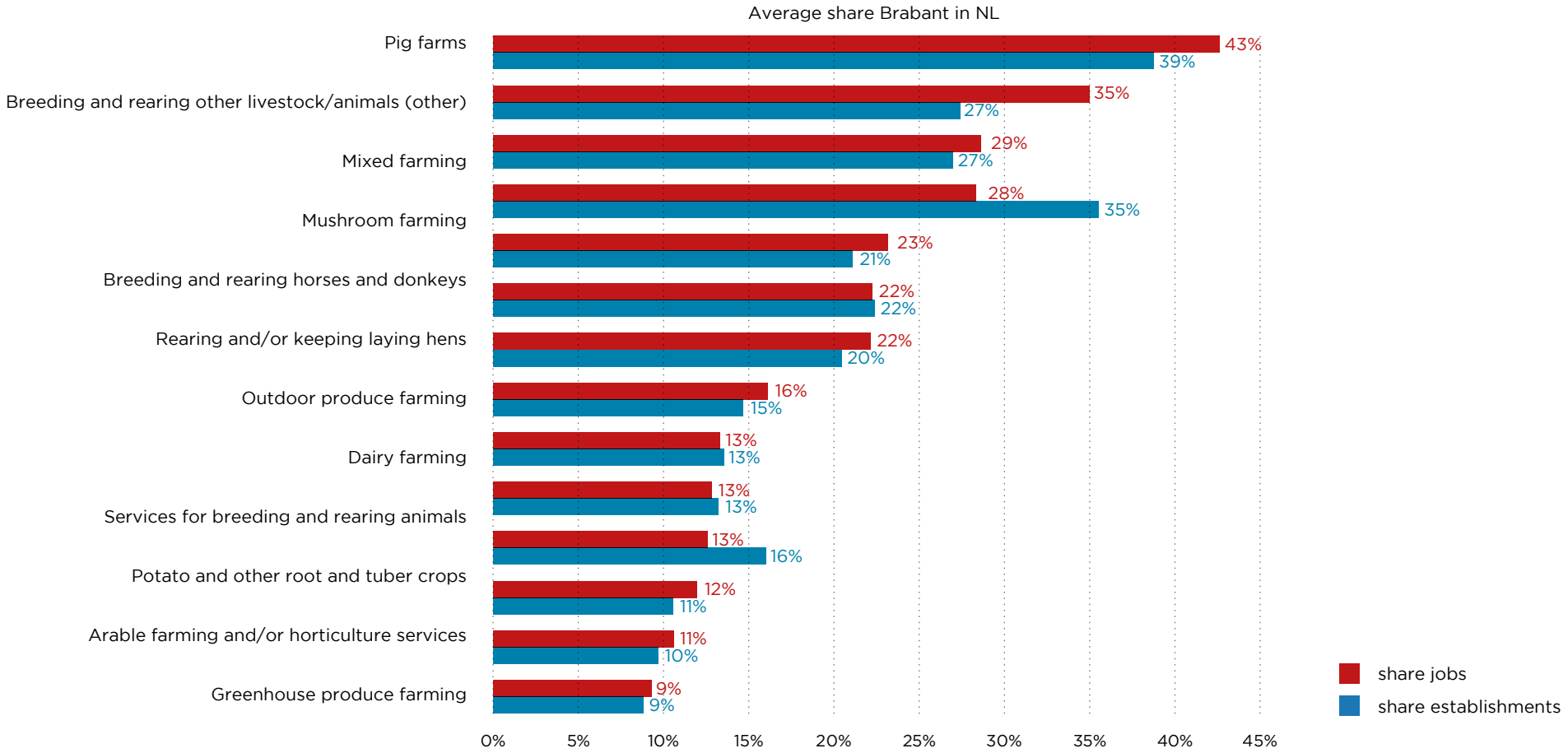
The wholesale branch in non-specialised food is particularly significant and the branch accounts for more than 7,200 jobs in Brabant, thanks to the fact it is home to the headquarters of two of the largest Dutch supermarket chains – Jumbo and Sligro. They are both based in Veghel (Meierijstad), in the heart of the north-eastern part of Brabant, an area often referred to as the AgriFood Capital.

NUMBER OF JOBS IN THE LARGEST PRIMARY SECTOR BRANCHES IN BRABANT, 2018



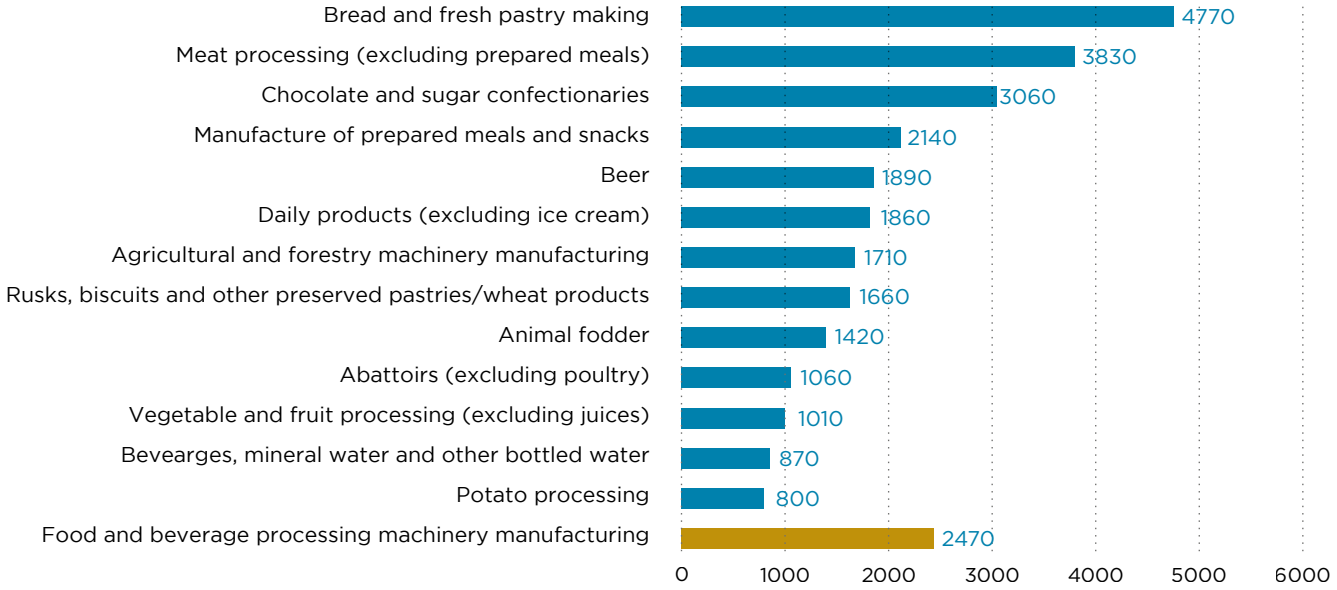
Source: Brabant Register of Establishments, adapted by Fanion Onderzoek & Advies

PRIMARY SECTOR BRANCHES WHERE BRABANT DOMINATES THE NETHERLANDS (AND EMPLOYS 500 OR MORE PEOPLE)

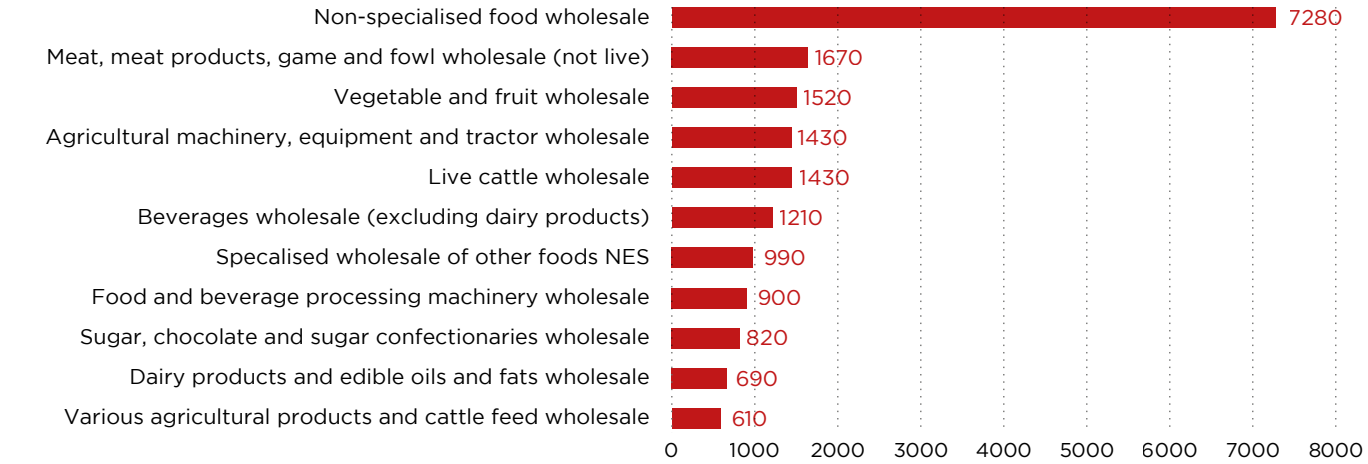


Source: Vestigingenregister province North-Brabant 2017, adapted by Fanion onderzoek & advies

LARGEST FOOD PROCESSING BRANCHES IN EMPLOYMENT TERMS, 2018 (AT LEAST 500 JOBS)



LARGEST WHOLESALE BRANCHES IN EMPLOYMENT TERMS, 2018 (AT LEAST 500 JOBS)



Source: Brabant Register of Establishments, adapted by Fanion Onderzoek & Advies

NUMBER OF BUSINESSES BY SIZE – 13,912 BUSINESSES IN TOTAL, 2018

The overwhelming majority of AgriFood businesses are small in terms of people employed, with over 89.2% having less than five employees and only a few businesses with more than 100 employees (0.7%).

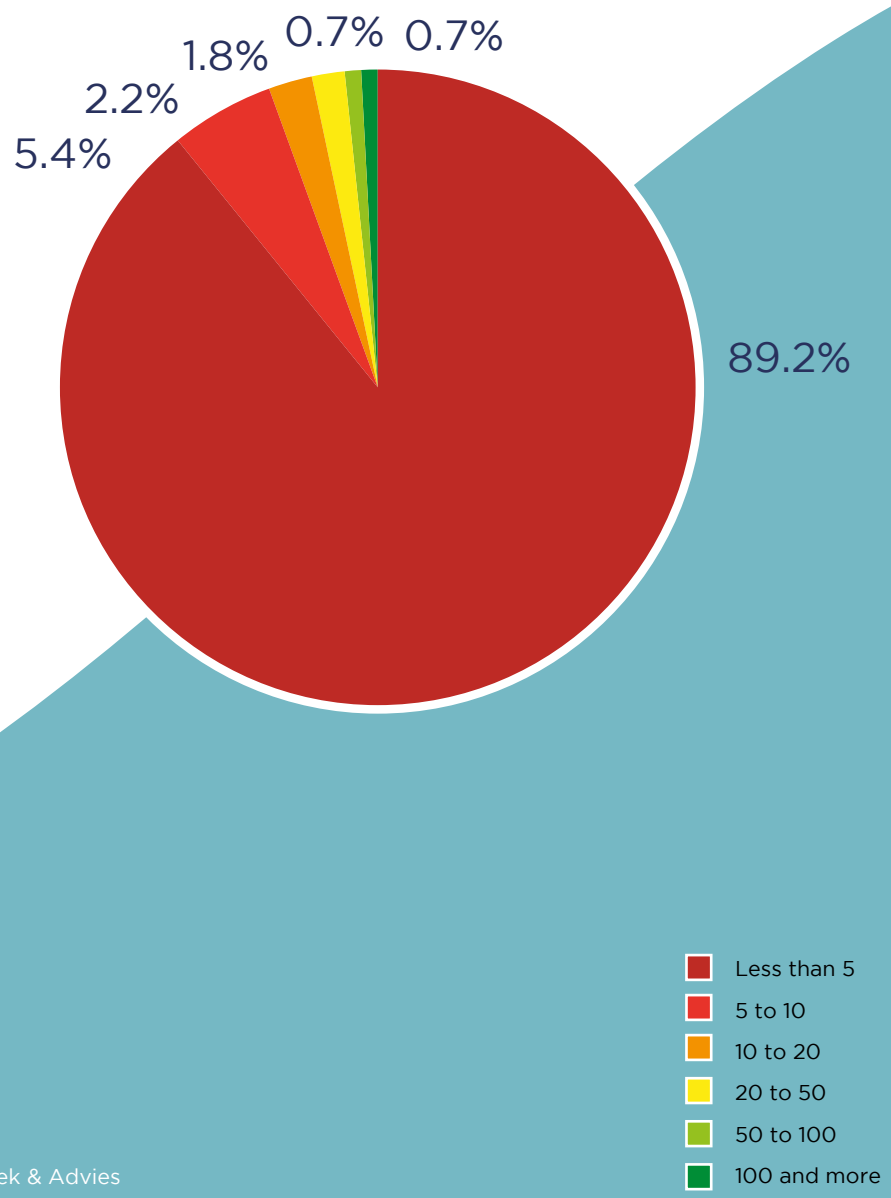
But there are important differences between the subsectors. The primary sector consists almost entirely of businesses with fewer than 20 employees, given that mechanisation and automation have replaced most of the jobs.

Wholesale also accounts for many small firms, with only two percent of them employing a workforce larger than 50.

However, large food processing companies are far more numerous, with over ten percent employing more than 50 people. Some of these are very large indeed, with a workforce of 1,000 or more. The SMEs have a comparatively small share of just under 60%.

Finally, in the *other* category, comprising of equipment and services suppliers and AgriFood R&D companies, there are once again many larger firms and some 20% of these employ more than 20 people.

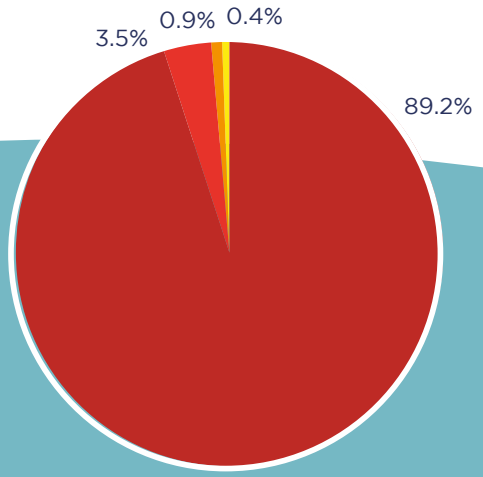
TOTAL AGRIFOOD



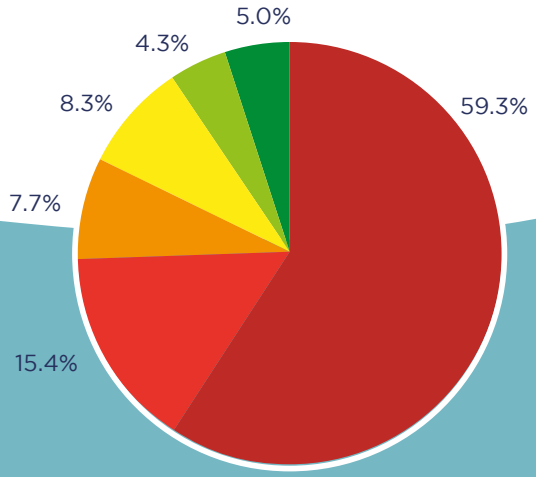
Source: Brabant Register of Establishments, adapted by Fanion onderzoek & adviesFanion Onderzoek & Advies

NUMBER OF BUSINESSES BY SIZE PER SUBSECTOR, 2018

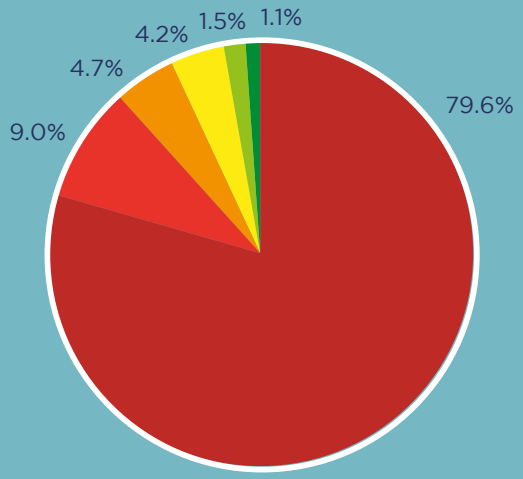
PRIMARY SECTOR



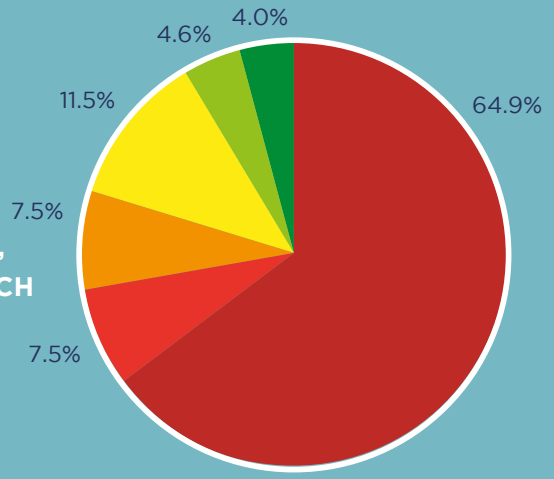
FOOD PROCESSING



WHOLESALE



OTHER: R&D, SUPPLIERS, SERVICES AND AGROTECH



Source: Brabant Register of Establishments 2018, adapted by Fanion Onderzoek & Advies

D. Growth of AgriFood companies and jobs

1. Businesses

The number of businesses in the AgriFood industry in Brabant grew by 1.6% from 13,696 in 2014 to 13,912 in 2018, as opposed to a slightly higher overall growth rate in the Netherlands of 3%.

The subsector comprising the food industry shows a different picture, as it grew much faster, both in Brabant (24.9%) and in the Netherlands (20.4%). The number of wholesale companies also grew, once again both in the Netherlands and the province. There was a decrease in the number of businesses in the other subsectors: the primary sector shrunk by 0.8% and other (suppliers and R&D) by 7.4%.

In general terms, these trends can be explained by the fact that the number of individual farmers in Brabant is decreasing because of consolidation of farms (increases of scale) or the absence of somebody to take over the family business. The same goes for most of the suppliers – economies of scale encourage consolidation and mergers/acquisitions.

Different trends are evident in the food industry: more variety in diets, with the move from animal proteins to plant-based proteins and a rise in the local production of produce and food products driving strong growth and increasing diversity, not necessarily on a larger scale.

2. Employment

The total number of jobs in AgriFood rose by 12% in Brabant between 2014 and 2018, from 72,470 in 2014 to 81,160 in 2018. As such, the province is outperforming the country as a whole, where employment in the industry grew by 7.3%.

Food processing (27.8%) and wholesale (21.2%) both show strong employment growth on a higher level than Dutch national figures.

Employment in the primary sector decreased in Brabant by 5.2%, a larger drop than the national average. The reasons for this are consolidation (merging farms improves economies of scale in certain cases), increased mechanisation and automation, the absence of somebody to take over the family farm and increasingly critical public debate about the future of traditional farming in the Netherlands.

In the *other* sector (suppliers and R&D), employment rose by 8.6% between 2014 and 2018 (higher than national growth) while the number of businesses fell (see above). Consolidation is also having an impact in this field – mergers, acquisitions and the consolidation of operations at a single location all mean that operational units have grown in size.

Taking a more detailed look at the branches in Brabant, we can see that employment has grown the most in Prepared meals and snacks (141%), Meat and meat products and game and fowl (not live) wholesale (54%), Non-specialised food wholesale (33%), Fruit and vegetables wholesale (30%) and Meat processing (excluding prepared dishes) (29%).

The following branches (employing at least 1,000 people) suffered the biggest drop in employment: Vegetable, root and tuber farming (-69%), Manufacture of animal fodder (-18%), Pig farming (-11%), Vegetable and fruit farming (-10%) and Dairy farming (-9%). These subsectors have not shrunk in economic terms but have been struggling to find labour during harvests. The outcome is that they have invested heavily in mechanisation (including harvesting robots) and automation, while employees (temporary seasonal workers) are increasingly hired from countries such as Poland and Romania.

One branch that deserves mention is the AgTech and FoodTech sectors already referred to above, both part of a High Tech Systems & Materials industry that is growing at an extraordinary rate in the Netherlands, particularly in the Eindhoven metropolitan area. In reality, the Eindhoven region of Brabant is the heart of the Netherlands' high tech industry and has been formally dubbed Brainport Eindhoven and is one of the three designated mainports in the country, the other two being the Amsterdam metropolitan area (including Schiphol Airport and surrounds) and the Rotterdam metropolitan area (including its port). The mainports are the primary economic pillars that the Dutch economy has been built on.

In terms of High Tech Systems & Materials employment figures, Brainport Eindhoven is growing much faster than any other Dutch region.

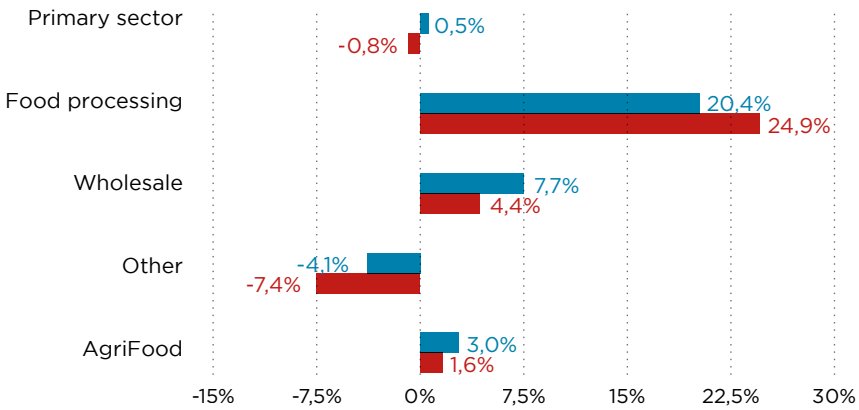
GROWTH IN BUSINESSES AND JOBS IN AGRIFOOD, 2014-2018, BRABANT AND THE NETHERLANDS

	Business			Business		
	Brabant			Netherlands		
Sector or subsector	**2014**	**2018**	**2014-2018**	**2014**	**2018**	**2014-2018**
Primary sector	10,299	10,215	-0,8%	64,025	64,361	0,5%
Food processing	847	1,058	24,9%	5,410	6,514	20.4%
Wholesale	2,362	2,465	4.4%	15,182	16,344	7.7%
Other: supplier and R&D	188	174	-7.4%	1,307	1,254	-4.1%
AgriFood	13,696	13,912	1.6%	85,924	88,473	3%

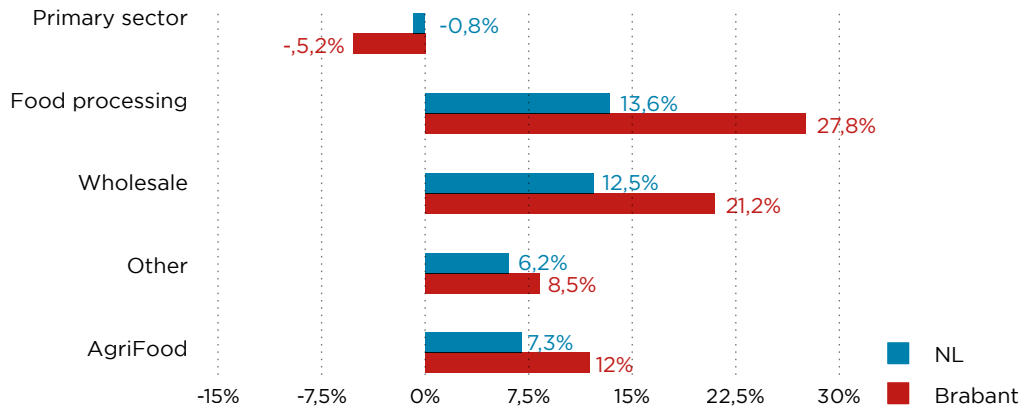
	Jobs			Jobs		
	Brabant			Netherlands		
Sector or subsector	**2014**	**2018**	**2014-2018**	**2014**	**2018**	**2014-2018**
Primary sector	28,690	27,190	-5.2%	168,240	166,920	-0.8%
Food processing	21,840	27,910	27.8%	119,060	135,250	13.6%
Wholesale	17,770	21,540	21.2%	120,530	135,580	12.5%
Other: supplier and R&D	4,170	4,530	8.6%	29,130	30,940	6.2%
AgriFood	72,470	81,160	12%	436,950	468,700	7.3%

Source: LISA, Brabant Register of Establishments, 2014-2018, adapted by Fanion Onderzoek & Advies

GROWTH IN BUSINESSES, 2014-2018, BRABANT AND THE NETHERLANDS

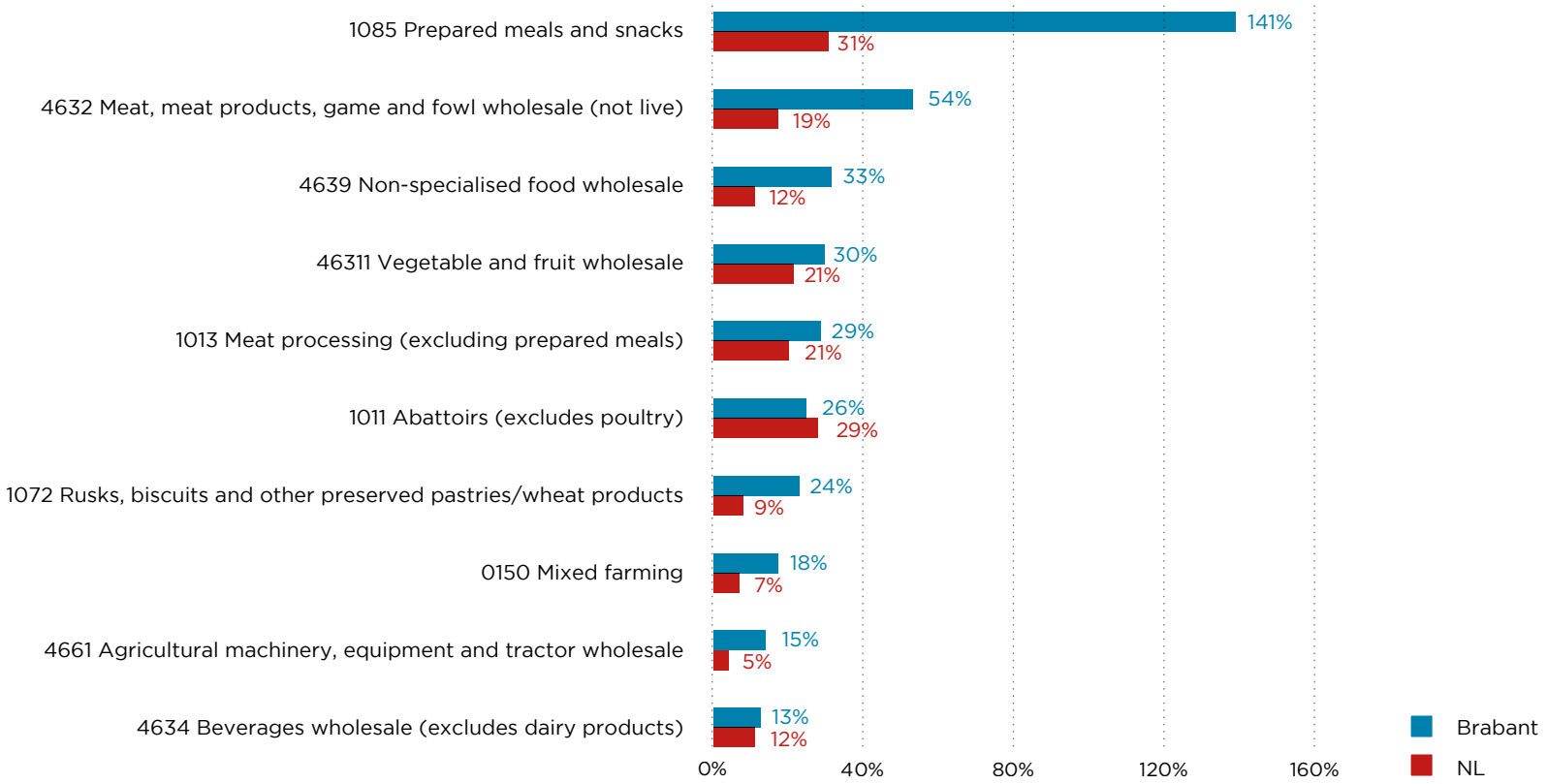


EMPLOYMENT FIGURES, 2014-2018, BRABANT AND THE NETHERLANDS



Source: LISA, Brabant Register of Establishments, 2014-2018, adapted by Fanion Onderzoek & Advies

TOP 10 BRANCHES* JOBS GROWTH IN BRABANT, 2014-2018



*) branches employing at least 1,000 people in Brabant

Source: LISA, Brabant Register of Establishments, 2014, 2018, adapted by Fanion Onderzoek & Advies

E. Regional distribution of AgriFood activities in Brabant

In total, the AgriFood sector in Brabant employs over 81,000 people, nearly 6.3% of all jobs in Brabant. Employment is clustered around the major centres of Breda, Helmond, Tilburg and Den Bosch, which are home to large food processing and wholesale companies.

The relatively small municipality of Meierijstad, and the town of Veghel in particular, alone accounts for 735 businesses and 8,200 jobs in AgriFood. Important AgriFood companies such as Mars (chocolate bars/pet food), Jumbo (the supermarket chain's head office), Sligro (wholesale/supermarkets, head office) and FrieslandCampina all have a significant presence in Veghel. Other cities with high AgriFood employment figures are Helmond, Breda, Tilburg, Den Bosch, Boxmeer and Oss.

The AgriFood industry is relatively strong (with an employment share of 20%) in a number of smaller municipalities such as Sint Anthonis (24%), Steenbergen (22.6%), Laarbeek (19.5%), Alphen-Chaam (19.1%) and Asten (18.1%). These are mainly rural municipalities where the economy is largely centred on agriculture, often livestock.

FIVE TOP MUNICIPALITIES IN BRABANT IN TERMS OF EMPLOYMENT FIGURES

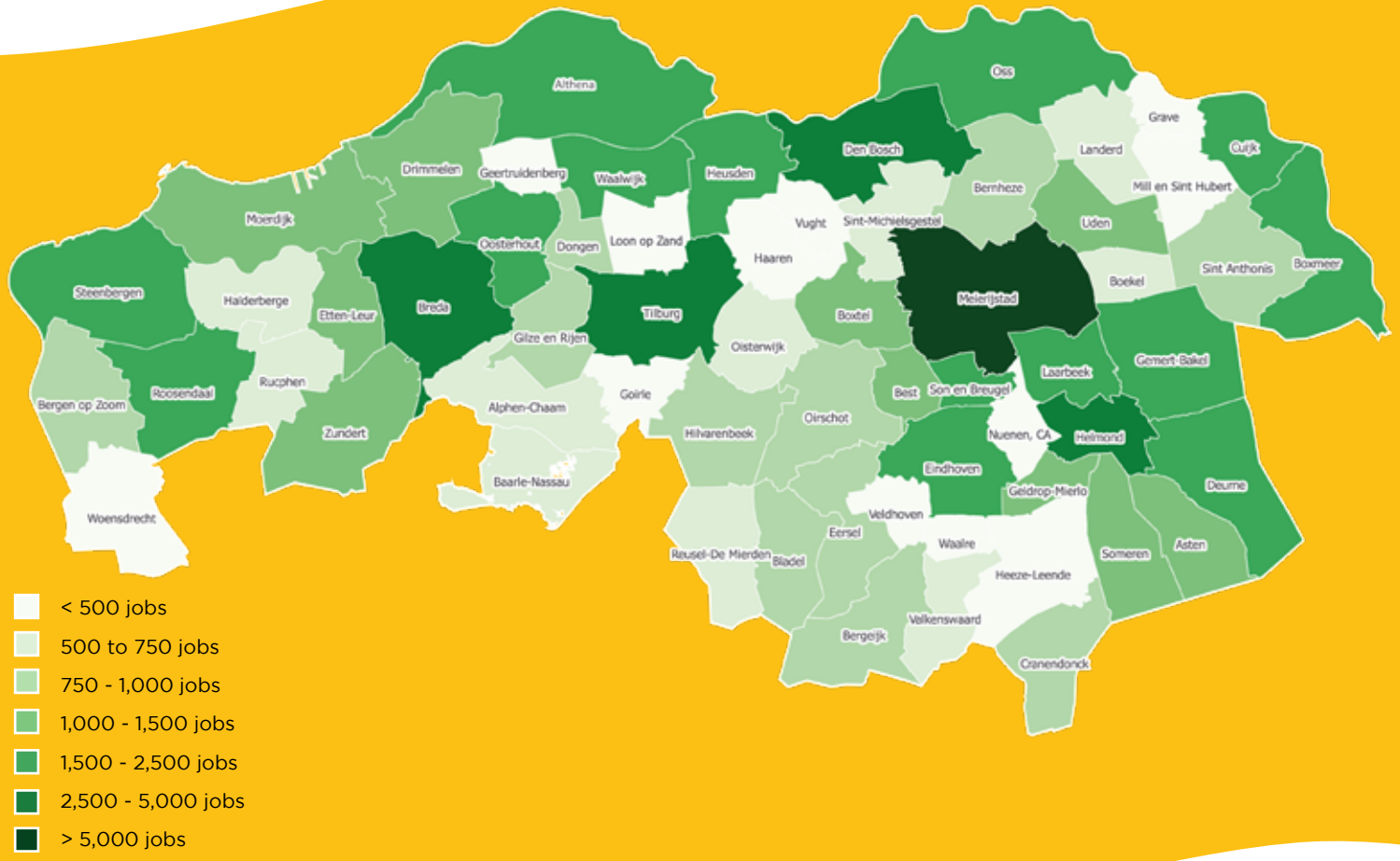
Municipality	# of jobs
Meierijstad (Veghel)	8,210
Helmond	4,020
Breda	3,430
Tilburg	3,680
Den Bosch	2,990

FIVE TOP MUNICIPALITIES IN BRABANT IN TERMS OF EMPLOYMENT SHARE OF AGRIFOOD JOBS

Municipality	% AgriFood in total jobs
Sint Anthonis	21%
Steenbergen	22.6%
Laarbeek	19.5%
Alphen-Chaam	19.1%
Asten	18.1%

Source: Brabant Register of Establishments 2018, adapted by Fanion Onderzoek & Advies

AGRIFOOD EMPLOYMENT FIGURES BY MUNICIPALITY

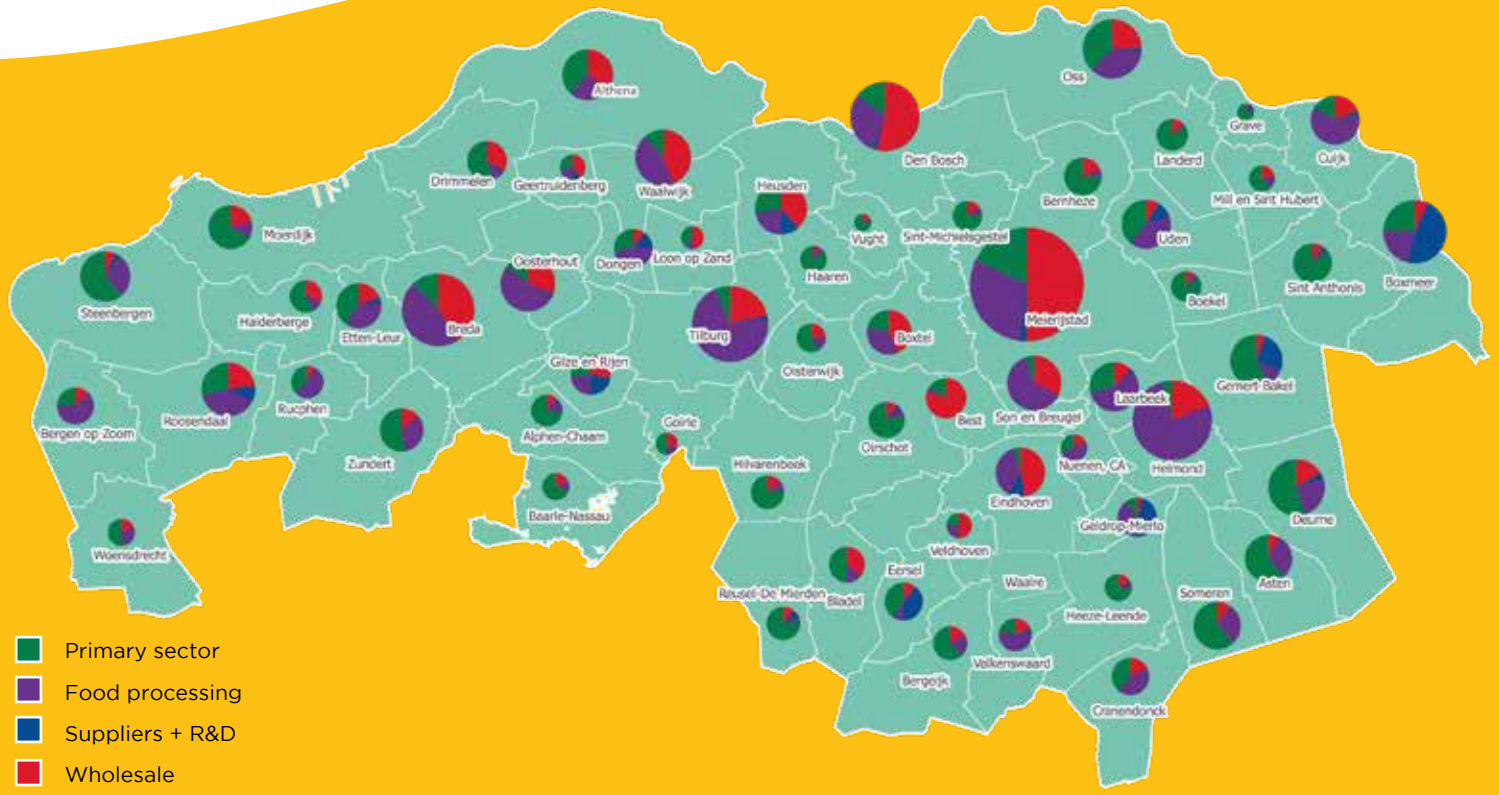


Source: Brabant Register of Establishments 20018, adapted by Fanion Onderzoek & Advies

AGRIFOOD EMPLOYMENT MUNICIPALITY HOTSPOTS

Source: Brabant Register of Establishments 2018, adapted by Fanion Onderzoek & Advies

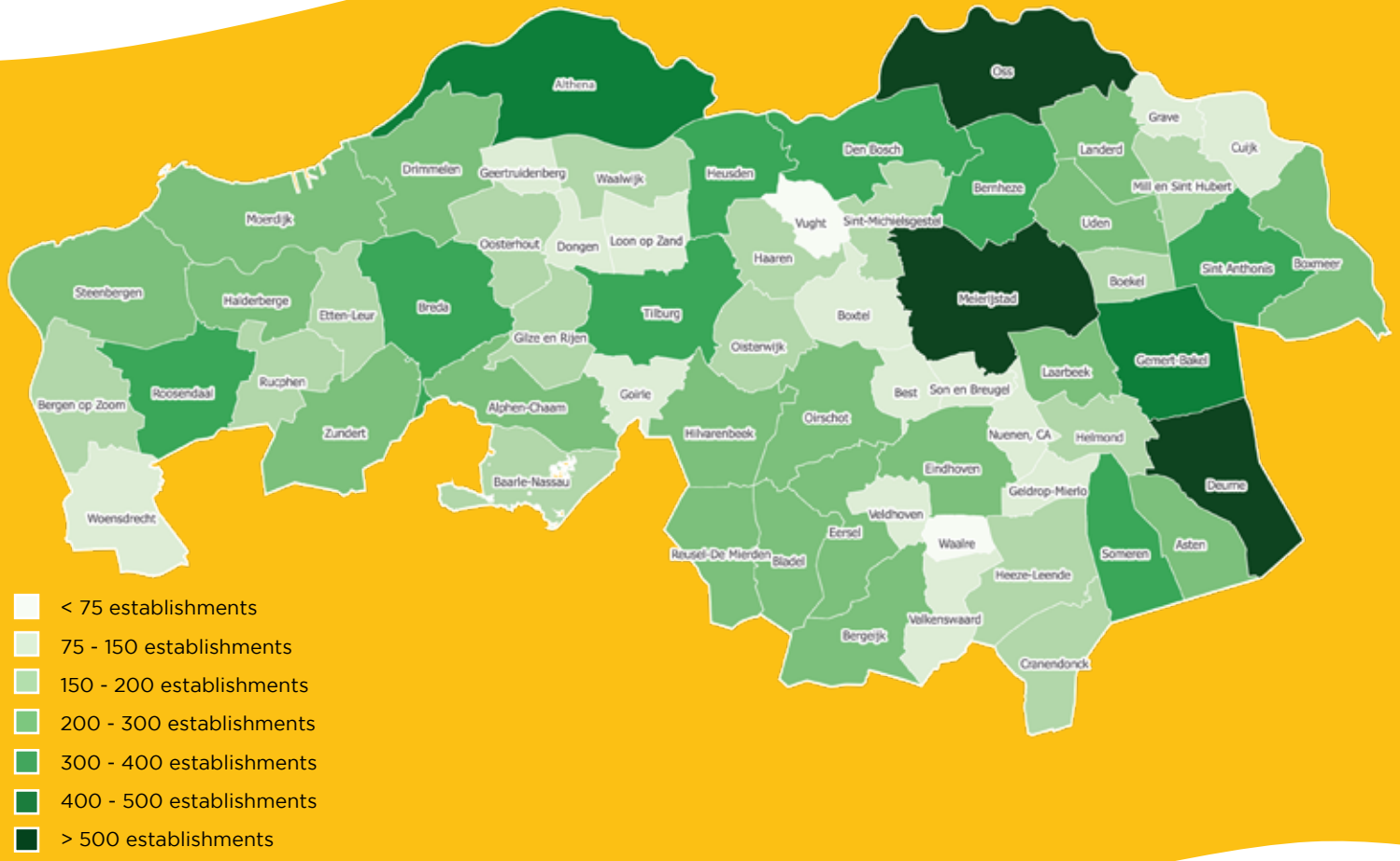
AGRIFOOD EMPLOYMENT HOTSPOTS BY SUBSECTOR AND MUNICIPALITY



The map plots the AgriFood employment figures by subsector and municipality. Municipalities are very divergent when it comes to employment in the different AgriFood subsectors. Meierijstad and Den Bosch lead the way in wholesale, whereas Tilburg and Breda have many food processing jobs. The AgriFood industry in the smaller and more rural municipalities, such as Steenbergen, Deurne, Sint Anthonis and Gemert-Bakel, is dominated by the primary sector.

