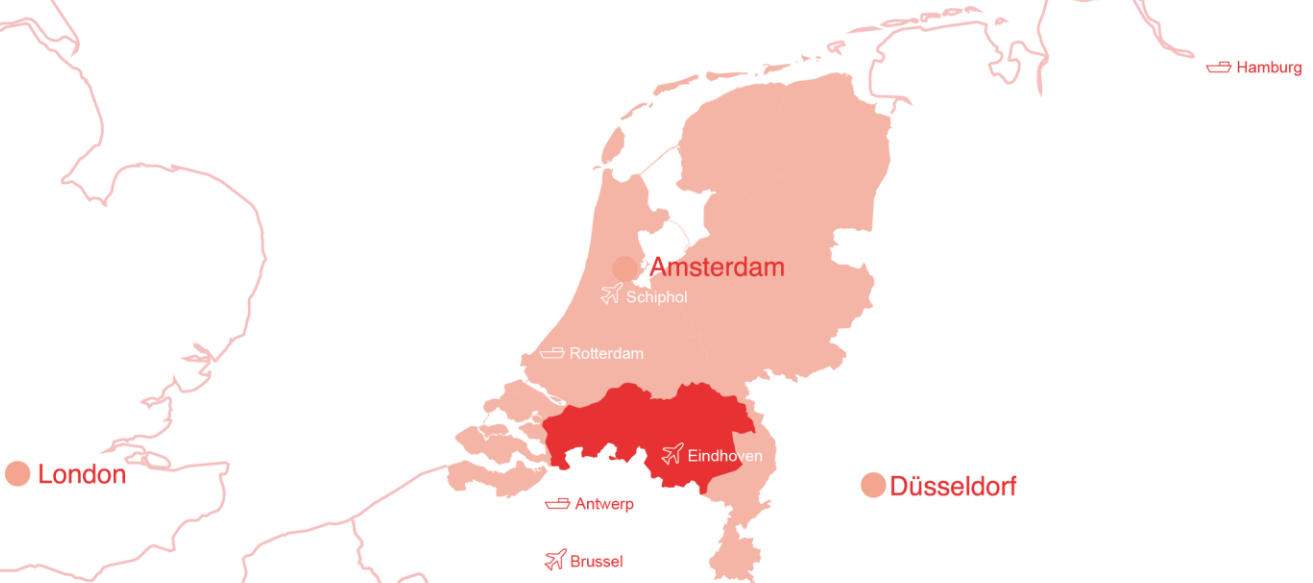
CIRCULAR BIOBASED ECONOMY

in Brabant

BRABANT IS BRIGHT

This is why
Brabant excels



Brabant is an integral **part of the biggest chemical cluster in the world** (ARRRA), offering European market accessibility, utilities and physical infrastructure.

Availability of a **well-educated, flexible workforce, graduates and students**, and access to several (technical) universities within a 150 km radius.

A competitive feedstock position: widely available and guaranteed deliverable in time, due to well organized transport by truck, train, shortsea and barge.

Many, well **interconnected locations** that include possibilities for research, engineering, co-siting, shared utilities and collaboration.

One of the most **innovative agro-industrial ecosystems** in the world, consisting of corporations, research institutes and test facilities

Introductions into **a network of finance, capital funds and business development** because of close cooperation within Brabant's biobased triple helix.

BRABANT IS BRIGHT

Circular Biobased Economy

TODAY

2023

Circular Biobased Delta is working on CO_2 reduction in the southwest of the Netherlands by means of projects in seven markets, namely: green chemistry, biofuels, bioenergy, agro, construction and infrastructure, transport and packaging. Brabant considers the biobased economy as an engine for the Brabant knowledge economy and employment. Our region is committed, together with knowledge partners, the business community and development companies, to develop clusters and chains that make a difference (inter)nationally.

Cosun

SUIKER UNIE

Cargill

sabic

Shell

LambWeston

TOMORROW

2050

Brabant is striving for an economy that is largely circular by 2050. This is in line with the government-wide program Netherlands Circular 2050. Here, the preservation of natural capital is an important starting point. Therefore, many new initiatives are under construction, such as the development of Green Chemistry Campus phase 3, innovative technologies and scaling up of circular processing of plastic residual flows – for example by developing pyrolysis pilot plants at the Port of Moerdijk. At the Cosun Innovation Center, the development of biobased concepts, products and applications in the food and non-food industries is enhanced.

RODENBURG

DARLING INGREDIENTS

ubq

FOOTPRINT

bluesphere

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Within the circulair biobased economy **Brabant particularly excels in:**

Biobased **building materials**: reuse of raw materials in a.o. timber frame construction, biobased plastics, paints, resins, biobased asphalt, but also the application of biobased materials into for example building blocks from grasses and fungi.

Recycling from **plastic** resources. The industry in Brabant is eager reducing the environmental pressure of the packaging industry with circular activities and the use of biobased plastics, such as pots for plants and packaging for foodstuffs.

Making energy supply **CO_2-neutral**, partly done by energy from water and sun, but also by generating from biomass plants and biofuels. Companies are also adding value to the manure surplus and use it for sustainable energy issues.

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Cluster size

Circular Biobased Economy

KEY FACTS
BIOBASED (RELATED) ECONOMY

12,120
companies

77,310
jobs

17.2%
of the Dutch biobased companies is established in Brabant

19.8%
of the Dutch biobased jobs are in Brabant

5.8%
Share of Biobased economy related to total Dutch economy

FLOW OF RAW MATERIAL

98,124
kTON/year

JOBS

40,000
in biomass production

25,550
in conversion of biomass

2,720
in bio-energy

290
in biobased research

PATENT APPLICATIONS

50%
of all European patent applications from the Netherlands are generated in Brabant

5th
place in Europe for regions with the highest number of patent applications

Source: In-depth Analysis Biobased Economy, 2022 (commissioned by BOM)

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Milestones **foreign investment**

2021

FOOTPRINT CENTER

FOOTPRINT

US-based company Footprint, focusing on materials technology for the food industry, established its European R&D Center at the Brainport Industries Campus (BIC) in Eindhoven. This Center will feature a prototype and test lab, research facility, and a primary hub of sustainable solutions innovation for European customers seeking to transition away from single-use plastics.