Source: Brabant Register of Establishments 2018, adapted by Fanion Onderzoek & Advies

THE MAP BELOW PLOTS THE TOTAL NUMBER OF BUSINESSES IN THE AGRIFOOD INDUSTRY PER MUNICIPALITY.



Source: Brabant Register of Establishments 2018, adapted by Fanion Onderzoek & Advies

SPREAD OF BUSINESSES EMPLOYING MORE THAN 20 PEOPLE, BY BUSINESS ACTIVITY

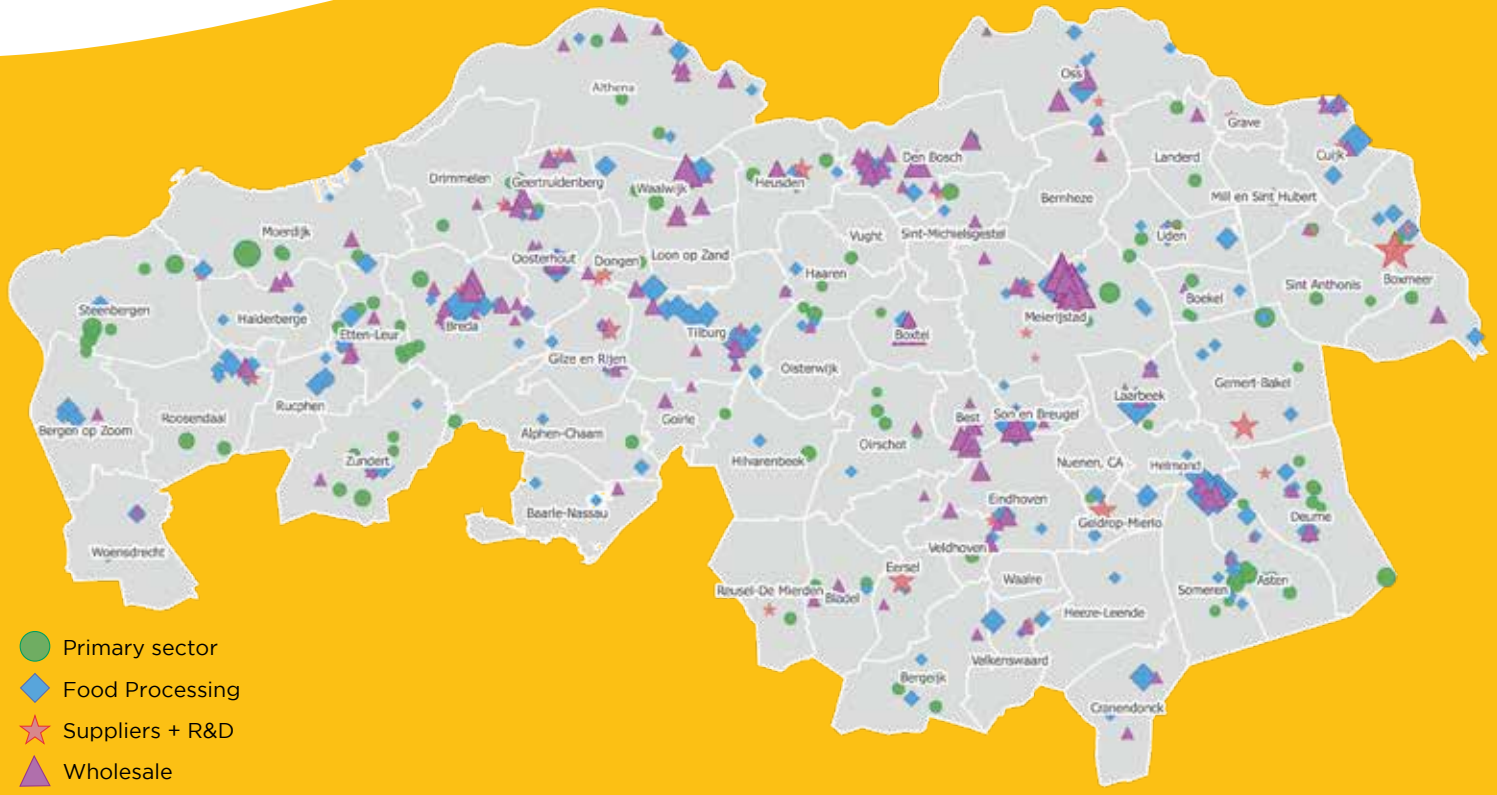
What the following map illustrates is that the AgriFood industry is very widely spread across the entire the province of Brabant, while the range of business activities (from R&D to manufacturing, sales, and wholesale) are also well-distributed. Looking at the centres of activities, one can see that food processing and wholesale are concentrated in the larger cities, such as Tilburg, Helmond, Breda, Den Bosch and Meierijstad (including Veghel). Meanwhile, the AgriFood primary sector businesses are generally found in the rural areas.

Cities like Boxmeer and the Eindhoven metropolitan area are distinct hotspots in their own right. Boxmeer is home to the largest animal health cluster in the Netherlands, with companies like MSD (Merck) Animal Health, Hendrix Genetics, Nutreco and Marel Poultry. Boxmeer has not featured in earlier graphics because MSD Animal Health, which has a 1,500-strong workforce, is not considered an AgriFood company for statistical purposes. But even without those 1,500 MSD employees, the other three companies still employ well over 2,000 people.

Eindhoven is the high tech centre of the Netherlands, home to dozens of AgTech machinery companies and technology businesses of all sizes. These companies are also not considered AgriFood businesses and as such are not featured in this chart, but they do play a vital role in the industry.

Source: Brabant Register of Establishments 2018, adapted by Fanion Onderzoek & Advies

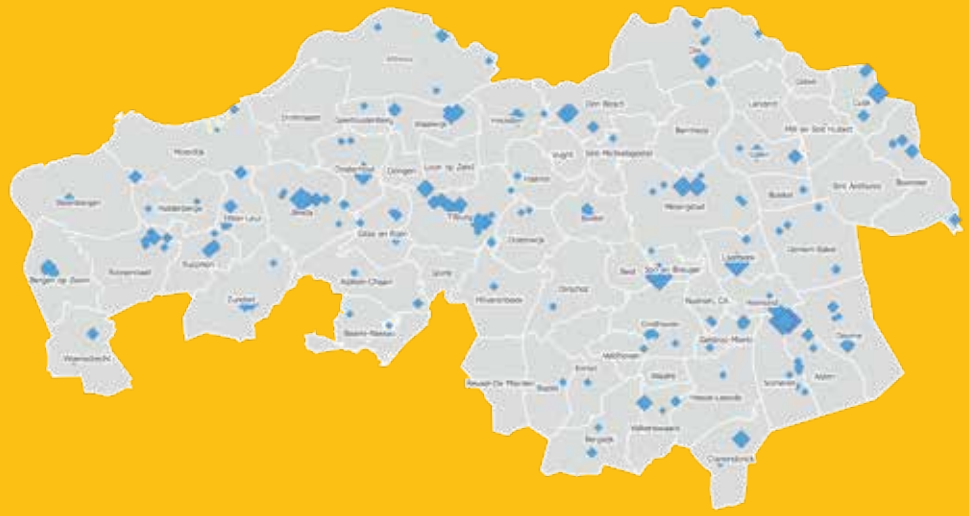
SPREAD OF BUSINESSES EMPLOYING MORE THAN 20 PEOPLE, BY BUSINESS ACTIVITY



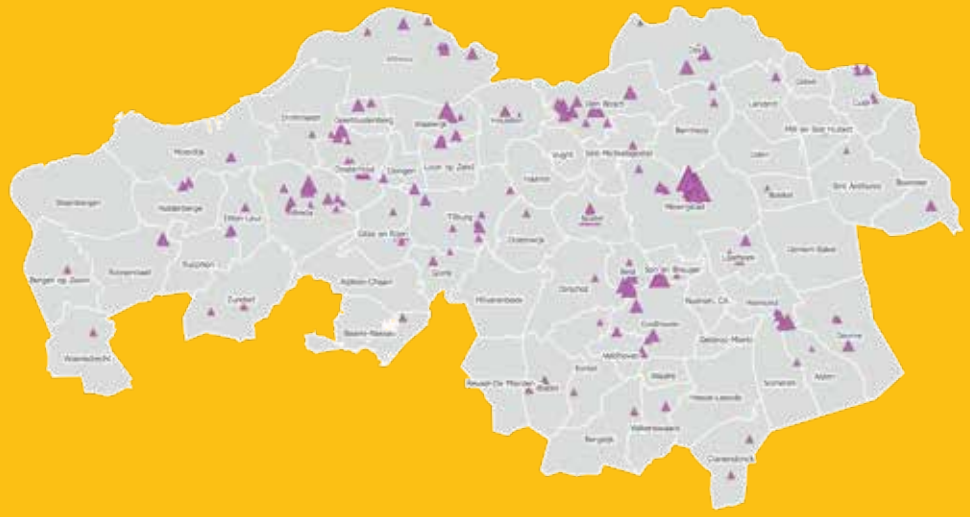
Source: Brabant Register of Establishments 2018, adapted by Fanion Onderzoek & Advies

SPREAD OF PRIMARY SECTOR BUSINESSES EMPLOYING OVER 20 PEOPLE

SPREAD OF FOOD PROCESSING BUSINESSES EMPLOYING OVER 20 PEOPLE



SPREAD OF WHOLESALE BUSINESSES EMPLOYING OVER 20 PEOPLE



SPREAD OF OTHER (SUPPLIERS + R&D) BUSINESSES EMPLOYING OVER 20 PEOPLE

Source: Brabant Register of Establishments 2018, adapted by Fanion Onderzoek & Advies

F. AgriFood companies in Brabant

AGRIFOOD COMPANIES IN BRABANT

In this section we list the biggest AgriFood companies in Brabant according to their business activities. Some of the better-known companies that feature on the list include AB InBev, Heineken, Danone Nutricia, Coca-Cola, Mars, Cargill, Cosun, MSD (Merck) Animal Health, Marel Poultry and VDL.

LARGEST COMPANIES IN THE PRIMARY SECTOR – TOP 20

Company	City	Main activities	# of Jobs
Rijk Zwaan Breeding	Fijnaart	Seed breeding	200-400
Keizersberg/Jos van Deurzen	Elsendorp	Feed for high bred fur animals	100-200
Van Adrichem Kwekerijen	Steenbergen	Tomatoes	100-200
Driemaster	Someren	Tomatoes	100-200
Greenco Helenaveen	Helenaveen	Tomatoes	100-200
Gebroeders Raijmakers kwekerijen	Heusden	Tomatoes	50-100
4evergreen/Kwekerij Grootscholte	Steenbergen	Bell peppers	50-100
Fudinto	Dinteloord	Tomatoes	50-100
Kwekerij Van der Houwen	Steenbergen	Tomatoes	50-100
Verhoeven QH	Prinsenbeek	Snack cucumbers	50-100
Kwekerij Gebr. Mies	Wouwse Plantage	Root and root vegetables	50-100
GoFresh	Wernhout	Mushrooms	50-100
Tuinbouwbedrijf van de Ven	Oisterwijk	Strawberries	50-100
Gebr. Van Duijn	Steenbergen	Eggplants	50-100
GP Someren	Someren	Snack tomatoes	50-100
Kwekerij Wilbert van Oers	Etten-Leur	Tomatoes	50-100
Kwekerij Gerard Aarts	Heusden	Tomatoes	20-50
Heemskerk Dairy	Diessen	Dairy cattle breeding	20-50
Kwekerij Hoogerbrugge	Steenbergen	Tomatoes	20-50
Van den Elzen Groenteverwerking	Uden	Leeks	20-50

LARGEST FOOD PROCESSING COMPANIES – TOP 50

Company	City	Main activities	# of Jobs
Mars Nederland	Veghel	Chocolate bars/pet food	>1,000
Van Rooi Meat	Helmond	Pork abattoir	>1,000
Van Loon Son	Son en Breugel	Meat products	800-1,000
Hessing Helmond	Helmond	Processed vegetables	800-1,000
Swinkels Family Brewers (Bavaria)	Lieshout	Beer and soft drinks	500-800
Perfetti Van Melle Benelux	Breda	Confectioneries	500-800
FrieslandCampina DMV	Veghel	Milk powder and proteins	500-800
VION	Tilburg/Boxtel	Meat products (pork and beef)	500-800
Danone Nutricia	Cuijk	Baby food	200-500
Heineken	s-Hertogenbosch	Beer	200-500
Coca-Cola European Partners	Dongen	Soft drinks	200-500
Dohler Holland	Oosterhout	Food ingredients	200-500
Zwanenberg food	Oss/Giessen	Meat products	200-500
Refresco Benelux	Maarheeze	Soft drinks	200-500
BACU Bakkerij	Uden	Bread and pastries bakery	200-500
Banketbakkerij Merba	Oosterhout	Cookies/biscuits	200-500
Cargill	Bergen op Zoom	Modification of cereals	200-500
Van Geloven	Tilburg/Helmond	Snacks	200-500
Group of Butchers	Tilburg	Meats	200-500
Dutch Bakery	Waalwijk, Tilburg, Eindhoven, Budel	Bread bakery	200-500
Agristo	Tilburg	Frozen potato products	200-500
Maitre Paul	Tilburg	Pastries	200-500
AB-Inbev	Valkenswaard/Eersel/Breda	Beer	200-500
Conveni	Liessel	Ready-made meals	200-500
Peka Kroef	Odiliapeel	Potato products	200-500
Vitelco	's-Hertogenbosch	Calf abattoir	200-500
Ardo	Zundert	Processed vegetables	200-500
Nutreco Nederland	Boxmeer	Baby food	200-500
Culivers	Eindhoven	Ready-made meals	200-500

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LARGEST FOOD PROCESSING COMPANIES – TOP 50

Company	City	Main activities	# of Jobs
Huijbregts Groep	Helmond	High quality blends for the food industry	200–500
Daelmans Banket	Nieuwkuijk/Oss	Pastries	200-500
Lamb Weston/Meijer	Bergen op Zoom/Breda	Frozen potato products	100-200
Cloetta Holland	Roosendaal/Oosterhout	Sweets/Candy	100-200
Cosun Beet Company (Royal Cosun)	Dinteloord/Roosendaal	Sugar refinery	100-200
Hak	Giessen	Processed vegetables	100-200
Delicia	Tilburg	Chocolate products	100-200
Rendac	Son en Breugel	Processing offal and carcasses	100-200
Zonnemaire	Waspik	Organic bread bakery	100-200
Continental Bakeries	Rucphen	Pastries, toasted products bakery	100-200
Hill's Pet Nutrition Manufacturing	Etten-Leur	Pet food	100-200
FrieslandCampina	Nuenen	Whipped cream/cream	100-200
De Banketgroep	Tilburg	Waffles	100-200
Exberry/GNT International	Mierlo	Natural products for colouring food	100-200
Bettinehoeve	Etten-Leur	Goat cheese	100-200
Borgesius Breda	Breda	Bread bakery	100-200
Dawn Foods International	Steenbergen	Ready-to-bake and ready-to-finish products/bakery ingredients	100-200
Barry Callebaut Decorations	Zundert	Chocolate products	100-200
Plukon	Ommel	Slaughtering poultry/poultry processing	100-200
Broviand	Someren	Poultry processing	100-200
Mola	Beugen	Puff pastry	100-200

LARGEST COMPANIES IN WHOLESALE – TOP 50

Company	City	Main activities	# of Jobs
Jumbo Supermarkten	Veghel	Head office, second-largest supermarket/ retail chain in the Netherlands	>1,000
VION Food Nederland	Boxtel	Meat products	500–1,000
Sligro Food Group	Veghel/Eindhoven/Den Bosch	Head office, foodservice and food retail companies' deliveries	500–1,000
Spar Supermarkten	Waalwijk	Head office, supermarkets	200-500
Lekkerland Nederland	Son en Breugel	Convenience foods	200-500
Makro Zelfbedieningsgroothandel	Breda/Best/Den Bosch	Wholesale food market	200-500
Udea	Veghel	Wholesale in organic food	200-500
Aldi	Best	Distribution centre, supermarkets	200-500
Bidfood	Helmond/Tilburg	Food products for catering industry wholesale	200-500
Meat Friends	Best/Son en Breugel/Roosendaal	Meat products	200-500
Hazera Seeds	Made	Seeds	100 -200
HANOS-ISPC Breda	Breda	Food products for catering industry wholesale	100-200
Nettorama Verbruikersmarkten	Oosterhout	Head office, supermarkets	100-200
Van Hoeckel	's-Hertogenbosch	Food for hospitals and care institutions	100-200
Padifood	Oss	Asian foods	100-200
Scherpenhuizen	Eindhoven	Packaged vegetables	100-200
Interfood	Bladel	Dairy products and derivatives	100-200
Vriesekoop Oudewater	Rosmalen	Poultry	100-200
Dalco Food	Oss	Snack/food ingredients	100-200
Uniekaas Holland	Kaatsheuvel	Cheese	100-200
KCC Nisbets	Eindhoven	Catering industry wholesale	100-200
Multi Bier	Helmond	Beer	100-200
vanRijsingencarrotconcepts	Helmond	Carrot products	100-200
Kwetters	Veen	Eggs	100-200
Mondelez Nederland	Oosterhout	Snacks	100-200
Froster	Waalwijk	Fresh frozen food	50-100
Van der Horst Beef	Roosendaal	Beef	50-100

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LARGEST COMPANIES IN WHOLESALE – TOP 50

Company	City	Main activities	# of Jobs
Peeters Landbouwmachines	Etten-Leur	Agricultural machinery	50-100
Anova Seafood	's-Hertogenbosch	Seafood products	50-100
Hero Nederland	Breda	Jam and fruit snacks	50-100
Paridaans en Liebregts	's-Hertogenbosch	Livestock	50-100
Jansen-Dongen	Tilburg	Potatoes, onions, carrots	50-100
Patisserie Hoeben	Liessel	Pastries	50-100
C J Wildbird Foods Limited	Vierlingsbeek	Bird food	50-100
Bresc	Sleeuwijk	Herbs and spices	50-100
Levens Cooking & Baking Systems Nederland	Gilze	Cooking and baking equipment	50-100
Beko groothandel	Veghel	Raw materials for bakeries	50-100
Aartsen Fruit Breda	Breda	Fruit and vegetables	50-100
Tanis Confectionery	Oosterhout	Food processing machinery	50-100
Smit seafood	Veghel	Seafood products	50-100
Cor Segers Cheese	Gemert	Cheese	50-100
BSB EESV	Etten-Leur	Beer and selected beverages	50-100
A Brand New Day Drinks Company	Breda	Alcoholic beverages	50-100
Snack Connection	Giessen	Peanuts and nuts	50-100
Teeuwissen Products (Sarval Petfood)	Katwijk NB	Pet food	50-100
D'Anvo Backeries	Riel	Bread and dough products	50-100
Megagroup	Veghel	Water systems	50-100
Protix	Dongen	Insects	50-100
Bredabest	Raamsdonksveer	Nuts	50-100
Boumans Groenten & Fruit	Eindhoven	Fruit and vegetables	50-100

LARGEST COMPANIES IN OTHER RELATED BRANCHES: EQUIPMENT, SERVICES, RESEARCH – TOP 50

Company	City	Main activities	# of Jobs
Marel (Stork) Poultry Processing	Boxmeer/Dongen	Poultry processing equipment	800–1,000
Kuhn-Geldrop	Geldrop	Agricultural machinery	200-500
GEA Food Solutions	Bakel	Machinery for preparing and packaging food products	200-500
Vencomatic Group	Eersel	Poultry farming systems/equipment	200-500
SodaStream International	Rijen	Soda water systems	200-500
Benier Nederland	Nieuwkuijk	Bakery machines	100-200
VDL Systems	Uden	Equipment for food processing and packaging	100-200
Ploeger Constructie	Roosendaal	Agricultural machinery	100-200
Marel Further Processing	Boxmeer	Processing equipment	100-200
VDL PMB-UVA	Eindhoven	Machinery for making, finishing and packaging cigars	50-100
Van Uitert	Dongen	Internal transport systems and specialised machines	50-100
VDL Agrotech	Eindhoven	Stable systems	50-100
Imants	Reusel	Agricultural machinery	50-100
Taks Handling Systems	Etten-Leur	Potato and vegetable processing systems	20-50
Masterlab (Nutreco)	Boxmeer	Animal and human nutrition laboratories	20-50
Ploeger Machines	Roosendaal	Harvesting technology and machinery	20-50
Pelleting Technology Netherlands	Schijndel	Pelleting machinery for feed	20-50
FRAmelco	Raamsdonksveer	Drinking water and feed additives	20-50
ROBA Laboratorium	Deurne	Animal and human nutrition laboratory	20-50
Conver	Giessen	Agricultural machinery	20-50
GEA Westfalia Separator	Cuijk	Food processing machinery	20-50
Marvu food processing equipment	Sint-Oedenrode	Food processing equipment	20-50
Van Dinther	Velp	Stable systems	20-50
Lareka	Valkenswaard	Food packaging machinery	20-50
Buts Meulepas	Oss	Agricultural machinery	20-50
Baselier Agri Tech	Steenbergen	Agricultural machinery	20-50
IPCO Process Systems	Breda	Food processing machinery	20-50
Welvaarts Weegsystemen	‘s-Hertogenbosch	Weighing systems	20-50
IRS	Dinteloord	Knowledge institution for sugar beet farming	20-50

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LARGEST COMPANIES IN OTHER RELATED BRANCHES: EQUIPMENT, SERVICES, RESEARCH – TOP 50

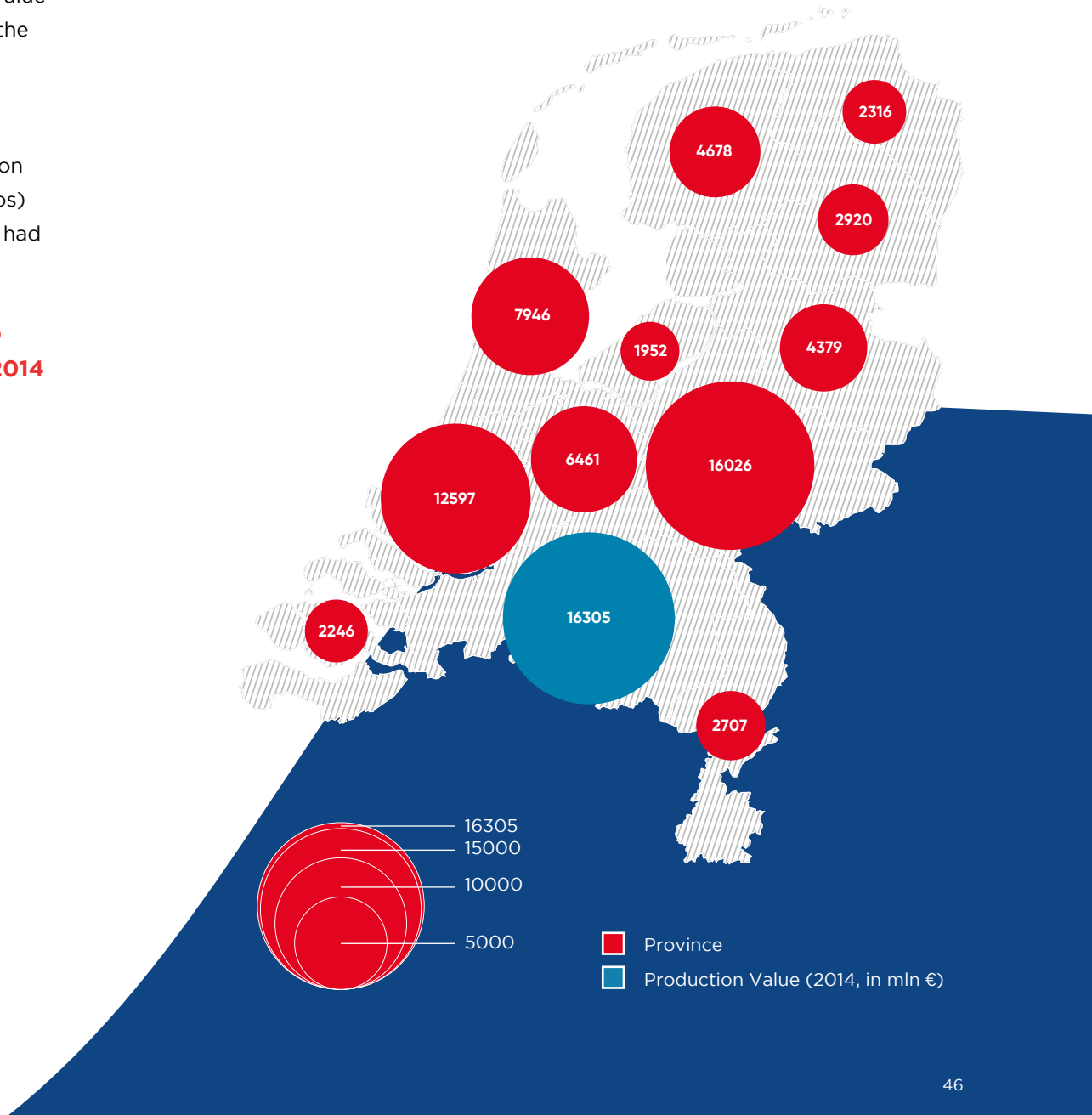
Company	City	Main activities	# of Jobs
Verba	Sint-Oedenrode	Feeding troughs	20-50
AB Mauri	Made	Baking research	20-50
Smicon Works	Wanroij	Food processing machinery	20-50
Tanis Equipment Production	Oosterhout	Confectionery machines	20-50
Cerescon	Heeze	Harvesting machinery	20-50
ITR Benelux	Tilburg	Parts for agricultural machinery	10-20
Van Osch Uden	Uden	Stable systems for pigs	10-20
Sleegers Techniek	Nieuwkuijk	Food processing machinery	10-20
Van der Meijden Machines	Udenhout	Food processing machinery	10-20
Ferm-O-Feed	Schijndel	Fertilisers	10-20
Spako food machinery	Deurne	Food processing machinery	10-20
Nutreco Swine Research Centre	Sint Anthonis	Research centre for swine breeding	10-20
Daub Bakery Machinery	Goirle	Bakery equipment	10-20
Agro America	Odiliapeel	Manure processing	10-20
Lammers Handelsonderneming	Deurne	Agricultural machinery	10-20
Abemec	Veghel	Agricultural machinery	10-20
Berkvens greenhouse mobility	Asten	Greenhouse equipment	10-20
Willemse & van Engelen Bakkerijmachines	Roosendaal	Confectionary bakery equipment	10-20
Romkon	Zevenbergen	Agricultural machinery	10-20
Flingk Machinebouw	‘s-Hertogenbosch	Agricultural machinery	10-20
Van den Berg - Keijsers	De Rips	Agricultural machinery	10-20

G. Production value

Statistics Netherlands (CBS) has published data on the production value of AgriFood for 2014 at the geographic level of the provinces, with the primary sector and food industry included and wholesale and other sectors (suppliers and R&D) excluded.

Brabant was the leading province in 2014 with an output of 16.3 billion euros, closely followed by the province of Gelderland (16 billion euros) and, at some distance behind, the province of South-Holland, which had an AgriFood production value 12.6 billion euros.

AGRIFOOD PRODUCTION VALUE (PRIMARY SECTOR AND FOOD INDUSTRY) BY PROVINCE IN MILLIONS OF EURO, 2014



Source: Monitor Topsectoren 2017, CBS

H. Further AgriFood companies (not falling under the priority industry definition)

1. AgriFood high tech manufacturing

A strong addition in Brabant to the traditional AgriFood sector as defined by the delimitation of the Dutch Top Sector AgriFood (paragraphs C to H of this chapter) are the HighTech and in particular the AgTech and FoodTech sectors. These are the companies that develop and manufacture HighTech components, sensors, software, machines and processing technology for all phases in the AgriFood value chain, from primary production via processing to sales and distribution.

These companies, and there are a large number of them, are registered with a different activity (sbi) code. This can be the result of a backlog in the Chamber of Commerce of provincial registry; because the company is registered as technology developer instead of AgriFood company or just because the company itself has never changed its sbi code to new company activities (or registered it correctly).

In October 2020, in-depth analysis of the HighTech sector in Brabant confirmed that in the Brabant region AgriFood and HighTech are cooperating intensively and are already developing the solutions for global sustainable food production. Screening of the 1,600+ HighTech companies in Brabant with more than 10 employees unveiled that more than 30% of these establishments were active in the AgriFood sector. These 487 companies currently employ more than 27,000 employees.

AgTech
In AgTech (Agriculture technology) their activities range from stable and animal housing construction, air treatment and climate control via stable and greenhouse automation to agricultural machines, harvesters and handling systems for sorting and packing of the harvest. Including the whole range of part suppliers.

FoodTech
In FoodTech (processing technology for the food industry) these companies are involved in process technology & optimization, maintenance and inspection services, handling machines, packaging machines, air treatment and climate control, system cabinets, (quality) control equipment and – again – the full supply chain with regards to parts & components.

Several of these companies are dedicated innovators aiming to make food production as sustainable as possible. They can be well-established companies but also disruptive start-ups / scale-ups that develop:

- New plant-based proteins (a.o. The Protein Brewery)
- Dry-misting technologies to keep food products fresh longer (e.g. Contronics Engineering)
- Protein-enriched food products (a.o. Carezzo Nutrition)
- Indoor farming technology and components / plant breeding concepts (a.o. Signify Horticulture and PlantLab)
- 3D food printers (a.o. byFlow), to name just a few.

This group of HighTech companies supplying to and cooperating with the Brabant AgriFood sector has a total of more than 27,000 employees. The largest companies are VDL and GEA Group that both have several operational units in Brabant supplying to the AgriFood industry.

SOME OF THE INNOVATIVE HIGH TECH COMPANIES ACTIVE IN AGRIFOOD – THE TOP 30

Company	Main activities	City	Size (employees)	Country of origin
VDL	Filter installations, machine engineering, modules for food industry machinery, air treatment, plastic parts	Eindhoven, HelmondEersel, Heeze	>1,000	The Netherlands
GEA Nederland	Cooling systems and vending machines	Den Bosch/Bakel	100-200	Germany
Fri-Jado	Food preparation equipment	Etten-Leur	200-500	The Netherlands
Gamko	Cooling technology	Etten-Leur	100-200	The Netherlands
KSE Process Technology	Dosing and weighing systems	Bladel	100-200	The Netherlands
FUJI SEAL EUROPE	Product labelling machines	Deurne	100-200	Japan
Lan Handling Technologies	Handling systems	Tilburg	100-200	The Netherlands
Knapen Trailers	Agricultural trailers	Deurne	100-200	The Netherlands
Bilfinger Tebodin Netherlands	Engineering and consultancy services	Eindhoven	50-100	Germany
Lubron Waterbehandeling	Water treatment systems	Oosterhout	50-100	The Netherlands
Haval disposables	Hygiene material packaging	Gemert	50-100	The Netherlands
Cups4you	Plastic packaging power supply	Oss	50-100	The Netherlands
Precia Molen Nederland	Weighing and dosing systems	Breda	50-100	The Netherlands
Henkelman	Vacuum machines	‘s-Hertogenbosch	50-100	The Netherlands
Optimum Sorting	Sorting machines	Eindhoven	50-100	Belgium
Voets en Donkers Koeltechniek	Cooling technology and air treatment	Schijndel	50-100	The Netherlands
Bato Plastics	Plastic horticultural products	Zevenbergen	20-50	The Netherlands
Tummers Food Processing Solutions	Food industry machinery	Hoogerheide	20-50	The Netherlands
Van Beek	Screw conveyors	Drunen	20-50	The Netherlands
Premier Tech Chronos	Weighing and packaging	Eersel	20-50	Canada
HVL METAALBEWERKING	Food industry machinery	Liessel	20-50	The Netherlands
Van Aaken Automatisering	IT and data science solutions for AgriFood	Rosmalen	20-50	The Netherlands
Tomra Sorting	Sorting machines	Eindhoven	20-50	Norway
Willems Machinebouw	Food industry machinery	Bladel	20-50	The Netherlands
VMEngineering Niras	Engineering and consultancy services	Rosmalen	20-50	Denmark

Source: Brabant Register of Establishments/Fanion Onderzoek & Advies

Continued on next page >

SOME OF THE INNOVATIVE HIGH TECH COMPANIES ACTIVE IN AGRIFOOD – THE TOP 30

Company	Main activities	City	Size (employees)	Country of origin
Arodo Nederland	Packaging machines	Reusel	20-50	Belgium
Roestvaststaal Apparaten Fabriek	Food industry machinery	Raamsdonksveer	20-50	The Netherlands
GELING ADVIES	Agricultural industry consultancy	De Rips	10-20	The Netherlands
Herbert Solutions	Sorting and handling machines	Eindhoven	10-20	Netherlands
Van Rooij Landbouw Mechanisatie	Agricultural machinery	Neerkant	10-20	Netherlands

Source: Brabant Register of Establishments/Fanion Onderzoek & Advies

2. Specialised logistics services providers to the AgriFood industry

Adding to Brabant's overall strengths in AgriFood is its abundance of specialised logistics providers with dedicated systems and materials for both agricultural and food products – no less than 75 specialist dedicated AgriFood logistics companies have significant operations in Brabant, with warehouses, transportation facilities and equipment specifically designed for AgriFood that cools, refrigerates, controls temperatures and monitors conditions. A selection of these companies is listed in the table below.

Company	City	Country of origin
Rhenus Logistics	Tilburg, Eindhoven, Son, Etten-Leur, Best	Germany
XPO logistics	Eindhoven, Tilburg, Oosterhout, Oss, Eersel	USA
DB Schenker	Tilburg, Breda	Germany
Panalpina World Transport	Tilburg, Eindhoven, Waalwijk	Switzerland
Vos Logistics	Oss	Netherlands
Lineage Logistics	Bergen op Zoom, Waalwijk	United States
ID Logistics Benelux	Tilburg	France
Van Rooijen Logistiek	Eindhoven	Netherlands
Van den Bosch Transporten	Erp	Netherlands
Farm Trans	Zevenbergen	Netherlands
E. van Wijk Logistics	Giessen	Netherlands
Koel- en Vriestransport Voesenek	Breda	Netherlands
Zandbergen's Transport Tilburg	Tilburg	Netherlands
I.T.C. Holland Transport	Oss	Netherlands
Darvi Transport	Bergen op Zoom	Netherlands
Den Ouden Pluimveeservice	Oirschot	Netherlands
Nabuurs Transport	Haps	Netherlands
Distrifresh	Boxtel	Netherlands
Maasoever Cold Store	Waspik	Netherlands
Transportbedrijf A. Willems en Zonen	Rijkevoort	Netherlands
Blokland Cold Stores	Cuijk	Netherlands

Continued on next page >

Company	City	Country of origin
Eikelenboom European Food Transport	Bergen op Zoom	Netherlands
Abrex Horeca Logistics	‘s-Hertogenbosch	Netherlands
P. van der Nat	Giessen	Netherlands
Hurkmans Transport en Handelsmaatschappij	Someren	Netherlands
Buchner Transport	Imkerk	Netherlands
Holland Crop	Ossendrecht	Netherlands
Coldservice Warehouse	Waalwijk, Veghel	Netherlands
Driessen United Blenders	Deurne	Netherlands
Beekmans Transport	Erp	Netherlands
Cool Runnings Transport	Tilburg	Netherlands
I&L Chauffeursdiensten	Berkel-Enschot	Netherlands
H&S Foodtrans	Oss	Netherlands
The Greenery	Breda	Netherlands
Giesko	Giessen	Netherlands
Bonda’s Veevoederbureau	‘s-Hertogenbosch	Netherlands
Mestdistributie Albers	Landhorst	Netherlands
De Hart Temperature Controlled Transport	Heesbeen	Netherlands
Van Dalen koel- en vriestransport	Nuenen	Netherlands
Frigolanda Benelux Transport	Dongen	Netherlands

I. The complete AgriFood value chain is both present and well-developed

Our overview in the previous sections of the AgriFood industry in Brabant makes one thing abundantly clear: the complete AgriFood value chain in all its aspects is present in the region and very well-developed. The same is also true for AgriFood support services, AgriFood knowledge institutions and universities and, of course the AgTech and FoodTech sectors. All in all, this is a very robust industry in all aspects of agriculture, horticulture, livestock breeding, food processing and the end food product. The following graphic provides a good illustration of this fact.

THE FULLY INTEGRATED AGRIFOOD VALUE CHAIN IN BRABANT - INCLUDING A SELECTION OF COMPANIES

- Cobb-Vantress
- Hazera
- Hendrix Genetics
- Rijk Zwaan
- Topigs Norsvin

- Advanced Berry Breeding

- Aviko
- Cosun Beet Company
- Driscoll's
- FrieslandCampina
- Genson Group
- Van Asten Group
- Van den Borne Aardappelen
- Van Loon Group

- Campus Almkerk
- PlantLab
- Signify

- AFB International
- Cargill
- Cosun Beet Company
- Darling Ingredients International
- IFF
- Trobas Gelatine
- Van Hessen Netherlands Meat Products
- vanRijsingengreen
- VION Food Group

- PeelPioneers
- The Protein Brewery

- Agrifirm
- Bavaria
- Dalco Food
- Danone Nutricia
- HAK
- Lamb Weston / Meijer
- MARS
- Nutreco
- Perfetti van Melle
- Schouten Europe
- Zwanenberg Food Group

- BOON Food Concepts
- Botanic Bites
- Carezzo Nutrition
- Fruitfunk
- Novish
- Protix
- The Vegetarian Butcher

- HANOS-ISPC
- JUMBO Omnichannel
- Oriental Merchant Europe
- Ploegmakers Food Ingredients (Ardo Group)
- Schuiema
- Sligro Food Group
- The Greenery
- Van Geloven

- BRESC
- Ferrero
- Haribo Benelux
- Hero Benelux
- Hutten Business Catering
- JUMBO Supermarkten
- La Place Food
- Lekkerland Nederland
- Mondelêz International
- Spar Holding

- JUMBO Supermarkten
- Landwinkel
- Philips Fruit Garden
- Sligro Food froup
- UDEA

- Covetrus

AGRICULTURE TECHNOLOGY (AGTECH) & FOOD PROCESSING TECHNOLOGY (FOODTECH): R&D, MANUFACTURING & IMPLEMENTATION

PlantLab – Signify – Pascal Processing – Bodec – Cerescon – GEA Food Solutions – AvL Motion – Marel Poultry – Contronics – VDL ETG – Growficient – VMEngineering/Nirás – Fri-Jado KSE Process Technology – Helia Biomonitoring – SAVAL – Skalar Analytical – Premier Tech Chronos – KIN Machinebouw – ENGIE Services – AAE, Advanced Automated Equipment Vencomatic Group - SodaStream International – VDL AgroTech

SUPPORT INDUSTRY & SERVICES: LOGISTICS, ANIMAL HEALTH, HR, FINANCE, IP, IT, CERTIFICATION, PACKAGING ETC.