2021

bluesphere
Turning Unlimited Waste Into Unlimited Energy

BLUESPHERE

Bluesphere has built a large manure digester in Sterksel, one of the largest plants in the Netherlands. The digester produces green biogas from manure and supplies it to the Dutch natural gas grid. The American company is investing €30 million to ferment manure, grass and other co-products. Per hour, the plant delivers 3,000 cubic meters of biogas.

2022

ubq

UBQ MATERIALS

By the end of 2022, a special product will be made at UBQ's new production location in Bergen op Zoom: a raw material for the plastics processing industry that is made from solid household waste. Expected is an annual production of 80,000 tons, which will serve the Western European market. The operation will create 250 jobs for the region.

2024

Shell

SHELL CHEMICAL

Shell's new plant at Port of Moerdijk will make chemicals from plastic waste, and will improve the quality of pyrolysis oil, so it can be reused in factories. This investment aligns with Shell's and Brabant's ambition to further develop the chemical recycling industry and turn difficult-to-recycle plastics into new and useful products. The plant is expected to be operational in 2024.

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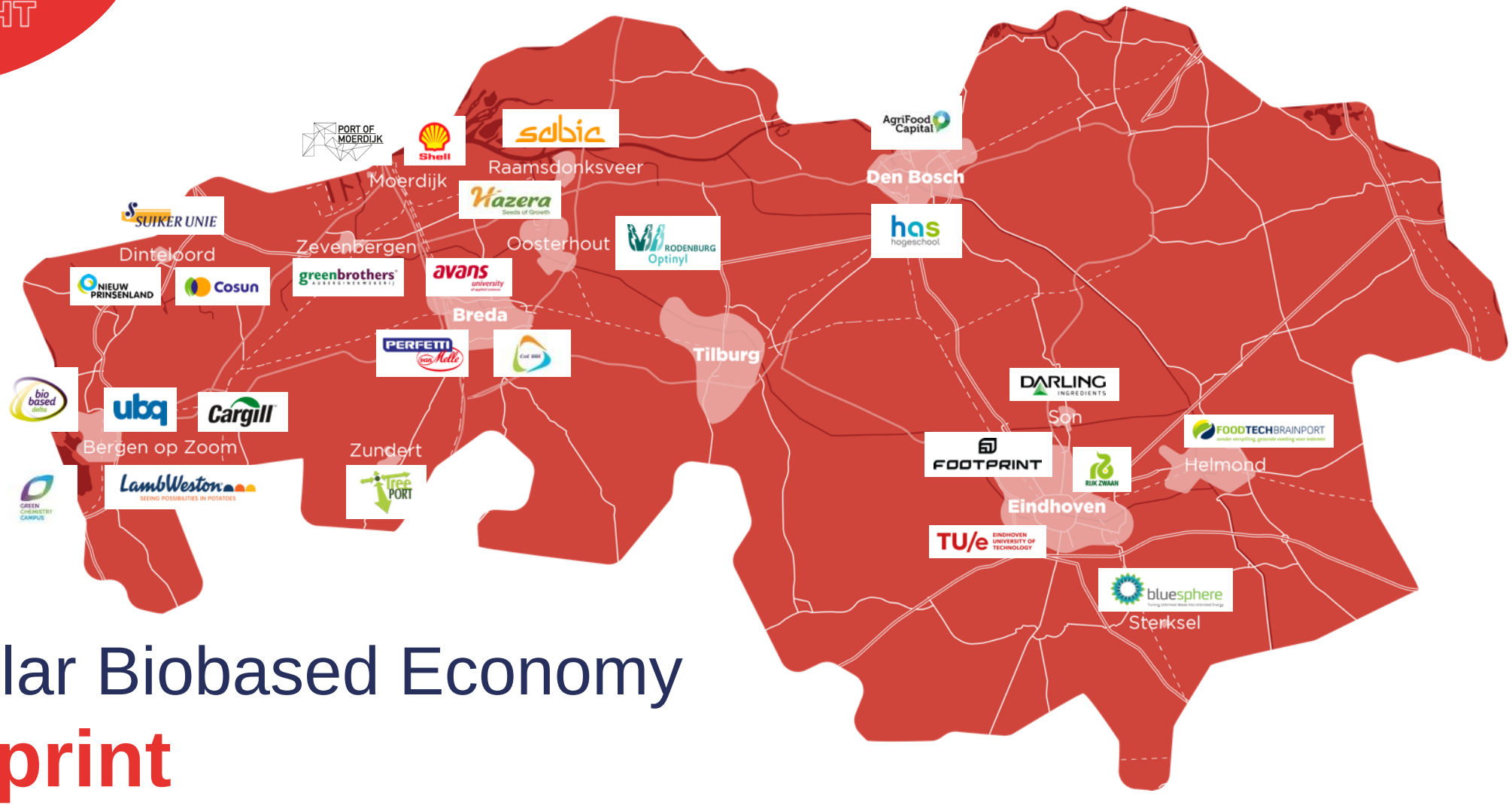

Circular Biobased Economy

footprint

ECOSYSTEM

The Biobased economy in Brabant is a thriving network of SME’s, industries, knowledge and faclities.
All company establishments highlighted are production or R&D operations.