Duni Group – VAA Data Works – YieldComputer – Normec Foodcare – MSD (Merck) Animal Health – Agrisim – Ardagh Glass – CANPACK Group – Farm Trans – Rhenus – XPO – Schenker Logistics Panalpina World – MOL Logistics – Scholle IPN – JDA Software Netherlands – SAP Netherlands – Roba Laboratorium – AB Mauri – Bilfinger Terbodin – Van Aaken Automatisering – Haval Disposables Nabuurs Transport

UNIVERSITIES & KNOWLEDGE INSTITUTES

WUR, Wageningen University & Research – HAS University of Applied Sciences in AgriFood (Den Bosch)
JADS, Jheronimus Academy of Data Science (Den Bosch, Eindhoven, Tilburg) - TU/e, Eindhoven University of Technology

Source: Engel – Een Heldere Blik helder@benengel.nl – +31 (0)652612671

- Start-up, scale-up or newly spun-off company
- AgriFood

4. UNIVERSITIES AND KNOWLEDGE INSTITUTIONS

A. General

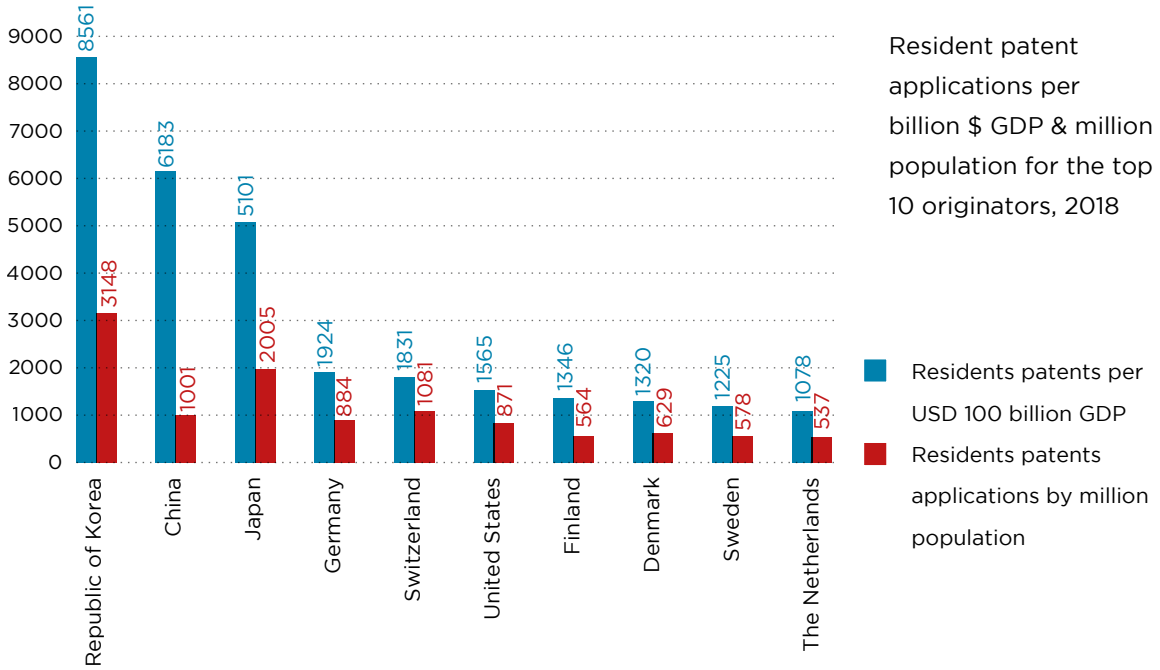
UNIVERSITIES AND PATENT APPLICATIONS

The Netherlands has a large number of high-quality universities and knowledge institutions, which is also why the country took fourth place in the Global Innovation Index 2019 of the World Intellectual Property Organization (WIPO) and is ranked tenth among countries with highest number of patent applications in proportion to GDP and population.

GLOBAL INNOVATION INDEX 2019

Ranking	Country	Global Competitiveness Index
1.	Switzerland	67.24
2.	Sweden	63.65
3.	United States	61.73
4.	**Netherlands**	**61.44**
5.	United Kingdom	61.30
6.	Finland	59.83
7.	Denmark	58.44
8.	Singapore	58.37
9.	Germany	58.19
10.	Israel	57.43

NETHERLANDS IN THE GLOBAL TOP 10 FOR PATENT APPLICATIONS



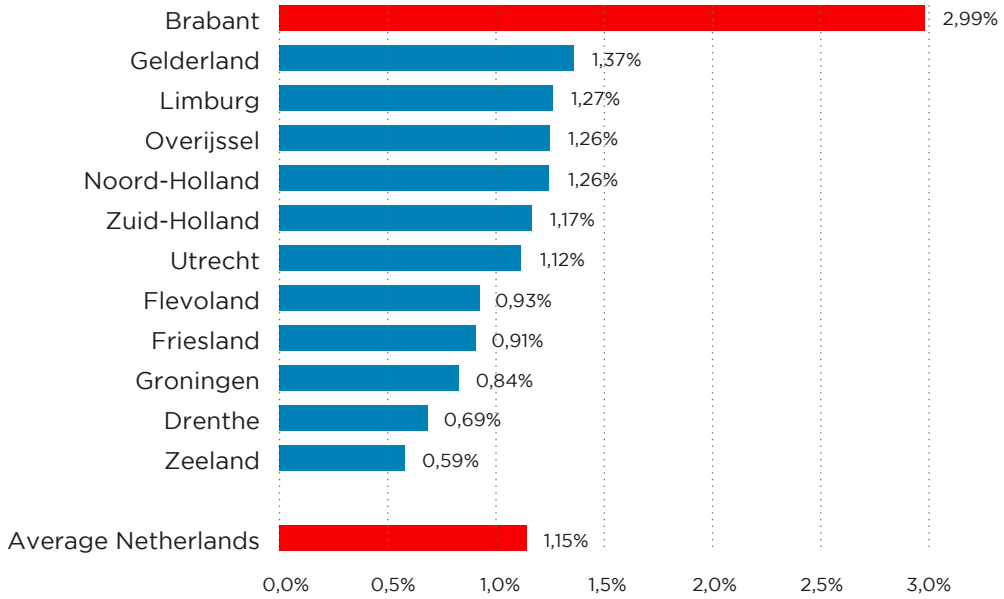
Resident patent applications per billion $ GDP & million population for the top 10 originators, 2018

Source: WIPO (World Intellectual Property Organization) 2019 , World Intellectual Property Indicators 2019

HIGH R&D LEVELS IN BRABANT

Brabant has the most R&D activity of all provinces in the Netherlands. Total private sector R&D expenditure in proportion to regional gross domestic product is 2.99%, more than double the national average (1.15%).

PRIVATE R&D EXPENDITURE (PERCENTAGE OF GDP) IN 2017



Source: CBS (2019), adapted by Fanion Onderzoek & Advies

HIGH-SCORING R&D REGIONS IN EUROPE

Brabant is well-known for its activities and strong showing in industrial R&D. On the European stage, Brabant ranks fifth in the list of regions with the highest number of patent applications.

LEADING EUROPEAN REGIONS IN PATENT APPLICATIONS AT THE EUROPEAN PATENT OFFICE 2018

	Region	Country	2018	Growth
1	Bayern	Germany	8.238	8.8 %
2	Île-de-France	France	6.713	-4.4%
3	Nordrhein-Westfalen	Germany	5.125	3.9%
4	Baden Württemberg	Germany	5.082	2.2%
5	**North Brabant**	**The Netherlands**	**3.582**	**-0.8%**
6	Stockholm	Sweden	2.280	7.7%
7	Hessen	Germany	2.205	-0.5%
8	Greater London	Great Britain	1.943	11.9%
9	Niedersachsen	Germany	1.712	16.6%
10	Rhienland-Pfalz	Germany	1.598	0.9%
11	Vlaanderen	Belgium	1.482	7.2%
12	Hovedstaden	Denmark	1.465	9.8%
13	Lombardia	Italy	1.406	-1.5%
14	Auvergne-Rhône-Alpes	France	1.319	3.0%
15	Vaud	Switzerland	1.192	1.2%
16	Helsinki-Uusimaa	Finland	1.188	-11.4%
17	South Holland	The Netherlands	1.066	3.2%
18	Austria West	Austria	1.023	4.4%
19	Zürich	Switzerland	1.014	7.3%
20	Basel-Stadt	Switzerland	980	3.7%

Source: European Patent Office in Link Magazine (March 2019)

B. AgriFood universities in the Netherlands

1. WAGENINGEN UNIVERSITY & RESEARCH (WUR)

Wageningen University & Research is a partnership between Wageningen University and the Wageningen Research Foundation.

The university's mission statement is: *'To explore the potential of nature to improve the quality of life'*. It has a staff of 6,500 people and its 12,000-strong student body comes from more than a hundred countries around the world, all focusing on a healthy diet and environment.

The university offers six bachelor's, thirty master's and three online master's degree programmes. These programmes focus on the current and future global issues that are of increasing importance to industry and government alike.

The scientific and educational syllabus of WUR consists of three related core areas:

1. Food and food production
2. Living environment
3. Health, lifestyle and livelihood

RESEARCH AT WAGENINGEN UNIVERSITY & RESEARCH

WUR's main research programmes are:

I. CIRCULAR AND CLIMATE NEUTRAL

Through its Towards a circular and climate-positive society research programme, WUR is aiming to create new production systems for food and non-food products. Its vision is that such systems should not only be circular and climate-neutral but that they should also benefit the environment. WUR conducts research that contributes to circular and climate-positive production systems on land and in water. Until the year 2022, WUR will be working on the transition towards a circular and a climate-positive society through three interlinked topics:

a) Building blocks for governance: the development of instruments that facilitate the transition towards a circular and climate-positive society
b) New primary production systems for food, feed and biomass
c) Commercialising biomass: the biobased economy will exclude fossil fuel-based products. Alternatives have to be discovered

WAGENINGEN
UNIVERSITY & RESEARCH

II. FOOD SECURITY AND THE VALUE OF WATER

Through its Food security and valuing water research programme, WUR aims to develop new paths towards creating a sustainable food system. The main challenges in trying to achieve this goal are to address the depletion of freshwater resources, climate change, land management, soil degradation, declining biodiversity, migration and the rise of agricultural production – it is not just the amount of food being produced that is important; availability and affordability are also crucial.

The Food security and valuing water programme focuses on research and development and assessing new concepts that shape the transition towards sustainable food security and that can be used in middle- and low-income regions across the globe.

III. SAFE AND HEALTHY FOOD SYSTEMS

Given the need for increased circularity and sustainability of our food system, the focus of this programme is on the impact of changes to food production and consumption on health and safety. This aspect is complementary to the other programmes, which focus on circularity, food security and other sustainability-related issues. The scope of this programme is based on a food systems-approach for Western consumers, focusing on the production and consumption of individual food products in the context of the whole food system, diet and society.

The goal is to develop the knowledge required to improve the health benefits and safety of our food system, using different perspectives and taking into account its complexity and related sustainability issues. WUR aims to develop knowledge for innovative interventions that contribute to healthy and safe food and place them in the context of a sustainable food system.

IV. NATURE-INCLUSIVE TRANSITIONS

In the Biodiversity in a nature-inclusive society (Nature-inclusive transitions) research programme, WUR reflects on and responds to the key issues and challenges in relation to the decrease in biodiversity that we are witnessing. Over 30 research projects are presently being funded by the programme, led by researchers specialising in diverse fields including ecology, agriculture, social sciences and economics. They fall within three thematic areas:

a) Exploring ecosystem-functioning on different scale levels: for example, the insect fauna of different forms of agriculture is sampled in order to calculate the value of different cultural practices for nature conservation
b) Developing and testing innovative techniques and methodologies for biodiversity measurement and monitoring, including the use of eDNA to establish the presence of species that may otherwise be hard to detect or in habitats that are difficult to sample. Elsewhere, monitoring by drones and remote sensors is linked to the use of machine deep learning so that species can be identified and habitats classified using artificial intelligence
c) Investigating the triggers that lead stakeholders to engage in processes of transition and to change their behaviours when it comes to the transition to a nature-inclusive society

V. DATA-DRIVEN AND HIGH TECH

The future is digital. The digitisation of society as a whole, including the food producing system (farm to fork) and the natural environment, implies a strong role for and impact from data-driven and high tech innovations using new technologies, sensors, robotics and artificial intelligence. WUR strives to play an important role in enabling the digital transformation in AgriFood and Life Sciences. Key challenges in the near future are further developing artificial intelligence and big data analytics to be applied in AgriFood and Life Sciences innovations. WUR will establish shared and FAIRified data infrastructures that can operate across scientific disciplines and industry and investigate human-robot-environment interaction. Such achievements drive technical developments in many areas, such as precision farming, on-site food safety monitoring and tailor-made food advice based on individual human and animal health and welfare needs. They allow the efficient management of complex, dynamic and responsive food production and contribute to sustainable food supply chains and conscious stakeholders – including consumers – and allow us to anticipate climate, nature and environmental changes.

THE RESEARCH INSTITUTES

Wageningen University & Research derives its global reputation from the close relationship between the university and its renowned research institutes. In 2016 Wageningen University and its research institutes branded themselves collectively as 'Wageningen University & Research'. The research institutes (which you may know under their former names) have consequently been renamed as follows:

LEI	» Wageningen Economic Research
Alterra	» Wageningen Environmental Research
Central Veterinary Institute	» Wageningen Bio-veterinary Research
Livestock Research	» Wageningen Livestock Research
Food and Biobased Research	» Wageningen Food & Biobased Research
PPO and PRI	» Wageningen Plant Research
IMARES	» Wageningen Marine Research
Wageningen Academy	» Wageningen Academy
Centre for Development Innovation	» Wageningen Centre for Development Innovation
Rikilt	» Wageningen Food Safety Research

THE GLOBAL REPUTATION OF WAGENINGEN UNIVERSITY & RESEARCH

The scientific quality of Wageningen UR is evident from the prominent position the university occupies in international rankings and citation indexes. In March 2020, Wageningen University & Research was pronounced the world's best agricultural university for a fourth consecutive year in the QS World University Ranking list. WUR outranks the US university UC Davis and the Swedish University of Agricultural Sciences. In the field of environmental studies (8th place) and development studies (14th place), WUR is in the upper echelons.

According to the 2018 ShanghaiRanking's Global Ranking of Academic Subjects, Wageningen University & Research (WUR) leads the pack globally in the fields of agricultural science and food technology. Wageningen also scored well in the categories ecology (5th place) and veterinary sciences (8th place).

LOCATION OF WAGENINGEN UNIVERSITY & RESEARCH

Wageningen UR is located in Brabant's neighbouring province, Gelderland, but is just 40 km from the north-eastern part of Brabant. The driving time to WUR from anywhere in Brabant is 30 to 60 minutes at most. WUR is responsible for several internationally-known spin-offs, some of which are actually located in Brabant (particularly those involved in animal breeding).

www.wur.nl

2. HAS UNIVERSITY OF APPLIED SCIENCES IN AGRIFOOD AND THE ENVIRONMENT, DEN BOSCH

HAS University of Applied Sciences is the best educational and expertise centre in the southern Netherlands when it comes to the AgriFood and environmental industries, with its main campus in Den Bosch and a secondary campus in Venlo in the province of Limburg. The university has over 450 staff members, 3,000 students and 300 participants in professional courses.

HAS sets itself apart in the AgriFood educational sector by focusing on working together with farmers and the food industry to effectively implement new knowledge and technologies in AgriFood businesses. HAS is truly an enterprising, outward-focused university with a comprehensive educational programme in agribusiness, food and the environment. As a result, 70% of HAS graduates are employed within two months of graduating.

HAS is an independent university that works actively with both local and international businesses. The HAS educational concept is an entrepreneurial way of studying, involving substantial cross-fertilisation with day-to-day business practice in agriculture and/or the food industry. These ties provide real-life experience for HAS students and lecturers as well as strong support for businesses in terms of innovation, development and life-long learning.

EDUCATION

HAS offers the following 15 bachelor programmes in AgriFood subjects and the environment:

1. Business management in agriculture and food
2. Business administration and AgriFood business
3. Business administration and agribusiness
4. Business administration and food business
5. International food and agribusiness
6. Horticulture and business management
7. Animal husbandry
8. Applied biology
9. Environmental innovation
10. Food innovation
11. Food technology
12. Geomedia and design
13. Healthy living
14. Horticulture and arable farming
15. Spatial and environmental planning

EXPERTISE AND RESEARCH CENTRES

Expertise and research centres (ERCs) are knowledge groups within higher education institutions that establish connections between education, professional practice and applied research in areas of social relevance. In most cases, an ERC consists of a 'knowledge circle', a group of lecturers and lecturer-researchers led by a professor.

HAS currently has 15 expertise and research centres, and its Sustainable Protein Sources, Precision Livestock Farming and Protein Transition in Food ERCs are all active in fields of great current relevance.

1. Design Methods in Food
2. Future Food Systems
3. Food and Health
4. Green Health
5. Healthy Farming
6. Innovative Bio-Monitoring
7. Innovative Entrepreneurship in Rural Areas
8. Location Intelligence
9. New Business Models for Agriculture and Food Transition
10. New Cultivation Systems
11. Plant-Soil Health
12. Sustainable Protein Sources
13. Precision Livestock Farming
14. Protein Transition in Food
15. Sustainable Production

www.hasuniversity.nl

HAS KNOWLEDGE TRANSFER

Over and above its education mission, HAS University of Applied Sciences is also committed to a two-way 'knowledge transfer' network with local companies. HAS' knowledge transfer is consequently another important source of interns for local companies, thanks to their understanding of innovation in AgriFood production and processing. HAS has initiated a number of programmes to support companies in themes such as food, green areas, agribusiness, animal and the environment.

www.has.nl/en/has-collaborates/collaboration-opportunities

3. EINDHOVEN UNIVERSITY OF TECHNOLOGY (TU/E)

The crucial facts and figures for the TU/e are:

- 12,000 students
- 5,000 knowledge workers
- 90 nationalities
- 14 unique laboratories

SPIRIT OF COLLABORATION

Eindhoven University of Technology is a young university, founded in 1956 by industry, local government and academia. Today, that spirit of collaboration is still at the heart of the university community. The university fosters an open culture where everyone feels free to exchange ideas and take initiatives.

Eindhoven University of Technology provides academic education that is driven by both fundamental and applied research. Its educational philosophy is based on personal attention and room for individual ambitions and talents. TU/e's research meets the highest international standards of quality and the work produced pushes the boundaries of science. This puts TU/e at the forefront of various rapidly emerging areas of research.

Eindhoven University of Technology combines scientific curiosity with a hands-on approach. Fundamental knowledge enables the institution to design solutions for the highly complex problems of today and tomorrow. Its motto is: 'We understand things by making them and we make things by understanding them'.

The TU/e Campus is in the centre of one of the most powerful technology hubs in the world, Brainport Eindhoven. Globally, the university stands out when it comes to collaborating with advanced industries, as it has done with Royal Philips since its inception. Together with other institutions, TU/e forms a thriving ecosystem with one common aim – to improve quality of life through sustainable innovations.

TU/E HAS 10 RESEARCH DEPARTMENTS

I. Biomedical Engineering
II. Built Environment
III. Electrical Engineering
IV. Industrial Design
V. Industrial Engineering and Innovation Sciences
VI. Chemical Engineering and Chemistry
VII. Applied Physics
VIII. Mechanical Engineering
IX. Mathematics and Computer Science
X. Eindhoven School of Education

TU/E HAS 10 STRATEGIC RESEARCH AREAS

1. Artificial Intelligence
2. Smart Mobility
3. Energy
4. Engineering Health
5. Integrated Photonics
6. High Tech Systems
7. Complex Molecular Systems
8. Data Science
9. Humans and Technology
10. Smart Cities

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

AGRIFOODTECH@TU/E

TU/e has one focal point that is being nurtured together with other universities, research institutes and industrial partners: developing the interdisciplinary and data-intensive field of AgriFoodTech (this means encouraging crossovers between AgriFood and engineering, including data, materials, robotics, sensors, logistics and business models).

AgriFoodTech@TU/e works closely with Wageningen University & Research (WUR) and other universities/knowledge institutions such as the HAS University of Applied Sciences (Den Bosch), the University of Utrecht (Future Foods programme) and JADS (the Jheronimus Academy of Data Science in Den Bosch).

A longer-term goal of the initiative is to build an effective ecosystem of companies, organisations and knowledge institutions for rapidly integrating innovation and deep fundamental research. AgriFoodTech@TU/e focuses on three key themes:

1. Smart Farming: e.g. precision farming for crops and animals, breeding, urban and vertical farming
2. Smart Foods: e.g. food processing and personalised foods
3. Education

Translating the three themes into a coherent and sustainable programme and attracting structured funding is an important objective. Key phrases and challenges of AgriFoodTech include:

- to go beyond existing approaches to feed nine billion people sustainably by 2050
- to combine different types of people in cross-functional teams
- to deal with the effects of climate change and related water and energy issues
- the digitisation of society (IoT, big data, algorithms)
- food practice (making the right choices, lifestyle monitoring), health and wellbeing

STRONG PARTNERSHIP BETWEEN WAGENINGEN UNIVERSITY & RESEARCH (WUR) AND EINDHOVEN UNIVERSITY OF TECHNOLOGY (TU/E)

Wageningen's strategic plan means that it is seeking out further partners, and Eindhoven University of Technology is firmly in its sights. Researchers from WUR and TU/e are already working together on precision agriculture, printed food and plasma technology... with much more to come.

AgriFood meets *High Tech*, over and over again, and increasingly so. Three years ago, WUR joined the cooperative federation of the technical universities of Delft, Eindhoven and Twente, with the 3TU now called 4TU. WUR's favoured partner in this 4TU is Eindhoven. TU/e, which focuses its high tech research on health, energy and mobility, now sees opportunities in the world of AgriFood.

And partnership is growing at a rapid rate, as can be seen by the following joint projects:

PRODUCING FOOD SUSTAINABLY

WUR and TU/e are helping to make food production more sustainable in the province of Brabant:

- This aim is put into action by, for example, researching better use that can be made of vegetable residual flows. Using new extraction and drying techniques, carrot scraps are processed into high-quality juices, fibres and pectin – big business in Brabant, where almost half of all Dutch carrots are grown.
- The researchers are also developing new sensing, vision and data processing and communication tools for measuring the welfare of pigs. In this, the Smart Pig Value Chain project, they also investigate innovative barn concepts, breeding programmes and adapting feed products to improve the health of the animals. The intention is that antibiotic use is decreased and mate quality improves. Once again, there are significant business interests involved, given that Brabant is home to over a thousand pig farms and over half the pig population of the Netherlands.
- A third project focuses on precision farming in potato growing, which will lead to the more efficient use of water, nutrients and pesticides. Wageningen and Eindhoven share expertise in the field of model development, data interpretation and the design and development of smart machines.

PURIFYING LIGHTNING

Plasma is ionised gas in an electric field, such as lightning or a fluorescent tube. TU/e Professor Guus Pemen creates plasmas for medical and environmental applications, such as filtering unclean air through a device that generates a kind of mini-lightning to create clean air. Agriculture can also benefit from this technique, the professor believes, and he is now conducting a pilot project to capture and remove ammonia, particulate matter and bacteria in pig farms using plasma technology. He is also conducting a test with Masja Nierop Groot of Wageningen Food and Biobased Research to reduce the rotting of stored apples by capturing the rotting gas, ethylene, using plasma. In both cases the technique works, but it is still far too expensive.

PRINTED FOOD

For the past year, WUR has teamed up with TU/e and TNO on the Digital Food Processing Initiative. ‘Eindhoven excels at printer technology, Wageningen excels at food and TNO excels at development processes,’ says project coordinator Katja Pahnke of the Eindhoven University of Technology. ‘Together we are working on research proposals on printed food. A PhD student is already working on the structure of printed food.’ For example, you could have carrots in the form of a smoothie, for the elderly who struggle to chew and swallow, says Pahnke, but you could also print an attractive insect-based burger or personalised food for allergy-sufferers.

A MINI SPECTROMETER

Plants absorb light from a particular wavelength, and spectrometers use that data to measure things such as leaf growth or to or determine whether strawberries have reached their sweet stage. To date, these spectrometers have been relatively large and expensive devices. Eindhoven Professor of Photonics, Andrea Fiore, is aiming to create a cheap and small chip that can do exactly the same job and that can be inserted in a device such as a smartphone. Fiore has devised a way to measure light using a micro-spectrometer has worked out which filters to use to convert the different wavelengths into data, but he does not yet know exactly which wavelengths provide what plant information and how sensitive the filters must be. This was the underlying reason for seeking out a partnership with the Wageningen Imaging Spectroscopy Hub (WISH), and although the partnership is still in its infancy, Fiore is already conducting fundamental research and fieldwork in greenhouses together with WUR.

APPLE-PICKING ROBOT

Eindhoven, Wageningen and a number of other universities are part of the NWO Flexcraft programme, which entails scientists creating new robots. The research leader is Eldert van Henten, professor of Agricultural Business Technology at WUR, and Flexcraft is dedicated to spending up to four million euros on robots that can, for example, pick ripe apples and tomatoes and pack chicken fillets in slaughterhouses.

SMART ORGANIC FARMING

Together with the universities of Utrecht and Delft, WUR and TU Eindhoven have submitted their Synergia programme proposal to NOW, a programme that envisages using high tech to create efficient ecological agriculture. In concrete terms, they hope to create robot systems for mixed crops and strip cultivation, as well as many other applications. ‘We are the world champions in robot football at TU,’ says Professor Jakob de Vlieg. ‘To get the robots to work together, we use a range of sensing techniques and artificial intelligence. We hope to use this knowledge in arable farming for, for example, targeted weeding and making mixed crops economically viable.’

CHECKING UP ON TURKEYS

Peter de With, a computer vision expert at Eindhoven University of Technology, is to conduct research with Wageningen animal scientist Piter Bijma. Together with the Boxmeer-based company Hendrix Genetics, they will monitor the individual behaviour of turkeys in industrial coops using cameras. They will have to be able to tell hundreds of individual animals apart. De With has developed healthcare detection methods for recognising tumours and is now looking into the possibilities of using the technology for breeding purposes.

4. JHERONIMUS ACADEMY OF DATA SCIENCE (JADS) IN DEN BOSCH, TILBURG AND EINDHOVEN

The Jheronimus Academy of Data Science (JADS) is a unique concept in the Netherlands, which allows graduates to study, research and apply data science at three different Data Science Centres (TU Eindhoven, Tilburg University and Mariënburg Campus, Den Bosch) as part of the PDEng programme and to incorporate what they learn into existing ecosystems. The mission of JADS is to understand and further the value of data for solving complex societal and business challenges, with the academy serving as a linchpin between industry and the applied data science research conducted throughout JADS. The AgriFood industry is a Priority Industry to JADS, given that linking AgriFood to high tech by means of data communication, big data processing and artificial intelligence (AI) is one of society's challenges when it comes to sustainably feeding the world's growing population.

The Data Science and Entrepreneurship Graduate School turns out entrepreneurial and innovative data scientists who are just as good at performing cutting-edge scientific research as they are at applying it to the most pressing societal and business challenges. These graduates learn to operate in a collaborative ecosystem, fostering a stream of new scalable (or exponential) business models in Brabant and beyond.

The current JADS student body numbers 1,500-2,000 scattered across a range of programmes and three research centres.

APPLIED RESEARCH LABS

In the applied labs research focuses on how data science can be used in specific industries, creating specialist knowledge that can be applied directly, is in-depth and relevant.

- **DATA & AGRIFOOD**
  Fourth paradigm research and innovative crossovers between AgriFood, data and engineering in all its forms will be essential for feeding the world by 2050 while simultaneously reducing the environmental footprint of current food production systems. Solutions will only be created by working together.
- **DATA & HEALTH**
  Data & Health aims to bridge the gap between technical possibilities and practical ambitions. Exploring innovative methods for disease prevention, detection, treatment and follow-up. Advancing and accelerating learning capabilities within the full healthcare ecosystem.
- **DATA & CITIES**
  Data & Cities focuses on providing a novel perspective on the complexity of cities (and urban areas) by developing new data-based envisioning methods for *cities4people*.
- **DATA & SMART INDUSTRY**
  Data & Smart Industry uses data science to deal with the complex dynamics of production systems. Detailed real-time information allows the right product to be delivered to the right customer at the right time and at a minimal cost. Data science helps to improve the daily planning and monitoring of operations, is the basis for optimising production systems, and enables new concepts in the design of products and services.
- **DATA & SMART MOBILITY**
  Data & Smart Mobility aims to improve and perfect the way data is used from two perspectives – smarter connected vehicles and improved services surrounding mobility (such as *Maas*). The success and sustainability of these developments is greatly dependent on the quantity and quality of the underlying data.

FUNDAMENTAL LABS

The fundamental labs focus primarily on establishing and advancing the scientific side of data science:

- Computational Personalisation
- Dynamic Organisational Networks
- Jheronimus Academy Data Engineering (JADE) Lab
- Recommender Lab
- Digital Business Models & Ecosystems
- Ambitious Digital Entrepreneurship

JADS AND THE AGRIFOOD INDUSTRY: DATA-DRIVEN FOOD VALUE CHAIN MANAGEMENT

This JADS course connects the challenges faced in the AgriFood industry to the potentials offered by data science. Guest speakers from the TU/e and HAS University of Applied Sciences provide insight into the data-driven food chain: from precision agriculture to control engineering and marketing.

Students also receive lectures in the fields of AI (artificial intelligence), control systems, statistics and experimental design, sensing, data fusion and analytics and software engineering. They then use that knowledge to work on a current case, with the following options available: the business model of strip farming (multi-cropping), the smart pig value chain or the use of data in tomato farming.

The course provides students with a better understanding of the AgriFood industry and the available opportunities for creating value using technology and data science. They are required to review both existing and new business models and to seek out and exploit the opportunities on offer in an era of digitisation and sensing technology. From a teaching perspective it is a tough challenge to bring together these large and complex areas (Agriculture & Food and Data Science/AI), all of which are evolving globally at lightning pace. It is a major undertaking to get students to grasp the relationships and opportunities within such a short period of time. The course coordinators are Dr Rogier Brussee and Prof. Jakob de Vlieg.

THE JADS SME DATA LAB

The JADS SME Datalab helps companies create value through data by conducting short-term projects with professional and student data scientists. The students receive professional guidance from experienced professionals and scientists. Wherever a student hits a stumbling block, the JADS lab will always ensures that the project reaches completion.

The lab works together with its clients to define a data project with a concrete outcome. Preference is given to projects that deliver immediate savings or increased profits. Sometimes the client's aims extend beyond a single project, in which case we examine how a series of projects might produce the intended outcome.

A student spends about 60 to 80 hours on a project over six to ten weeks (depending on examination periods and other obligations). The JADS SME Data Lab charges a fixed price of 2,750 euros per project, part of which goes to the student involved in the form of remuneration.

'THE SMART PIG-FARMING VALUE CHAIN', AN ASSIGNMENT

Gé Backus is the person behind the 'smart pig value chain' assignment, part of the JADS Data-driven Food Value Chain Management course. He heads the company Connecting Agri & Food. He instructed the data science students to develop a tool that allows pig farmers to determine the impact of the climate conditions in a pig-shed on the health of their animals and help them to take measures to improve the conditions in the pig-shed. He supplied datasets from 20 pig farms collected over a period of several months.

The datasets dealt with information on the indoor climate (temperature, humidity and CO2 levels), outdoor climate (temperature and humidity near the pig-shed) and slaughter quality (including abnormalities in organs indicating diseases). 'The challenge in this assignment was twofold: first of all, students had to extract relevant information from the data,' says Backus, 'and next they had to translate that information into an action – which management-based decision should be taken at what time?'

Backus has been active in the field of AgriFood technology for many years, having spent 31 years at Wageningen UR before launching his own company. 'After years of writing advisory reports for others, I started wondering whether this was my life goal or if I wanted to get involved in the industry myself.'

He chose the latter, and today Backus creates IT tools for livestock farming through his company, Connecting Agri & Food. 'We create dashboards based on real-time measurements, which are easy to use for livestock farmers. User-friendliness is very important for this target group, made up of people who are not inclined to stare at a screen all day.'

Contributions to the curriculum

He came into contact with Jakob de Vlieg of JADS through a matchmaking session hosted by the Province of Brabant and they clicked immediately. 'I thought it would be great to contribute to the master's degree curriculum and I also saw it as an opportunity to familiarise data science students with the challenges faced in the AgriFood industry.' The secret to his success was good preparation. 'There was a lot of energy in the group, and no less than six teams chose to work on my assignment. '

A fresh perspective

Backus was very curious to see what the students' results were. 'They are young people with a fresh perspective, I was curious if they would identify issues that I had missed.' And he was not disappointed. 'Each team adopted a different approach: one had conducted a thorough data analysis, another had developed a live demo, and yet another created a dashboard with suggested actions based on measured values. One team had even dived into the literature to determine the exposure time at which the ammonia concentrations posed a risk.'

We're just getting started...

The experience proved to be a learning partnership, and that was just as true for Backus. 'We're just getting started collecting the data and the results are already very promising. I am convinced that this approach will add value to the pig farmers' business.' And are the results usable? 'As we collect more data, we can better estimate whether the students' findings and tools are scalable and suitable for automation purposes.'

5. AVANS UNIVERSITY OF APPLIED SCIENCES

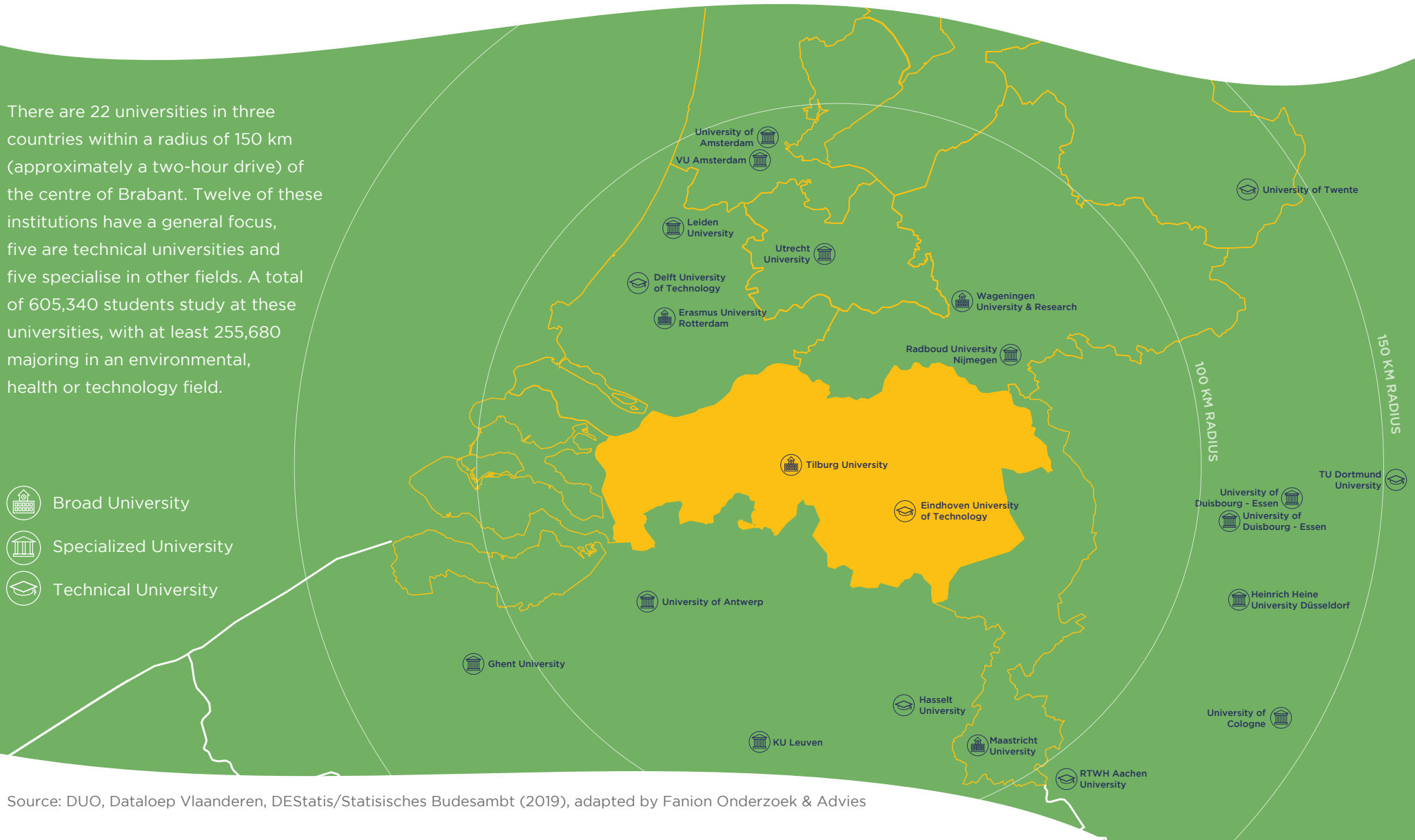
Avans University of Applied Sciences has approx. 60 Higher Vocational Education programs. 33,000 students. And 3,000 employees. Avans is located in Breda, s-Hertogenbosch, Roosendaal and Tilburg. Avans is divided into Faculties. The Faculty for technology of Health and Environment offers bachelor programmes in the field of AgriFood and Environmental subjects. Many of their students do an internship or work in the agri-food industry after they graduate. Their education is hands-on and the students work on projects within their field of expertise. This allows Avans to work with many companies in the region.

Avans offers the following bachelor programmes in AgriFood and environmental subjects:

Programme	Number of students
Biology and Medical Laboratory Research	683
Chemistry	675
Chemical Technology	187
Environmental Science for Sustainable Energy and Technology (ESSET)	240

C. Universities offering relevant courses within a 150 kilometres radius

There are 22 universities in three countries within a radius of 150 km (approximately a two-hour drive) of the centre of Brabant. Twelve of these institutions have a general focus, five are technical universities and five specialise in other fields. A total of 605,340 students study at these universities, with at least 255,680 majoring in an environmental, health or technology field.



Source: DUO, Dataloep Vlaanderen, DEStatis/Statisisches Budesambt (2019), adapted by Fanion Onderzoek & Advies

UNIVERSITIES WITHIN A TWO-HOUR DRIVE OF BRABANT

The Netherlands City	University	Distance	Type of university	Number of students	Students in Environmental, Health and Technology studies
Tilburg	Tilburg University	0	Specialist university	15,730	460
Eindhoven	Eindhoven University of Technology	0	University of technology	11,970	11,900
Nijmegen	Radboud University Nijmegen	80 km	General university	21,680	7,090
Utrecht	Utrecht University	90 km	General university	31,800	13,580
Rotterdam	Erasmus University Rotterdam	90 km	Specialist university	26,960	3,830
Delft	Delft University of Technology	110 km	University of technology	24,510	23,900
Wageningen	Wageningen University & Research	110 km	Specialist university	11,940	11,840
Maastricht	Maastricht University	110 km	Specialist university	17,190	5,590
Leiden	Leiden University	130 km	General university	29,050	6,390
Amsterdam	VU Amsterdam	130 km	General university	24,570	10,060
Amsterdam	University of Amsterdam	130 km	General university	34,070	8,960
Enschede	University of Twente	180 km	University of applied sciences	10,670	7,650
			Total Netherlands	**260,140**	**111,250**

Belgium City	University	Distance	Type of university	Number of students	Students in Environmental, Health and Technology studies
Hasselt	Hasselt University	70 km	Specialist university	5,700	3,330
Antwerp	University of Antwerp	90 km	General university	20,220	9,310
Leuven	KU Leuven	110 km	General university	56,490	29,110
Ghent	Ghent University	150 km	General university	51,450	23,360
			Total Belgium	**133,860**	**65,110**

Source: DUO, Dataloep Vlaanderen, DEStatis/Statistisches Bundesambt (2019), adapted by Fanion Onderzoek & Advies

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UNIVERSITIES WITHIN A TWO-HOUR DRIVE OF BRABANT

Germany City	University	Distance	Type of university	Number of students	Students in Environmental, Health and Technology studies
Duisburg	University of Duisburg - Essen	130 km	General university	15,870	.
Dortmund	TU Dortmund University	130 km	University of applied sciences	33,810	33,810
Aachen	RTWH Aachen University	130 km	University of applied sciences	45,510	45,510
Essen	University Duisburg - Essen	140 km	General university	26,600	.
Düsseldorf	Heinrich Heine University Düsseldorf	140 km	General university	35,560	.
Cologne	University of Cologne	170 km	General university	53,000	.
			Total Germany	**210,350**	**79,320**
The Netherlands / Belgium / Germany				**Total number of students**	**604,340 255,680**

Source: DUO, Dataloep Vlaanderen, DEStatis/Statistisches Bundesambt (2019), adapted by Fanion Onderzoek & Advies

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5. TALENT AND EDUCATION, INCLUDING THE LABOUR MARKET

General characteristics of the Brabant labour market

Brabant's workforce has proven to adapt easily to the cultures of foreign companies and multilingualism is the norm. Over 94% of the labour force has conversational knowledge of a second language, with English (90%), German (71%) and French (29%) being the most common. At least three-quarters of the population speaks two languages aside from Dutch and a third are competent in four languages. Two world-class universities (one offering technical studies, the other economics and law) and numerous universities of applied sciences guarantee a steady influx of new talent into the province.

LABOUR FORCE BY GENDER AND AGE

Gender	Breda region	Tilburg region	Den Bosch region	Eindhoven region	Brabant	Participation rate
Male	180,000	139,000	191,000	226,000	736,000	76.0%
Female	157,000	119,000	164,000	187,000	628,000	66.3%
Total	**337,000**	**258,000**	**355,000**	**413,000**	**1,364,000**	**71.2%**

Age	Breda region	Tilburg region	Den Bosch region	Eindhoven region	Brabant	Participation rate
15-24 yr	54,000	45,000	57,000	65,000	221,000	72.1%
25 - 44 yr	130,000	102,000	135,000	167,000	534,000	89.0%
45 -74 yr	153,000	111,000	163,000	181,000	609,000	60.4%

LABOUR FORCE, 2018

Brabant 1,364,000 people (14.9% of total)

The Netherlands 9,125,000 people (100%)

Source: Statistics Netherlands, 2019

NUMBER OF STUDENTS ATTENDING SECONDARY AND HIGHER EDUCATIONAL INSTITUTIONS IN BRABANT (2018/2019)

	Secondary education (Prevocational or general secondary education)	Medium vocational education (Vocational secondary education)	Higher Professional education (University of technology)*	University BSc, MSc
Breda region	36,980	15,690	See Brabant total	70
Tilburg region	24,820	17,640	See Brabant total	15,730
Den Bosch region	36,950	22,880	See Brabant total	x
Eindhoven/Helmond region	43,420	22,280	See Brabant total	11,970
Brabant	**142,170**	**78,490**	**86,910**	**27,770**

** Data for universities of technology unavailable at sub-regional level due to mergers between these institutions. Data only available at provincial level. Universities of technology have institutions in all four sub-regions.*

QUALITY OF EDUCATION AND TRAINING SYSTEM

Unlike many other countries, the Netherlands offers multiple forms of secondary education, giving children the opportunity to choose their path based on their talents and interests. The Netherlands has an excellent system of lower, secondary, higher and professional education. The World Economic Forum's Global Competitiveness Report ranks the Netherlands third in the world, as evaluated by business leaders, based on the quality of education and training systems.

GRADUATE SKILLS LEVELS

RANKING		SKILLS OF GRADUATES
1.	Switzerland	81.4
2.	Finland	77.0
3.	**The Netherlands**	**74.4**
8.	Singapore	73.4
3.	United States of America	71.2
6.	Luxembourg	71.1
7.	Denmark	71.0
8.	Quatar	70.9
9.	Austria	70.8
10.	Iceland	70.1

Source: DUO, 2019, World Economic Forum, The Global Competitiveness Report 2019

The Brabant labour market for AgriFood

A. Current employment
B. Education: students and graduates
C. Unemployment: registered jobseekers

A. Current employment

In Brabant there are 81,160 people currently working in the AgriFood industry. The Den Bosch region is home to the largest AgriFood workforce, with 27,780 people, followed by the Eindhoven/Helmond region. Almost half of all people employed in AgriFood have a lower qualification, 31% are qualified to mid-level and 19% are tertiary-level graduates.

The differences in levels of education between the regions of Brabant are minimal – in the Eindhoven/Helmond region there are slightly more professional graduates while in the Breda region the workforce has nominally lower levels of education.

EMPLOYMENT ACCORDING TO LEVEL OF EDUCATION IN AGRIFOOD

Education level	Total	low	mid-level	high
Breda region	17,070	5,350	8,490	3,230
Tilburg region	12,400	3,850	6,140	2,420
Den Bosch region	27,780	8,630	13,770	5,380
Eindhoven/Helmond region	23,910	7,320	11,830	4,750
Brabant	**81,160**	**25,150**	**40,230**	**15,780**

Shares education levels	Total	low	mid-level	high
Breda region	100%	31.3%	49.7%	18.9%
Tilburg region	100%	31%	49.5%	19.5%
Den Bosch region	100%	31.1%	49.6%	19.4%
Eindhoven/Helmond region	100%	30.6%	49.5%	19.9%
Brabant	**100%**	**124%**	**198,30%**	**77,70%**

Source: Brabant Register of Establishments 2018, CBS 2018, adapted by Fanion Onderzoek & Advies

B. Education: students and graduates

BRABANT HAS A VERY STRONG EDUCATIONAL OFFER – AT ALL POSSIBLE LEVELS

Brabant is proud of its robust and complete offer of AgriFood education at all levels. From the secondary school, via vocational education & training to universities and universities of professional educational level, they are all present in or very close to the region, of high quality and strong.

STUDENTS AND GRADUATES IN BRABANT

Universities/Universities of applied sciences

Graduates form the largest group of new people entering the labor market. **Wageningen University & Research (WUR)** is the only academic university that is specialized in the education of AgriFood scientists. It offers 18 bachelor programmes and 30 master programmes in or related to AgriFood. Wageningen is located in the province of Gelderland and be reached from any location in Brabant in a 30 – 45 minutes' drive.

Over the past 5 years the number of students at WUR has been climbing from 8,905 in 2014 to 12,942 in 2018. With the growing number of students, the number of graduates is increasing as well. In 2013 there were 2,286 graduates in AgriFood related courses, in 2017 the number of graduates had increased to 3,121.

The number of students in AgriFood at the **HAS University of Applied Science** in AgriFood in Den Bosch has also steadily increased from 2,797 students in 2014 to 3,674 in 2018. As a result the number of graduates is growing accordingly: in 2013 476 students obtained their bachelor's degree, in 2017 there were 603 graduates.

Eindhoven University of Technology (TU/e) had a total number of 11,985 students in 2019 and awarded 2,951 degrees in total that year: 1,240 BSc's ; 1,318 MSc's; 129 PDEng's and 264 PhD's.

Medium vocational level

At the medium vocational level approximately 3,380 students graduated in 2018 from a specific AgriFood related study. Most of them, 1,910, graduated in the Den Bosch region. Education centres that offer AgriFood vocational studies at secondary and higher level are widespread, both in The Netherlands as a whole and in Brabant. In Brabant a number of large institutes offer AgriFood vocational training: AOC West-Brabant, ROC West-Brabant in Etten-Leur, De Rooi Pannen in Tilburg, Helicon and ROC Koning Willem I College in Den Bosch, ROC de Leijgraaf in Veghel , Summa College in Eindhoven and Helicon and ROC Ter Aa in Helmond.

Secondary school

Moreover, 9,630 students follow a secondary school education preparing to continue studying for a job in AgriFood and / or Life Sciences. They have followed a programme that prepares them for further education in Nature & Health or Nature & Technology studies. These students mostly continue their education at a higher level at a university or university of applied sciences (UAS).

HELICON EDUCATION

One of the most eminent vocational schools in Brabant is Helicon Education. Helicon provides green education. As a Vocational Education and Training centre (VET) the schools offer a wide range of programmes and courses in Animal care, Agriculture, Environmental Science, Food, Flowers, Green living environment and Sustainability in urban life.

Helicon is based in the South of the Netherlands with 12 schools: 4 preparatory secondary schools (VMBO) and 8 schools for Vocational Education and Training (MBO - VET). Helicon currently employs 900 educational professionals educating 6,500 students and 500 participants to professional courses. The schools are mostly located in the middle and eastern part of Brabant.
Helicon uses a lot of didactic variation to provide students with an open perspective while exploring the world. Students are encouraged to work together; to discover their entrepreneurial skills and to reflect. In daily learning local and international business are involved. By working together with companies, students and teachers have real-life experiences.

Helicon prepares its students for the job market and / or continued studies. Either way Helicon teaches students to take responsibility in working on finding solutions for regional and global issues in the areas of nutrition, sustainability and quality of life. In addition to regular education Helicon also offers customized vocational training in the fields of agriculture, forestry and gardening. Finally, basic training for working conditions and safety is available.

STUDENTS AND GRADUATES AT WAGENINGEN UNIVERSITY, BY COURSES

	# Students					# Graduates				
	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017
Bachelor students	**4,423**	**4,667**	**5,178**	**5,225**	**6,095**	**845**	**948**	**877**	**1,057**	**1,153**
B Agrotechnology	128	118	137	266	37	17	33	17	32	25
B Animal Sciences	354	335	322	161	513	83	73	84	85	74
B Business and Consumer Sciences	455	523	597	618	596	42	77	90	102	128
B Biology	496	465	519	633	522	98	120	85	92	111
B Biotechnology	247	298	368	504	228	45	45	40	56	83
B Forest and Nature Management	221	218	236	279	247	47	50	38	54	54
B Communication and Life Sciences	55	60	56	42	127	16	15	15	9	8
B Economy and Policy	109	125	148	246	125	13	17	22	19	31
B Environmental Sciences	101	109	138	174	201	25	19	22	24	30
B Food Technology	339	405	460	422	682	63	53	79	88	122
B Health and Society	202	234	230	41	388	26	43	55	56	65
B International Land and Water Management	197	211	249	342	226	34	46	34	58	37
B International Development Studies	315	311	310	143	435	71	61	70	83	76
B Landscape architecture and Spatial planning	208	197	217	272	229	44	54	34	45	45
B Molecular Life Sciences	173	207	244	310	196	41	28	31	39	53
B Plant sciences	146	177	204	324	236	31	27	23	28	57
B Soil, Water, Atmosphere	228	215	239	337	190	58	72	48	48	45
B Nutrition and Health	449	459	504	111	917	91	115	90	139	109

WAGENINGEN
UNIVERSITY & RESEARCH

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STUDENTS AND GRADUATES AT WAGENINGEN UNIVERSITY, BY COURSES

	# Students					# Graduates				
	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017
Master students	**4,482**	**4,937**	**5,389**	**4,867**	**6,847**	**1,441**	**1,549**	**1,611**	**1,838**	**1,968**
M Animal Sciences	345	337	332	196	549	146	130	136	132	119
M Aquaculture and Marine Resource Management	81	104	120	120	110	31	23	25	37	42
M Biobased Sciences	0	0	0	8	6	,	,	,	,	,
M Bioinformatics	46	53	51	67	70	8	15	22	21	17
M Biology	243	270	266	257	283	75	70	87	83	87
M Biosystems Engineering	66	81	81	183	32	23	27	20	32	30
M Biotechnology	234	282	350	428	302	70	75	92	116	143
M Climate Studies	66	68	74	86	105	15	21	16	26	27
M Communication, Health and Life Sciences	136	169	172	46	292	22	29	51	69	52
M Development and Rural Innovation	46	48	57	52	85	17	10	21	16	21
M Earth and Environment	130	170	201	241	143	37	45	41	65	63
M Environmental Sciences	277	273	313	279	384	82	128	92	119	141
M Food Quality Management	80	82	78	60	136	20	26	40	27	25
M Food Safety	141	147	185	87	273	46	50	52	62	71
M Food Technology	389	428	503	406	797	156	144	159	167	208
M Forest and Nature Conservation	221	222	240	289	279	62	65	80	81	77
M Geo-information Science	91	93	109	194	75	31	29	30	24	39
M Hydrology and Water Quality	5	0	0	0	0	6	5	0	0	0
M International Development Studies	258	271	261	130	415	52	61	84	83	76
M International Land- and Water Management	119	140	145	144	134	36	36	43	49	52
M Landscape Architecture and Planning	124	138	130	115	145	51	36	34	42	34
M Leisure, Tourism and Environment	75	65	64	32	99	19	31	19	21	22

WAGENINGEN
UNIVERSITY & RESEARCH

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M Management, Economics and Consumer Studies	319	350	355	352	357	132	115	114	125	129
M Molecular Life Sciences	108	112	106	131	92	33	38	38	47	36
M Nutrition and Health	314	393	460	120	859	113	122	106	138	186
M Organic Agriculture	125	131	151	167	211	30	51	46	56	57
M Plant Biotechnology	88	85	107	168	99	26	43	31	29	43
M Plant Sciences	243	292	343	413	354	78	84	88	126	112
M Urban Environmental Management	112	133	135	96	161	24	40	44	45	59
Total	**8,905**	**9,604**	**10,567**	**10,092**	**12,942**	**2,286**	**2,497**	**2,488**	**2,895**	**3,121**

WAGENINGEN
UNIVERSITY & RESEARCH

NUMBER OF STUDENTS AT HAS UNIVERSITY OF APPLIED SCIENCES

Bachelor's programme	2014	2015	2016	2017	2018
Business Administration and Agribusiness	430	442	428	458	436
Animal and Livestock	347	384	402	411	410
Food Innovation	421	458	538	607	595
Geo Media and Design	89	117	157	178	174
International Food and Agribusiness	79	115	160	192	192
Management of the Living Environment	218	214	207	215	215
Environmental Science	123	138	159	179	197
Applied Biology	523	565	673	753	817
Horticulture and Agriculture	246	251	258	281	283
Food Technology	321	358	392	394	355
Total	**2,797**	**3,042**	**3,374**	**3,668**	**3,674**

NUMBER OF GRADUATES AT HAS UNIVERSITY OF APPLIED SCIENCES

	2013	2014	2015	2016	2017
Bachelor's programme	476	420	450	519	603
Business Administration and Agribusiness	79	89	69	79	91
Animal and Livestock	86	59	73	83	64
Food Innovation	37	52	53	58	91
Geo Media and Design	0	0	14	15	28
International Food and Agribusiness	0	0	8	14	25
Management of the Living Environment	68	51	34	41	39
Environmental Science	25	22	25	24	24
Applied Biology	80	63	80	88	105
Horticulture and Agriculture	41	44	38	49	51
Food Technology	60	40	56	68	85
Total	**476**	**420**	**450**	**519**	**603**

Source: DUO, adapted by Fanion Onderzoek & Advies

SECONDARY EDUCATION GRADUATES IN AGRIFOOD

	Secondary vocational	Secondary general	Pre-university	Total
Breda region	730	750	820	2,300
Tilburg region	490	510	480	1,480
Den Bosch region	1,910	870	840	3,620
Eindhoven/Helmond region	250	1,020	950	2,220
Brabant	**3,380**	**3,150**	**3,100**	**9,630**

has university of applied sciences

C. Unemployment - registered jobseekers

In 2018 there were 1,350 people with an agricultural background in Brabant registered as jobseekers and 25,510 people with a technical background. Unfortunately, their qualifications are not further specified. Of the jobseekers with a technical background, some 70% had a low education profile and are not qualified to enter the labour market. About a quarter had secondary level education and only three percent of the jobseekers were highly educated.

The following graph depicts the number of people registered as jobseekers.

LEVEL OF EDUCATION

Breda region	**low**	**mid-level**	**high**	**Total**
Agricultural professions	290	70	10	370
Technical professions	4,600	1,350	330	6,280
Tilburg region	**low**	**mid-level**	**high**	**Total**
Agricultural professions	190	50	-	240
Technical professions	4,630	1,000	220	5,850
Den Bosch region	**low**	**mid-level**	**high**	**Total**
Agricultural professions	240	70	10	320
Technical professions	4,090	1,100	290	5,480
Eindhoven/Helmond region	**low**	**mid-level**	**high**	**Total**
Agricultural professions	320	80	20	420
Technical professions	6,050	1,420	430	7,900
Brabant	**low**	**mid-level**	**high**	**Total**
Agricultural professions	1,040	270	40	1,350
Technical professions	19,370	4,870	1,270	25,510

Source: UWV, 2018

6. LOCATION, CAMPUSES AND FACILITIES

A. Location

1. BRABANT, THE NETHERLANDS: YOUR GATEWAY TO EUROPE

In geographic terms the Netherlands – and Brabant in particular – has historically been the key port of entry to mainland Europe.

This is also true in a literal sense, as Brabant is part of the delta stretching between Rotterdam (Europe's largest port) and Antwerp (the continent's second largest port) and three of Western Europe's busiest airports: Amsterdam Schiphol, Brussels Airport and Dusseldorf International Airport. Excellent infrastructure (by road, rail, water and air) and IT and data communication networks that are second-to-none anywhere in the world are added bonuses.

This combination of strengths helps industry in the area to fluidly reach 170 million consumers in a radius of 500 kilometres (300 miles). These consumers with significant financial means (north-western Europe is one of the wealthiest markets in the world) are all within 24 hours of Brabant.

Efficient logistics services empowered by **INNOVATION & COLLABORATION**

#1 ENTRY POINT
In Europe for overseas products

#1 LOGISTICS
Hub in Europe

COMPETITIVE COST
for labour, real estate and transport

500 km proximiy to European markets
170 MILLION CONSUMERS

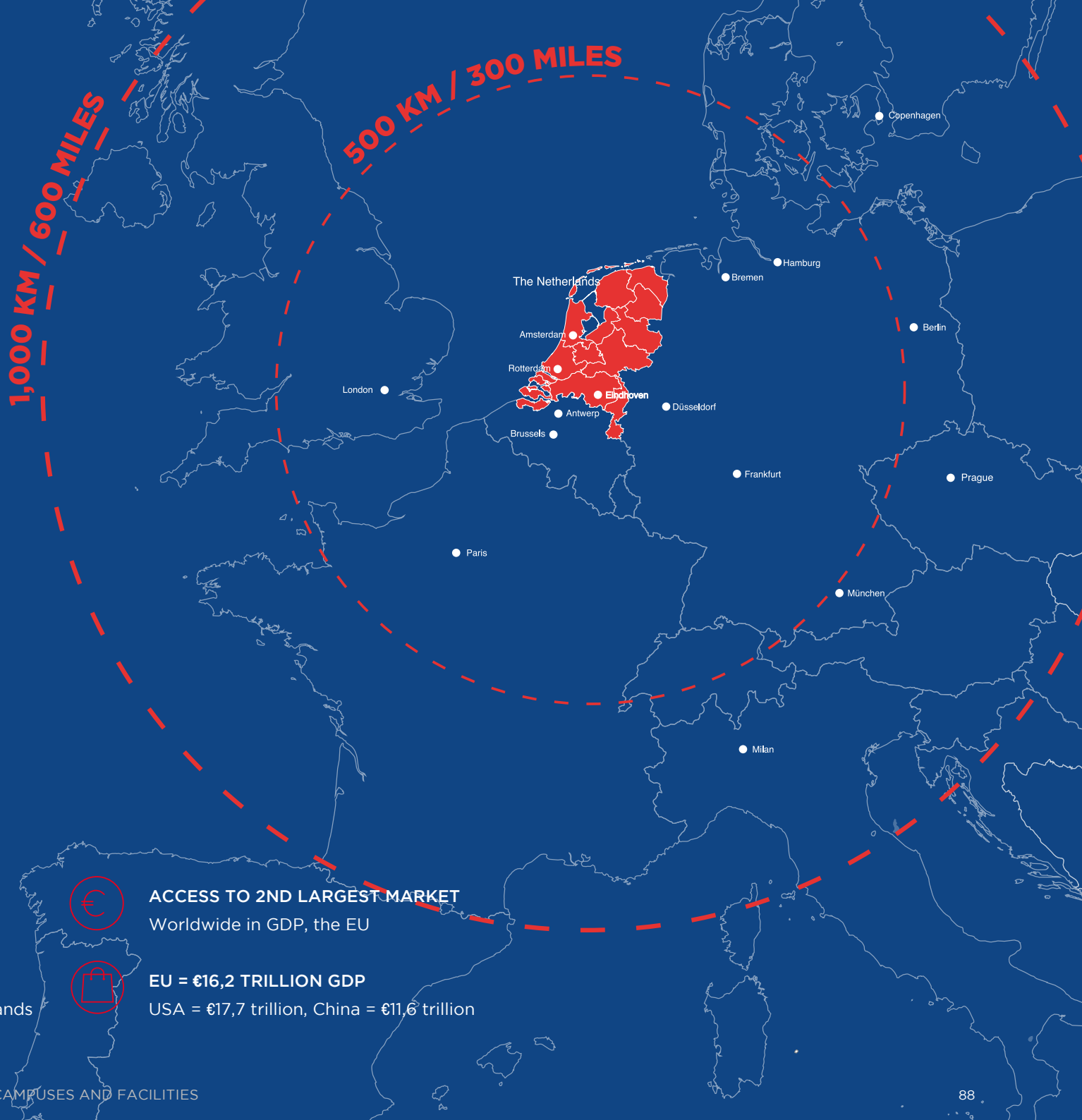
3 MAINPORTS
For air, data and sea

EXCELLENT CONNECTIVITY
To Europe and all continents

World class & competitive business environment
NO VAT PAYMENT AT IMPORT

2. BRABANT, THE NETHERLANDS: ACCESS TO THE SECOND LARGEST MARKET IN THE WORLD

Within a radius of 500 kilometres, businesses can reach 170 million consumers in Western Europe, and if that circle is extended to a radius of 1,000 kilometres (600 miles) – still within easy and rapid reach – this figure grows to 250 million people. The largest European economies – Germany, France, the United Kingdom and the Benelux region – are all within a day's reach. The rest of the European Union (the second largest market in the world in GDP terms) is just as accessible from Brabant, with an additional 24 to 36 hours in transit time.



170 MILLION CONSUMERS
Within a 500 km / 300 mile radius

250 MILLION CONSUMERS
Within a 1,000 km / 600 mile radius

PERFECT SPRINGBOARD
into European market

MAJOR EUROPEAN ECONOMIES
are within a day's reach of the Netherlands

ACCESS TO 2ND LARGEST MARKET
Worldwide in GDP, the EU

EU = €16,2 TRILLION GDP
USA = €17,7 trillion, China = €11,6 trillion

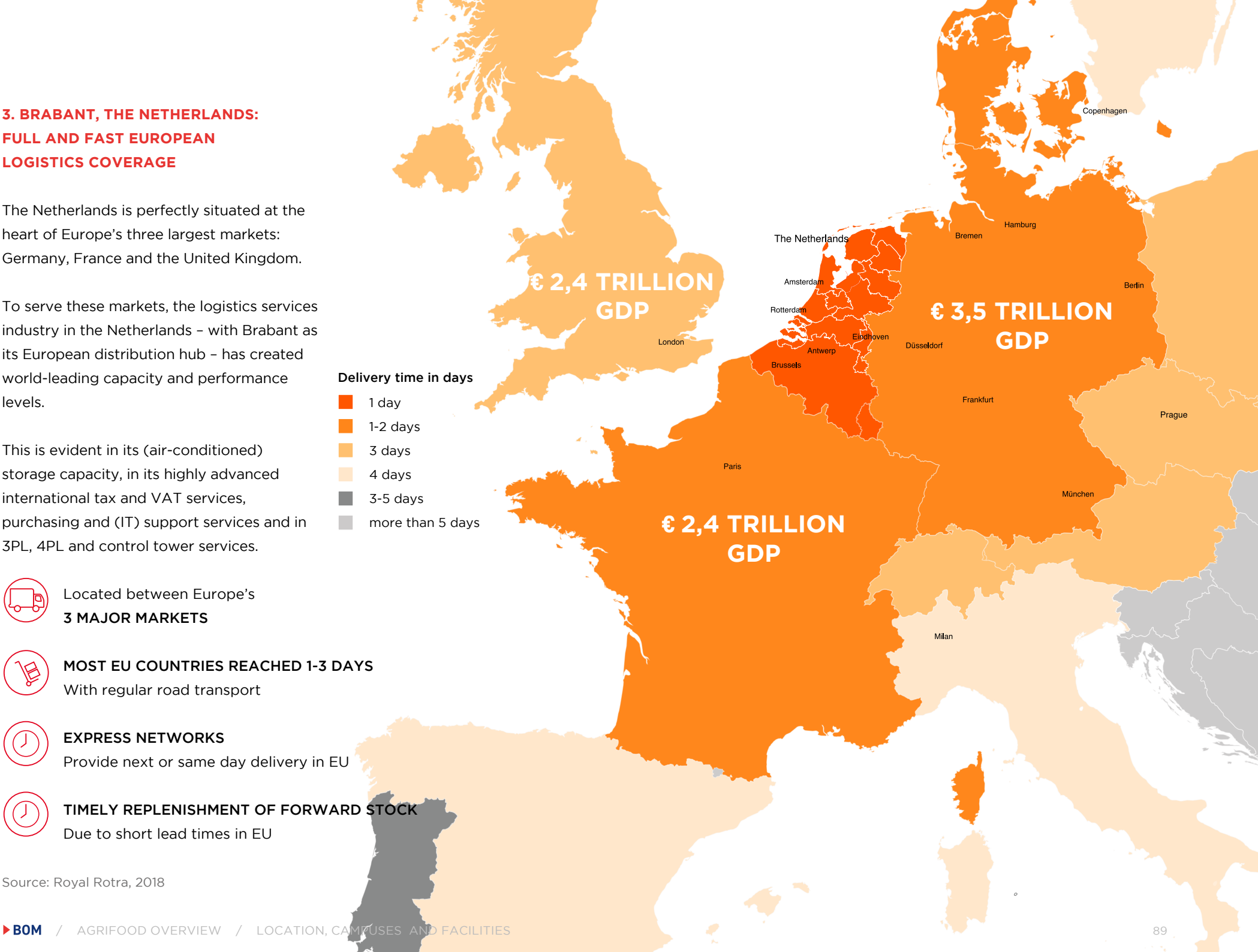
Source: Invest in Holland, 2018

3. BRABANT, THE NETHERLANDS: FULL AND FAST EUROPEAN LOGISTICS COVERAGE

The Netherlands is perfectly situated at the heart of Europe's three largest markets: Germany, France and the United Kingdom.

To serve these markets, the logistics services industry in the Netherlands – with Brabant as its European distribution hub – has created world-leading capacity and performance levels.

This is evident in its (air-conditioned) storage capacity, in its highly advanced international tax and VAT services, purchasing and (IT) support services and in 3PL, 4PL and control tower services.



Located between Europe's
3 MAJOR MARKETS

MOST EU COUNTRIES REACHED 1-3 DAYS
With regular road transport

EXPRESS NETWORKS
Provide next or same day delivery in EU

TIMELY REPLENISHMENT OF FORWARD STOCK
Due to short lead times in EU

Source: Royal Rotra, 2018

B. Campuses and facilities

1. FOOD TECH PARK BRAINPORT, HELMOND

Food Tech Brainport is an eco-system offering food grade test facilities, production locations, networks, and access to research and educational institutes for food processing companies and technology providers. The objective of Food Tech Brainport is to feed more people and to use the earth's resources more sparingly. This requires smart technologies that are both more sustainable and affordable.

Food Tech Brainport brings together technology providers, food processing companies, and talent. This way they accelerate innovation and manufacture products with longer shelf life without compromising on taste or nutritional value, reduce food waste, and lower energy consumption. Food Tech Brainport:

1. **Accelerates innovation** for food processing companies time to market, lower investment and reduce risk;
2. **Brings technology to the market** (TRL 6-8 to 9) with technology providers and research institutes;
3. **Develops professionals** being able to implement innovative technology to the marketplace.

Food Tech Brainport has several food grade (test and scaling-up) Fieldlabs, allowing them to contribute to healthier circular food systems, in the fields of:

- Mild separation;
- Mild preservation;
- Total use – no waste; Utilising all the raw materials derived from a product
- Smart food processing; Cobots, vision, sensoring, AI, etc.

Food Tech Park Brainport welcomes startups, SMEs and multinational companies. Innovative products and applications can be tested and manufactured in an open field lab environment, bringing them to market at an accelerated pace. Food Tech Brainport provides support for the entire process, from product development through to production and market introduction.

www.foodtechbrainport.com
www.acsfprocessing.com

FOODTECH BRAINPORT
Join innovation

2. GROWWISE RESEARCH CENTER BY SIGNIFY, EINDHOVEN

In 2015, Signify (formerly Philips Lighting) opened a state-of-the-art urban farming research centre on the High Tech Campus in Eindhoven, named GrowWise.

Research conducted by Philips provides custom LED lighting that enables farmers to improve yields and grow healthy and tasty vegetables throughout the year.

The new facility, at 234 m^2 one of the largest in the world, focuses on optimising cultivation methods for leafy vegetables, strawberries and herbs. Other areas of research include growing high-carb crops, such as potatoes and wheat.

GrowWise develops blueprints for various types of indoor farming.

www.signify.com/global/our-company/news/gallery/professional-lighting/horticulture

3. PRECISION AGRICULTURE CENTRE SOUTH, REUSEL

The primary objective of the Precision Ag Centre South (Praktijkcentrum voor Precisielandbouw) is to accelerate the adoption and use of precision agricultural practices in the Netherlands, advancing the exploitation of the benefits precision agriculture has to offer. Research shows that the adoption levels of precision agriculture (especially the combination of site-specific measurements and variable cultivation measures) is currently limited. To accelerate this adoption of the available technologies and practices, more applied research and innovation is required, which is why an independent experimental and pilot project centre was established in Reusel in Brabant.

The Precision Agriculture Centre South focuses on the following objectives and activities:

- Making data and measurement data accessible for (collective) use by agricultural companies, suppliers, the processing industry and knowledge institutions
- Developing joint technological applications, user-friendly interfaces and analysis methods
- Providing demonstration and test facilities for manufacturers and buyers
- Facilitating pilot projects in the experimental centre and on location
- Creating further knowledge through applied research with research partners

The lead partners of the Precision Ag Centre South are:

van den borne aardappelen · Rusthoeve AIKC · ZLTO · Delphy · TU/e Eindhoven University of Technology · has university of applied sciences · Wageningen University & Research

AGRI DRONE PORT, REUSEL

The Ag Centre South has a fairly unique feature in the Netherlands, a licensed airport for agricultural drones – the Agri Drone Port Reusel. The airport is an RPAS airport with closed flight area under airspace class G above the test fields of Jacob van den Borne, director of the Precision Ag Center South.

The test fields have about 40 data layers per point, which is ideal for calibrating drone sensors and monitoring cultivation experiments for making agriculture more sustainable through the daily use of drones. High tech takes wing with AgriFood using an open innovation space with staff, a control tower and sensor and sampling facilities from the Precision Agriculture Centre South.

The flight area has three 'airports', each with a registered take-off and landing site measuring three square meters. As at any airport, a certified RPAS pilot needs permission from the control tower to fly. RPAS pilots may operate their crafts under the permits they hold. For example, if a drone operator is permitted to exceed the standard altitude, this will be communicated to the Eindhoven Air Base as additional information on the morning the flight plan is logged.

The primary goal of this airport regulation is to ensure safe drone usage in an airspace, with the initial step being to inform other/scheduled air traffic above the area that electric RPAS/drones with payloads of up to 150 kg will be flying in this area on a given day.

www.pcvpl.nl

4. GREEN CHEMISTRY CAMPUS, BERGEN OP ZOOM

At the Green Chemistry Campus in Bergen op Zoom, businesses, public agencies and knowledge institutions work together to scale-up new and sustainable materials and chemicals for the construction materials and packaging industries. Renewable raw materials such as elephant grass, organic municipal waste and wood residuals form the basis for this goal.

The campus offers members of the Green Chemistry Campus Community access to facilities such as laboratories, a demonstration site and office space and also provides support in the form of financing, marketing and technology.

Companies on the Campus have already demonstrated that their concept for a biobased product works on a small scale, and they now aim to expand the concept and show that the product can also be produced on a larger scale with a consistent quality.

The Green Chemistry Campus is located on a large industrial estate with SABIC Innovative Plastics and Cargill manufacturing plants situated right next door. Both these companies support a variety of projects being conducted on the Green Chemistry Campus.

www.greenchemistrycampus.com

GREEN CHEMISTRY CAMPUS

BIORIZON

Shared Research Center Biorizon is located on the Green Chemistry Campus. Biorizon is a trans-border initiative between TNO, VITO, ECN (part of TNO) and the Green Chemistry Campus and is part of Biobased Delta. Biorizon aims to achieve commercial production of bio-aromatics by 2025.

To accomplish this, Biorizon is focusing on upscaling the technology required to pave the way for industrial-scale production coupled with continuous processing. The organisation is presently engaged in validating its continuous processes and working with industry partners towards the next stage – the demonstration phase. Once the technology is successfully demonstrated, the knowledge gained will facilitate commercial implementation. This will result in bio-aromatic building blocks that are highly functional, renewable, competitively priced and safe, and will also mean a significant reduction in CO2 emissions, helping to combat climate change.

Biorizon has developed three programme lines or Horizons that industrial partners can be a part of:

- Horizon I focuses on thermochemical processes
- Horizon II focuses on sugar/furan technology
- Horizon III focuses on lignin technology

www.biorizon.eu

Biorizon
The way to aromatics

5. NIEUW PRINSENLAND (AGRICULTURAL AND FOOD CLUSTER), DINTELOORD

Nieuw Prinsenland is an industrial estate owned by Royal Cosun (Cosun Beet Company) dedicated specifically to cutting-edge companies active in or associated with the AgriFood industry, the biobased economy, value added logistics, services and research and development. The site is located right next to a related park that is dedicated to greenhouse horticulture. Several links have been established between the sites for sharing heating, water and/or CO2. Generating green gases and wind energy and the exchange of residual heat can form the basis of a profitable partnership.

Site details:

- 50 hectares of net issuable lots
- Lot sizes range from 0.5 hectares to more than 10 hectares
- Lots are 70-90 meters long or 120-150 meters and longer
- Construction height of up to 40 meters
- The ground level is +1 m NAP (Normal Amsterdam Level)

GREENHOUSE LOCATION

The greenhouse site is 644 acres (261 hectares), with a net area of 495 acres (200 hectares) available for use. At the time of writing (January 2020) all lots have either been sold or optioned. If lots become available, they will be advertised on the Nieuw Prinsenland website.

www.nieuwprinsenland.nl

NIEUW PRINSENLAND

6. COSUN INNOVATION CENTER, DINTELOORD

Processing arable and horticultural crops at an industrial level and their application in food ingredients calls for specific expertise, and Cosun has a great deal of specialist know-how available. Cosun R&D brings together all of the company's knowledge and expertise, performing work for and on behalf of the Cosun business groups (Cosun Beet Company, Aviko, Duynie, Sensus and SVZ). Cosun R&D coordinates research, support, knowledge and development activities within the Cosun groups.

Cosun's goal is to enhance the development of biobased concepts, products and applications in the food and non-food industries. Cosun R&D also actively takes steps to create added value from the raw materials processed by the Cosun business groups (sugar beet, potatoes, chicory, fruit and vegetables). By-products are used to extract various materials for animal feed and energy generation. Cosun R&D works closely with universities and other knowledge institutions, both in the Netherlands and abroad.

Cosun R&D specialises in two fields: support and improvement and development. Its Support & Improvement division supports and improves existing products and production processes, while the Development division works with the Cosun group of businesses to initiate and oversee the development of new product concepts, production processes and to investigate the sustainability of current and future production facilities.

Together with Cosun Biobased Products, Cosun Innovation and the IRS, Cosun R&D is housed in the Cosun Innovation Center in Dinteloord at Nieuw Prinsenland (between Rotterdam and Breda). The Cosun Innovation Center has state-of-the art research laboratories, a pilot factory, application laboratories and conference facilities. Offices and labs can be made available for other companies and startups/scaleups where opportunities exist for synergy.

www.biorizon.eu

Cosun innovation center

7. AGRI & FOOD PLAZA, DEN BOSCH

Agri & Food Plaza is the network centre for innovative organisations in the agriculture and food industries in Den Bosch. Agri & Food Plaza is the home-base of the ZLTO, Grow Campus, OndernemersLift +, Agri Food Health Innovation Center and AgriFood Capital as well as numerous startups/ scaleups. Companies in the agriculture and food fields work here from their own perspectives, on innovations, networks and partnerships that contribute to strengthening the AgriFood industry.

The building is situated in a central location, amid other leading players and facilities in the world of health and nutrition, including HAS Den Bosch, Helicon, Avans University of Applied Sciences, King Willem I College and the Jeroen Bosch Hospital.

Agri & Food Plaza provides workplaces with associated facilities and meeting rooms and include catering services.

www.agrifoodplaza.nl

AGRI&FOOD PLAZA

8. GROW CAMPUS, DEN BOSCH

The Grow Campus is both a physical location and a network (the Growth Campus Community) of lecturers, teachers, experts, researchers, students and new and experienced entrepreneurs. There are also close ties with financiers, incubators and advisors who can help businesses find funding.

The underlying philosophy of the Grow Campus is that AgriFood businesses grow stronger when they work together. Companies need partners or experts in order to grow, while experts need challenging projects in the field. Meanwhile talented and ambitious students want to come into contact with interesting companies during and after their studies. The Grow Campus brings all these parties together.

The partners on the Grow Campus offer a large number of attractive facilities, labs and research equipment that can also be utilised by others, which include:

- facilities for the food industry, environmental technology, greenhouses and closed cultivation systems
- research laboratories
- engineering and architectural workshops
- work and meeting rooms
- conference facilities

The Grow Campus is centrally located in Den Bosch, close to the A2, A59 and A65 motorways and is easily accessible by public transport.

www.growcampus.nl

GROWCAMPUS
EMPOWER YOUR AMBITION IN AGRIFOOD

9. DE JAMFABRIEK, DEN BOSCH

De Jamfabriek ('The Jam Factory') is the place to be for innovation, partnerships and support in the world of food. This dynamic location in Den Bosch offers a great mix of startups, scaleups and fully-formed companies in the food and food-related sectors.

A workplace in De Jamfabriek is more than just accommodation, it is a place where companies are part of a dynamic community environment. Support is available for new and innovative companies to, for example, achieve growth objectives, while a range of funding options are also on the table.

www.dejamfabriek.com

10. DELTA AGRIFOOD BUSINESS, BERGEN OP ZOOM

Delta AgriFood Business (DAB) is an open innovation and expertise centre for business and education that is located in Bergen op Zoom. It is a breeding ground that gathers and shares AgriFood-related knowledge. DAB focuses on the shift from animal to vegetable proteins, the development of personalised food (including 3D printing) and on sustainable food packaging techniques and materials.

The major points of focus at Delta AgriFood Business are AgriFood, protein transition, food packaging, 3D food printing, soil and water and energy. Royal Cosun, Lamb Weston Meijer, Rijk Zwaan, Protix, Budelpack, Basagro, Waterpoort, Brabantse Wal, FoodQloud, ZLTO, Rabobank, CZAV, the Municipality of Bergen op Zoom, HAS and Curio are all associated with DAB.

www.deltaAgriFoodbusiness.nl

7. PARTNERSHIPS AND NETWORKS IN BRABANT (BUSINESS, SCIENCE, GOVERNMENT)

A. Partnerships in Brabant - history, culture, past and present

INTRODUCTION

Brabant has a distinctly strong culture, history and tradition of informal constructive partnerships that are based on trust and 'open innovation'. This is particularly evident in the following respects, along with numerous others:

- The fact that some of Brabant's largest companies (VION, Cosun/SuikerUnie, FrieslandCampina) have a history of working together
- The century-old roots of some of the region's industrial giants and the fact that these companies are completely intertwined with the development of the region, the cities, the universities, the schools, housing, leisure, the football clubs, and so on (Philips in Eindhoven, MSD via Organon in Oss, MSD Animal Health through Akzo/Intervet and Hendrix in Boxmeer)
- The fact that Philips decided, 17 years ago, to open up its originally hermetically-sealed NatLab research site in Eindhoven and began to invest in 'open innovation' by inviting other companies to join in. The company invested hundreds of millions of euros in further developing the campus and facilities to optimise joint research, the result being the Philips High Tech Campus. The site, located in the middle of Eindhoven and home to 12,000 researchers from over 200 companies and institutes from around the world, is now owned by a property investor and named the Eindhoven High Tech Campus (HTCE). Key tenants remain Philips Healthcare, Philips Research and Signify (formerly Philips Lighting) as well as NXP, ASML, Holst Centre and Xeltis.
- The concept (joint research, shared facilities, intensive cooperation and significant outsourcing when it comes to drug discovery and development) and success of the Pivot Park biopharmaceutical campus in Oss.

The advantages of this culture are that cooperative ventures, both informal and highly intensive, are ingrained in the area. Many CEOs in the region, the mayors and councillors of the cities and knowledge institution academics are regularly cited as saying 'the door is always open, so don't hesitate to drop by', 'we make the best decisions sitting at the kitchen table' and 'we know each other's mobile phone numbers and we pick up the phone whenever we see a friend is calling'.

In short: building partnerships in the region is a quick and fluid process – and faster than anywhere else in the Netherlands. Outsiders who wish to join the club and make an actual contribution will quickly and easily reap the rewards.

CONNECTING GLOBAL GIANTS: BRABANT'S INDUSTRIAL ICONS

In Brabant a number of key ingredients have been fruitfully mixed together for over a century, creating one of the strongest high tech systems regions in the world:

- Entrepreneurship
- Corporate social responsibility
- Cooperation and open innovation
- Roots in AgriFood and Health
- Strong regional pride and loyalty, but with a
- Focus on a global market

The growth of three remarkable Brabant business families in the past century exemplifies and characterises how this region developed to attain its current strong position and open approach to working and partnerships. Three extraordinary individuals started businesses here that developed into three connected clusters of companies, consisting of specialised SME Tier 1 and 2 suppliers, dedicated logistics service providers and renowned research centres all the way through to certification bodies and a number of global multi-billion dollar OEM companies.

These three individuals were Frederik Philips, Saal van Zwanenberg and Wim Hendrix.

- In 1891, Frederik Philips built a modest light bulb factory in Eindhoven
- Saal van Zwanenberg founded a slaughterhouse for export in 1887 in Oss
- Wim Hendrix started off selling chickens in Boxmeer in 1916

They all started out small, some of them on their own. But their businesses grew, flourished, diversified and have been entering new markets ever since. And, in the process, the parent companies have bred hugely successful subsidiaries and spinoffs:

- Frederik founded Philips, today's Royal Philips (Healthcare), a global 18 billion euro-company with 74,000 employees that also gave birth to other icons, such as ASML, FEI Company, Thales and NXP, all of them still headquartered in the region or with their global research centres based in the province
- Saal started Zwanenberg, which became Organon and then Chefaro, and is part of today's MSD (Merck) that focuses on human health and specialises in pharmaceutical and biological research and manufacturing, including one of the world's latest cancer treatments, Keytruda (pembrolizumab)
- Wim started selling chickens to farmers, after which his entrepreneurial spirit saw companies born that grew to become Hendrix Genetics, MSD (Merck) Animal Health (formerly Intervet), Nutreco and Marel Poultry

Today these companies are still leading the way, with crossovers found between the domains of Life Sciences and Health and High Tech Systems and Materials. New solutions are being developed in areas such as

Today these companies are still leading the way as cross-overs are found between the domains of Life Sciences and Health and High Tech Systems and Materials. New solutions are developed in areas such as:

- Imaging, monitoring and guided surgery
- Big data and smart algorithms in animal husbandry
- Vision and sensor technology for monitoring welfare
- Needle-free, intradermal vaccination devices

A SUCCINCT OVERVIEW OF PHILIPS' GROWTH OVER THE LAST CENTURY CAN BE FOUND IN THE 'PHILIPS TREE' (DATING FROM 2016)

Some of these companies have grown to similar sizes and with a greater stock market value than their parent company, such as ASML (with a turnover of €10.9 billion), FEI (now Thermo Fisher Scientific) and NXP (with a turnover of $9.4 billion), to name just a few.