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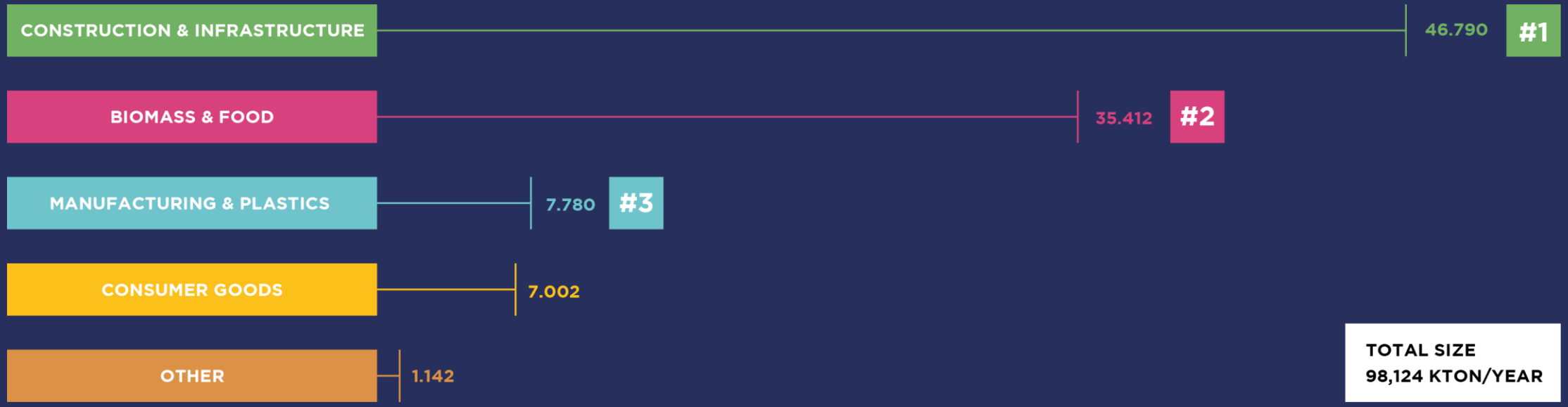
Feedstock

Brabant offers a competitive feedstock position. Feedstock is widely available within the region and deliverable in time (‘guaranteed stock delivery’). It can be obtained from various resources, such as sugar beets, cellulosic biomass, residues and manure, and at favorable costs. Currently the Netherlands, and more specific the sugar beets area in the southwestern part of the country, is one of the most efficient sugar production areas in the world. As such, supply of feedstock can be ensured.

This overview shows the amount and type of feedstock flows in Brabant (2020) as a potential base for the circular economy.



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ARRRA cluster

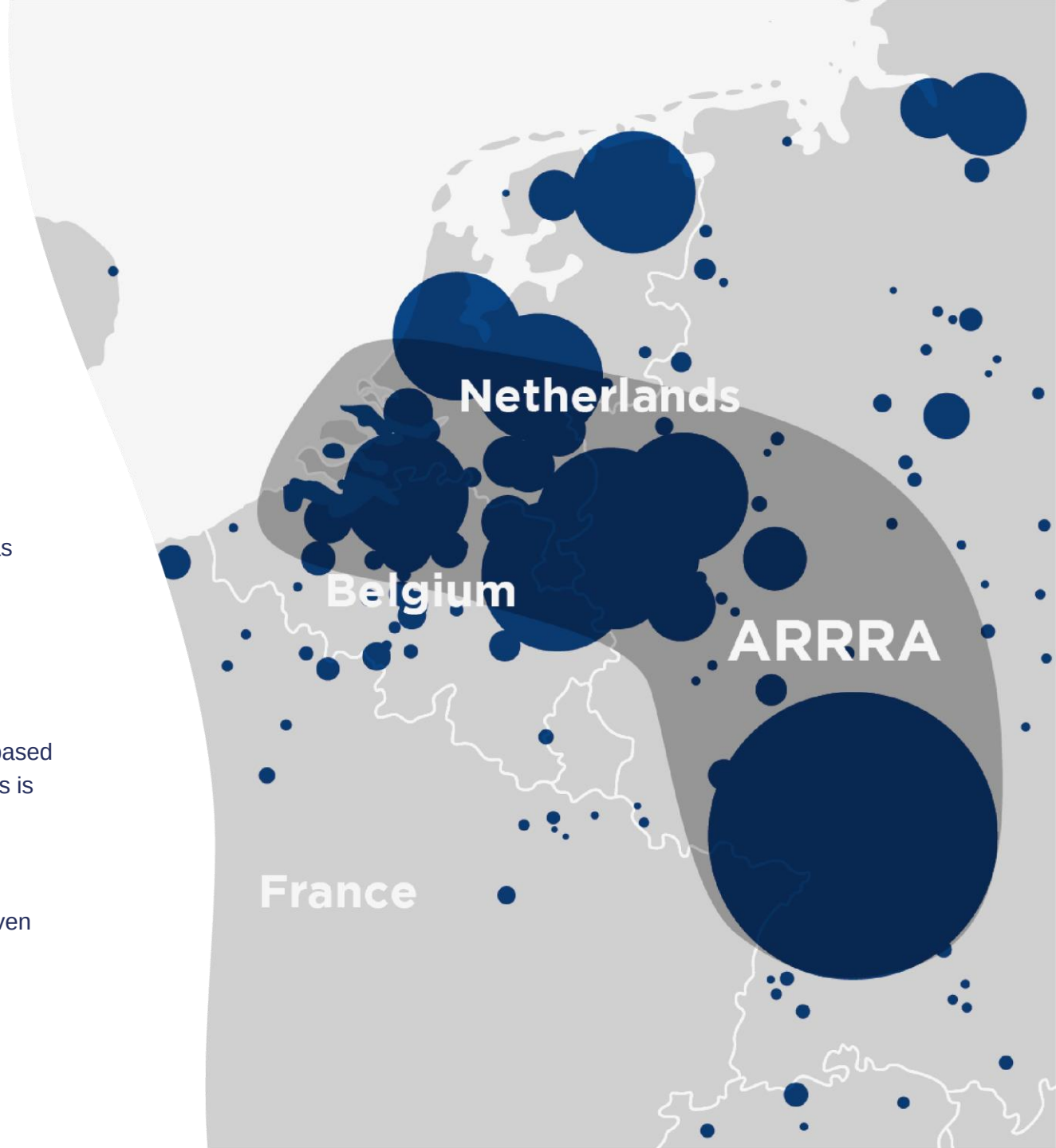
ARRRA CLUSTER

The ARRRA-cluster offers huge market opportunities:

- Being part of the ARRRA offers market access. Chemical companies such as AkzoNobel, BASF, Bayer, Dow Chemical and DSM, and 'brand owners' like Unilever, Coca-Cola, KLM and Procter & Gamble are all located here and searching for 'greenification' and flexibility in feedstock.