The tree gave rise to a new branch in 2019 – Signify (formerly Philips Lighting) has now gone public and is a separate entity with a workforce of 29,000 people and a turnover in 2018 of €6.4 billion.

B. Successful networks and public-private partnerships (PPPs)

1. BREED4FOOD

Animal genetics is a scientific and industrial field in which numerous Brabant-based companies are global leaders, including Hendrix Genetics, Cobb-Vantress and Topigs Norsvin. A fourth such company, CRV, is also Dutch and is just a stone's throw away in the province of Gelderland.

These four companies have started a joint development programme with Wageningen University & Research to develop a world-leading institute for research and innovation in livestock genetics, Breed4Food:

'Animal breeding has always been and will increasingly become more knowledge-intensive. The "genomic revolution" is rapidly opening new opportunities for innovation and scientific research, allowing breeding companies to expand their world-leading role and competitive position through a focus on improving food security and new traits needed for sustainable, future animal production chains.

Four Netherlands-based animal breeding companies (TOPIGS, CRV, Hendrix Genetics and Cobb Europe) are prominent global players in animal breeding. These companies, in partnership with Wageningen University & Research's Animal Breeding and Genomics Group, have joined forces in Breed4Food. Partners in Breed4Food aim to jointly develop a world-leading institute for research and innovation in livestock genetics, Breed4Food, in the Netherlands. The move will bolster the position of the companies on the world market and strengthen the scientific position of Wageningen UR, ensuring it retains its dominant global position in genetics and genomics research.

Breed4Food allows the four breeding companies to run a breeding programme that clearly outperforms the competition. The joint development of pre-competitive knowledge is crucial to achieving the goals of Breed4Food.'

2. THE FOOD VALUE INITIATIVE

Fully one third of the food we produce annually worldwide is not consumed. That is not only a waste, it also puts the environment under enormous pressure. BOM supports businesses in creating innovative business cases that deal with waste prevention. 'The optimal use of raw materials offers huge opportunities.' Worldwide, 1.3 billion tons of edible food is lost annually, the equivalent of a 2.5 km high mountain with a diameter of more than three kms, according to British newspaper *The Guardian*.

Food waste is at odds with the global challenge of feeding nine billion mouths by 2050, but it also has major implications for the climate and our water supply. We not only waste food, we also waste all the labour, energy, water and land needed to produce, package, transport and cool it. Waste occurs throughout the food chain, from ground to mouth. Consumers buy more food than they need or fail to keep it under the right conditions, causing it to spoil more quickly, while growers, processors, producers, supermarkets and restaurants also create waste by, for example, cutting losses and the high quality demands placed on saleable fruit.

REDUCING FOOD WASTAGE

The annual waste generated by Dutch consumers and companies must be cut by a million tons by 2030, a reduction of roughly 50% compared to 2015, when about 125 kg of edible food per inhabitant was lost. The reduction in CO2 emissions as a result of that cut equates to 666,000 cars not being driven for a year, and the water saved is enough for the daily shower for all residents of the Netherlands for 6.5 years.

'Together we will make the Netherlands one of the first countries to halve food wastage. And that will make us a frontrunner and a global example in achieving Sustainable Development Goal 12, Responsible Consumption and Production' – this is the goal of the Together Against Food Waste foundation (known under its Dutch acronym of SSTV).

As a partner of SSTV, BOM (the Brabant Development Agency) focuses on the role that businesses can play in this challenge. For example, BOM Brabant Ventures offers knowledge and venture capital to Brabant companies that develop solutions for preventing food losses or upgrading the value of residual flows to their greatest possible extent (maximum exploitation). BOM is also helping to create ecosystems through innovative projects in which promising ideas can be launched on the market at an accelerated pace. A good example of this is Three-Sixty, the innovation centre for the circular economy in Veghel.

THE FOOD VALUE INITIATIVE

Since 2019, BOM has been a part of this effort together with the other regional development agencies (ROMs) in the Netherlands and SSTV under the national guise of the Food Value initiative. Joint inspiration sessions are hosted where growers, processors, technology players and food companies are brought together so that new partnerships can arise.

One of the first milestones in the Food Value project is BOM's Business Innovation Program Food. Over the course of ten modules, motivated entrepreneurs with promising ideas are guided through the development of a profitable business scenario that deals with the optimal use of raw materials. Afterwards, they are ready to launch a pilot project or even a market launch.

'By working together we create sustainable innovative business cases with social impact and economic opportunities,' says Linda van Mierlo, Programme Manager Agrofood at BOM. 'In a world of scarcity, waste reduction is not only a necessity, it also offers plentiful opportunities for businesses, given the strong Brabant AgriFood and high tech industries.'

BOM firmly believes that innovative companies can play a key role in the transition to a circular economy, in which scarce raw materials are optimally exploited. The following business cases, ideas and philosophies illustrate what has already been achieved.

WASTE REDUCTION IN THE FOOD SUPPLY CHAIN

A better understanding of the shelf life of strawberries:

- Challenge: Soft fruit is rejected relatively frequently due to its limited shelf life. Fruit that does end up on supermarket shelves and is bought by customers ripens too quickly and is discarded
- Solution: the OneThird optical scanner predicts the shelf life of fruit and vegetables based on machine-learning algorithms. Growers and retailers can improve their shelf life management, so that products arrive on the shelves on time
- Parties involved: OneThird, Genson Fresh Fruits & Vegetables
- Role BOM: OneThird originally developed the system for tomato growers, but also wanted to test it on strawberries. BOM introduced the startup to Genson, a strawberry grower

REDUCING WASTE IN THE CATERING INDUSTRY

Less waste with a camera installed above the waste bin:

- Challenge: all hospitality-related companies throw away thousands of kilograms of food every year. They have little understanding of how much they throw away and how to avoid such waste
- Solution: a smart camera and scales installed in the waste bin map out the business's food waste. Hospitality companies then know exactly how much they throw away and when they prepare too much food, so that they can take this into account in the kitchen and in their purchasing policy. This allows a restaurant to cut down by an average of 4,000 kilograms of waste annually
- Parties involved: Zero Food Waste
- BOM's role: BOM, together with DOEN Participaties, is an investor in Zero Food Waste.

COMMERCIALISATION OF RESIDUAL FLOWS IN THE CATERING AND RETAIL INDUSTRIES

Every currant bun made using Dutch orange oil:

- Challenge: annually, 250 million kilograms of citrus peel are thrown away in the Netherlands. They do not compost well and are only moderately suitable for fermentation purposes. As a result, they often end up being incinerated
- Solution: PeelPioneers collect millions of kilograms of orange peel from supermarkets and restaurants each year and transforms them into raw materials in its factory in Son for cleaning products, food applications (including orange oil) and animal feed
- Parties involved: PeelPioneers
- BOM's role: BOM, together with ABN-AMRO, the DOEN Foundation and Tekkoo, is one of the investors in PeelPioneers

COMMERCIALISATION OF FOOD PROCESSING WASTE

A new life for cutting leek and onion waste:

- Challenge: much waste is generated when processing leeks and onions for vegetable packs, such as the leaves of leeks and the outer layers of onions. How can these materials be optimally exploited?
- Solution: growers and technology companies (including Biorefinery Solutions and Bodec) are investigating which colours, flavours, proteins and fibres can be used for food applications
- Parties involved: Cooperative Horticultural Development Platform South U.A. (TOP Zuid)
- BOM's role: Together with TOP-Zuid, the ROMs have organised sessions with businesses, which have led to business cases, connections between partners and promising ideas for leek and onion applications

3. GPEC – GREEN PROTEIN CENTER OF EXCELLENCE

The Green Protein Excellence Center (GPEC) is an open innovation centre founded by Royal Cosun, HAS University of Applied Sciences in Den Bosch and the innovation-focused SME, The Protein Brewery.

- Royal Cosun is a modern, forward-looking cooperative based in Brabant but active across the globe. Working together with thousands of growers, the company produces plant-based ingredients and foodstuffs for people and animals, as well as green biobased applications and energy
- HAS University is the leading AgriFood and Environmental Issues education and research centre in the southern Netherlands
- The Protein Brewery is a high tech company that specialises in developing and manufacturing animal-free proteins in a sustainable manner

The underlying idea of GPEC is to focus on the development of alternative (vegetable) proteins and shape it as an innovation cluster around large-scale circular processes and systems in the arable farming and horticultural value chains. GPEC (together with a number of core partners) plays the role of driver/catalyst for this innovation cluster. HAS Den Bosch and The Protein Brewery are participants and the core project partners in conjunction with Cosun. The setup allows for partnerships with any other company and institutions in this regard.

This project is to be used by Cosun to shape (strategic and operational) developments in the field of green proteins, both for Cosun and its business groups in relation with other companies and educational institutions. The core activities of the innovation cluster will take place in the Inicio facility and the Cosun Innovation Center on the Nieuw Prinsenland industrial estate in Dinteloord, Brabant. The Inicio facility is a location specifically designed to house small-scale manufacturing activities and pilot factories.

The Cosun Innovation Center (CIC) is a knowledge and expertise centre that concentrates on product development, process technology, analysis and research. This high tech centre houses a range of laboratories (analysis, product development, microbiology and non-food labs), a fully-equipped sensory research space, twelve meeting rooms and an indoor test factory. The Cosun Beet Company makes intensive use of these facilities and uses them for meeting customers, partners and other companies.

Both facilities are used to support advances created by Cosun's own business groups as well as companies from outside (startups and scaleups) and provide accommodation, security and other necessities. The end goal is that research, tests, test runs and analyses will also be conducted here in an open innovation setting.

STRATEGIC PARTNERSHIP ROYAL COSUN (INNOVATION CENTER) AND THE WAGENINGEN UNIVERSITY CAMPUS-BASED STARTLIFE

In April 2020, Royal Cosun and StartLife have announced a strategic partnership to actively bring innovative AgriFood startups together. Cosun's aim is to become a leader in plant-related innovations and, in order to increase their innovative strengths and growth speed, they are looking for partnerships with innovative startups.

Cosun's goal is to be 100% plant-based, circular and transparent by 2030. Entrepreneurship and open innovation play an important role in achieving this ambition. This is why, with the help of StartLife, Cosun has opened its doors to innovative AgriFood startups. 'Cosun has always worked with Wageningen University, so a partnership with StartLife, one of the leaders in Europe in the field of AgriFood which is located on the Wageningen Campus, was logical,' says Frank van Noord, Vice President Cosun Innovation.

Coaching and sharing of R&D facilities: Cosun has a lot to offer to AgriFood startups. They can use the R&D facilities in the Cosun Innovation Center in Dinteloord, while the company also offers individual coaching to the startups and they share their knowledge with them. 'We know how new companies can scale up and we are familiar with the challenges and hurdles you face when you launch an innovative product,' says Frank says. 'Our experts look forward to coaching young entrepreneurs and brainstorming together with them on their business cases.'

Making a difference together: Cosun is a valuable addition to the upward trend in StartLife's corporate partnerships. 'Cosun's focus on plant-based innovations and AgriFood, our overlapping innovation themes and our shared vision to innovate with startups, means it's a great match between our companies,' says Jan Meiling. 'We are also enthusiastic about Cosun's 2030 goals. They really want to make a difference, just like StartLife and our startups.'

About StartLife: StartLife is one of Europe's largest organisations dedicated to innovative AgriFood startups. StartLife's mission is to promote entrepreneurship and support entrepreneurs and their teams in turning innovative business ideas into global companies with a lasting impact. It provides training, guidance, financing and access to a thriving community of startups, investors, companies and experts. StartLife is located on the Wageningen Campus and has a strong focus on science-oriented companies. Since its inception in 2010, StartLife has guided and financially supported more than 300 startups.

4. APPLICATION CENTER FOR SUSTAINABLE FOOD PROCESSING

At the close of 2019 HAS University of Applied Sciences and Food Tech Brainport signed an agreement to create an expertise centre devoted to sustainable food processing for SMEs (+) for the next four years. The centre focuses on how to reduce industrial food waste and is committed to using by-products and residual flows through mild preservation and mild separation technologies.

'We are excited that we are now structurally implementing our partnership with HAS University of Applied Sciences,' says Jos de Boer, managing director of Food Tech Brainport. 'We are both working on the food of today and tomorrow – students and lecturers standing shoulder-to-shoulder with business and politicians to make a difference in the field of healthy nutrition and efficient food processing. Thanks to the knowledge generated by HAS and the lab, demo and production facilities at Food Tech Brainport, we can provide even more value to companies who want to optimise their processes and improve the quality of their product. For us to be joining forces is a great step forward.'

An important area of focus for HAS is sustainable processing, which aims to make food production processes more sustainable as part of Sustainable Development Goal 12, Responsible Consumption and Production. The research group and Food Tech Brainport are working together on this goal and have decided to create a field lab focusing on applied research. 'We focus on long-term programmes,' says Elies Lemkes-Straver, a lecturer on sustainable production in the AgriFood sector. 'This is the basis for the expertise centre. Students play an important role in the research, and we aim to have four internships, two projects and four professional assignments commissioned by companies each year. The facilities and infrastructure in Food Tech Brainport provide a unique basis for performing these professional assignments.'

The municipality of Helmond is contributing financially to the partnership between HAS University of Applied Sciences and Food Tech Brainport, and the creation of this expertise centre is in line with the strong triple helix structure adhered to in the Brainport region (the partnership between industry, government and science and education), which underpins the region's excellent economic standing in the food industry. In addition, the partnership makes a major contribution to the social challenges faced by the government in the field of sustainability and circularity. 'We are very pleased with this strong link between HAS University of Applied Sciences and the business community through Food Tech Brainport and the opportunity it gives us to operate closely with businesses in Helmond. In doing so, we are demonstrating our commitment to broader developments in Brabant, Limburg and Zeeland,' says Dick Pouwels, chairperson of the Executive Board of HAS University.

5. CHIEF, CENTRE FOR HELP WITH INNOVATION, EDUCATION AND EXPERIENCING PLANT-BASED PROTEINS

CHIEF (Centrum Hulp bij Innovatie, Educatie en Fascinatie Plantaardige Eiwitten) is an initiative of the companies Schouten Europe and HAK, which aimed to create a centre for education, innovation and inspiration in the field of plant-based proteins.

- Schouten Europe is an international company specialising in plant-based proteins as foodstuffs. The company and its founding family have more than 30 years of experience in developing and manufacturing plant-based protein foodstuffs and offer a wide range of products. Schouten works with major retailers and snack, salad and meal manufacturing companies, as well as global fast food chains and many other industrial, intermediate and institutional market players.
- HAK was founded 65 years ago by the Hak family in Giessen, Brabant, and HAK has processed and sold produce, beans and legumes ever since, with the focus on quality, transparency and locality. The company is already a market leader in the Benelux region and aspires to become the leading brand in north-western Europe when it comes to fair and healthy vegetable and legume-based foodstuffs.

CHIEF's mission is for the centre to play a role in accelerating the protein transition to a healthy and sustainable lifestyle, increasing consumer awareness by the following means:

- Innovation: the centre revolves around science. Space is given to startups in order to facilitate contact between participating companies and to enable the use of test plots and the experimental kitchen
- Education: an educational package for students has been created and workshops will be hosted for adults. An exhibition is also being set up
- Experience: CHIEF intends to offer an all-in experience through having visitors attend, prepare and taste food products and participate in the process

The initiative soon gained the support of the Brabant provincial government, the Brabant Development Agency (BOM), HAS University and many companies and educational institutions. The following presently play a role in the CHIEF centre in Almkerk: Schouten Europe, HAK, the Province Brabant, Walnut FHM, Altena College, BOM, Royal Cosun, HAS University, Jumbo, LIB, Nestlé, the Province of Flevoland, Rabobank Altena, REWIN, the municipality of Altena, ProVeg and the Western Brabant region.

The foundations have now been cast, with funding secured, educational programmes developed and a location for the centre identified – on the grounds of the Almkreek golf club in Almkerk (Altena municipality), in Brabant. The site has much potential and provides a great deal of space for CHIEF's envisaged activities. Both CHIEF and the Almkreek golf club are very excited about the partnership and the opportunity to further each other's aims, and they share the overarching values and ideals of health and sustainability. CHIEF will play an active role in the club restaurant's menu (80% plant-based) and establish a cooking studio/test kitchen, lecture room, exhibition and an experiential garden.

TIMING/COVID 19

CHIEF was originally set to be launched in March/April 2020, but when the coronavirus pandemic hit the world CHIEF's founders and business partners were forced to focus instead on their companies and employees, and CHIEF activities were temporarily suspended. The new launch date has been shifted to the start of 2021.

6. PROJECT GROW! – HIGH TECH SENSOR TECHNOLOGY IN GREENHOUSES

The GROW! project partners are the Holst Centre research institute in Eindhoven (a joint venture between Stichting IMEC Nederland and TNO), Proefcentrum Hoogstraten, HAS University of Applied Sciences, the University of Antwerp, UCLouvain, LTO Glaskracht and the Flemish Centre for Storing of Horticultural Products *(Vlaams Centrum voor Bewaring van Tuinbouwproducten)*.

The GROW! project sees research bodies, universities and other academic institutions working together with partners in the greenhouse industry to build and optimise high tech green houses. The aim of the interregional partnership between Dutch and Belgian organisations is to make greenhouse horticulture more efficient and introduce further innovations. Using the correct sensors and plant modelling, plant diseases can quickly be detected and eradicated and abiotic stress can be measured and prevented.

The project uses climate, light and ion-selective sensors that are specifically designed for greenhouse horticulture. The ion-selective sensors measure pH levels, conductivity and specific nutrients in the water, which means scientists can identify which nutrients are absorbed by the plants. Climate sensors are also used and optimised in order to measure temperature, humidity, CO2 and other factors.

COMPACT, STURDY AND CHEAP

The sensors developed in the GROW! project are compact, sturdy and should be inexpensive, while their integration is not power-intensive. The solutions under investigation are suitable for most farmers in both financial and practical terms. The best methods for processing and visualizing the sensor data collected are also being studied.

Source: Holst Centre – Hoogstraten testing facility, where a tomato greenhouse has been fitted out with sensor technology

AIRFLOW BOX

Temperature and humidity sensors must be protected against chemical spraying, water and other contaminants, as must their batteries. This was why the airflow box – a casing that protects the sensors and batteries from outside influences, including solar heat – was created.

SOLAR PANELS

The airflow box batteries generally have a six to nine-week lifespan. GROW! researchers perform a power consumption analysis for each sensor transmission sent over the LoRaWAN wireless network, and they are now assessing whether environmentally friendly power sources such as solar panels can be used.

TESTING PROTOTYPES IN GREENHOUSES

In 2019, greenhouses in Hoogstraten in Flanders and at HAS University of Applied Sciences in Den Bosch were used as test sites for wireless sensor network prototypes. A similar test was also performed in a closed climate chamber (BrightBox Venlo) using the GROW! sensors and the network. These tests are being used to assess both the sensors and the quality and usability of the data generated.

PHYSIOLOGY, PATHOLOGY AND STRESS

In addition to measuring environmental factors such as water, CO2 and relative humidity, the GROW! project also investigates the physiology, pathology and stress levels of plants. For example, sensors are being developed that monitor the (real-time) absorption of nutrients and the impact of the microclimate on the spread of diseases. The resultant data is linked to the environmental data and is interpreted using intelligent mathematical models. By displaying the relevant control data (through dashboards and apps), farmers can make decisions with pinpoint accuracy for optimising crop yields.

7. FOODSWITCH – FOODUNITES ROADMAP: DATA-DRIVEN INNOVATION IN THE FOOD SUPPLY-CHAIN

FOODSWITCH PROGRAMME

To stimulate economic growth in The Netherlands, post-COVID-19, Dutch government has launched a new industry & innovation investment fund in September 2020: the Growth Fund. The Dutch AgriFood sector is working on a very large-scale joint innovation programme called FoodSwitch with a good chance of Growth Fund financial support.

FoodSwitch aims to generate new business models and earning capacity as a result of the required switch to sustainable global food production. This sustainability switch provides a unique opportunity for the Netherlands: as a leading nation in AgriFood, Horticulture & HighTech, the Netherlands now has the opportunity to lead the global transition to a sustainable food system.

The FoodSwitch programme enables companies to develop the technology, production systems and methodologies and bring these systems to the international markets, thus facilitating local food production in a sustainable manner around the world. FoodUnites is an important project line and roadmap within the overall FoodSwitch programme.

FOODUNITES ROADMAP: DATA-DRIVEN INNOVATION IN THE FOOD SUPPLY-CHAIN

Within the FoodSwitch programme, the long-term goal of FoodUnites roadmap is to stimulate innovations using HighTech, digitalization and digitization for sustainable food production methods. This will result in:

- Transparency & efficiency across the entire food production chain
- Sustainable and largely closed production chains
- New cost-effective business models
- Training of new talent who can co-develop and implement this approach.

Food production chains must guarantee a reliable supply of safe, healthy, varied and tasty food based on locally produced ingredients with a limited ecological footprint, whereby residual flows are optimally utilized.

INNOVATION APPROACH

FoodUnites' approach focuses on greater precision and the realization of new connections in the value chain, enabled by rapid developments in high-tech, digitization and Artificial Intelligence (AI). Value chain integration is key in this approach, whereby the activities in the individual links in the value chain, from seeds, fertilizers and (precision) agriculture, from production processes and use of residual flows, to consumer knowledge and supermarkets, can be optimized. This requires digitization for the coordinated exchange and analysis of data across the chain – upwards and downwards – creating opportunities for new value and revenue models (e.g. for demand-driven product development).

However, FoodUnites will advocate a revolutionary approach: instead of exchanging raw data to provide insight into the quality of production processes, including price indications and origin, it is often more practical, due to IP considerations, to share the underlying models and computer-based prediction. The systematic collection of data using sensors (e.g. multi-sensing, computer vision) from administrative processes, the use of AI and HighTech applications such as robotics and bio-based material science can lead to completely new data-driven revenue models or the rewriting of current models in this era of big data and online platform economies.

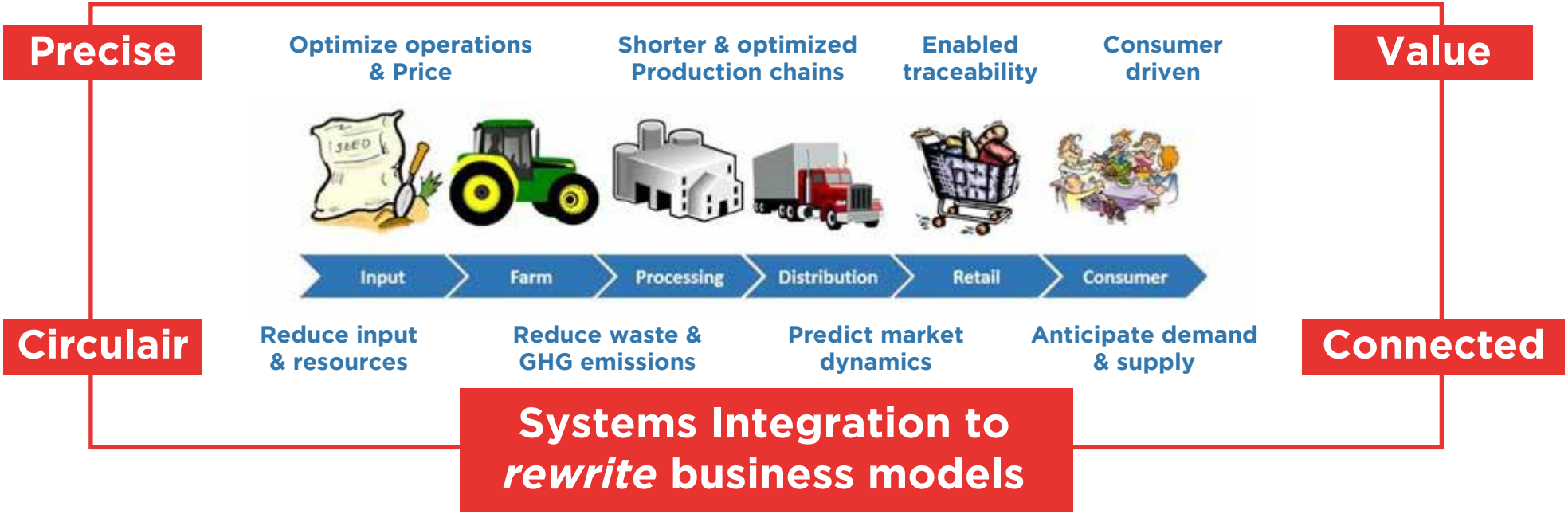
FoodUnites therefore focuses on AI and data science for sharing and connecting models in the value chain to develop new data-driven revenue models, upgrade the value of residual flows and improve efficiency and transparency of sustainable food production.

STARTING ALLIANCE

TU/e -JADS, WUR, UU, AgriFood Innovation Initiative, Regiodeal Foodvalley, Regiodeal Brabant, Taskforce Korte Keten , Transitiecoalitie Voedsel, Sustainable Food Initiative, FoodValley, AgriFoodCapital, World Food Center, Utrecht Food Freedom, Future Food Lab Utrecht, DVG, Citydeal Voedsel op de stedelijke agenda, Greendeal Natuurinclusieve landbouw in het Groene Onderwijs, Regiodeal Bodemdaling, RIVM, AI Coalitie, Provincial & municipal governments (Utrecht, Amsterdam, Almere, Den Bosch), Boerencollectieven (farmers collectives), retail Makro, CLI, branch organizations : primary agriculture, food industry (startup, SME, large), banking, insurance.

PROGRAMME LEAD

- TU/e, Eindhoven University of Technology / JADS, Jheronimus Academy of Data Science
- UU, Utrecht University



Food value integration & value chain reversal by HighTech and digitalization – Data-driven FoodUnites roadmap

8. GOVERNMENT SUPPORT

A. Government support structure

On a national level, the Dutch national and regional authorities work together through the Invest in Holland consortium to help foreign companies to establish themselves in the Netherlands. The national investment agencies NFIA (the Netherlands Foreign Investment Agency), HIDC (the Holland International Distribution Council) and all Dutch provinces, regions and metropolitan areas work together under the Invest in Holland brand.

In the province of Brabant, a broad support structure has been developed by regional and local governments for AgriFood companies. The provincial government and the municipal authorities of all the larger Brabant cities generally have a positive, practical and supportive attitude towards the industry and want to see it prosper in the region. Teams of professionals exist in many organisations for providing operational and strategic support to AgriFood, including BOM, Brainport Development, REWIN, AgriFood Capital, the High Tech Campus Eindhoven team, the TU/e team, and many others.

Four operational government agencies in Brabant have been specifically established to support industry:

- **BOM - Brabant Development Agency**
- **Brainport Development Eindhoven**
- **REWIN West Brabant**
- **AgriFood Capital**

INVEST IN Holland

Holland International Distribution Council

BOM

BRAINPORT EINDHOVEN

REWIN

AgriFood Capital

1. Invest in Holland

Under the name of Invest in Holland (IiH), the Netherlands Foreign Investment Agency (NFIA) – an operational branch of the Ministry of Economic Affairs – has joined forces with the Ministry of Foreign Affairs and several regional partners in the Netherlands. This network represents and promotes the Netherlands abroad as an attractive location for investments or establishing businesses. It also provides support to foreign companies that are setting up or expanding their international activities in the Netherlands.

THE NFIA – NETHERLANDS FOREIGN INVESTMENT AGENCY

SERVICES

- The NFIA provides information, practical assistance and advice to foreign companies
- It was founded 40 years ago as an operational unit of the Dutch Ministry of Economic Affairs
- It is responsible for identifying and attracting direct investments (green field or expansion) from companies that could be made in various countries, including the Netherlands
- It provides access to a broad network of business partners and government agencies
- It is headquartered in The Hague and has a staff of 35
- NFIA initial support is provided abroad through its 27 offices and representatives around the world, staffed by around 75 people
- The NFIA works closely with embassies, consulates and other organisations that represent the Dutch government around the world, as well as with a broad network of partners in the Netherlands

www.investinholland.com

2. BOM - BRABANT DEVELOPMENT AGENCY

SERVICES

When companies are in the process of relocating, setting-up a new subsidiary or expanding their operations, they need the essentials to be taken care of quickly and comprehensively. BOM Foreign Investments was established to be the industry's partner for every one of those steps, providing a wide range of services and support that save on both time and money and clear any obstacles. BOM has a local team of experts available that provide free support for a wide range of matters – whether it be issues with building permits, finding new premises or sites for development, questions on employment law, understanding tax incentives or help with business development, networking and the creation of consortiums for joint research and innovation.

Based in Tilburg, BOM Foreign Investments is part of the Brabant Development Agency (BOM), which is staffed by 85 highly specialised professionals. In order to facilitate foreign investment in Brabant, the team combines its services with the unique expertise and support of their colleagues working in complementary fields within BOM, expertise that includes managing R&D programmes, initiating innovative industrial cooperative projects and venture capital funding.

1. SUPPORT FOR FOREIGN COMPANIES – THE STRENGTH OF BRABANT; A WORLD-CLASS ECONOMY

Located centrally in one of the world's largest markets and with a supply industry and a world-class knowledge economy, Brabant is an attractive location for many foreign companies. BOM Foreign Investments highlights the strengths that Brabant offers and assists newcomers and established foreign companies alike to fully utilise the province's opportunities as a business location.

BOM always works closely with the Netherlands Foreign Investment Agency (NFIA) and the Holland International Distribution Council (NDL), the country's logistics agency, in order to provide potential investors with the following essentials:

- Information: national and regional regulations are demystified by BOM's team of experts, and provides information on taxes and the business climate in the investor's industry.
- Network: a business and supply-chain network and talent acquisition are key to a company's success and often prove to make all the difference. BOM and partners introduce newcomers to Brabant (or companies looking to expand) to their extensive network of contacts in industry, academia and government, ensuring that investors immediately have the best possible contacts.
- Location and site selection: where and when – both crucial decisions in the investment process. BOM can function as a potential investor's guide and advisor from start to finish and help look for suitable sites until a perfect fit has been found

2. DOING BUSINESS ABROAD

BOM International Trade offers those businesses that have outgrown their Dutch roots hands-on support for growing successfully in foreign markets. BOM establishes relevant business and government contacts abroad and provides targeted information on markets and available funding. The International Trade team focuses on three of Brabant's Priority Industries: High Tech Systems & Materials, Life Sciences & Health and AgriFood.

BOM is a public agency that brings companies, knowledge institutions and public bodies together. As BOM has no commercial interests, its independent standing opens doors that often remain closed to commercial ventures. In this respect BOM's goal is to help to create a strong Brabant economy and guarantee that Brabant businesses play a leading role on the world stage. Current target markets for BOM International Trade include China (Jiangsu region), southern Germany (Baden-Württemberg and Bavaria regions) and the United States (Midwest and Texas). BOM International Trade works closely with partners such as the Netherlands Enterprise Agency, the Chamber of Commerce and embassies and consulates around the globe.

3. DOING BUSINESS IN BRABANT - EXPERTISE AND VENTURE CAPITAL FOR STARTUPS AND SCALEUPS

As a growth accelerator with over 35 years of experience, BOM Brabant Ventures helps ambitious Brabant companies to grow in a future-proof manner. Through its knowledge and risk capital, the agency focuses on startups and scaleups in Brabant's Priority Industries: High Tech Systems & Materials, Agrofood, the Biobased Economy, Life Sciences & MedTech and Maintenance & Supply Chain.

4. HELPING INDUSTRIAL CLUSTERS AND BUSINESS ECOSYSTEMS TO GROW IN BRABANT

BOM Ecosystems Development assists in bringing the right companies and institutions and the right people together to accelerate innovation and generate new business for your company. This could entail the expansion of an existing business, moving in a new strategic direction, integrating sustainability in your core activities and/or developing a new business model. Partnerships can be formed in Brabant or across the Netherlands as well as on an international scale, working together with BOM Foreign Investments & Trade.

Because innovation requires time, effort, knowledge, facilities and financial resources, BOM Ecosystem Development believes that small and medium sized enterprises (SMEs) can accelerate the market launch of innovative products by working together. Partnerships can be forged with other SMEs and/or large companies and by joining forces with knowledge institutions and public agencies. The BOM team will help your company find these partners and set up the cooperative venture.

5. CREATING ENERGY PROJECTS - CONTRIBUTING TO ENERGY TRANSITION IN BRABANT

BOM Renewable Energy facilitates energy conservation and sustainable energy generation. The team works with businesses, property owners and citizens' initiatives to create sustainable energy projects. BOM Renewable Energy encourages energy conservation in the property market and industry and provides advice and assistance for cost-effective solutions that will help make Brabant energy-neutral.

BOM Renewable Energy advises on project organisation and structuring and can also invest in the projects and use its network to kick-start projects. The team's focus is on major projects, such as wind farms and solar parks, and on connecting and bringing smaller projects together. Smaller projects are supported through BOM's EsCo (energy service company) partners, who are active in specific markets, such as solar panel manufacturing or social housing and energy conservation for SMEs.

www.brabantisbright.nl
www.bom.nl

3. BRAINPORT DEVELOPMENT EINDHOVEN

SERVICES

Brainport Development, a part of Brainport Eindhoven, is the association that concentrates on innovation and economic development. Brainport Development fosters economic growth in the region by attracting international high tech and manufacturing companies and providing them with local support. From startups and scaleups to large multinationals, Brainport shares knowledge and advises on issues such as funding, putting them in touch with other companies and with local and international talent. It is also responsible for implementing the economic strategy defined by the Brainport Foundation, on the grounds of which Brainport Development partners with companies, knowledge institutions and public agencies as an independent body.

The region's philosophy is 'we can grow faster when we grow together', and that businesses only require occasional guidance or additional assistance. And this is what Brainport Development offers to both foreign and local companies. In reality, it is an economic development association and is funded by all 21 municipalities within the Brainport region.

www.brainporteindhoven.com/en/

4. REWIN WEST-BRABANT

REWIN West-Brabant, the regional development agency for the western region of Brabant province, works to boost the regional economy by encouraging business investment. REWIN provides support for establishing and/or relocating both branch offices and entire companies, and it has a special interest in the following key industries: Logistics, Maintenance, AgriFood/ Biobased Economy and Creative services.

SERVICES

REWIN provides help and guidance on a wide range of issues, including:

- Advice on availability and the pricing of business locations in the western part of Brabant, including advice on locations and viewing properties together with you
- Support for legal and tax issues, such as incorporating a business or appealing a tax assessment
- Information on the regional business climate, labour market and residence and work permits
- Guidance on the availability of financial assistance, grants, venture capital and private investment opportunities
- Assistance with grant and permit applications
- Information on staff recruitment and training, current labour and salary conditions

REWIN will assist newcomers to western Brabant through introductions to its network of local authorities, educational institutions, knowledge networks and technological expertise and business networks throughout the region. Companies can also participate in a range of business development programmes in the key economic industries of logistics, maintenance and the biobased economy.

www.rewin.nl/en

5. AgriFood Capital

AgriFood Capital is a joint venture between industrial partners, public authorities and knowledge institutions in north-eastern Brabant that targets growth and innovation in the AgriFood industry. The partnership assists the AgriFood industry in developing smart regional solutions to global AgriFood challenges. Its mission is to create the smartest and most sustainable food production systems.

SERVICES

AgriFood Capital offers a platform for food companies and game-changers that wish to pool their diverse resources in order to uncover new ways of making food, develop new knowledge and to leverage their talent for the AgriFood industry of tomorrow, or those that wish to start a company or take one to the next level. Food companies have access to the knowledge, coaching, networks and funding required to reach these goals. By working together with other industries, such as high tech, logistics and education, AgriFood Capital plays a role in the further development of the strong and distinct AgriFood ecosystem of north-eastern Brabant.

www.agrifoodcapital.nl/nl/about-agrifood-capital/

6. AgriFood as a Priority Industry

The AgriFood Priority Industry is one of the nine Priority Industries in which the Netherlands aims to excel on a global level. Businesses, universities, research centres, public agencies and social organisations work together on knowledge and innovation, internationalisation, human capital and cutting red tape in order to further strengthen the country's position in this respect.

SOCIETAL CHALLENGES

he world is facing enormous challenges, with the population set to increase by a further two billion over the next generation while today 800 million people are either malnourished or undernourished. The upshot is that more food than ever before will have to be produced.

At the same time, we are also witnessing the need for different kinds of food. Increasing prosperity levels around the globe have seen the demand for high quality proteins such as vegetables, dairy and meat on the rise. An increasing proportion of the population suffers from diet-related health issues (such as obesity and diabetes) and consumers are increasingly choosing healthier and more sustainable foodstuffs.

Even though, when measured per kilogram of food produced globally, the Dutch agricultural industry has the least impact on the environment, climate and biodiversity, further steps are both necessary and possible. That is why extra attention needs to be paid to developing climate neutral, sustainable and robust production systems, where circularity and reuse of waste and by-products are also important. Animal welfare is and will remain an important topic.

ECONOMIC OPPORTUNITIES

These societal challenges also offer great economic opportunities, and the Dutch agricultural sector has important assets that can play a role. The country's AgriFood industry is a global market leader and is strong, highly productive and innovative with very efficient processing and logistics services. Dutch knowledge institutions are among the best in the world and the public-private partnerships between businesses, knowledge institutions and government are embedded in Dutch genes. By joining forces, the industry and all its stakeholders can address societal challenges and simultaneously improve the economic clout of the industry – both in the Netherlands and abroad.

THE AGRIFOOD INDUSTRY: AMBITIOUS OBJECTIVES IN INNOVATION

The AgriFood Priority Industry aspires to be a world leader when it comes to solving global agriculture and food challenges. More specifically, the industry's Knowledge and Innovation Agenda highlights the following priority issues:

1. Circular agriculture
2. Climate-neutral agriculture and food production
3. Climate-proof rural and urban areas
4. Healthy and safe food that is appreciated
5. A sustainable and safe North Sea, oceans and inland waters
6. Creating and maintaining the best-protected and most habitable delta in the world
7. Key enabling technologies

The AgriFood Priority Industry encourages the development of new knowledge and innovations, first and foremost by creating and funding research and innovation projects. This does not just include fundamental and applied research, but also the exploitation and commercialisation of such research.

AGRIFOOD TOP TEAM

Final responsibility for AgriFood lies with the Top Team, which is made up of representatives from the business sector, academia and government (the Triple Helix). The Top Team acts as the management committee and is chaired by an industry member.

THE AGRIFOOD KNOWLEDGE AND INNOVATION AGENDA (KIA) FOR 2018-2021

The AgriFood Priority Industry aspires to be a world leader when it comes to solving global agriculture and food challenges. More specifically, the industry's Knowledge and Innovation Agenda highlights the following priority issues:

1. Tasty, healthy and safe food for a growing world population
2. Climate-neutral and robust food systems
3. Circularity and resource efficiency of chains and food systems
4. Strengthening of innovation and business earning capacity
5. Exploitation in successful chains

The KIA 2018-2021 is discussed in greater detail in Chapter IX.B.1, International Trends & Developments.

www.topsectoragrifood.nl/en/

7. HOLLAND EXPAT CENTER SOUTH

Holland Expat Center South is a non-profit governmental agency that is a joint initiative of the participating municipalities (almost every municipality in Brabant), the Netherlands' Immigration and Naturalisation Services (IND), Brainport Development, and the province of Brabant.

SERVICES

The Holland Expat Center South compiles the procedures and provides information that helps expats and their families to settle into their new living (and working) environment. Expats can obtain information about the region from the Expat Center and learn more about events organised specifically for the expat community. Its main purpose is to help expats feel welcome and at home.

The Expat Center helps companies employing expats and expats themselves to fulfil the formalities required for residing in the Netherlands, such as acquiring the compulsory BSN (Citizen Service Number), help with visa/residence permits, work permits (if required), converting a driver's license, TB testing, etc.

www.hollandexpatcenter.com

B. Incentives and grants/support programmes

1. Highly-Skilled Migrant Permit

Highly-skilled migrants do not require an employment permit to work in the Netherlands. The national scheme for highly-skilled migrants is available for employee transfers that do not fall under the scope of the EU's intra-corporate transfers (ICT) directive. This may be the case for employees who, for the duration of their assignment, are placed on the Dutch payroll of the recipient company. Japanese nationals and Turkish nationals do not require an ICT residence permit either; they can apply for a highly-skilled migrant residence permit.

WHAT IS A HIGHLY-SKILLED MIGRANT?

A highly-skilled migrant or knowledge migrant (in Dutch, a kenniswerker) is any foreign employee who:

- comes to the Netherlands to work as an employee;
- earns at least €4,612.00 (excluding holiday allowances and 13th cheques) gross per month;
- or earns at least €3,381.00 (excluding holiday allowances and 13th cheques) gross per month, if under the age of 30.

These salary amounts are applicable for 2020. The sums are index-linked annually.

Fixed allowances for housing and a company car may be added to the employee's base salary in order to comply with the above salary criteria, but only if these allowances are agreed to in writing and paid in monthly instalments.