- Chemical production facilities in the ARRRA are also looking ahead by differentiating through sustainability. New value chains are being designed based on sugars, lignin and industrial streams such as CO2, CH4, and syngas. This is driven by affluent and green-minded customers and supported by ambitious governments.

- Sugar beets provide the ARRRA, and West-Brabant in particular, with a proven cost competitive feedstock position for the biobased chemical industry.



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Delta Corridor

THE PORT AUTHORITY OF ROTTERDAM AND SEVERAL INDUSTRY PARTNERS, INCLUDING CHEMELOT, ARE SUPPORTING THE DEVELOPMENT OF THE DELTA CORRIDOR PROJECT, CONSISTING OF A BUNDLE OF FOUR PIPELINES BETWEEN THE PORT OF ROTTERDAM, CHEMELOT AND THE GERMAN RHINELAND.

This project provides access to clean hydrogen and capacity for carbon capture and storage (CCS) that is being realized. It also reduces transport movements because propylene and LPG can now be transported by pipeline.

The infrastructure connects major domestic industrial clusters in the Netherlands and Germany with branches along the entire corridor. This connection is urgent and essential to meet the EU's 2030 climate goals.

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Pipeline infrastructure

PIPELINE INFRASTRUCTURE

Brabant plays a considerable role in the distribution of oil, gas and chemical products, largely because its excellent position between:

- The Ports of Rotterdam and Antwerp
- The German Ruhr area
- The largest chemical clusters in the southern part of the Netherlands (DSM Limburg, Dow Chemical Zeeland).

RPR	Rotterdam Rhine Pipeline
RMR	Rotterdam Main Rohrleitung
PRIVATE	Pipeline linked to ARG
DOW	DOW Propylene
TOTAL	Zeeland refinery
PPS	Petrochemical Pipeline Services
RAPL	Rotterdam Antwerp Pipeline
ARG	Aethylen Rohrleitung Geseilschaft
RC2	50% PoR & 50% ARG
AL	Air Liquide industrial gasses

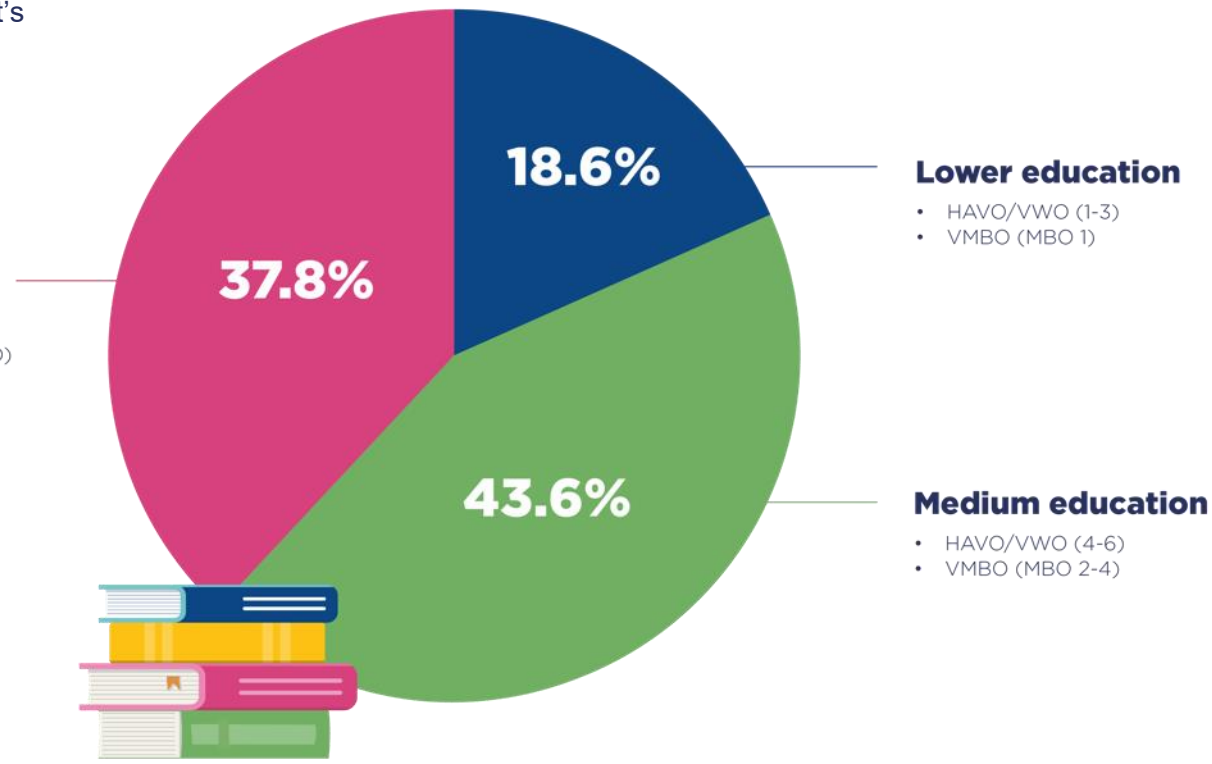
Source: Port of Rotterdam, edited by BOM

BRABANT IS BRIGHT

Highly educated **workforce**

NUMBER OF JOBS BY EDUCATION LEVEL IN THE BIOBASED ECONOMY

Percentage of Brabant's Biobased labour force (total: 77,310 jobs)



High education
- HBO (bachelor/master)
- WO (bachelor/master/PhD)