An application for a permit can be declined if the salary is not a competitive one in the industry in question. This income requirement does not apply to scientific researchers and physicians training to become specialists, or to people working for educational or research institutions.

Employers that wish to employ highly-skilled migrants are no longer required to also apply for work permits for these employees, and they now only have to submit an application for admission and residence for the employee and his family to the Immigration and Naturalisation Department (IND). The application procedure takes two to three weeks. A residence permit for highly-skilled migrants will be granted for the duration of the intended employment, up to a maximum of five years.

Professional soccer players and ministers or teachers of religion are not eligible for residency as highly-skilled migrants. Directors and major shareholders cannot apply for the knowledge migrant scheme either if they hold a stake larger than 24% in the company, as they are then liable for any company risks and can influence their own incomes.

The income requirement for highly-skilled migrants will be reviewed on 1 January of every year on the basis of the most recent index figure for negotiated salaries, as published by Statistics Netherlands (CBS). The average yearly increase of the salary criteria has been 2.6% for the past three years. Whenever a highly-skilled migrant submits an application for the extension of his or her residence permit or switches employers, the IND will apply the most recently indexed salary criteria.

Thus, if a highly- skilled migrant applies to extend his or her residence permit three years after being admitted for the first time, he or she must take into account that the applicable salary criteria has increased by almost 8%.

If a highly-skilled migrant under the age of 30 continues working for the same employer after turning 30, the lower salary requirement that was in force when he or she first applied for a residence permit remains applicable. If the highly-skilled migrant applies for an extension and continues to work for the same employer, the most recently indexed salary criteria for the under-30 age category is applicable. However, if this employee switches employers after turning 30, the most recently indexed salary for those over the age of 30 is applicable.

2. The 30% Ruling (Tax-free Allowance)

The Netherlands has a special tax regime for expatriates, known as the 30% ruling, which exempts them from a substantial portion of their income tax (up to 30%). This is viewed as a reimbursement of the extra costs involved in living abroad, the extraterritorial expenses. Rather than having to specify and prove the extraterritorial expenses incurred by an employee or an employer for its employees each year, the costs are set at a maximum of 30% of the taxable remuneration. In addition, the employer may reimburse certain costs tax-free. This includes international school fees, certain relocation expenses and a moving allowance up to a given limit.

THE PART OF THE INCOME TO WHICH THE ALLOWANCE APPLIES

Under the tax rules, the employer may grant the employee a tax-free allowance of up to a maximum of 30% of his or her taxable remuneration package. Incidental and flexible forms of income such as bonus payments and stock options that are paid out during the duration of the 30% ruling are also included. Severance and pension payments, however, are excluded.

METHOD OF CALCULATION

Under the regulation, the taxable and the non-taxable part of the income has to be split in the employment contract itself. In other words, the 30% tax-free allowance must be granted as a separate part of the employee's salary. Standard wording is used to state this in either the employment contract or in a separate addendum to the contract. For employees with net salary contracts and irregular payments, it can be difficult to precisely determine the non-taxable part of 30% on a monthly basis, and so in these cases they may determine and pay the exact tax-free reimbursement on an annual basis.

RULING AND PENSION

An employee cannot accrue a pension under a qualifying plan in the Netherlands (or social security benefits) on the tax-free allowance. This affects employees who have a pensionable base equal to their full gross salary. Employees who may apply the 30% ruling may only accrue pension on the taxable part of their salary. There is way to avoid this, although the employer must fulfil a number of legal formalities and draft special documents for this purpose.

EXTRATERRITORIAL COSTS

The 30% ruling is a practical solution for employers wishing to reimburse, tax-free, the additional costs incurred by the employee working in the Netherlands as opposed to their home country, the extraterritorial costs (instead of keeping all receipts of the actual costs claimed by the employee). The Dutch State Secretary passed a special decree that further detailed which costs, allowances and benefits in kind that are typically paid to expatriates qualify as extraterritorial costs. In the case an employee who was hired or assigned from abroad to work in the Netherlands and was not deemed eligible for the 30% ruling, it is still possible to reimburse the de facto extraterritorial costs to this employee tax-free. In this event, the employer must retain proof of the extraterritorial expenses incurred.

INTERNATIONAL SCHOOL FEES

Under the 30% ruling, the employee may receive an additional tax-free reimbursement of the fees paid for children to attend an international school. A school is regarded as an international school when a) the education is based on a foreign school system, and b) in principle the school only accepts the children of foreign employees.

RELOCATION EXPENSES/MOVING ALLOWANCE

The costs of moving as well as the costs for transporting household goods as part of the employment or secondment package are not considered extraterritorial costs, which means that these costs can - to a certain extent - be reimbursed tax-free. Actual relocation costs of up to €7,750 (2019) can be reimbursed.

PERIOD OF VALIDITY OF THE 30% TAX-FREE ALLOWANCE

The 30% ruling is available for a period of five years (60 months). The rules stipulate that the tax authorities can demand that the employer demonstrates at all times that the employee still meets the conditions. Where the employee no longer meets the conditions of the 30% ruling, it can no longer be applied. This will result in a retroactive adjustment (when required). If the employee's contract in the Netherlands has ended, the 30% ruling will also simultaneously cease to apply. As such, the 30% ruling cannot be applied to any payments made after that time.

The duration of any previous stay or period of employment in the Netherlands is subtracted from the maximum five-year period. However, this reduction will not occur if the expatriate has not stayed or worked in the Netherlands during the 25 years preceding his or her most recent arrival date in the Netherlands (or has only stayed in the country for very limited periods).

CONDITIONS FOR QUALIFYING

In order to qualify for the 30% ruling, the following conditions must be met:

- The employee (board members and supervisory board members also qualify for the 30% ruling) must be recruited (or assigned) from abroad;
- The employer must be a Dutch wage tax-withholding agent. If the employee has a Dutch resident employer (a Dutch corporation or branch of a foreign corporation) this condition is usually met. If the employee has a foreign based employer which has no taxable presence in the Netherlands, the employer must have one or more employees working in the Netherlands, perform payroll administration in the Netherlands, and be registered as a withholding tax agent with the tax authorities.
- The employee must have lived outside of a 150 km radius from the Dutch borders for at least two-thirds of the 24 months prior to the start of their employment in the Netherlands;
- The employee must have the specific expertise required to perform the function and which is not available or scarce on the Dutch labour market. This is based upon a salary standard that must be met; and
- The 30% ruling must be contractually agreed upon between the employer and employee. This also implies that the employee is aware that the 30% ruling reduces his or her gross salary.

3. Incentives for Research and Development Costs in the Netherlands (WBSO)

Companies established in the Netherlands performing research and development work (Speur- en Ontwikkelingswerk: S&O or R&D) may be eligible for tax relieve on wage costs and additional costs. The WBSO R&D scheme is intended to provide entrepreneurs with an incentive to invest in research by means of reducing the R&D wage costs. The WBSO scheme for R&D includes salary and other costs and expenses directly related to R&D activities.

The benefit amounts to 32% of the first EUR 350,000 of R&D costs (both salary and other costs and expenses) and 16% for R&D expenses above €350,000. For startups, the percentage for the first bracket is higher, at 40% instead of 32%. The WBSO does not have an upper limit, although the maximum benefit may not exceed the wage sum.

CONTRIBUTION

The R&D allowance takes the form of a reduction in wage taxes and social security contributions. The WBSO can be applied to costs and expenditure directly allocable to the company's R&D activities, whereby:
1) costs must be incurred exclusively (for 100%) for R&D;
2) expenditure must serve R&D (can also be partly allocable).

When applying for the WBSO one can choose between a lump-sum application (based on the number of R&D hours; no R&D expenditure will be subsidised) or an estimate of the actual amount of costs and expenditure incurred.

ACTUAL COSTS AND EXPENDITURES

Only costs and expenditure directly allocable to R&D and which serve R&D purposes can be taken into account. In this respect, note that not all activities related to R&D projects can be recognised as R&D work. For example, administrative and organisational costs are excluded.

As far as the costs are concerned, it is only those costs that are borne by the taxpaying company itself). When it comes to expenditure, the allowance only applies to newly manufactured business assets insofar as:

- these assets have not been previously used;
- they have not been included in previous R&D declarations (subsidy applications);
- these assets fall under own R&D activities;
- expenses are borne by the taxpaying company payer (or a group company of an affiliation, in tax terms, that the taxpaying company is a part of)

CONDITIONS

The R&D project must meet the following conditions before one can apply for the R&D allowance:

- the proposed R&D activities take place within your own company
- the technological development is new to your company
- the development brings with it technical issues
- the R&D work has yet to be undertaken (which means you must always submit a WBSO application in advance).

R&D work is defined as a systematically organised activity, related directly and exclusively to:

- technical scientific research
- the development of:
  - (Parts of) physical products
  - (Parts of) physical production processes
  - Software (technically new (parts of) software)
  - Software components (technically new)

WBSO support is explicitly NOT intended to support feasibility studies, software upgrading, software modifications for different hardware or software platforms, developing services, routine activities, market research, organisational or administrative work, policy and strategy studies, the adaptation or deployment of purchased goods, quality control and assurance, the adaptation or implementation of existing technology, pilot plants and related products on a production scale with commercial value.

4. Innovation Box

Companies can benefit from an effective tax rate of just 7% for income from intangible assets created by their Dutch taxpaying entity. The effective tax rate of 7% will increase to 9% in 2021. Patented intangible assets as well as intangible assets that have been created by the Dutch taxpaying entity and for which an R&D declaration (an approved WBSO application) was obtained, may qualify for the Innovation Box. In practice, this means that technological innovations developed in-house qualify.

The lower tax rate of 7% is claimed in the corporate income tax return filed by the Dutch taxpaying company. The lower tax rate is actually an exemption for a substantial part (72%) of the profits that can be allocated to the Innovation Box. By applying the general Dutch corporate income tax rate of 25%, this results in an effective rate of approximately 7%.

The Innovation Box does apply:

- in situations where the period between an application for a patent and the granting of the patent is unusually long. Subject to certain conditions, profits that are attributable to the relevant patented asset may, during the period from the year in which the patent was applied for up to the year preceding the year in which the patent was granted, also be brought within the scope of the Innovation Box.

The Innovation Box does not apply:

- to marketing intangibles such as trademarks and logos
- to intangible assets for which a patent was obtained if the asset was already in existence before 1 January 2007
- to intangible assets for which an WBSO R&D declaration was obtained if the asset was already in existence before 1 January 2008

As a result of EU talks on favourable EU IP regimes and the introduction of minimum rules for preferential IP regimes (OECD BEPS project), as of 2017 the Netherlands has altered the Innovation Box regime in order to be compliant with the new requirements. The changes relate to the entry tickets to the Innovation Box (you now require a WBSO R&D declaration) and allocation of income that qualifies for the special tax rate.

Originally, there was no cap on the amount of profits that could be allocated to the Innovation Box, although a taxpayer had to be able to prove that the profit was related to the qualifying intangible assets. As of 2017, restrictions have been introduced (the modified nexus approach). It is recommended that an agreement be reached in advance with the Dutch tax authorities on which method to apply – they will do this on request. At present, the Innovation Box regime has the following relevant features:

R&D ACTIVITIES (ENTRY TICKET)

Originally, the Patent Box or Innovation Box incentive could only be applied to income generated from registered patents, but this has now been extended to include income from R&D projects for which a WBSO R&D declaration has been obtained. Henceforth, a distinction is drawn between small and other taxpaying companies.

Small taxpayers are companies with worldwide net group sales of under €50 million per year and a gross benefit from IP not exceeding a total of €37.5 million in five consecutive years (an average of €7.5 million per year). For small taxpaying companies the WBSO R&D declaration suffices as an entry ticket to the Innovation Box.

Larger taxpaying companies not only need to obtain a WBSO R&D declaration but must also have a recognised *legal access ticket*. For larger taxpaying companies, these legal tickets granting access to the Innovation Box can consist of, inter alia, patents and plant variety rights and applications, software developed within the WBSO and certain market authorisations/ approvals (particularly for pharmaceuticals). This category of taxpayers will thus be subject to a twofold test. A small taxpaying company can also include unprotected IP in the Innovation Box regime.

MAXIMUM REVENUES (ALLOCATION OF INCOME)

A restriction is in place with respect to the level of income that can be allocated to the Innovation Box (the modified nexus approach). It is now more important whether or not R&D will be performed in-house and how R&D costs are divided between the parties involved. This implies that the more R&D activities are outsourced to related parties, the lower the profits that can be allocated to the intangibles resulting from such R&D activities.

9. TRENDS AND DEVELOPMENTS IN AGRIFOOD

In this chapter we take a closer look at the national and international trends and developments in AgriFood:

A.
The first section summarises the national agricultural policy of the Ministry of Agriculture, Nature and Food Quality (LNV).

B.
In the second section we detail the AgriFood Innovation Policy of the Netherlands: the AgriFood Knowledge & Innovation Agenda (KIA) for 2018-2021. This four-year plan has been jointly developed by government, the AgriFood industry, science and education bodies and citizens and outlines expected developments in the Netherlands in the Agricultural and Food industries and in related science and education fields.

C.
Next, we present a bird's eye overview of the most important trends and developments in the international AgriFood industry. This section is been divided into the following subsections:

1. The European Union's Food 2030 trends and objectives
2. The Netherlands' interpretation of these trends and objectives
3. The consequences for Brabant; resultant challenges and opportunities

A. The Netherlands' national agriculture policy

1. Dutch Agriculture Policy, 2020–2030: an overall vision for a strong and sustainable agriculture industry in 2030

SHIFT TO CIRCULAR AGRICULTURE

Under this policy there is a strong incentive to shift to circular agriculture. In order to tackle any obstacles that might impede innovations, farmers engaged in circular agriculture are assigned experimental areas. The transition to a strong and sustainable agricultural industry is taking further shape through the amendment of laws and regulations that will cut fertiliser use and encourage the use of animal manure. In order to be able to use (food) residual flows as animal feed more widely, national regulations are also being amended. Staatsbosbeheer (the National Forest Service) provides land to farmers who intend making their farms nature-inclusive but lack the space.

Carola Schouten, Minister of Agriculture, Nature and Food Quality (LNV) has set these aims out in the implementation plan for her vision for a sustainable and strong agricultural industry in 2030, which was brought before the House of Representatives. The minister explained how the move towards circular agriculture had been initiated and is irreversible:
'No longer producing as cheaply as possible but producing with the least possible loss of raw materials and careful management of soil, water and nature. That is the core of circular agriculture, which we are working towards together. This is not a matter for the authorities alone. The switch will only succeed with the help and commitment of banks, retail, social organisations, consumers and of course the farmers themselves: he or she must earn a good income and be able to innovate in order to run a healthy business. Our agricultural industry has been thriving worldwide for decades, and I am proud of that. Through circular agriculture and the associated innovations, we aim to maintain that position.'

FUNDING THE TRANSITION

In order to achieve circular agriculture, a large part of the ministry's budget (€135 million in 2019) will be devoted to activities that contribute to the goals of this vision. Innovation funds will also focus on it. Supplementary funding is also available under the Coalition Agreement, such as funds for the voluntary cessation of pig farming activities (€200 million) and for improving nature and water quality (€40 million). In 2020, €25 million will be set aside for innovations that contribute to circular agriculture and climate-resilient agricultural practices.

The new Common Agricultural Policy (CAP) for the period 2021-2027 is being drafted by the EU. The Netherlands is committed to using the money it will receive under the CAP to assist Dutch farmers and horticulturalists in the transition to circular agriculture, insofar as is possible. The implementation plan will help the sector platform for Agriculture and Land Use to achieve its goal of reducing CO2 emissions by 6 million tons instead of 3.5 million tons as part of the Climate Agreement. The Government will make additional resources available for this goal.

THE THREE PRIMARY MODULES OF THE CIRCULAR AGRICULTURE POLICY

I. From fertiliser to animal manure

The feed-manure cycle in the Netherlands is not closed. The aim is to fertilise pastures, arable land and horticultural fields with high-quality fertilisers, including more locally available residual flows, compost or animal manure. Artificial fertiliser use will be discouraged. The fundamental revision of the national manure policy is under development and will soon be released. It is crucial that nutrients from animal and human faeces are recovered and properly utilised. In a European context, the Netherlands advocates using high-quality natural fertilisers as a replacement for artificial fertilisers. The ministry is supporting pilot projects that study the effects of this on agriculture and the environment

II. Soil and innovation

In 2020 a baseline measurement will be performed of the condition of agricultural soils in the Netherlands and unambiguous measuring methods will be introduced to continue monitoring their condition in the future. In September, the first Soil Summit will be held (which will be an annual event) in order to exchange knowledge and deal with any other relevant matters. Thanks to precision agriculture, technology can be used to determine exactly what the soil, crops or livestock need. The National Agenda for Precision Agriculture is expected to be released in 2020. In 2019, ten farmers started precision farming pilot projects, with a further ten following suit in 2020. It is being investigated how technology can help to improve the fertilisation of grasslands, protect nests and fauna in grasslands and how technology can contribute to better weed control.

III. The strong position of the farmer is a precondition

To make the transition to circular agriculture, the position of the farmer is crucial: he or she must be sufficiently valued and earn an income that is high enough to earn returns on the necessary investments. Initiatives are being taken to improve the earning capacity of farmers. Consultations on what the most important preconditions are for the earning capacity of farmers in the switch to circular agriculture will follow.

Access to investments is important, as is the reward for social services, such as agricultural nature and landscape management. The business acquisition fund for young farmers creates financial space to invest in sustainable business development at the time of and immediately after an acquisition.

Combating unfair commercial practices is a precondition, which is why a number of unfair commercial practices are prohibited by law. The Authority for Consumers and Markets (ACM) will supervise compliance with legal provisions and will investigate pricing practices in the chain from producer to consumer.
There will also be a disputes committee which farmers can approach for accessible and independent dispute resolution. The ACM shall ensure that farmers and horticulturalists receive higher prices from customers who set standards that are higher than legally required, such as excessive sustainability or animal welfare standards.

2. Additional government measures for reducing nitrate emissions in the Netherlands

The Dutch government announced a broad investment package of more than €5 billion in 2020 for reducing nitrogen precipitation and restoring nature in the period up to 2030. It is investing over €2 billion in establishing efficient nitrogen reduction or management measures in agriculture (including keeping cows in the pasture longer, improved stabling, different feed and financial schemes for farmers wanting to switch to more sustainable agriculture and farmers wanting to opt out), industry (improved technology for fewer peak load emissions) and construction (clean mobile equipment).

In general, measures in livestock farming are the most effective, because reduction by a kiloton of ammonia emissions yields more than a reduction of a kiloton of nitrogen oxides, as there are more moles of nitrogen in ammonia than in nitrogen oxides.

In the short term, the government is investing in innovation programmes to develop new technologies and approaches to make stables more sustainable. The innovation scheme for livestock farming is an example of this approach. It will be a few more years before the exact results of the plan are known. Once there is a better understanding of the effects of innovations on reducing emissions, these can be incorporated into new standards and an appropriate transition period can be set. This will become clearer in 2023.

Earlier, the government also decided to focus on reducing nitrogen in 2020 by modifying animal feed. Less crude protein in feed means fewer nitrogen emissions from manure. Farmers have also stated that the protein content of animal feed can be lowered. Currently – May 2020 – steps are being taken to determine the degree to which different animal feeds affect nitrogen levels and what measures can reasonably be expected from farmers.

The measures to reduce nitrogen emissions between 2020 and 2030 are:

1. Modifying the composition of cattle feed: with less protein in animal feed, less ammonia is produced by manure
2. Reducing manure emissions:
   a. Diluting fertiliser
   b. Central manure processing
3. Encouraging farmers to switch to another type of (AgriFood) business: Transition fund
4. Investing in sustainable stables for livestock farming: a subsidy scheme for ource-oriented measures to develop sustainable stables
5. Business termination scheme for farmers wanting to quit:
   a. A subsidy scheme for the shrinking the pig farming industry
   b. The targeted buy-out of farms close to Natura 2000 nature reserves
   c. National termination scheme
6. Farmers are encouraged to leave their cows in the pastures longer, ensuring that urine and manure are separated so that less nitrogen is produced in the form of ammonia

B. The Netherlands' AgriFood Innovation Agenda

In the Netherlands, all stakeholders in the AgriFood industry – government, the agricultural industry, the food industry, science and education and citizen organisations – have launched a joint innovation policy for the period until 2021: the Knowledge & Innovation Agenda (KIA) for 2018-2021. This document details the most important trends and developments the industry will be focusing on in the Netherlands in the period between 2018 and 2021.

1. AgriFood Priority Industry Knowledge and Innovation Agenda (KIA) for 2018-2021

The AgriFood Priority Industry aspires to be a world leader when it comes to solving global agriculture and food challenges. More specifically, the industry's Knowledge and Innovation Agenda highlights the following priority issues:

A. Tasty, healthy and safe food for a growing world population
B. Climate-neutral and robust food systems
C. Circularity and resource efficiency of chains and food systems
D. Strengthening innovation and business earning capacity
E. Commercialisation in successful chains

The Priority Industry's focus on developing new knowledge and innovations is combined into five central themes:

1. **Consumer and society:** consumption of sustainable, safe and healthy products, a healthy diet, a healthy lifestyle, consumer-driven chains, information and transparency in chains, a fair price, consumer confidence.
2. **Climate-neutral production systems:** ecological and economic shelf life, reduction in emissions, efficient use of resources, reduction of greenhouse gasses, biodiversity, good soil quality, sustainable water management, healthy plants and animals, optimal animal welfare.
3. **Healthy and safe products and production processes:** development of safe products for a healthy diet, sustainable food processing (efficient, mild conservation), aimed at the whole chain, guaranteeing the health and safety of food, animals and production processes.
4. **Circular systems:** resource-efficiency, closing cycles, loss limitation, adding value to side and residual flows from the agricultural food industry for food and non-food.
5. **Smart technology:** IT/big data, robots, drones, sensors, innovative materials and other technology that contributes to efficient, climate-neutral, circular production and even healthier and safer food.

In the following pages, companies with their main operational facilities in Brabant are printed in bold.

THEME 1. CONSUMER AND SOCIETY

GOAL

The AgriFood Priority Industry aims to develop consumer-driven chains that develop, produce and market healthy and sustainable products in an innovative and efficient manner that contribute to general social welfare and to an economically strong chain. The focus is on the consumer who is capable of making choices and opts for a healthy diet and a healthy lifestyle.

PROJECT EXAMPLE:

PERSONALISED NUTRITION AND HEALTH

In order to keep healthcare affordable, effective prevention programmes are essential. Over the last few years, lifestyle advice through mass media campaigns has not led to significant improvements in public health.
The programme develops a method to measure a person's nutritional intake and state of health and translates this information into a personal advice. The expectation is that consumer's healthy behaviour is likely to continue over a longer period due to the rapid feedback concerning their behaviour and thus considerably reducing the risk of diet-related diseases.

Ahold, Bayer CBS, CropScience, **Danone**, DSM, **FrieslandCampina**, Campbell Soup, Google Ireland, **Jumbo**, Kaiteki Institute, Migros, NIPED, Noldus Information Technology, **Philips**, Priva, PS In Food Service, Sense Health, SmartWithFood, Vital 10, VitalinQ, Addam, Flavourspace, the municipality of Rotterdam and Wageningen University & Research are all a part of this consortium.

THEME 2. CLIMATE-NEUTRAL PRODUCTION SYSTEMS

GOAL

The Priority Industry plans to help develop climate-neutral, efficient, sustainable and robust production systems, with a focus on animal and plant health, animal welfare and biodiversity. Climate neutrality is the target point for reducing or compensating for the emission of greenhouse gases.

The following sub-themes have been identified:

- Integral, more sustainable and robust production systems: reducing emissions, efficient use of resources, use of minerals, sustainable raw materials, biodiversity, climate adaptation and mitigation, circularity
- Greenhouse gases: CO2, nitrous oxide and methane reduction, efficiency and storage
- Soil and water: good soil quality, sustainable water management
- Healthy animals and people (crossover with Healthy and Safe): the reduced use of antibiotics, including reduced antibiotic resistance, managing zoonoses, resilient animals, interventions, protection and improvement of animal health, animal welfare
- Plant health (Crossover with Horticulture and Starting Materials)
- Sustainable fishing industry and aquaculture

PROJECT EXAMPLE:

BETTER SOIL MANAGEMENT

Healthy soil not only contributes to higher crop yields, it is also beneficial for the climate, contributes to good water management and creates biodiversity. However, soil quality is under pressure worldwide. In the project, several methods for improving soil quality are being examined. Ways to improve soil fertility, increase soil resilience, how integral soil management can be bolstered and what effect soil treatment has on soil structure are all being investigated. The project allows us to understand issues such as the effects of reduced soil treatment on several crops, how organic matter content can be increased and what climate-proof measures can be taken.

Participants are **Agrifirm**, AVEBE, CZAV, **Royal Cosun**, Stichting IRS and Wageningen University & Research.

THEME 3. HEALTHY AND SAFE PRODUCTS AND PRODUCTION PROCESSES

GOAL

This central theme aims to contribute to improving public health by producing healthy, safe and tasty food. The salt, sugar and fat content in products is reduced and the fibre content is increased. The reduction of food allergies is also part of the central theme. A sustainable, energy and water-efficient way of post-harvest processing with minimum waste is a clear goal for the production process. A precondition is food safety, as well as human health in relation to animal health in livestock farming (1Health).

The following sub-themes have been identified:

- Development of products and processes for a healthier diet: redefining the issue, research into the relationship between products (taste, smell, texture), purchasing behaviour, preparation and a healthy diet, reduction of food allergies and strengthening the immune system.
- Sustainable food processing: efficient, mild and aimed at the entire chain, quality and safety in the chain, packaging and storage, reducing food waste.
- Health and safety of food and animals: micro-organisms, use of antibiotics, controlling zoonoses, safe production methods, reduced environmental pressure, pathogens and particulate matter.
- Food and health: methods for measuring the effects of food on health (including food allergies).

PROJECT EXAMPLES:

NEXT-GENERATION MEAT SUBSTITUTES

In terms of nutritional value, vegetable proteins are highly suited to catering in part to the increasing demand for high-quality proteins. As yet, only a small percentage of animal proteins are being substituted for vegetable proteins. The main causes are the different structure and taste sensation.

In this project, which has seen Wageningen University & Research and TU Delft team up, a technology is being developed to create the next generation of better-tasting meat substitutes in order to widen the market for vegetable proteins.

The partners are: Meyn Food Processing Technology, Avril SCA, Givaudan, Saturn Petcare, Nutrition et Nature SAS, **De Vegetarische Slager**, **Unilever**, Ingredion.

SUSTAINABLY FROZEN AND TASTY

Freezing is a much-used method for preventing food from going off and losing value and is consequently a major contributor to the reduction of food waste. Frozen food has a poor image when compared to food prepared from fresh products due to energy use, quality loss, weight loss and food products sticking together when packaged.

This project allows us to understand the physical causes of the loss of quality in frozen products. With this new knowledge, improvements to the processing and distribution process can be introduced in order to improve product quality and reduce energy use.

Lamb Weston/Meijer, **Cargill**, Koninklijke Nederlandse Vereniging voor Koude, SOK, Food Process Solutions Corporation and Wageningen University & Research all participate in this project.

THEME 4. CIRCULAR SYSTEMS

GOAL

The main focus of the Circular systems theme is to close cycles, limit losses and add value to side and residual flows in the agricultural food industry. The entire chain is involved, from primary production to processing and end products.

The following sub-themes have been identified:

- Developing new and modified raw materials (green raw materials)
- Exploitation of proteins, carbohydrates, oils and fats
- Integrated (small-scale) biorefinery
- Processing and commercialising animal manure

PROJECT EXAMPLES:

SUSTAINABLE PACKAGING MATERIALS FROM AGRICULTURAL SIDE FLOWS

Side flows from the agricultural industry contain valuable components that can be used in non-food and other applications. **Sugar beet pulp**, for example, contains saccharic acid that can be used for the production of PET materials. However, the technology for extracting these components in a cost-effective way is very frequently absent.

This PPS project, with **Refresco**, Corbion, Wageningen University & Research as partners, develops technologies to extract these components in a cost-effective manner. The benefits are twofold: adding value to a raw material and reducing dependency on fossil fuels

BIOREFINERY FOR RAW MATERIALS, CREATING AVAILABILITY AND FLEXIBILITY

Processing agricultural residual and side flows for non-food applications is highly beneficial as it reduces dependency on fossil fuels and adds to crops. In the past few years some biorefinery processes have proven to be economically viable, such as extracting fibre from potato pulp and processing mixed protein into high-quality applications.

In this project, technologies are being developed up to the demonstration phase, creating opportunities for extracting proteins from side flows from the potato, vegetable and egg industries and environmentally friendly processing technologies for sugars in the chemical industry.

The project participants are Teboza, Provalor/**GreenProtein (Royal Cosun)**, EMsland Stärke GmbH, Egga Food, Lutèce and Wageningen University & Research.

In Brabant, the following initiatives are directly linked to this area of expertise:

- **NewFoss**, a company in Uden, has constructed a successful biomass refinery test facility that processes 10 tons of fibre a day and is presently being upscaled to a full commercial plant processing 11,000 tons a year
- **Food Tech Brainport's Fieldlab Smart Food Processing**, with demonstration systems for robots, cobots and digital shop floor technologies for use in the food industry. The organisation also demonstrates other technologies for mild separation and mild preservation and uses them specific foods or foodstuffs.

THEME 5. SMART TECHNOLOGY

GOAL

Technology is of crucial importance in all central themes. This is especially true when the theme revolves around smarter and more accurate production and processing methods, such as the use of sensors and drones, technologies that reduce the use of raw materials, opportunities for applying the Internet of Things, block chains, the deployment of data analysis and systems architecture and systems integration.

This central theme sees the High Tech Systems & Materials (HTSM) and the Horticulture & Source Materials Priority Industries come aboard, with all the industries operating under the umbrella of **High Tech to Feed the World (HT2FtW).**

The following themes have been identified:

- Data collection: sensors, detection, vision systems
- Analysis and use of data: IT, big data, interpretation (from data to information)
- Automation and monitoring: activation, manipulation, handling, robotics
- Materials and processing: nanomaterials, soft matter, smart surfaces

PROJECT EXAMPLES:

ON THE ROAD TO PRECISION AGRICULTURE 2.0

Precision agriculture in the Netherlands is still very much based on location technologies and linear systems. By gathering and analysing GEO and sensor information, we can take a big step forward. Cultivation measures can then be planned optimally in terms of time and location. But much R&D work is required to enable this step, and the integration of numerous components, like sensors, data, models, IT and mechanisation (implements) will lead to effective and sustainable applications.

Aerovision, Agrico, Agrifirm Plant, Agrometius, Avular, Bayer CropScience, BO Akkerbouw, **Cosun/Cosun Beet Company**, Dacom/Crop-R, HZPC, Kverneland Group NieuwVennep, a number of avenue tree nurseries (seven companies) and a flower bulb company, LTO Noord, NAK, Neo, Phenovation, Stichting HWodKa, TerraSphere Imaging & GIS, ZLTO and Wageningen University & Research are all participants in this programme.

DATA-INTENSIVE SMART AGRIFOOD CHAINS

Data-intensive land cultivation management and the storage and processing potatoes, grains and roughage can contribute considerably to making AgriFood chains more sustainable.

In this project, three practical case studies have been designed that combine data collected from sensors, machines and internet data platforms. The data is analysed and subsequently used to make cultivation decisions. Data on nutrients, relevant environmental factors, substances and quality is being converted into concrete management advice for man, animal and machine. The data is collected in real time and is as location and object-specific as possible.

Participants are **Agrifirm**, Cumela, BO-Akkerbouw, Meijer Breeding, McCain, LTO Noord, **ZLTO, Cosun/Cosun Beet Company**, FME, **TU/e**, NLR and Wageningen University & Research.

CROSSOVERS IN COOPERATION WITH OTHER DUTCH PRIORITY INDUSTRIES

As there are many other Priority Industries in the Netherlands that are also developing their own Knowledge & Innovation Agendas, the AgriFood Priority Industry is well aware that cooperation with other industries can be very beneficial when it comes to finding solutions for AgriFood issues.

Provisions have consequently been made for cooperative ventures and joining forces in the following crossover domains, whenever opportunities arise:

1. Horticulture & Source Materials: sustainable plant-based production systems, plant health, soil, food and health, food safety
2. **High Tech Systems & Materials/IT and Horticulture & Source Materials (of particular relevance to Brabant): as part of High Tech to Feed the World (HT2FtW), partnerships in the field of high tech sensor technology and vision, IT and big data, automation and robotization, smart materials and process technology**
3. Life Sciences & Health, Creative, Energy, Horticulture & Source Materials: transitions and the human dimension. In the programme, the Priority Industries cooperate to create healthy and sustainable consumer behaviour (consumers capable of making choices)
4. **Chemistry, Energy and the Biobased Economy (of particular relevance to Brabant): circular agriculture and the biobased economy concern the development of technology and production processes for 'green' raw materials and substances, developing high-quality biobased plastics and improved biorefining processes (total value creation)**
5. Life Sciences and Health: the relationship between food and health (TNO), Netherlands Centre for One Health (NCOH)

Numbers 2 and 4 are particularly relevant for the Brabant region, because its industry and scientific foundations are also very well developed in these complementary industries. Bringing AgriFood and these two industries together will be especially beneficial in this part of the Netherlands.

2. Knowledge and Innovation Agenda (KIA) Agriculture, Water, Food for 2020-2023

In order to increase the impact of the individual actions, the AgriFood KIA has been incorporated into the Agriculture, Water & Food Knowledge & Innovation Agenda, which is a co-production with two other, closely-related Priority Industries in the Netherlands: Horticulture & Propagation Materials and Water & Maritime. This KIA – the Agriculture, Water, Food Knowledge and Innovation Agenda for 2020-2023 – encompasses the content of the AgriFood KIA and links it to horticulture and water management.

The agenda was drawn up in close consultation with all stakeholders – government ministries, the public sector, the business sector, regional authorities and water boards – which means it is a broadly-supported document that will give direction to the Joint Priority Industries and Innovation Policy for the coming years. The agenda builds on the topics of the previous knowledge and innovation agendas of the three Priority Industries, such as sustainable water use, sustainable and safe food, climate-neutral and circular production, high-quality plant-breeding materials and smart technology. The fact that the three Priority Industries and the national and provincial authorities are working together more closely means that there is a more integrated approach to the topics at hand. The new themes are biodiversity, climate adaptation, water quality, a sustainable North Sea and other large bodies of water and the circular use of raw materials.

By working together and investing in knowledge development and innovation, a major contribution can be made to solving societal issues, both in the Netherlands and abroad. The objective of the KIAs is that the Netherlands will remain the global hotspot for smart solutions for future issues in agriculture, horticulture and the water sector.

Together, these Priority Industries have defined the following six key societal missions in the fields of agriculture, water and food:

A. Circular agriculture
B. Climate-neutral agriculture and food production
C. Climate-resistant rural and urban areas
D. Healthy, safe and sustainable food
E. A sustainable and safe North Sea, oceans and inland waters
F. That the Netherlands is and remains the best protected and habitable delta in the world

In addition, the development and application of technology has been identified as one of the decisive elements for the ability to deliver the intended results of the missions. These technologies – which can often be applied across multiple missions – have been clustered together in a support-building block, called G. Key technologies.

One can see these missions in chart form below. The columns and support-building blocks shaded green are those missions specifically focused on the AgriFood industry.

A. CIRCULAR AGRICULTURE	B. CLIMATE-NEUTRAL AGRICULTURE AND FOOD PRODUCTION	C. CLIMATE-PROOF RURAL AND URBAN AREAS	D. SUSTAINABLE, HEALTHY AND SAFE FOOD	E SUSTAINABLE AND SAFE NORTH SEA, OCEANS AND INLAND WATERWAYS	F. THE NETHERLANDS REMAINS THE BEST PROTECTED AND LIVEABLE DELTA IN THE WORLD, EVEN AFTER THE YEAR 2100
• Reducing the use of fertilizers and water, and better utilization of nutrients, reducing nitrogen deposition on vulnerable nature. • Healthy, robust soil and cultivation systems • Reuse organic side and residual flows • Protein supply for human consumption from (new) vegetable sources. • Biodiversity in circular agriculture	• Emission reduction in methane farming • Agricultural soils, reduction of nitrous oxide emissions, increase of carbon sequestration • Reduction of peat oxidation peat meadow • Increase carbon sequestration in forest and nature • Energy saving, production and use (including greenhouse as energy source) • Production and use of biomass	• Climate-resistant rural areas: prevention of flooding and water shortage • Climate-adaptive • Agricultural and horticultural production systems • Water-robust and climate-resistant urban areas • Improve water quality	• Appreciation for food • Healthy food and easy choice • Safe and sustainable primary production • Durable and safe processing	• North Sea • Nature-inclusive agriculture, fisheries & water management in the Caribbean • Rivers, lakes and intertidal areas • Other seas and oceans (Blue Growth) • Fisheries	• Sustainability and cost control of water management implementation projects • Adapt to accelerated sea level rise and increasing weather extremes • The Netherlands Digital Waterland • Energy from water

G. KEY TECHNOLOGIES

- Smart Technology in Agri-Horti-Water-Food
- (Green) Biotechnology and Breeding

Source: Agriculture, Water & Food Knowledge & Innovation Agenda for 2020-2023

C. Bird's eye view of international trends in the AgriFood industry

In any review on the subject of the global food supply and the development of both the agricultural and the food industries, the same overarching key principles, objectives and developments always emerge. In this section we have opted to start with how the European Union defines these trends, followed by how these principles and objectives can be implemented at a national level and, finally, the specific implications thereof for Brabant.

1. Trends and objectives of the European Union's Food 2030 policy

A. FOOD 2030

In response to international policy developments, including the global Sustainable Development Goals (or SDGs) and the global agreement on climate change, that the Paris Agreement adopted at the Paris Climate Change Conference (COP21) in December 2015, the European Union has created the FOOD 2030 policy.

FOOD 2030 is the EU research and innovation policy built on four key Food and Nutrition Security priorities:

I. Nutrition: sustainable and healthy diets for all
II. Climate: smart and environmentally sustainable food systems
III. Circularity: closed circles and resource-efficiency of food systems
IV. Innovation: boosting innovation, while empowering communities

A. FOOD 2030

For all intents and purposes, this means that the EU research and innovation programmes have the following objectives:

I. Nutrition

Ensuring that nutritious food and water is available, accessible and affordable for all. It involves reducing hunger and malnutrition, ensuring high levels of food safety and traceability, reducing the incidence of non-communicable diet-related diseases, and helping all citizens and consumers adopt sustainable and healthy diets for good health and wellbeing

II. Climate

Building climate smart food systems adaptive to climate change, conserving natural resources and contributing to climate change mitigation. It seeks to support healthy, productive and biodiverse ecosystems. Ensuring diversity in food systems (including production, processing, distribution and logistics) and inclusiveness in terms of cultural and environmental diversity. Natural resources (water, soil, land and sea) are used sustainably within the planetary boundaries and are available to future generations.

III. Circularity

Implementing resource-efficient circular economy principles across the whole food system while reducing its environmental footprint. Circularity is applied for sustainable and resource-efficient food systems and food losses and waste are minimised throughout.

IV. Innovation and Empowerment

Boosting innovation and investment, while empowering communities. A broad innovation ecosystem leading to new business models and value-added products, goods and services, meeting the needs, values and expectations of society in a responsible and ethical way. More and better jobs across the EU, fostering thriving urban, rural and coastal economies and communities. Through closer partnerships with industry and food producers, the development and implementation of markets that function in a responsible manner, fostering fair trade and pricing, inclusiveness and sustainability.

Scientific evidence and knowledge from a wide diversity of actors underpinning the development and implementation of Food & Nutrition Security relevant policies, at all their relevant geographical scales (Local to Global).

B. THE FARM TO FORK STRATEGY - FOR A FAIR, HEALTHY AND ENVIRONMENTALLY-FRIENDLY FOOD SYSTEM

AD 1. ENSURING SUSTAINABLE FOOD PRODUCTION

- Encouraging a circular biobased economy, including the use of renewable energy
- Reducing the overall use and risk of chemical pesticides
- Reducing the excess of nutrients (especially nitrogen and phosphorus) in the environment
- Reducing agriculture's share of the EU's GHG emissions: non-CO2 GHG (methane and nitrous oxide)
- Reducing overall EU sales of antimicrobials for farmed animals and in aquaculture
- Improving animal welfare and health through amended animal welfare legislation, including legislation on animal transport and slaughtering
- Improving the protection of plants from emerging pests and diseases and increasing plant innovation, seed security and diversity
- Promoting of organic farming
- Accelerating the shift to sustainable fish and seafood production
- Strengthening the position of farmers and fishers in the supply chain in order to enable them to capture a fair share of the added value of sustainable production

AD 2. ENSURING FOOD SECURITY

The Commission will step up its coordination of a common European response to crises affecting food systems in order to ensure food security and safety, reinforce public health and mitigate their socio-economic impact in the EU. Drawing on the lessons learned, the Commission will assess the resilience of the food system and develop a contingency plan for ensuring food supply and food security to be put in place in times of crisis.