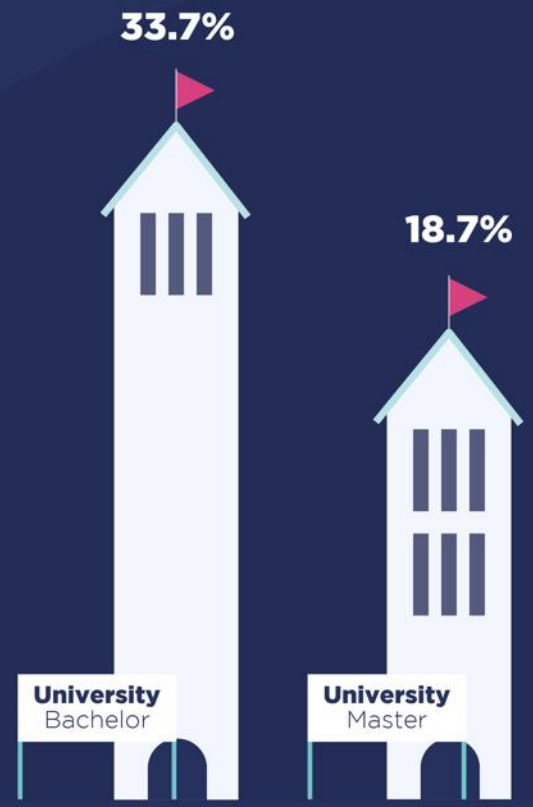
Lower education
- HAVO/VWO (1-3)
- VMBO (MBO 1)

Medium education
- HAVO/VWO (4-6)
- VMBO (MBO 2-4)

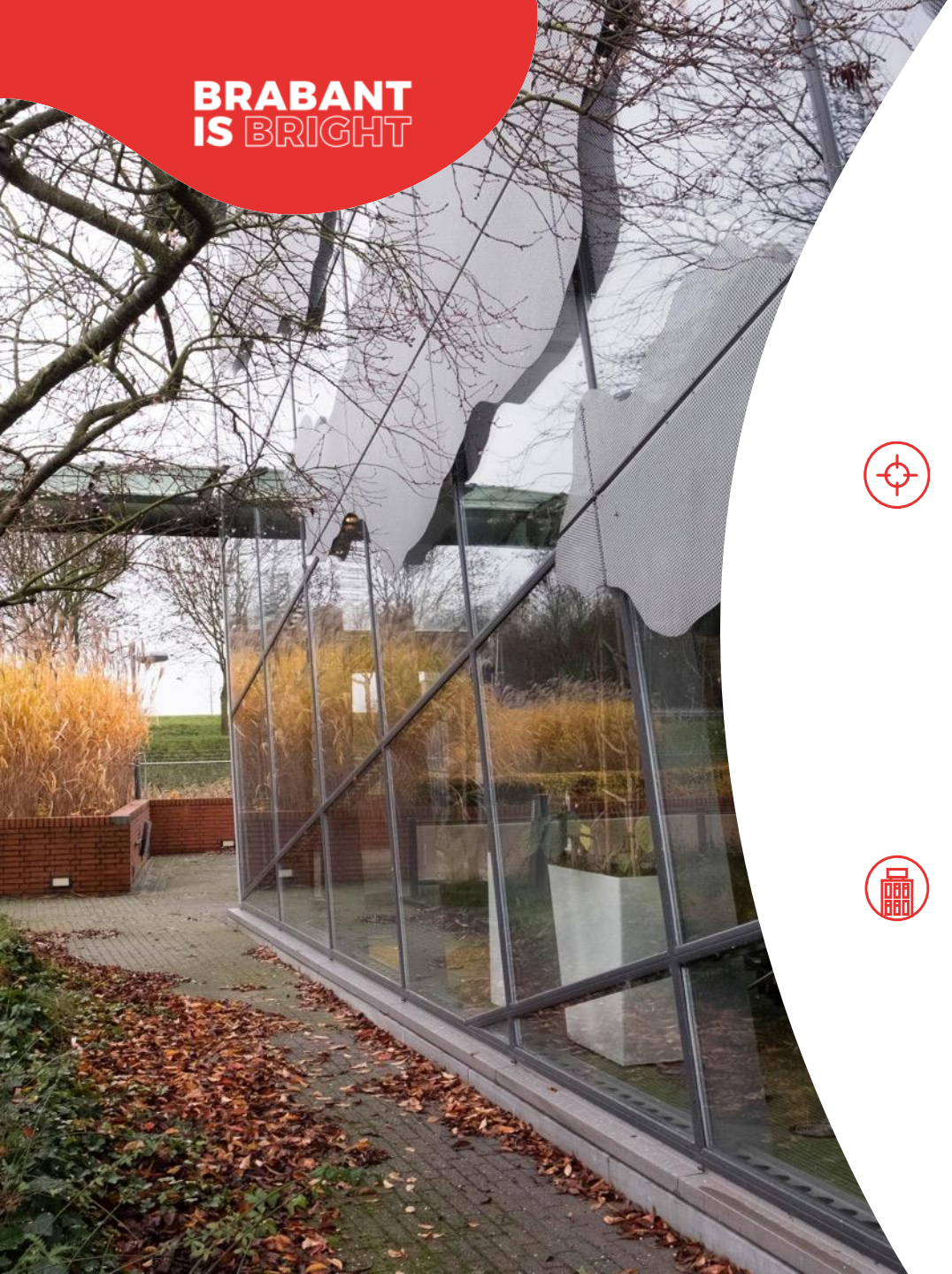
Source: CBS, LISA 2020, Vestigingenregister Noord-Brabant 2020, edited by Fanion onderzoek & advies

NUMBER OF GRADUATES IN THE BIOBASED ECONOMY

% growth since 2016



Source: DUO, 2020. Adapted by Fanion onderzoek & advies



BRABANT IS BRIGHT

State-of-the-art facilities

Green Chemistry Campus

OBJECTIVES

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 his goal.

FACILITIES

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

SCALING

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.

LOCATION

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

GREEN CHEMISTRY CAMPUS

BRABANT IS BRIGHT

State-of-the-art facilities

Nieuw Prinsenland

FACILITIES

Site details:

- Tens of hectares of net issuable lots
- Lot sizes range from 0.5 hectares to more than 10 hectares
- Lots vary from 70 to 90 meters long or 120 to 150 meters long
- Construction height of up to 40 meters
- Ground level is +1 meter NAP (Normal Amsterdam Level)

LOCATION

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 CO_2. Generating green grass and wind energy and the exchange of residual heat can form the basis of a profitable partnership.

OBJECTIVES

The Nieuw Prinsenland business park offers ample space modern enterprises operating in, or linked to, the agro-food sector, the bio-based economy, value added logistics, services, research and development. There are flexible lot sizes for companies ranging from SMEs to multinationals. Through clustering and shared facilities, the site offers numerous opportunities for sustainable and profitable cooperation. The combination of the perfect location, variable lots and an excellent price/quality ratio, makes the Nieuw Prinsenland business park an interesting annd sustainable business locaton. Business park Nieuw Prinsenland is a hub for the bio-based economy.

NIEUW PRINSENLAND

BRABANT IS BRIGHT

State-of-the-art facilities

Port of Moerdijk

LOCATION

The Port and Industrial complex Moerdijk is strategically situated in the Netherlands, between the international ports of Rotterdam and Antwerp. The Port has a strong and extensive chemicals cluster. Via the pipeline system, it is directly connected with the chemicals clusters in Antwerp, Rotterdam, Zeeland, Limburg and the Ruhr area, transporting (petro-)chemical products and gases.

FACILITIES

The industrial estate is characterised by a diversity of industrial activities and excellent shared facilities. The total area comprises 2,345 hectares. Currently more than 400 companies are based here, ranging from industrial companies, commercial service providers and stevedores, through to logistic service providers and transporters.

COMMUNITY

In Moerdijk, chemical and petrochemical companies have plenty of space for growth and for greening. Also, chemical and chemical related companies make use of each other's raw materials and residual streams and thus close the chains.

SPACE

An area of 120 hectares in the port and industrial estate is currently available for chemical and chemical related business in the heaviest environmental category.

PYROLYSIS

In the Pyrolysis Living Lab South Netherlands, 14 parties are experimenting with this technique, scaling up existing techniques and installations. Shell has recently invested in upgrading the use of plastic waste as feedstock.

PORT OF MOERDIJK

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State-of-the-art facilities

Food Tech Brainport

Food Tech Brainport is an eco-system offering food grade test facilities, production locations, networks, and access to research and educationalinstitutes for food processing companies and technology providers.

OBJECTIVES

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.

FACILITIES

- Food-grade field lab

KEY CHARACTERISTICS

- High Pressure Pascalization (HPP)
- Radio Magnetic Freezing (RMF)
- Pulse Electric Field (PEF)
- Agitated Thin film Dryer (ATFD)
- Membranes
- Spraydrying
- Vacuum drum drying

APPLICATION AREAS

- 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.

FOODTECHBRAINPORT

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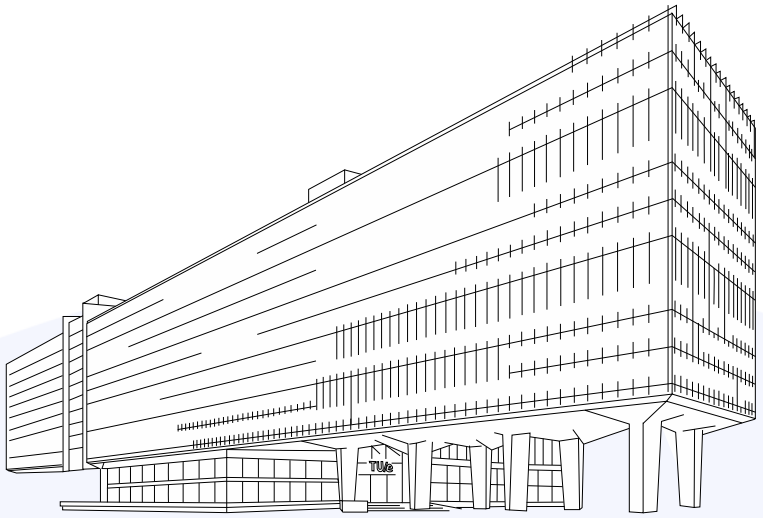


Quality Research Institutes

Eindhoven University of Technology

Eindhoven University of Technology offers academic education that is driven by fundamental and applied research. The TU/e Campus is in the centre of one of the most powerful technology hubs in the world: Brainport Eindhoven.

TU/e Eindhoven University of Technology in numbers

NATIONALITIES
90

DISTINGUISHING LABORATORIES
14

STUDENTS
12,000

RESEARCH DEPARTMENTS
10

KNOWLEDGE WORKERS
5,000

STRATEGIC RESEARCH AREAS
10

OBJECTIVES

- Combining scientific curiosity with a hands-on mentality.
- Fundamental knowledge enables design of solutions for the highly complex problems of today and tomorrow.

KEY CHARACTERISTICS

- Spirit of collaboration: the university fosters an open culture where everyone feels free to exchange ideas and take initiatives.

RESEARCH AREAS

- Advanced Research Center Chemical Building Blocks Consortium (ARC CBBC)
- Sustainability Transitions
- Built Environment

APPLICATION AREAS

- Chemical Engineering and Chemistry
- Smart foods/smart farming
- Food sustainability

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

BRABANT IS BRIGHT

HAS Hogeschool

STAFF MEMBERS
450

STUDENTS
3,000

PARTICIPANTS IN PROFESSIONAL COURSES
300

EXPERTISE AND RESEARCH CENTERS
15

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 Enterpreneurship 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

Quality Research Institutes

HAS University of Applied Sciences

HAS University distinguishes itself in the Agrifood educational sector because of its focus on working together with farmers and food industry to effectively implement new knowledge and technologies in Agrifood business operations.

OBJECTIVES

HAS University 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.

FACILITIES

- Insect Lab
- BrightBox Venlo

KEY CHARACTERISTICS

HAS University knowledge transfer
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.