AD 3. STIMULATING SUSTAINABLE FOOD PROCESSING, WHOLESALE, RETAIL, HOSPITALITY AND FOOD SERVICES PRACTICES

- The Commission will seek commitments from food companies and organisations to take concrete actions on health and sustainability, focusing in particular on: reformulating food products in line with guidelines for healthy, sustainable diets; reducing their environmental footprint and energy consumption by becoming more energy efficient; adapting marketing and advertising strategies taking into account the needs of the most vulnerable; ensuring that food price campaigns do not undermine citizens' perception of the value of food; and reducing packaging in line with the new guidelines.

- The Commission will take action to scale-up and promote sustainable and socially responsible production methods and circular business models in food processing and retail, including specifically for SMEs.

- Food packaging plays a key role in the sustainability of food systems. The Commission will revise the food contact materials legislation to improve food safety and public health (in particular in reducing the use of hazardous chemicals), support the use of innovative and sustainable packaging solutions using environmentally-friendly, re-usable and recyclable materials, and contribute to food waste reduction. In addition, under the sustainable products initiative announced in the CEAP, it will work on a legislative initiative on re-use in food services to substitute single-use food packaging and cutlery with re-usable products.

AD 4. PROMOTING SUSTAINABLE FOOD CONSUMPTION AND FACILITATING THE SHIFT TO HEALTHY, SUSTAINABLE DIETS

AD 5. REDUCING FOOD LOSS AND WASTE

The Commission is committed to halving per capita food waste at retail and consumer levels by 2030 (SDG Target 12.3). Using the new methodology for measuring food waste and the data expected from Member States in 2022, it will set a baseline and propose legally binding targets to reduce food waste across the EU.

AD 6. COMBATING FOOD FRAUD ALONG THE FOOD SUPPLY CHAIN

The Commission will scale up its fight against food fraud to achieve a level playing field for operators and strengthen the powers of control and enforcement authorities. It will work with Member States, Europol and other bodies to use EU data on traceability and alerts to improve coordination on food fraud.

2. The Netherlands' interpretation of these trends and objectives

The Netherlands has largely adopted the EU objectives in AgriFood. The Dutch government, industry and science (partnered in the AgriFood Priority Industry) have subsequently worked together to translate global and European policies into a working plan for the Netherlands.

The AgriFood Priority Industry has drawn up the Knowledge and Innovation Agenda 2020-2023 (discussed in section B of this chapter), and has stated its intention to become a world leader in successful solutions to global challenges in the fields of agriculture and food. The objectives in developing new knowledge and innovations are combined into five central themes:

1. **Consumer and society**
Promoting consumption of sustainable, safe and healthy products; developing healthy diets, a healthy lifestyle, consumer-driven value chains; ensuring information and transparency in the food value chains, a fair price for all parties in the value chain; fostering a rise in consumer confidence.

2. **Climate neutral production systems**
Increasing the ecological and economic shelf life of food products; developing solutions aimed at a reduction in emissions, efficient use of resources, reduction of greenhouse gasses; increasing biodiversity, good soil quality, sustainable water management; ensuring healthy plants and animals, including optimal animal welfare.

3. **Healthy and safe products and production processes**
The development of safe products for a healthy diet, sustainable food processing (efficient, mild conservation), aimed at the entire value chain, guaranteeing the health and safety of food, animals and production processes.

4. **Circular systems**
Working together to achieve resource efficiency, closing of cycles, loss limitation, adding value to side and residual flows from the agricultural food industry for food and non-food products.

5. **Smart technology**
Developing instruments, tools and technologies such as IT/big data, robots, drones, sensors and innovative materials that contribute to efficient, climate-neutral, circular production and even healthier and safer food.

3. The resultant consequences, challenges and opportunities for Brabant

All objectives as laid down by the EU and at a Dutch national level are also relevant to Brabant. However, as opposed to many other regions in the Netherlands and further afield, Brabant has a unique opportunity to provide many of the solutions to the challenges echoed by all the national and international studies. Aside from being a leading AgriFood region, Brabant is also the leading High Tech Systems and Materials (HTSM) region in the Netherlands, and in fact is one of the global leaders in this respect.

So the Netherlands' solution-oriented objective no. 5, Smart technology, is also Brabant's 'natural habitat': the HTSM industry in Brabant leads the pack by a long way in the Netherlands and has been working together with AgriFood for decades. That means that the joint development of instruments, tools and technologies such as IT/big data, robots, drones, sensors and innovative materials that contribute to efficient, climate-neutral, circular production and even healthier and safer food is already in full swing: AgriFood meets High Tech is how it is referred to in Brabant.

The upshot is that, even though the AgriFood industry faces major challenges in the region, these challenges create an immediate opportunity for the high tech industry in Brabant in respect of helping to develop and commercialise solutions.

BRABANT'S AGRIFOOD CHALLENGES (GLOBAL THROUGH TO LOCAL)
(and one can see that the trends observed in the EU and at a national level are echoed here):

- **Sustainability**

On a global scale: studies show that the growth of the world's population to 9 billion people by 2050 will mean that world food production needs to be raised by 60%. At the same time, with due regard for environmental concerns, production must become more sustainable, with a smaller CO2 footprint, less water consumption and more attention to biodiversity

- **Competition**

In Western Europe: competition will increase from large producers in emerging (Eastern European) economies and innovative startups. This necessitates the bolstering of the international market position of the Dutch AgriFood value chain. However, the available space for innovation in the Netherlands is under threat, with margins that are under pressure because each value chain contains a huge number of links and there is extreme regulatory pressure to boot

- **License to operate**

In Brabant and the Netherlands: the social support for the AgriFood industry is under pressure due to (perceived) negative influences on the environment and the nuisance/hindrance caused to local residents. Concerns have been raised about animal welfare, antibiotic resistance and the use of chemical agents (trends are towards zero pesticide residues). This presents a significant risk to the province of Brabant, where the AgriFood industry directly employs over 80,000 people and is indirectly responsible for some 150,000 jobs.

THE HIGH TECH INDUSTRY HAS THE POTENTIAL TO SOLVE SEVERAL AGRICULTURAL CHALLENGES AND TURN THEM INTO INTERNATIONAL OPPORTUNITIES

• Demand

On a global scale: the worldwide demand for technological AgriFood solutions is very high. The high tech industry in Brabant has the expertise and opportunity to develop these solutions and deliver them globally.

• High Tech Ecosystem

Right here on home soil: the high tech industry employs 110,000 people in over 10,000 companies and spends more than €1.9 billion on R&D annually. The entire high tech value chain is both present and well-developed, with skills available that range across the whole high tech spectrum, including robotics, chips, data science, sensor systems, imaging, photonics, artificial intelligence and vision technologies.

The industry excels at applied research for societal aspects but could also significantly increase its efforts and gains in AgriFood, thanks to the many opportunities available. Technology is developed in Brabant by the multinational OEMs, hundreds of innovative SMEs and knowledge institutions such as the Eindhoven University of Technology, Wageningen University & Research, JADS Jheronimus Academy of Data Science and HAS University of Applied Sciences in AgriFood.

And so the vision for the future of AgriFood in Brabant is to develop the value chain as follows:

1. Precise

Optimising production on the level of individual plants and animals; producing high-quality products, safety, sustainability and high animal welfare

2. Valuable

Creating agricultural products with the greatest possible added value from all product flows (including residual flows) in the value chain, while taking into consideration both economic concerns and civil/societal values

3. Circular and Closed

Closing cycles in agriculture and food production by the (re)use of residual flows to prevent waste of raw materials. And also closing cycles and developing solutions and alternatives for raw materials to prevent import/export of low-value product streams over large distances so as to ensure sustainable supply chains

4. Connected

The integration of production and processing; development and the offering of a higher number of value chain concepts with higher added value and margins, including total transparency of the production process and food product traceability

Source: Sources: Roland Berger; FAO; CBS; Province of Brabant; BCI; USDA, Groen Kennisnet, Netherlands Veterinary Medicines Institute

REGIONAL GOVERNMENT SUPPORT PROGRAMME: AGRIFOOD MEETS HIGH TECH

The provincial government and its primary development agency, BOM (Brabant Development Agency), have now launched a support programme specifically dedicated to finding solutions that further the strategic aims set out in the previous section. The AgriFood meets High Tech programme consists of the following four points of focus:

I. Smart Farming

Primary production, applying smart technology, with the reduced use of resources and achievement of higher output, both quantitatively and qualitatively. The programme targets two main activities:

a. Precision farming (plant-based and livestock farming)
b. Vertical farming

II. Smart Processing

Applying smart technologies in food processing to prevent and reduce food wastage; commercialising (upgrading) residual product flows; extending product shelf life and increasing food safety. Priority areas:

a. Application Center for Sustainable Food Processing/Field Lab Smart Food Processing – Food Tech Brainport
b. Food Value – more value from raw materials – BOM, the Brabant Development Agency

III. Protein transition

Creating alternatives to animal proteins and animal meat products using intelligent technologies. Priority areas:

a. Research into meat substitutes research conducted by The Vegetarian Butcher and others
b. Insect breeding by Protix and others
c. Research into biotechnological approaches for animal-free protein production, conducted by BioscienZ/The Protein Brewery and others

IV. Datafication

Introducing new partnerships and links in the value chain using big data and data science, creating room and paving the way for disruptive concepts and new business models. Action point:

a. Creating an AgriFood data lab

The operational implementation of this programme on behalf of the provincial government is performed by the BOM Ecosystems Development team, a part of the Brabant Development Agency.

Source: Sources: Roland Berger; FAO; CBS; Province of Brabant; BCI; USDA, Groen Kennisnet, Netherlands Veterinary Medicines Institute

10. SUMMARY OF BRABANT'S STRENGTHS IN AGRIFOOD

A. List of Brabant’s seven key strengths in AgriFood

Notwithstanding the fact that there are many additional initiatives and organisations in Brabant that perform top-class work and distinguish themselves from others, the main strengths of Brabant in the world of AgriFood can be summarised in the following seven points.

1. THE COMPLETE AGRIFOOD VALUE CHAIN IN BRABANT - INCLUDING A SELECTION OF COMPANIES

- Cobb-Vantress
- Hazera
- Hendrix Genetics
- Rijk Zwaan
- Topigs Norsvin

- Advanced Berry Breeding

- Aviko
- Cosun Beet Company
- Driscoll's
- FrieslandCampina
- Genson Group
- Van Asten Group
- Van den Borne Aardappelen
- Van Loon Group

- Campus Almkerk
- PlantLab
- Signify

- AFB International
- Cargill
- Cosun Beet Company
- Darling Ingredients International
- IFF
- Trobas Gelatine
- Van Hessen Netherlands Meat Products
- vanRijsingengreen
- VION Food Group

- PeelPioneers
- The Protein Brewery

- Agrifirm
- Bavaria
- Dalco Food
- Danone Nutricia
- HAK
- Lamb Weston / Meijer
- MARS
- Nutreco
- Perfetti van Melle
- Schouten Europe
- Zwanenberg Food Group

- BOON Food Concepts
- Botanic Bites
- Carezzo Nutrition
- Fruitfunk
- Novish
- Protix
- The Vegetarian Butcher

- HANOS-ISPC
- JUMBO Omnichannel
- Oriental Merchant Europe
- Ploegmakers Food Ingredients (Ardo Group)
- Schuiema
- Sligro Food Group
- The Greenery
- Van Geloven

- BRESC
- Ferrero
- Haribo Benelux
- Hero Benelux
- Hutten Business Catering
- JUMBO Supermarkten
- La Place Food
- Lekkerland Nederland
- Mondelêz International
- Spar Holding

- JUMBO Supermarkten
- Landwinkel
- Philips Fruit Garden
- Sligro Food froup
- UDEA

- Covetrus

AGRICULTURE TECHNOLOGY (AGTECH) & FOOD PROCESSING TECHNOLOGY (FOODTECH): R&D, MANUFACTURING & IMPLEMENTATION

PlantLab – Signify – Pascal Processing – Bodec – Cerescon – GEA Food Solutions – AvL Motion – Marel Poultry – Contronics – VDL ETG – Growficient – VMEngineering/Nirás – Fri-Jado KSE Process Technology – Helia Biomonitoring – SAVAL – Skalar Analytical – Premier Tech Chronos – KIN Machinebouw – ENGIE Services – AAE, Advanced Automated Equipment Vencomatic Group - SodaStream International – VDL AgroTech

SUPPORT INDUSTRY & SERVICES: LOGISTICS, ANIMAL HEALTH, HR, FINANCE, IP, IT, CERTIFICATION, PACKAGING ETC.

Duni Group – VAA Data Works – YieldComputer – Normec Foodcare – MSD (Merck) Animal Health – Agrisim – Ardagh Glass – CANPACK Group – Farm Trans – Rhenus – XPO – Schenker Logistics Panalpina World – MOL Logistics – Scholle IPN – JDA Software Netherlands – SAP Netherlands – Roba Laboratorium – AB Mauri – Bilfinger Terbodin – Van Aaken Automatisering – Haval Disposables Nabuurs Transport

UNIVERSITIES & KNOWLEDGE INSTITUTES

WUR, Wageningen University & Research – HAS University of Applied Sciences in AgriFood (Den Bosch)
JADS, Jheronimus Academy of Data Science (Den Bosch, Eindhoven, Tilburg) - TU/e, Eindhoven University of Technology

Source: Engel – Een Heldere Blik helder@benengel.nl – +31 (0)652612671

- Start-up, scale-up or newly spun-off company
- AgriFood

2. THE DISTINCTIVE AND CONSTRUCTIVE BRABANT COOPERATIVE MODEL

Brabant has a distinctly strong culture, history and tradition in informal and constructive partnerships based on trust and open innovation. The advantage of this culture is that partnerships, whether informal and/or highly professional and intensive, come naturally in the region. Business, science and government thought leaders in the region publicly invite interested parties to contact them and explore mutual interests.

In short: building partnerships in the region is a quick and fluid process – and faster than anywhere else in the Netherlands. Outsiders who wish to join the club and make an actual contribution will quickly and easily reap the rewards.

Inspiring examples of existing public-private networks and partnerships include:

- **Breed4Food**

A cooperative venture between Wageningen University (WUR) and Hendrix Genetics, Cobb-Vantress, Topigs-Norsvin and CRV in animal genetics

- **GPEC – Green Protein Center of Excellence**

An open innovation centre founded by Royal Cosun, HAS University of Applied Sciences and The Protein Brewery, focusing on the development of alternative (vegetable) proteins

- **Application Center for Sustainable Food Processing**

A four-year cooperative programme between HAS University of Applied Sciences, Food Tech Brainport and participating AgriFood companies dedicated to developing sustainable food processing methods and technologies

- **CHIEF, the centre for help with innovation, education and experiencing plant-based proteins**

Accelerating the protein transition through partners Schouten Europe, HAK, Province of Brabant, Walnut FHM, Altena College, BOM, Royal Cosun, HAS University, Jumbo, LIB, Nestlé, the province of Flevoland, Rabobank Altena, REWIN, Municipality of Altena, ProVeg and the Western Brabant region

- **Project GROW! – High tech Sensor Technology in Greenhouses**

Building and optimising high tech greenhouses by the Holst Center research institute in Eindhoven (a joint venture between Stichting IMEC Nederland and TNO), Proefcentrum Hoogstraten, HAS University of Applied Sciences, University of Antwerp, Catholic University of Louvain, LTO Glaskracht and the Flemish Centre for Storing of Horticultural Products.

3. THE IDEAL GEOGRAPHIC LOCATION AND PERFECT STEPPINGSTONE INTO EUROPE

The Netherlands was dubbed the Gateway to Europe decades ago, and nothing has changed since. That is a label that is even more appropriate to Brabant, located midway between the largest ports, airports and markets in north-western Europe. And it is not just its geographic position, the excellent infrastructure and the vast amount of logistical expertise that make Brabant stand out; an international focus is also part of the Dutch DNA. The Dutch have been global traders and partners for more than four centuries, and Dutch and Brabant-based entrepreneurs and scientists actually look forward to working together with specialists from abroad. This is because such partnerships can only improve the end results and also add enjoyment to (working) life. The Dutch thrive on discovering other cultures and Brabanders (the people of Brabant) are particularly happy to, in turn, share their own culture with others!

4. AN EXCEPTIONALLY STRONG MANUFACTURING INDUSTRY IN PRIMARY FOOD PRODUCTION AND FOOD PROCESSING

Many of the largest and most advanced food processing and food manufacturing plants in the Netherlands are located in Brabant. Danone/ Nutricia opened its largest manufacturing plant in the world two years ago in Haps, Brabant, employing 450 people in this state-of-the-art infant nutrition production plant. MARS has its chocolate factory with a 1,500-strong workforce in Veghel, the largest chocolate factory on the planet. Meanwhile, MSD (Merck) Animal Health in Boxmeer (1,500 employees) is an all-encompassing animal health development and manufacturing facility. And if you had not guessed already, it is also the largest animal vaccine plant in the world.

It is tempting to continue: LambWeston/Meijer spent €100 million enlarging its Bergen op Zoom manufacturing plant (chips), which provides one with some idea of the size of the whole factory. Coca-Cola did the same in 2016 with a €90 million investment in its Dongen bottling plant, which manufactures 85% of all Coca-Cola products sold in the Netherlands. And Can-Pack invested some €120 million in a new packaging plant (aluminium cans) in Helmond, and it is still growing.

But Brabant is not just home to the very large companies. Specialist contract manufacturers in every size and shape can be found throughout the province, as can beer breweries, ranging from the enormous (Heineken and Bavaria) to home-based micro-breweries and a real abbey, Abdij Onze Lieve Vrouw van Koningshoeven, that is still producing beer. A final example: plant proteins, fresh vegetables and ingredients are developed and manufactured the traditional way by Schouten Europe's contract manufacturers, Dalco Foods, HAK and vanRijsingengreen, as well as in near-laboratory conditions at The Protein Brewery.

Historically, agriculture and food processing are exceptionally strong features in Brabant. The province is – metaphorically speaking – the locomotive, the powerhouse, of AgriFood in the Netherlands. Several other provinces have an extensive agriculture and/or food manufacturing industry, but none have the combined strength of significant agricultural primary production, extensive industrial food processing and manufacturing activities together with an internationally renowned High Tech and AgTech cluster – all of which Brabant does have. Neighbouring province Gelderland comes closest, thanks to its world-famous Wageningen University and Research, but fortunately for Brabant, no part of Gelderland is more than an hour's drive away!

5. WELL-DEVELOPED AGRIFOOD CLUSTERS, CAMPUSES AND JOINT FACILITIES OFFERING DISTINCTIVE EXPERTISE AND RESOURCES

- Food Tech Park Brainport, Helmond
- GrowWise Research Center by Signify, Eindhoven
- Precision Ag(riculture) Center South, Reusel
- Green Chemistry Campus, Bergen op Zoom
- Nieuw Prinsenland (AgriFood Cluster), Dinteloord
- Cosun Innovation Center, Dinteloord
- Agri & Food Plaza, Den Bosch
- Grow Campus, Den Bosch
- De Jamfabriek, Den Bosch
- Delta AgriFood Business, Bergen op Zoom

6. EXCELLENT UNIVERSITIES, KNOWLEDGE INSTITUTES & EDUCATION IN AGRIFOOD

- HAS University of Applied Technology in AgriFood (Den Bosch)
- WUR - Wageningen University & Research, Wageningen (province of Gelderland)
- TU/e, Eindhoven University of Technology (Eindhoven)
- JADS - Jheronimus Bosch Academy of Data Science (Den Bosch, Tilburg & Eindhoven)

Four knowledge institutes within a 50 kilometer radius. All of them interested in joint research and bringing agriculture and the food industry at an even higher level. Easy to find and easy to connect with, if necessary with free support by the regional government agencies such as BOM, REWIN and Brainport Development.

Brabant's AgriFood educational offer is equally strong – at all possible levels. From secondary school to vocational education & training in preparation for work in the AgriFood sector or continuation of education at universities and universities of professional educational level, the schools & institutes are all of high quality, well-developed and located in or very close to the region.

7. THE PRESENCE OF SEVERAL FULLY DEVELOPED INDIVIDUAL FOOD PRODUCT VALUE CHAINS IN THE BRABANT REGION

Brabant is not only home to the full spectrum of the AgriFood sector as a whole but can boast the presence of the complete value chains of a range of individual food products as well. Some examples are the value chains:

- from potatoes to frozen potato fries and starch
- from sugar beets to pastries, sweets and (powder) sugar
- from milk to dairy products and specialized infant nutrition
- from livestock to meat products (beef, pig, poultry – in every possible variety)
- Soft fruit (strawberries, raspberries, blueberries, blackberries etc.) to fresh fruit products to jams, fruit juices and candy

This is an attractive proposition for those companies, Dutch or foreign, looking to cooperate with or expand in any of these domains.

B. Graphic summary of Brabant's fully-developed AgriFood value chain

A graphic outline is the best way to illustrate why professionals in the AgriFood industry should keep the region in mind and/or set up business operations there. The combination of the full industry value chain and the presence of excellent universities and innovative campuses paints a perfect and all-inclusive AgriFood picture.

THE FULLY INTEGRATED AGRIFOOD VALUE CHAIN IN BRABANT - INCLUDING A SELECTION OF COMPANIES

- Cobb-Vantress
- Hazera
- Hendrix Genetics
- Rijk Zwaan
- Topigs Norsvin

- Advanced Berry Breeding

- Aviko
- Cosun Beet Company
- Driscoll's
- FrieslandCampina
- Genson Group
- Van Asten Group
- Van den Borne Aardappelen
- Van Loon Group

- Campus Almkerk
- PlantLab
- Signify

- AFB International
- Cargill
- Cosun Beet Company
- Darling Ingredients International
- IFF
- Trobas Gelatine
- Van Hessen Netherlands Meat Products
- vanRijsingengreen
- VION Food Group

- PeelPioneers
- The Protein Brewery

- Agrifirm
- Bavaria
- Dalco Food
- Danone Nutricia
- HAK
- Lamb Weston / Meijer
- MARS
- Nutreco
- Perfetti van Melle
- Schouten Europe
- Zwanenberg Food Group

- BOON Food Concepts
- Botanic Bites
- Carezzo Nutrition
- Fruitfunk
- Novish
- Protix
- The Vegetarian Butcher

- HANOS-ISPC
- JUMBO Omnichannel
- Oriental Merchant Europe
- Ploegmakers Food Ingredients (Ardo Group)
- Schuiema
- Sligro Food Group
- The Greenery
- Van Geloven

- BRESC
- Ferrero
- Haribo Benelux
- Hero Benelux
- Hutten Business Catering
- JUMBO Supermarkten
- La Place Food
- Lekkerland Nederland
- Mondelêz International
- Spar Holding

- JUMBO Supermarkten
- Landwinkel
- Philips Fruit Garden
- Sligro Food froup
- UDEA

- Covetrus

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- AgriFood

11. OPPORTUNITIES IN AGRIFOOD

BRABANT'S PRIORITY NICHES AND DEVELOPMENT AREAS

On the occasion of this in-depth review of Brabant's AgriFood industry, the authors have performed a SWOT analysis of the industry. The interviews with the many operational and academic representatives of the industry were of invaluable help in this work.

This analysis led to the identification of ten strategic areas as 'high potential targets' for the activities of the Brabant Development Agency and its partners in the economic development community. This group of ten areas has been divided in two categories: the priority niches and the development areas. In the first category, the priority niches, Brabant AgriFood companies and clusters are already international market leaders. In the second category, the development areas, the Brabant AgriFood industry (in partnership with the high tech industry) has already developed such an outstanding business and science platform to build upon that further development will likewise turn them into global leaders.

THE PRIORITY NICHES ARE

1. Brabant is the location for innovative arable farming concepts
2. Brabant is the place to be for the development, production and application of alternative proteins
3. Brabant is home to Europe's leading animal health cluster
4. Brabant is a centre of excellence in AgriFood technology, component manufacturing and machine building
5. Brabant is home to Europe's leading cluster in the field of optimising, raising and processing poultry and eggs

THE DEVELOPMENT AREAS ARE

1. Brabant is the global development centre and test location for sustainable agriculture, livestock breeding and animal welfare and healthy food
2. Brabant is building a distinctive Big Data and Data Science cluster devoted to AgriFood
3. Brabant is developing into a centre of excellence in sustainable food extraction, upgrading and commercialisation
4. Brabant has the building blocks to become a centre of excellence for greenhouse and indoor farming technology, crop cultivation and management
5. Brabant has the development centre for sustainable manure processing and natural agriculture-grade manure production

A. Brabant's priority niches

Activities in this niche contribute explicitly to two of the six missions of the Agriculture, Water & Food Knowledge & Innovation Agenda for 2020-2023: B. Climate-neutral agriculture and food production, and D. Sustainable, healthy and safe food. The supporting Key Technologies are essential for creating these solutions.

1. Brabant is *the* location for innovative arable farming concepts

USPs for Brabant	In Brabant, both the AgriFood and high tech value chains are present and fully-developed. The fact that there are many large-scale locations that can serve as experimental testing grounds and that the willingness to innovate and cooperate is a part of Brabant's DNA make the region a perfect breeding ground for farming innovations
Universities/Research institutes involved	WUR, Wageningen University & Research; HAS University of Applied Sciences (Den Bosch), TU/e, Eindhoven University of Technology; JADS, Jheronimus Academy of Data Science (Den Bosch/Tilburg/Eindhoven)
Leading companies/disruptors/best practices	Van den Borne Aardappelen; ZLTO; Cosun/Cosun Beet Company; Aris Vision; Signify; MS Schippers; Pixelfarming; Robotics; PlantLab; Rijk Zwaan; Advanced Berry Breeding
Leading programmes	Food Value – more value from raw materials (BOM and others)
Facilities/Locations/Campuses	Campus Almkerk (Almkerk); Precision Agriculture Center South (Reusel); PlantLab (Den Bosch); GrowWise Research Center by Signify (Eindhoven); Cosun Innovation Center/ GPEC, Green Protein Center of Excellence & Nieuw Prinsenland (Dinteloord); Green Chemistry Campus (Bergen op Zoom)

INTRODUCTION

Experience has taught us that today's most efficient arable farming concepts are sometimes detrimental from an ecological perspective, leading to issues such as decreasing biodiversity, soil exhaustion and a rise in vulnerability to diseases in monocultures, both in plants and in animals.

THE CHALLENGE

New farming concepts must be created and perfected to prevent these negative effects. On the other hand, global food production must increase dramatically in order to feed the future world population as explained by the FAO, the Food and Agriculture Organization of the United Nations:

'By 2050 the world's population will reach 9.1 billion, 34% higher than today. Nearly all of the population increase will occur in developing countries. Urbanisation will continue at an accelerated pace, and about 70% of the world's population will be urban (compared to 49% today). Income levels will be many multiples of what they are now. In order to feed this larger, more urban and richer population, food production (net of food used for biofuels) must increase by 70%. Annual cereal production will need to rise to about 3 billion tons from 2.1 billion today and annual meat production will need to rise by over 200 million tons to reach 470 million tons.'

FINDING SOLUTIONS – WHAT MAKES BRABANT THE PERFECT LOCATION?

Brabant has what it takes when it comes to tackling challenges of such complexity. And the reason is that its primary production sector for plants and livestock is among the most efficient in the world and it has also recently learned there are limits to what can be demanded – on the grounds of sustainably and ethics – from soil, water, plants and animals.

The region has the full AgriFood value chain at its disposal, and has many disruptors ready to challenge the traditional farming concepts as well as a superior high tech industry that already plays a significant role in AgriFood but that could also be responsible for a true paradigm shift. Finally, thousands of hectares of arable land, greenhouses and indoor farms are available for testing purposes, from highly experimental projects through to large-scale farming.

ONGOING INITIATIVES

a. Pixel Farming

This arable farming concept is a radically different approach to arable farming, aimed at overcoming the shortcomings of conventional agriculture. The core idea is a production system in which the fields are divided into very small soil units of approximately 10 x 10 cm, also known as farm pixels. This enables a polyculture farming system that can be digitally managed and maintained using ultra-light, high-resolution pixel farmbots, robots that manage the land autonomously, from seed bed preparation, sowing, pest control and water supply to fertilising and harvesting. In all of these steps, the robot uses sensor technology to only provide as much as an individual plant needs at any given time.

Campus Almkerk

An innovation centre for agriculture and sustainability, has been established in Brabant. Ten hectares of land have been redeveloped into a regional innovation campus with workspaces, labs and testing grounds for an agricultural approach that is based on biodiversity, nature-inclusive agriculture and sustainable construction and energy concepts:

- 50,000 m^2 of testing grounds for innovative agricultural activities focused on organic food that is grown using biodiversity and Pixel Farming concepts
- 40,000 m^2 testing grounds for biodiversity based on nature-inclusive agriculture
- 5,000 m^2 of testing grounds suitable for innovative construction and installation technology and living concepts
- 1,000 m of workspaces and labs

Pixel Farming seeks to provide solutions to societal challenges of sustainable arable farming and preventing depletion of the earth, to create better-tasting produce, healthier nutrition and preserve arable farming in the Netherlands. It involves a range of innovative arable farming methods and techniques, such as a high degree of digitisation, big data processing, robotization, vision technology, pest and weed control, fertiliser application and much more. It also requires new knowledge, experience and activities, many of which are already available in Brabant, sometimes in other industries:

- The company Pixelfarming Robotics designs and produces advanced agricultural robots. The company was founded in 2019 and aims to be at the forefront of developments in future-proof food supply and soil improvement. In an optimal scenario, all plants are planted exactly where they should be to achieve maximum results. This optimum can be calculated and predicted using a computer model and then the plants can be planted, tended to and harvested using robot technology.

Research by Wageningen University & Research shows that this cultivation method provides up to 50% more yield per hectare, without the need for chemicals and fertilisers. It does however mean that more manual work is required to achieve similar returns. Robot and vision technology offer solutions for cutting down on this manual labour. This is why agrorobotics is considered a growth industry that will change the world in the coming years to a more sustainable way of farming.

b. The further development of Brabant concepts in **precision farming** in this domain also fits in, including the Precision Ag Center South and its agricultural, industrial and academic partners, such as TU/e, Van den Borne Aardappelen, HAS, ZLTO, Dacom and others.

c. To form a cluster or encourage greater cooperation in the field of **greenhouse and indoor farming and engineering**, with the objective of further optimising these farming concepts. See also niche no. 8.

Activities in this niche concern contributions to support mission G. Key Technologies. As such, these supporting technologies will also contribute to the three 'AgriFood' missions in the KIA for 2020-2023: A. Circular agriculture, B. Climate-neutral agriculture and food production, and D. Sustainable, healthy and safe food.

2. Brabant is *the* centre of excellence in AgriFood technology, component manufacturing and machine building

USPs for Brabant	Both the full high tech and AgriFood value chains are present and well-developed, with over a hundred AgTech and FoodTech companies (employing more than 7,000 people) among them
Universities/Research institutes involved	TU/e, Eindhoven University of Technology; WUR, Wageningen University & Research; JADS, Jheronimus Academy of Data Science (Den Bosch/Tilburg/Eindhoven); HAS University of Applied Sciences (Den Bosch) DataLab AgriFood (Den Bosch) Holst Centre (Eindhoven); TNO (Eindhoven); IMEC (Eindhoven/Louvain)
Leading companies/disruptors/best practices	PlantLab; Signify GrowWise; Pascal Processing; Bodec; GEA Food Systems; Marel Poultry; VDL ETG; VMEngineering/Nirás; Fri-Jado; KSE Process Technology; SAVAL; Skalar Analytical; Premier Tech; Knapen Trailers; KIN Machinebouw; ENGIE Services; AAE, Advanced Automated Equipment; NXP; Dacom; Aris Vision; Brainport Industries
Leading programmes	Breed4Food (WUR, Hendrix Genetics, Cobb-Vantress, Topigs-Norsvin, CRV); Eindhoven Artificial Intelligence Systems Institute (EAISI)
Facilities/Locations/Campuses	High Tech Campus Eindhoven; TU/e Campus Eindhoven; Eindhoven Artificial Intelligence Systems Institute (EAISI); DataLab AgriFood (Den Bosch); JADS Campus (Den Bosch); Precision Agriculture Center South (Reusel); Application Center for Sustainable Food Processing/Food Tech Brainport (Helmond); PlantLab (Den Bosch); GrowWise Research Center by Signify (Eindhoven); Cosun Innovation Center/GPEC, Green Protein Center of Excellence (Dinteloord)

INTRODUCTION

In view of the many challenges the planet is facing (feeding nine billion people by 2050 while significantly reducing the impact on the climate and earth), it has become very clear that the further integration of advanced technology in all phases and types of agriculture and livestock farming could be a large part of the solution.

THE CHALLENGE

Traditional farming methods will not be able to feed the world's population of nine billion people in 2050 without irrevocably changing the climate and harming our planet. Many aspects of traditional farming have served the population well so far, but now they have to change. Technology and the use of information (data) will enable that change.

There are many potential areas for change, from providing small farmers around the world with data on soil quality, crop conditions or weather conditions to indoor farming concepts and growing techniques, monitoring systems for animal welfare, drone and satellite imaging for crop management, manure processing technologies, and so on.

FINDING SOLUTIONS – WHAT MAKES BRABANT THE PERFECT LOCATION?

Brabant, as we saw in Chapter III, Industry Overview, is home to the complete AgriFood value chain and all the required technological support. More than a hundred companies specifically focus their high tech activities on the AgriFood sector, developing high tech components, agricultural machinery, food processing technology or data communication and processing equipment and software.

One of the most esteemed high tech ecosystems in the world, the Eindhoven metropolitan area, is located in Brabant. This area is home to global OEMs such as ASML, Philips Healthcare, Paccar/DAF and NXP and is one the three officially designated mainports in the Netherlands, together with the Port of Rotterdam and Amsterdam and Schiphol Airport. And its name says everything about the nature of the region: Brainport Eindhoven.

Dozens of companies in Brabant and the Eindhoven region are involved in both the development and manufacture of applications, including:

- Livestock and livestock farming: stables and animal enclosures, HVAC systems and air scrubbing systems, feeding and drinking water systems, animal welfare monitoring facilities, milking installations, on-farm mini-milk factories, etc.
- Arable farming: robots, cobots, sowing, harvesting and mowing machines
- Slaughterhouses and meat processing plants
- Food processing and food industry: extraction, separation, heating, catalysis, blending, cooling, monitoring, sensor technology, QA/QC, etc.
- Manure processing, such as biogas plants

All of which leads to a single straightforward conclusion: if AgriFood is going to meet high tech anywhere in the world, it must be in Brabant, the Netherlands.

Activities in this niche contribute explicitly to three of the six missions of the Agriculture, Water & Food Knowledge & Innovation Agenda for 2020-2023: A. Circular agriculture, B. Climate-neutral agriculture and food production, and D. Sustainable, healthy and safe food. The supporting Key Technologies are essential for creating these solutions.

3. Brabant is *the* place to be for the development, production and application of alternative proteins

USPs for Brabant	Brabant has the perfect combination of the strengths of a fully-developed traditional protein value chain – both animal and plant-based – and the innovative power of high tech disruptors in concepts such as 'protein breweries', 'vegetarian butchers' and state-of-the-art insect breeders
Universities/Research institutes involved	WUR, Wageningen University & Research; HAS University of Applied Sciences (Den Bosch); TU/e, Eindhoven University of Technology; TU Delft, Delft University of Technology
Leading companies/disruptors/best practices	The Protein Brewery; Schouten Europe; HAK; Cosun/GreenProtein; Carezzo Nutrition; Dalco Food; Protix; Beefy Green; The Vegetarian Butcher; Rijk Zwaan; vanRijsingengreen; Danone/Nutricia; Nutreco; Agrifirm; Bodec; Pascal Processing
Leading programmes	Protein Transition by Province of Brabant & BOM; Food Value – more value from raw materials (BOM and others)
Facilities/Locations/Campuses	Cosun Innovation Center/GPEC, Green Protein Center of Excellence and Nieuw Prinsenland (Dinteloord); Application Center for Sustainable Food Processing/Food Tech Brainport (Helmond); Campus Almkerk (Almkerk); CHIEF, Center for Education, Innovation and Inspiration in the field of Plant-based Proteins (Almkerk/Altena); Precision Agriculture Center South (Reusel); PlantLab (Den Bosch); GrowWise Research Center by Signify (Eindhoven)

INTRODUCTION

Even though opinions differ among scientists on whether plant-based proteins always have a smaller environmental footprint than animal proteins, the general consensus is that a global shift in people's diets towards eating more plant-based proteins instead of animal proteins will be better for our planet. For every food calorie generated, animal-based foods – and ruminant meat in particular – require multiples more in terms of feed and space and emit far more greenhouse gases than plant-based foods.

THE CHALLENGE

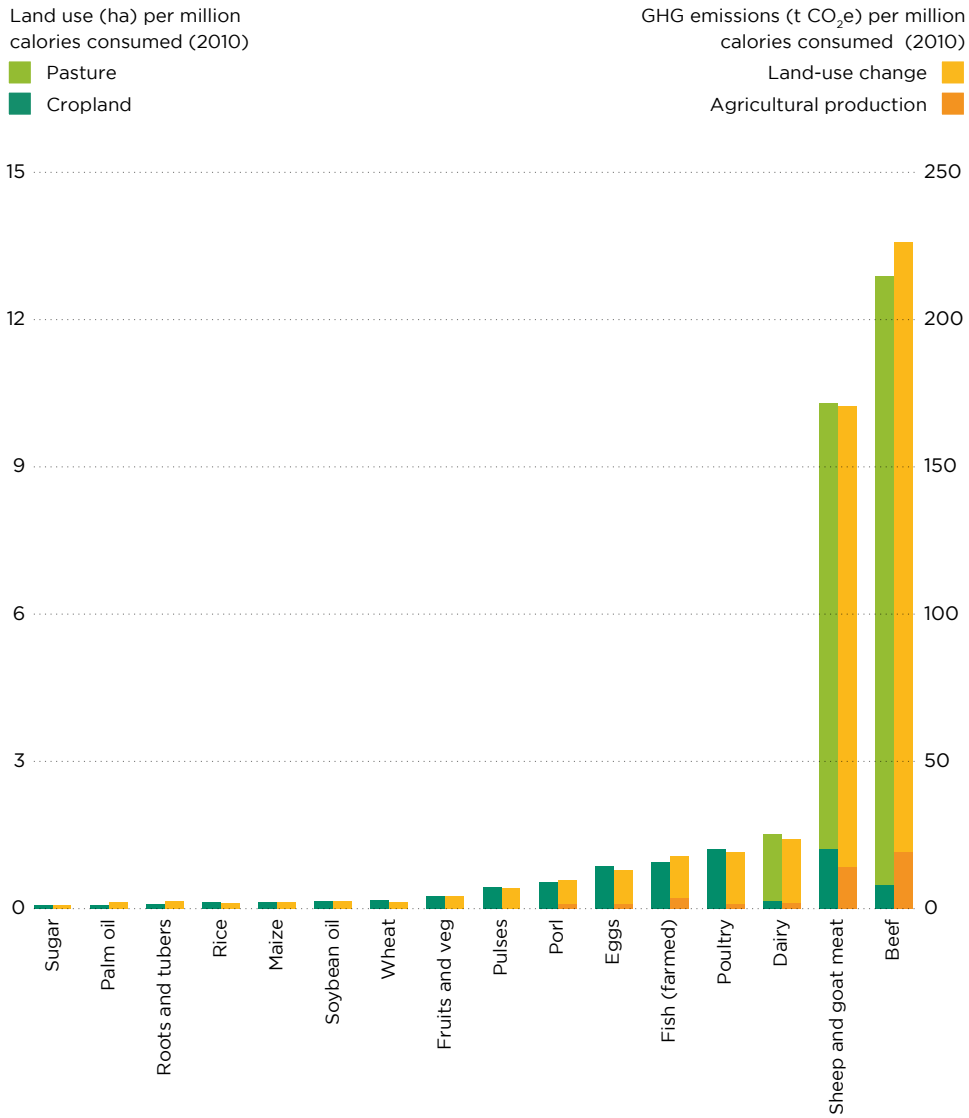
The challenge to help shift consumption to a lower-impact diet is threefold, says the World Resource Institute:

1. Product innovation. Businesses should continue to increase investment in development of meat substitutes (e.g., plant-based meats) and blended meat-plant products until they satisfy consumers who still want to enjoy the taste and experience of eating meat at less cost.

2. Promotion and marketing. Businesses, government, and civil society need to move beyond relying solely on information and education campaigns to shift diets. Rather, they should improve marketing of plant-based foods and plant-rich dishes. A suite of more sophisticated behaviour-change strategies, including minimizing disruption to consumers, selling a compelling benefit, maximizing awareness, and evolving social norms, has proven successful in shifting consumption patterns in other food and nonfood products.

3. Policy and pricing. Governments can support diet shifts through their own food procurement practices and policies that shape the consumption environment (e.g., marketing, display). Once the quality and price of nonmeat alternatives rival that of meat, retail-level taxes on meats or other animal-based foods might become politically acceptable.

ANIMAL-BASED FOODS ARE MORE RESOURCE-INTENSIVE THAN PLANT-BASED FOODS



Source: World Resource Institute – Creating a sustainable food future: a menu of solutions to feed nearly 10 billion people by 2050 (December 2018)

FINDING SOLUTIONS – WHAT MAKES BRABANT THE PERFECT LOCATION?