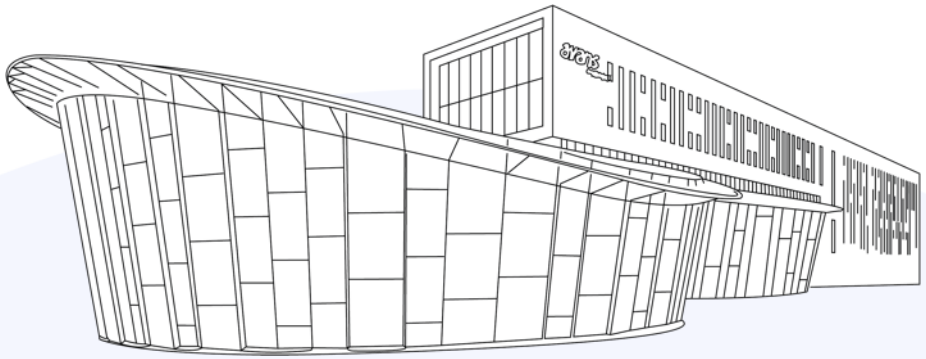
has hogeschool

BRABANT IS BRIGHT

Quality Research Institutes

Avans University

Avans is a university of applied sciences that develops talent by helping future graduates to become highly qualified professionals, people that continue to grow personally and professionally and who have a sense of social responsibility, whether on a local or international stage. The university aims to contribute towards shaping and archieving regional social, cultural, and economic development by entering into sustainable partnerships with regional companies, public agencies and organizations to develop, share, and generate knowledge and conduct practice-based research.



KEY CHARACTERISTICS

Avans offers courses in **economics** and **business, engineering, society** and **behavioral science, healthcare, science** and **technology, arts** and **culture, law** and **governance, education, earth** and **environment** and language and communications.
The university is part of many collaborative ventures with both regional and international businesses, industries, social organizations and public agencies, and actively seeks out new ones. Just one example of the many benefits partners can gain is:

20 AVANS STUDENTS TOOK PART IN THE 2016 FUJIFILM FUTURE CHALLENGE

The competition requires students to come up with innovative products or solutions for Fujifilm. The students spend three months working in teams on new business models, based on the technology employed by the multinational company.

PARTNERSHIP

The Center of Expertise Biobased Economy, working in partnership with Avans, helps businesses to shape this transition, for instance, by making use of practice-based research into innovations.

Avans University in numbers

STUDENTS
31,000

EDUCATION
BACHELOR'S AND MASTER'S DEGREES

LOCATION
TILBURG, BREDA, ROOSENDAAL, 'S-HERTOGENBOSCH

CONTACT
WWW.AVANS.NL/INTERNATIONAL

avans hogeschool

BRABANT IS BRIGHT

State-of-the-art facilities

Cosun Innovation Center

Cosun Beet Company works closely with the other Cosun business groups in the Cosun innovation center in Dinteloord. Opened in 2017, this high-tech campus is a knowledge and expertise centre for product development, process technology, analysis and research.

OBJECTIVES

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. 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.

CORE COMPETENCES

Cosun R&D specializes in two fields: support and improvement andd 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.

TEST/LAB FACILITIES

Cosun Innovation Center offers state-of-the art research laboratories, conference rooms, a pilot factory, application laboratories companies and startups/scaleups where opportunities exist for synergy.

APPLICATION AREAS

Cosun Beet Company makes intensive use of the facilities and uses them to welcome its customers, partners and business associates. The Cosun innovation center facilitates and encourages cooperation and knowledge sharing because collaboration with the other business groups accelerates the group's results. The Institute for Rational Sugar Production (IRS) has been housed in the Cosun innovation center since 2018.

Cosun innovation center

BRABANT IS BRIGHT

State-of-the-art facilities

Centre of Expertise BBE

The Centre of Expertise Biobased Economy (CoE BBE) is central to the transition to a biobased economy as a knowledge partner of many companies and organizations. The centre conducts applied research, helps companies with their biobased ambitions and ensures that biobased gets a place in all levels of education. The CoE BBE is a partnership between Avans University of Applied Sciences and HZ University of Applied Sciences.

OBJECTIVES

CoE BBE helps companies with their bio-based ambitions by innovating Higher Professional Education (HBO) and carrying out practice-based research. For example, CoE BBE provides highly educated professionals who can support and shape the transition to a bio-based society.

TEST/LAB FACILITIES

4 application centers and 3 international living labs.

APPLICATION AREAS

There are 4 research groups at the Centre of Expertise Biobased Economy (CoE BBE): **Biobased Building**, **Biobased Building Blocks & Products**, **Biobased Resources & Energy** and **Marine Biobased Specialties**.

CORE COMPETENCES

CoE BBE's activities are tailored to the needs of the business community. It provides well-qualified professionals, facilities for prototyping and a central knowledge point for bio-based education, research and facilitation. CoE BBE contributes to more than 50 research projects, all of which add to the treasure trove of new knowledge concerning the bio-based economy. With input from researchers, lecturing researchers and students, CoE BBE helps companies and government agencies investigate and realise biobased innovations.

CoE BBE

Centre of Expertise Biobased Economy

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State-of-the-art facilities

Circular Biobased Delta

Circular Biobased Delta Foundation (CBBD) is a triple helix networking organization that facilitates cooperation between businesses, provinces, seaports, municipalities, knowledge and educational institutions, industry parks, application centers and open labs within the Dutch provinces of Brabant and Zeeland.

MISSION / OBJECTIVES

Its mission is to accelerate the transition toward a circular biobased economy by initiating projects and inspiring and supporting companies toward greening and earning. The goal of CBBD is to accelerate the resource transition through biogenic pathways and find circular solutions. The focus is on green chemistry and chemical recycling.

CORE COMPETENCES

The Delta region has a unique and growing circular biobased ecosystem, infrastructure and network. The Circular Biobased Delta has the expertise and network to facilitate projects and collaborations that contribute to accelerating the raw materials transition in the Netherlands. By scaling up innovations, the major chemical clusters and supplying SMEs contribute to climate goals and new jobs.

APPLICATION AREAS

The Delta region was already at the forefront with the establishment of the Pyrolysis Experimentation Garden South Netherlands in 2015, together with the Moerdijk Port Authority. Also, Shell invested in pyrolysis technology to supply the company's crackers with biobased naphtha within a few years, and the development of the Green Chemistry Campus. The Circular Biobased Delta has the expertise and network to facilitate and accelerate developments on this topic not only regionally, but also nationally.

circular biobased delta

BRABANT IS BRIGHT

State-of-the-art facilities

Side Stream Innovation Valley

Side Stream Innovation Valley is an open-innovation biobased hotspot where production, research and collaboration is brought together. Here, companies and educational institutions work together on the high-quality valorisation of food waste flows.

CORE COMPETENCES

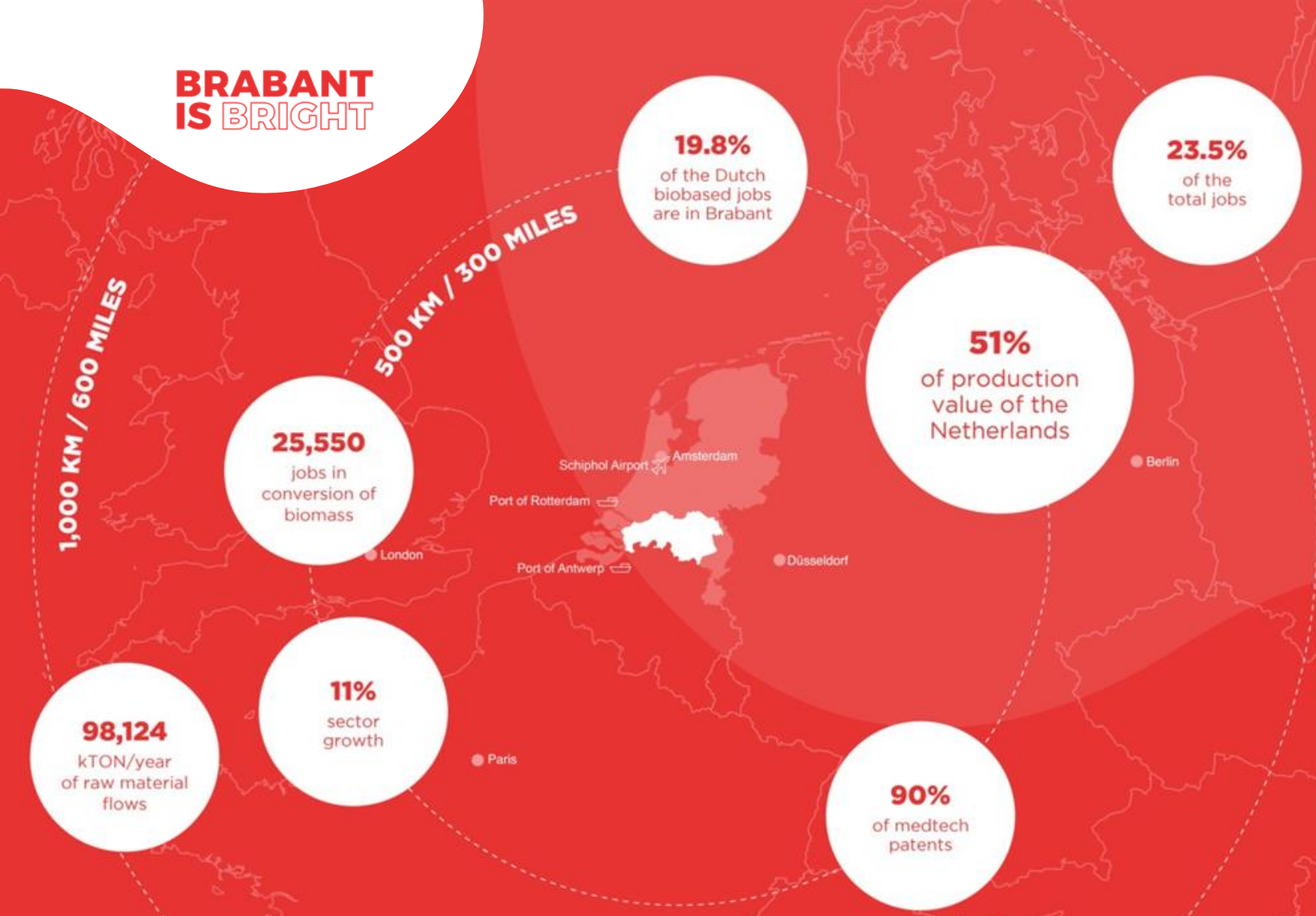
- A good location on highways A27, A59, A58, Wilhelmina Canal (connection to West Brabant Corridor). Sustainable transport by water.
- A unique raw materials database that provides continuous availability of the required materials.
- A sustainable and green location with sufficient parking space and supporting facilities.
- Open innovation under one roof through strong collaboration on campus with established, international and prominent companies, using the latest technology.
- Attracting talent through the strength and image of the campus and the connection with education on campus.
- Flexible and scalable housing; due to modular construction, scaling up of business space for research and testing is easy to realize.

MISSION / OBJECTIVES

SSIV is the place where the valorization of food waste takes the next step. From bold new ideas to actual production of 'new' raw materials and products, from startups and scale-ups to international companies, everything under one roof. For companies looking for new applications for their residual flows, SSIV wants to be the place to find innovation. SSIV intends to be a development partner for (food) producers of sustainable alternative raw materials.

SIDE STREAM INNOVATION VALLEY

BRABANT IS BRIGHT



Key location benefits
Circular Biobased Economy

Integral **part of the biggest chemical cluster in the world** (ARRRA), offering European market accessibility, utilities and physical infrastructure.

A competitive feedstock position: widely available and guaranteed deliverable in time, due to well organized transport by truck, train, shortsea and barge.

One of the **most innovative agro-industrial ecosystems** in the world, consisting of corporations, research institutes and test facilities.

Availability of a **well-educated, flexible workforce, graduates and students**, and access to several (technical) universities within a 150 km radius.

BRABANT
IS BRIGHT