Brabant is the place to be for the development, production and application of alternative proteins, as the full protein value chain is already present and highly developed in the province. Every single step in the value chain is listed below, together with a selection of Brabant companies and institutes already active in the phase in question:

1. Arable farming: growing suitable crops for protein production, including innovation centres:

a. CHIEF: the centre for help with innovation, education and experiencing plant-based proteins: Schouten Europe has, together with HAK, set up an experience centre in Altena, Brabant as a testing ground for the protein transition in the food chain.
b. Working with the western Brabant sugar beet farmers that are part of cooperatives such as COSUN, one can naturally (learn to) grow anything one wants to grow. The same applies to the potato farmers close to the Belgian border.

2. Research and development of alternative proteins:

a. BioscienZ and The Protein Brewery (Breda): a young company developing technology for the manufacture of food proteins based on fungal fermentation technology
b. Schouten Europe (Giessen): protein development the traditional way.
c. Protix (Tilburg/Bergen op Zoom): a market leader in scalable insect breeding. Using high tech solutions, artificial intelligence, genetic improvement programmes and robotics, Protix breeds larvae of the black soldier fly as a unique source of protein for food and feed.
d. The aim of Royal Cosun (Dinteloord) is to create a Vegetable Protein Open Innovation Center with its partners

3. Processing and the development of vegetable raw materials into tasty edible proteins:

a. Beefy Green (Helmond): producers of a quality meat alternative using pure oyster mushrooms (Eindhoven)
b. Dalco Food (Oss/Oosterhout): specialises in the production of meat substitutes – both vegetarian and vegan – and meat products. In 2016, Dalco opened an additional production facility in Oosterhout for 100% vegetarian and vegan protein products.
c. Carezzo Nutrition (Helmond)

4. Food industry players already working with vegetable proteins:

a. Schouten Europe (Giessen)
b. HAK (Giessen)
c. Cosun/GreenProtein (Dinteloord)
d. Danone/Nutricia (HAPS)
e. Carezzo Nutrition (Helmond): cluster for protein-enriched food that is innovative and already a success story. Carezzo Nutrition, vanRijsingeningredients, Bodec, Pascal Processing and other companies are already aboard
f. vanRijsingengreen (Helmond)
g. The Vegetarian Butcher (Breda): this company aims to deliver meat alternatives with no compromise when it comes to taste and texture. The company believes there is great potential in the protein-rich and organic lupines growing in the Netherlands.
h. Nutreco (Boxmeer)
i. Agrifirm (Heusden)

5. Processing and production technology for alternative protein products, including pilot, test and large-scale agricultural sites:

a. VDL ETG (Eindhoven)
b. Food Tech Brainport and Fieldlab Smart Processing (Helmond)
c. Bodec (Helmond)
d. Pascal Processing (Helmond)
e. Cosun Beet Company and cooperative and Cosun Innovation Center (Dinteloord)
f. Tummers Food Processing Solutions (Hoogerheide)
g. KSE Process Technology (Bladel)

6. Food safety:

a. Nutrilab (Giessen)
b. Charles Rivers Laboratories (Den Bosch (and elsewhere))
c. Eurofins Scientific (Oosterhout)

7. Sustainability: raw material processing including residual and side flows:

a. vanRijsingeningredients (Helmond)
b. Bodec (Helmond)

8. Knowledge and educational institutions:

a. HAS University of Applied Science in AgriFood (Den Bosch)
b. Helicon (Helmond)
c. De Leijgraaf (Oss)
d. TU/e University of Technology (Eindhoven)
e. JADS, Jheronimus Academy of Data Science (Den Bosch)

9. Specialised logistics companies:

a. Schenker Logistics Netherlands
b. XPO Supply Chain Netherlands
c. ID Logistics Benelux
d. Schenker Logistics Netherlands
e. Van Rooijen Logistics
f. Rhenus Contract Logistics

Activities in this niche contribute explicitly to three of the six missions of the Agriculture, Water & Food Knowledge & Innovation Agenda for 2020-2023: A. Circular agriculture, B. Climate-neutral agriculture and food production, and D. Sustainable, healthy and safe food. The supporting Key Technologies are essential for creating these solutions.

4. Brabant is home to Europe's leading animal health cluster

USPs for Brabant	One of the most extensive animal health clusters in the world is located in Brabant in and around the city of Boxmeer. Making up a perfect geographic triangle with the cities of Oss (a Biopharmaceuticals hotspot) and Eindhoven (a High Tech and MedTech hotspot)
Universities/Research institutes involved	Utrecht University Hospital and University; Wageningen University & Research; TU/e, Eindhoven University of Technology
Leading companies/disruptors/best practices	MSD (Merck) Animal Health; Hendrix Genetics; Nutreco; Marel Poultry; Covetrus; Dechra Veterinary Products; Dopharma; Floris Pharma; Perstorp; Produlab Pharma; Charles River Laboratories; Royal Canin (MARS); MS Schippers; AgriFirm; Nijsen/Granico (Limburg)
Leading programmes	IMAGEN (An**IMA**l **G**roup **SEN**sor)
Facilities/Locations/Campuses	Boxmeer Health Campus

INTRODUCTION

There is a major gap between the amount of food we produce today and the amount that will be required to feed the world by 2050, when the population will reach ten billion. That is around three billion more mouths to feed than in 2010. As incomes rise, people will increasingly consume more resource-intensive and animal-based foodstuffs. At the same time, it has become clear that greenhouse gas (GHG) emissions from agricultural production must be significantly reduced and the conversion of forests to agricultural land must be stopped.

THE CHALLENGE

According to the World Resource Institute (WRI), feeding ten billion people sustainably by 2050, requires us to close three 'gaps':

1. A 56% food gap between crop calories produced in 2010 and those needed in 2050 under 'business as usual' growth;
2. A 593 million-hectare land gap (an area nearly twice the size of India) between global agricultural land area in 2010 and expected agricultural expansion by 2050; and
3. An 11-gigaton GHG mitigation gap between expected agricultural emissions in 2050 and the target level needed to keep global warming below 2 °C (3.6 °F), the level necessary for preventing the worst impacts of climate change.

FINDING SOLUTIONS

WHAT MAKES BRABANT THE PERFECT LOCATION?

WRI research on how to create a sustainable food future has identified 22 solutions that must be simultaneously applied to close these gaps. The relative importance of each solution varies from country to country.

One of the most important strategic goals for the Netherlands is to reduce GHG emissions generated by agricultural production. GHG emissions from agricultural production arise from livestock farming, the use of nitrogen fertilisers, rice cultivation and energy consumption. These gases are projected to rise from seven to nine gigatons or more a year by 2050 (in addition to six gigatons or more a year as a result of changes to land-usage).

Three important developmental directions in respect of solving the GHG emissions issue are:

1. Reducing enteric fermentation through new technologies

Ruminant livestock were responsible for around half of all agricultural production emissions in 2010. Of these emissions, the largest source is 'enteric methane', or cow burps. Increasing productivity of ruminants also reduces methane emissions, mainly because more milk and meat is produced per kilogram of feed. In addition, new technologies can reduce enteric fermentation. For example, 3-nitrooxypropan (3-NOP), a chemical additive that inhibits microbial methane, was tested in New Zealand and cut methane emissions by 30% and may increase animal growth rates.

2. Reduce emissions through improved manure management

Emissions from 'managed' manure, originating from animals raised in confined settings, represented around nine percent of agricultural production emissions in 2010. Improving manure management by better separating liquids from solids, capturing methane, and other strategies can greatly reduce emissions.

3. Reduce emissions from manure left on pasture

Livestock faeces and urine deposited in fields turns into nitrous oxide, a potent greenhouse gas. This unmanaged manure accounted for 12% of agricultural production emissions in 2010. Emerging approaches involve applying chemicals that prevent nitrogen from turning into nitrous oxide, and growing grasses that prevent this process naturally.

Brabant has one of the most extensive animal health clusters in the world in and around the city of Boxmeer. In this geographic triangle with the cities of Oss (biopharmaceuticals) and Eindhoven (High Tech and MedTech), the AgriFood & Animal Health cluster alone comprises:

- 3,600 companies
- 40,000 employees
- €455 million spent on R&D
- €4.3 billion in AgriFood exports

The flagship companies in animal health are MSD (Merck) Animal Health, Hendrix Genetics, Nutreco and Marel Poultry. All four of these companies are actively involved in developing solutions for, in particular, the developmental directions no. 1 and no. 2 detailed above. Brabant plays an active role in finding solutions in developmental direction no. 3 too, but that falls under experiments and research into innovative arable concepts, as set out above under priority niche no. 1.

- MSD Animal Health has approximately 1,500 employees in Boxmeer. The operation is the European headquarters and the single largest animal health vaccine manufacturing and R&D site in the world. MSD, as a whole, employs 68,000 people and generates an annual turnover of roughly €35 billion.

- Hendrix Genetics has over 3,000 employees, has locations in more than 25 countries worldwide and is a global leader in turkey, layer hen and trout breeding. The company also has a growing international share in swine, salmon and guinea fowl breeding. Its global head office and core R&D operations are based in Boxmeer and the company's annual turnover of €500 million is increasing at a rapid pace.

- Nutreco has its roots in Boxmeer. It was initially named Hendrix' Voeders, after its founder Wim Hendrix. Decades later and after several takeovers, Nutreco today has some 12,000 employees worldwide and 100 manufacturing sites in 35 countries and generates an annual turnover of over €5 billion. While nine out of ten employees work outside the Netherlands, the Boxmeer site still plays a key role, with 250 staff members engaged in research, communication and marketing.

- With 1,500 employees, Boxmeer is also home to Marel's principal site (6,000 employees worldwide and a turnover of around €1,2 billion). In 2008, Marel Poultry (called Stork PMT at the time) was acquired by the Icelandic company Marel. Boxmeer is the global head office and R&D centre for all of Marel's poultry processing activities. Marel has a presence in some 150 countries.

Activities in this niche contribute explicitly to three of the six missions of the Agriculture, Water & Food Knowledge & Innovation Agenda for 2020-2023: A. Circular agriculture, B. Climate-neutral agriculture and food production, and D. Sustainable, healthy and safe food. The supporting Key Technologies are essential for creating these solutions.

5. Brabant is home to Europe's leading cluster in the field of optimising, raising and processing poultry and eggs

USPs for Brabant	Brabant is home to Europe's most advanced cluster for poultry and egg genetics, health, breeding, production, processing, trading and distribution
Universities/Research institutes involved	WUR, Wageningen University & Research; HAS University of Applied Sciences (Den Bosch); TU/e, Eindhoven University of Technology; Utrecht University; JADS, Jheronimus Academy of Data Science (Den Bosch/Tilburg/Eindhoven)
Leading companies/disruptors/best practices	Vencomatic; Hendrix Genetics; Cobb-Vantress; Kwetters; Coppelmans Eieren; Alpha Group; Nutreco; Agrifirm; MS Schippers; Marel Poultry; MSD (Merck) Animal Health; MS Schippers
Leading programmes	Breed4Food (WUR, Hendrix Genetics, Cobb-Vantress, Topigs-Norsvin, CRV)
Facilities/Locations/Campuses	Boxmeer –Marel, MSD Animal Health, Hendrix Genetics and Nutreco sites for joint research

INTRODUCTION

Over the last century an extremely strong cluster has grown up in Brabant that revolves around poultry and eggs. This growth was relatively independent and did not involve government backing. It is the world's fastest growing animal-protein market.

THE CHALLENGE

Because of its independence, both in terms of growth and operations, the unique strength of the cluster has slipped beneath the radar to some degree from a marketing and branding perspective. But technology and process development for improving chicken genetics, the breeding process, chicken feed, egg quality, sustainability and animal welfare in the region are all at an exceptionally high level. Helping to sustain the level of cooperation within the cluster and adding other knowledge-providers to the ecosystem will help maintain the cluster's leading position in this fast-growing global market.

FINDING SOLUTIONS

WHAT MAKES BRABANT THE PERFECT LOCATION?

Brabant sometimes overlooks its own strengths when it comes to poultry and egg genetics, breeding, production, processing, trading and distribution. The province is not only home to two of the largest poultry genetics companies in the world (Hendrix Genetics and Cobb-Vantress), but also to poultry farming equipment makers Vencomatic and MS Schippers, large chicken breeders, major chicken farms, feed manufacturers (Agrifirm and Nutreco) and, last but not least, large and giant egg trading and processing companies.

Finally, Brabant is also the location of one of the largest and the most innovative producers of chicken slaughtering and processing lines in the world (Marel Poultry) and of dozens of highly specialised logistics service providers transporting chickens and eggs. Brabant's chicken farmers are famed for their innovation and their branch is well-organised. Even issues such as manure processing have been tackled, a process that is now well-oiled, including an innovative poultry manure-generated power plant in Moerdijk.

ONGOING INITIATIVES IN BRABANT:

- **Poultry manure power plant**

The BMC Moerdijk power plant processes one-third of the total annual poultry manure output in the Netherlands. BMC generates 285,000 MWh of electricity through the incineration of manure – enough green power to run a city the size of Den Bosch. BMC also produces 60,000 tons of high-quality fertiliser through the thermal conversion of poultry manure. In the spring of 2017, CE Delft published a study on the use of poultry manure for generating electricity, and the scientists exhaustively compared the effects of large-scale thermal conversion as employed by BMC with other ways the manure can be processed. CE Delft concluded that the use of poultry manure for generating power is the best option from an environmental perspective.

- **Breed4Food - Animal genetics**

Three world-leading animal genetics companies are located in Brabant: Hendrix Genetics, Cobb-Vantress and Topigs Norsvin. A fourth such company, CRV, is also Dutch and is just a stone's throw away in the province of Gelderland. These four companies have partnered with Wageningen University & Research to create Breed4Food. Hendrix Genetics and Cobb-Vantress have a particular interest in this project, which focuses on the genetics of traditional poultry, turkeys, layer hens and broilers.

'Animal breeding has always been and will increasingly become more knowledge-intensive. The "genomic revolution" is rapidly opening new opportunities for innovation and scientific research, allowing breeding companies to expand their world-leading role and competitive position through a focus on improving food security and new traits needed for sustainable, future animal production chains.

Four Netherlands-based animal breeding companies (TOPIGS, CRV, Hendrix Genetics and Cobb Europe) are prominent global players in animal breeding. These companies, in partnership with Wageningen University & Research's Animal Breeding and Genomics Group, have joined forces in Breed4Food. Partners in Breed4Food aim to jointly develop a world-leading institute for research and innovation in livestock genetics, Breed4Food, in the Netherlands. The move will bolster the position of the companies on the world market and strengthen the scientific position of Wageningen UR, ensuring it retains its dominant global position in genetics and genomics research.

Breed4Food allows the four breeding companies to run a breeding programme that clearly outperforms the competition. The joint development of pre-competitive knowledge is crucial to achieving the goals of Breed4Food.'

B. Brabant's development areas

Activities in this niche contribute explicitly to three of the six missions of the Agriculture, Water & Food Knowledge & Innovation Agenda for 2020-2023: A. Circular agriculture, B. Climate-neutral agriculture and food production, and D. Sustainable, healthy and safe food. The supporting Key Technologies are essential for creating these solutions.

1. Brabant is *the* global development centre in sustainable agriculture, livestock breeding and animal welfare and healthy food

USPs for Brabant	Brabant has inherent strengths in all relevant AgriFood value chain areas and can combine them with its renowned strengths in AgTech and FoodTech. This means the province can be the frontrunner in developing solutions to the sustainable food challenges we face heading towards 2030 and later. It has the expertise, the locations, the worldwide contracts and the disruptors required to challenge the establishment.
Universities/Research institutes involved	TU/e, Eindhoven University of Technology; WUR, Wageningen University & Research; HAS University of Applied Sciences (Den Bosch); TNO (Eindhoven); Utrecht University; JADS, Jheronimus Academy of Data Science (Den Bosch/Tilburg/Eindhoven)
Leading companies/disruptors/best practices	PlantLab; Van den Borne Aardappelen; NXP; Cosun Beet Company; Aris Vision; Signify; Agrifirm; MS Schippers; Nutreco; Van Asten Group; MSD (Merck) Animal Health; Hendrix Genetics; Cobb-Vantress; Vencomatic
Leading programmes	Breed4Food (WUR, Hendrix Genetics, Cobb-Vantress, Topigs-Norsvin, CRV); Food Value – more value from raw materials (BOM and others)
Facilities/Locations/Campuses	Application Center for Sustainable Food Processing/Food Tech Brainport (Helmond); Campus Almkerk (Almkerk); Precision Agriculture Center South (Reusel); PlantLab (Den Bosch); GrowWise Research Center by Signify (Eindhoven); Cosun Innovation Center/GPEC, Green Protein Center of Excellence and Nieuw Prinsenland (Dinteloord); Green Chemistry Campus (Bergen op Zoom)

INTRODUCTION

Debate continues and strategies are being created in the Netherlands – and in Brabant in particular, as it is the country's AgriFood powerhouse – on the future of agriculture and the AgriFood sector as a whole. A balance is being sought between sustainability, feeding the world, economics, competitiveness, the global-versus-local question, animal welfare and numerous other societal and environmental challenges.

THE CHALLENGE

Geographically, the Netherlands is very small, covering less than 42,000 km^2 or 16,500 mi^2 - just one-ninth the size of Germany, one-eleventh the size of Sweden, or 231 and 237 times smaller than China and the United States of America, respectively.

But when it comes to population density, the picture is very different. At 17 million people, the Netherlands is one of the most densely populated countries in the world, with a population density of 508 inhabitants/km^2 or 1,316 inhabitants/mi^2. That is 14 times higher than the USA (36/km^2 or 94/mi^2), 20 times higher than Sweden (25/km^2 or 64/mi^2) and more than three times higher than China, even with that country's population of over 1.4 billion (153/km^2 or 397/mi^2).

With this in mind, many people are surprised to learn that the Netherlands is the second-largest exporter of AgriFood products in the world, with only the US ahead of it. *National Geographic* published an article on the subject in 2017 with the revealing title: 'This tiny country feeds the world - Agricultural giant Holland is changing the way we farm'.

The Dutch AgriFood industry punches far above its weight in terms of performance, efficiency and use of state-of-the-art technology and generally has a stellar reputation around the world when it comes to food safety and traceability and animal health and welfare. However, this might lead one to wonder whether or not the country has reached the limit in respect of what such a small location with so many inhabitants can sustainably and happily produce.

Both geographically and in terms of size, the country is in reality probably more similar to many large metropolitan areas elsewhere in the world. And the 'metropolitan area of the Netherlands' is now the first such region to both face and tackle the significant challenges of balancing a large population with large livestock herds, nitrogen and CO2 emissions, soil depletion, decreasing biodiversity, changing consumer diet preferences, the diminishing appreciation of the (primary) food sector and animal welfare concerns. And so the Netherlands, with Brabant as one of the leading AgriFood regions, is actually a few years ahead of much of the rest of the world, and it is just a matter of time before the other major metropolitan regions of the world start to experience the challenges the Dutch are currently facing.

FINDING SOLUTIONS

WHAT MAKES BRABANT THE PERFECT LOCATION?

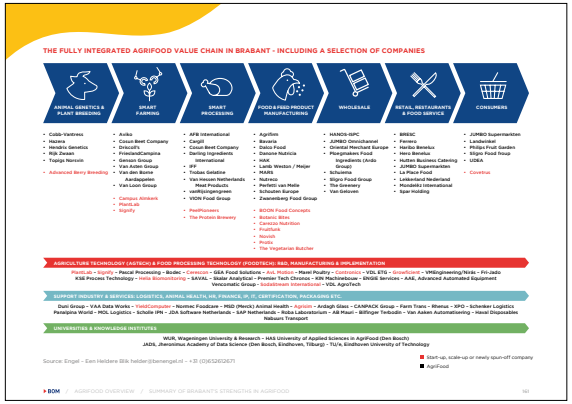
Because of its inherent strengths in *all* relevant AgriFood value chains, Brabant is able to act as the frontrunner for developing solutions to these challenges and introducing these concepts/products and processes and expertise to the world at large. It has the expertise, the locations, the worldwide contacts and the disruptors required to challenge the establishment.

This corresponds well with Brabant's ambition of making the region the place to be for pilot testing, upscaling and the full-scale implementation of new advances in AgriFood in the Netherlands. *AgriFood meets High Tech* in Brabant: the fundamental research conducted by Wageningen University & Research is further developed in Brabant for real-world applications.

Brabant is the Dutch 'locomotive' for the new AgriFood industries, with technologies such as sensor technology, vision technology, quality control, data science, farmbots, drones and many more being used for purposes such as the precision farming testing at the Precision Farming South experimental centre, benefitting all its partners in agriculture, industry and academia alike.

In the longer term this will lead to a situation where the research, development, testing and application of smart AgriFood products and processes continues to be conducted in this small, densely-populated country, but that not all AgriFood large-scale production would necessarily have to be performed in Brabant or the Netherlands. Production could be closer to consumers. And so both the environmental footprint caused by intensive primary production in the Netherlands and the logistics footprint of transporting bulk food products across the globe could shrink.

The above means that we should aim to continue developing and testing agricultural and livestock knowledge, experiences, processes, techniques and instruments in Brabant before implementing those results in the areas of the world where they are most needed and best fit the local conditions. This approach must then be converted into a revenue model for the Brabant AgriFood industry.



See the value chain on page 164

Activities in this niche contribute explicitly to supporting mission G. Key Technologies. In fact, big data, data science and AI are likely to be the decisive technologies for finding solutions to the challenges we face, and as such supporting technologies will also contribute to the three AgriFood missions in the KIA for 2020-2023: A. Circular agriculture; B. Climate-neutral agriculture and food production and D. Sustainable, healthy and safe food.

2. Brabant is building a distinctive Big Data and Data Science cluster in AgriFood

USPs for Brabant	Brabant already has a well-developed AgriFood industry and a world-class High Tech one, including a strong data science community, as demonstrated by JADS, the Jheronimus Academy of Data Science, and EIASI (Eindhoven Artificial Intelligence Systems Institute)
Universities/Research institutes involved	JADS, Jheronimus Academy of Data Science (Den Bosch/Tilburg/Eindhoven); TU/e, Eindhoven University of Technology; WUR, Wageningen University & Research; HAS University of Applied Sciences (Den Bosch); DataLab AgriFood (Den Bosch); Holst Centre (Eindhoven); TNO (Eindhoven); IMEC (Eindhoven/Louvain)
Leading companies/disruptors/best practices	Philips Research/Healthcare; Signify (GrowWise); PlantLab; NXP; Dacom; Van den Borne Aardappelen; Royal Cosun/Cosun Beet Company; Aris Vision; Hendrix Genetics; MSD Animal Health; VION; Marel Poultry
Leading programmes	Breed4Food (WUR, Hendrix Genetics, Cobb-Vantress, Topigs, CRV); Eindhoven Artificial Intelligence Systems Institute (EAISI)
Facilities/Locations/Campuses	High Tech Campus Eindhoven; TU/e Campus Eindhoven; Eindhoven Artificial Intelligence Systems Institute (EAISI); DataLab AgriFood (Den Bosch); JADS Campus (Den Bosch); Precision Agriculture Center South (Reusel); PlantLab (Den Bosch); GrowWise Research Center by Signify (Eindhoven); Cosun Innovation Center/GPEC, Green Protein Center of Excellence (Dinteloord)

INTRODUCTION

Data communication, big data, data analysis and artificial intelligence will be a – if not the – crucial factor over the next few decades for finding solutions to the challenges our society faces.

THE CHALLENGE

Brabant already has a well-developed AgriFood industry and a world-class High Tech one, including a strong data science community. Future work will aim to further integrate these two related fields of excellence. This is necessary because, firstly, some of the solutions for feeding the world in a sustainable, safe and healthy manner will be found at that point where AgriFood meets high tech, and secondly, because combining these strengths will further increase the global competitiveness of both industries in Brabant.

FINDING SOLUTIONS

WHAT MAKES BRABANT THE PERFECT LOCATION?

The further integration of the data science, big data and artificial intelligence component of Brabant's High Tech industry in AgriFood is already taking place through multiple projects and programmes in Brabant:

Data communication and data processing in a single link of the value chain, such as

- The data component in the precision farming pilot projects at the Precision Ag Center South, involving companies such as Van den Borne Aardappelen (potato farming), Dacom (sensor equipment and data-driven software), Aris (vision systems), Aerialtronics (AgriFood solutions-developer using drones, AI and IoT data) and institutes such as TU/e, Delphy, VITO and TNO
- The data component in the pixel farming concept on Campus Almkerk (described in more detail in section XI.A.1)

Data communication and data processing throughout the entire value chain, such as

- 'The Smart Pig Chain' project: strengthening the pig value chain using data and smart technologies, together with partners such as HAS, JADS, Hendrix Genetics, Agrifirm, MSD Animal Health, VION and others. In this project the feed value chain and the pig value chain work together to apply technologies for precision breeding, monitoring, feeding, animal welfare and data integration. In the next phase, retail and supermarkets will also be integrated in the chain to coordinate expected market demand peaks (for example, when public holidays fall on days when the weather is good, the demand for meat for barbecues rises) with pork processing levels
- Use of big data in the poultry value chain (Hendrix Genetics, VION, Van Rooi and others)
- The data component is crucial for optimising plant cultivation yield in greenhouses and indoor farming, and so one of Signify's priorities is the further development of their Yield Rolling Forecast data system

Data communication and data processing partnerships between value chains in different industries

- The data component in all food industry-related matters involving food safety and tracking and tracing (Danone/Nutricia, FrieslandCampina, Cosun Beet Company, Mars, Cargill, Heineken, Bavaria, Unilever, etc), with a high level of support from dedicated IT companies (such as AppsforAgri and AgriSim), sensor developers (such CowManager SensOor), manufacturers of monitoring systems like Nedap and many others

The Eindhoven Artificial Intelligence Systems Institute (EAISI) and AIMM, the AI lab for Manufacturing and Maintenance (AIMM)

- The Eindhoven Artificial Intelligence Systems Institute (EAISI, pronounced 'easy') is the new institute of the Eindhoven University of Technology devoted to artificial intelligence. The launch of EAISI reflects the university's intention to play a role in the growing importance of AI in society, business and science and to cater to the rapidly increasing demand for education, engineers and expertise in the field of AI. TU/e has been active in the field of artificial intelligence for decades, which gives the new institute an excellent starting position to build upon. Over the period extending to 2025, TU/e will invest €100 million in EAISI's education and research facilities, and a total of up to 150 people will be directly or indirectly involved in EAISI.

✓ In July 2020, TU/e and Marel Poultry announced the creation of a new artificial intelligence lab for manufacturing and maintenance (AIMM). This new AI lab is a joint project with four industry partners: Marel Poultry, Nexperia, KMWE and Lely Industries, and the lab will aim to improve the decision-making processes in manufacturing and maintenance using artificial intelligence. Together with the launch last year of the EAISI lab and the growing interest in using AI to perform sophisticated tasks, TU/e saw it as a logical step to create an AI-enabled Manufacturing and Maintenance (AIMM) lab. The lab will be part of the Dutch ICAI (Innovation Center for Artificial intelligence) network that focuses on the development of technology and talent between knowledge institutions, industry and government in the field of AI. The new lab embodies the ambitions of all participants to play a leading role in the further development of AI in the Netherlands.

Activities in the Brabant universities have already spawned a number of successful Brabant startups and scaleups, such as

- **AppsforAgri**

This company specialises in developing apps, complex internet applications and SmartFarm sensors. These include affordable sensors for crop monitoring, interactive software for agribusiness organisations that want to increase data communication and advanced algorithms for calculating the crop-climate relationship on the basis of measured and expected weather, the crop age and soil type. AppsforAgri has developed software solutions for international companies like Bayer CropScience, Syngenta, Friesland Campina and Nutreco and is working closely with knowledge institutions such as Wageningen University & Research and HAS Den Bosch.

- **Agrisim**

This company develops modelling and analytics tools for the agricultural industry that help public and private stakeholders to manage physical risks, reduce uncertainty, increase productivity and facilitate resilience-building decisions. Its target groups are farmers at any scale, suppliers of fertiliser, seed and machinery, consultants, cooperatives and farmers' associations, distributors and buyers of agricultural products, regional/national agricultural agencies and NGOs active in agriculture.

- **Connecting Agri & Food**

A consultancy that brings supply chain segments in the agricultural and food industries together. The company has inhouse expertise in every segment in the food supply chain. Using inside knowledge, it focuses its activities on creating synergies between agricultural suppliers, producers, processors and retailers. Core activities are analysing industry trends, developing market concepts and converting big data into relevant information.

Activities in this niche contribute explicitly to three of the six missions of the Agriculture, Water & Food Knowledge & Innovation Agenda for 2020-2023: A. Circular agriculture, B. Climate-neutral agriculture and food production, and D. Sustainable, healthy and safe food. The supporting Key Technologies are essential for creating these solutions.

3. Brabant is developing into a centre of excellence in sustainable food extraction, upgrading and commercialisation

USPs for Brabant	The (large-scale) Brabant food industry has been active in developing processes and technologies for the more efficient use of plant-based raw materials and upgrading (commercialising) residual flows for over a decade. Now, SME consortiums and the Smart Food Processing field lab, with its robots, cobots and digital shop floor technologies have joined them. Adding technologies such as mild separation and mild preservation
Universities/Research institutes involved	TU/e, Eindhoven University of Technology; WUR, Wageningen University & Research; JADS, Jheronimus Academy of Data Science (Den Bosch/Tilburg/Eindhoven); HAS University of Applied Sciences (Den Bosch); DataLab AgriFood (Den Bosch); Holst Centre (Eindhoven); TNO (Eindhoven); IMEC (Eindhoven/Louvain)
Leading companies/disruptors/best practices	Bodec; Pascal Processing; vanRijsingengreen; PlantLab; Signify GrowWise; GEA Food Systems; Marel Poultry; VDL ETG; VMEngineering/Nirás; KSE Process Technology; ENGIE Services; AAE, Advanced Automated Equipment; Brainport Industries
Leading programmes	Application Center for Sustainable Food Processing by HAS University and Food Tech Brainport; Protein Transition by Province of Brabant & BOM; Food Value – more value from raw materials (BOM and others); Breed4Food (WUR, Hendrix Genetics, Cobb-Vantress, Topigs-Norsvin, CRV)
Facilities/Locations/Campuses	Application Center for Sustainable Food Processing/Food Tech Brainport (Helmond); TU/e Campus Eindhoven; DataLab AgriFood (Den Bosch); Cosun Innovation Center/ GPEC, Green Protein Center of Excellence (Dinteloord)

INTRODUCTION

A central point of focus in the new mission-driven Knowledge & Innovation Agenda is the combination of economic opportunities based on societal challenges with the ambition to lead the way by implementing key technologies. The optimised commercial use of raw materials and fewer greenhouse gas emissions are two of the objectives set in this new mission-driven policy. The KIA agenda attaches great importance to a commitment to commercialisation (upgrading raw and residual materials) and implementation.

The Netherlands' climate agreement contains similar objectives as long-term aims for climate mitigation: improving the sustainable the use of raw materials, preventing food waste and increasing the share of plant-based proteins in consumer consumption. The business case of investing in maximising the value of raw materials - with waste prevention as the best possible starting point - has been studied and demonstrated a positive financial outcome. In addition, there is also an environmental gain, with less CO2 released, less water consumed and less land required.

THE CHALLENGE

In spite of the positive business case, the opportunities for the optimal use of raw materials are at present not being fully exploited. To truly take the industry beyond the tipping point requires a much larger group of companies that perceive these opportunities for optimisation and who believe that the sub-optimal use of raw materials is unacceptable. The upshot is that it is important that industry, science and academia experiment with new forms of collaboration and explore (new) key technologies in the use of raw materials.

FINDING SOLUTIONS

WHAT MAKES BRABANT THE PERFECT LOCATION?

The Brabant food industry has been active in developing processes and technologies for the more efficient use of plant-based raw materials and upgrading (commercialising) residual flows for over a decade. It was and still is in part a reason for the success stories of many of the very large raw material/food processing companies in the region, such as Royal Cosun/Cosun Beet Company (beet sugar), Cargill (starch), Mars (chocolate bars), Danone Nutricia (infant nutrition) and Unilever (soup). But today the suppliers to these major food producers are leading the way in new processing technology, as are consortiums of SMEs that develop food products on the basis of residual flows or new conservation techniques.

Companies and institutes in Brabant, large and small, are already active in

- Separating residual flows
- Commercialising side and residual flows
- Separating and conserving of nutrients
- Reducing energy and water consumption
- Preventing of nitrogen and CO2 emissions

Ongoing Brabant initiatives

- **Food Tech Brainport's Smart Food Processing field lab**, with its robots, cobots and digital shop floor technology demonstration systems for use in the food sector. In addition, other technologies in the fields of mild separation and mild preservation are demonstrated and used for testing specific food or food stuffs
- The Uden-based company **NewFoss**, with its successful biomass refinery test facility processing 10 tons of fibre a day, which it is currently upscaling to a full commercial plant processing 11,000 tons a year

THE SURPLUS FOOD FACTORY

An iconic example of Brabant's longstanding interest in preventing food waste is 'de Verspillingsfabriek' or **The Surplus Food Factory**. Given that in the region of €5 billion of perfectly good food is wasted annually in the Netherlands, food-lover and catering entrepreneur Bob Hutten decided he could no longer tolerate so many opportunities going to waste.

His solution was to put food industry surpluses to good use. Hutten obtained an empty factory in Veghel where he installed elaborate production and cooling systems. After receiving a sustainable impact loan from Rabobank, De Verspillingsfabriek opened its doors. The Surplus Food Factory has gathered together all food surplus-knowledge and expertise in one location in order to achieve a collective dream: to eliminate the waste of both food and talent throughout the world.

The Surplus Food Factory has an important point of departure, which is to take surplus food destined for human consumption and recover it for the same purpose. Devaluation of surplus food to animal feed and bio-fermentation is seen as a form of waste. The company believes it is essential to remain in the upper reaches of Moerman's waste ladder (a pyramid of food wastage) by engaging in prevention, reuse and recycling.

THE RESULTS

The PLUS supermarket chain bought the very first soups made using surplus ingredients for 12 of its Dutch stores. These soups made of *rescued ingredients* were marketed under the brand name *OverLekker* (which means *TooGood*, and is a pun on the Dutch word for 'leftovers'). One thing led to another, and The Surplus Food Factory concept took off like a rocket. The soups manufactured in The Surplus Food Factory have now not only been purchased by the Sligro wholesaler chain, they are also on sale through its Emte supermarket chain under the brand name *Barstensvol* (full to the brim). The Surplus Food Factory firmly believes that it is essential that retail chains participate in the acquisition of recycled food products, as this makes the production process feasible on a large scale. Their active support is part of the prevention process, making it possible for surplus food to be introduced into the food system, rather than channelled into animal feed production or ending up on a landfill.

Activities in this niche contribute explicitly to three of the six missions of the Agriculture, Water & Food Knowledge & Innovation Agenda for 2020-2023: A. Circular agriculture, B. Climate-neutral agriculture and food production, and D. Sustainable, healthy and safe food. The supporting Key Technologies are essential for creating these solutions.

4. Brabant as a centre of excellence in greenhouse and indoor farming technology, crop cultivation and management

USPs for Brabant	Brabant has all the building blocks required to become a centre of excellence in this domain: the leading companies Signify (GrowWise) and PlantLab (indoor farming), their suppliers and the knowledge-suppliers (TU/e, Eindhoven University of Technology; HAS University of Applied Sciences in Agriculture), the agricultural and horticultural clusters and the many food producers and retailers
Universities/Research institutes involved	TU/e, Eindhoven University of Technology; WUR, Wageningen University & Research; JADS, Jheronimus Academy of Data Science (Den Bosch/Tilburg/Eindhoven); HAS University of Applied Sciences and DataLab AgriFood (Den Bosch); Eindhoven Artificial Intelligence Systems Institute (EAISI)
Leading companies/disruptors/best practices	PlantLab; Signify GrowWise; VDL ETG; VMEngineering/Nirás; ENGIE Services; AAE, Advanced Automated Equipment; Brainport Industries
Leading programmes	Food Value – more value from raw materials (BOM and others)
Facilities/Locations/Campuses	PlantLab (Den Bosch); GrowWise Research Center by Signify (Eindhoven); HAS University Greenhouses (Den Bosch); DataLab AgriFood (Den Bosch)

INTRODUCTION

An impressive collection of companies and institutes are active in Brabant in all phases of the research, development and implementation of the most advanced greenhouse and indoor farming concepts. All of these organisations are highly connected in the Netherlands and abroad, but their contact with each other is currently less extensive.

THE CHALLENGE

Facilitating partnerships in Brabant between these companies and institutes will further accelerate the development of knowledge and technology. Attracting additional knowledge partners from outside the region will double or triple that impact. In other words, investing time and effort in creating those contacts will create a true ecosystem in this highly innovative domain with its many global opportunities.

FINDING SOLUTIONS

WHAT MAKES BRABANT THE PERFECT LOCATION?

Brabant could become a centre of excellence in this field, building on its leading companies Signify (GrowWise) and PlantLab (indoor farming), their suppliers and the knowledge-suppliers, including TU/e, Eindhoven University of Technology, HAS University of Applied Sciences in Agriculture, the many agricultural and horticultural clusters and the plethora of food producers and retailers in Brabant.

Some of the many relevant technological domains that are present In Brabant and that are waiting to be further developed include LED lighting systems, cultivation techniques, big data, data communication and data processing, cultivation and harvesting robots, optics (active glass of greenhouses) and greenhouse and/or indoor farm engineering.

Activities in this niche contribute explicitly to 2 out the 6 missions of Knowledge & Innovation Agenda Agriculture, Water & Food 2020 - 2023: A. Circular agriculture and B. Climate-neutral agriculture and food production. The supporting Key Technologies are key to finding solutions.

5. Brabant as *the* development centre of sustainable manure processing technologies and natural agriculture-grade manure production

USPs for Brabant	Brabant has both the highest concentration of livestock in the Netherlands and all of the high tech and chemistry knowledge required (in industry and academia) in order to find solutions for the industrial processing of manure
Universities/Research institutes involved	WUR, Wageningen University & Research; HAS University of Applied Sciences, Den Bosch; TU/e, Eindhoven University of Technology; Utrecht University
Leading companies/disruptors/best practices	Blue Sphere Corporation; Van Asten Group; Kamplan; Nutreco; VION Food; Agrifirm; MS Schippers; MSD (Merck) Animal Health; Hendrix Genetics; ZLTO; Mineralen Afzet Coöperatie Elsendorp (MACE)
Leading programmes	Breed4Food (WUR, Hendrix Genetics, Cobb-Vantress, Topigs, CRV
Facilities/Locations/Campuses	Sterksel

INTRODUCTION

Brabant has the highest concentration of livestock in the Netherlands. It is a very economically important sector (which includes the slaughtering and meat processing industries), while the capacity to provide animal protein for future human consumption also remains important. However, the manure that is produced as a result of the current system poses a problem. The Netherlands and Brabant produce too much of it and the manure leads to environmental issues and loss in appreciation of the industry by the average consumer.

THE CHALLENGE

The Dutch manure problem must be viewed from three angles. The first one is that of **over-fertilisation**. There was an excess of fertilisation containing nitrogen and phosphate in the past, and phosphate over-fertilisation still exists in the sense that more fertilisers and organic fertilisers are applied than is strictly necessary for crop production and maintaining soil fertility.

The second angle is that of the **manure surplus**. From an agricultural and environmental perspective, the Netherlands with its large livestock population produces more nitrogen and phosphate through animal manure than can be used. The reason for this manure surplus is that the import of minerals for animal feed is much greater than the removal (sales/export) via products, and that the manure produced exceeds the limit that may be disposed of in the natural environment. This creates a national manure surplus.

The third angle is that of **eutrophication**. Eutrophication is the excessive introduction of nutrients into bodies of water, which disturbs the ecology. Eutrophication is caused not only by nutrient discharges from agriculture, but also from households, industry, traffic and natural sources.
Over-fertilisation, surplus manure and eutrophication are closely related and, in reality, constitute a single problem. The manure problem will only be completely resolved once all three problems are eliminated at all relevant levels of scale, from local to international.

FINDING SOLUTIONS

WHAT MAKES BRABANT THE PERFECT LOCATION?

There is some irony in the fact that Brabant is perfectly positioned for finding solutions to the manure challenges, as described above. Research and development activities have been ongoing for some time and Brabant not only has more knowledge of livestock-keeping than any other region in Europe, it also has the tech companies and research institutions that are able to help find the solutions for solving the manure problem.

Ongoing developments in Brabant:

- Clean stabling systems (separating urine and faeces) still require a lot of work, but the results are already very promising. These systems would also be a great export product
- Animal feed optimisation to reduce nitrogen emissions. Developing and adding additives to feed to reduce ammonia concentration levels
- Manure processing technology: industrial manure processing/conversion into valuable materials

BRABANT DEVELOPMENT AGENCY (BOM):
READY TO CONNECT YOU!

Based in Tilburg, BOM Foreign Investments & International Trade is part of the Brabant Development Agency (BOM). Our BOM Foreign Investments team assists new and existing foreign companies to make optimal use of the opportunities offered by Brabant as a business location. We can offer you our support when it comes to finding sites or real estate, building and environmental permits, labor market analysis, talent acquisition, matchmaking for logistics, employment regulations, fact-finding missions, incentives, and relevant networks in the regional private and public sector.

Our BOM International Trade specialists provide hands-on support to companies in Brabant in growing their business abroad. We offer valuable contacts in foreign countries and provide targeted information on markets and available funding. Our international trade specialists also promote the successful economy of Brabant and its thriving ecosystems to foreign companies around the world.

We offer a range of free services and support designed to provide you with the information and network you need to explore new (business) opportunities.

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