

Biobased Economy

Campus Groningen:
driver of innovation

Foreword

Welcome to **Campus Groningen**, the Northern Netherlands driver of innovation. Here, businesses and organisations with a passion for research, education and entrepreneurship work closely together on achieving real impact. Together we focus on the impact fields of Healthy Ageing, Sustainable Society and Energy. The biobased economy touches on all three impact fields and is therefore an important topic receiving continuous investments.

As **Campus Groningen**, we emphasize on collaboration. Collaboration with a regional accent; collaboration in public-private partnerships; collaboration aimed at growth. Active network creation, hand-in-hand with our down-to-earth mentality and enterprising attitude, results in both social and economic impact. The interconnections are actively reinforced so that everyone gets the most out of their presence at the Campus.

Campus Groningen is a strong business environment. Not many places link research space with access to ground-breaking researchers, top-level education, future talent, innovative entrepreneurship, state-of-the-art facilities and accessible financing resources. Thanks to the great connections both inside and outside the region, new innovations that originate at Campus Groningen quickly find their way onto the market.

This bid book showcases the biobased opportunities **Campus Groningen** has to offer. We would be happy to discuss your requirements and wishes, and together look for suitable solutions on the topics of research, innovation, education, location, financing and real estate.



Edward van der Meer
Chief Executive Officer Campus Groningen

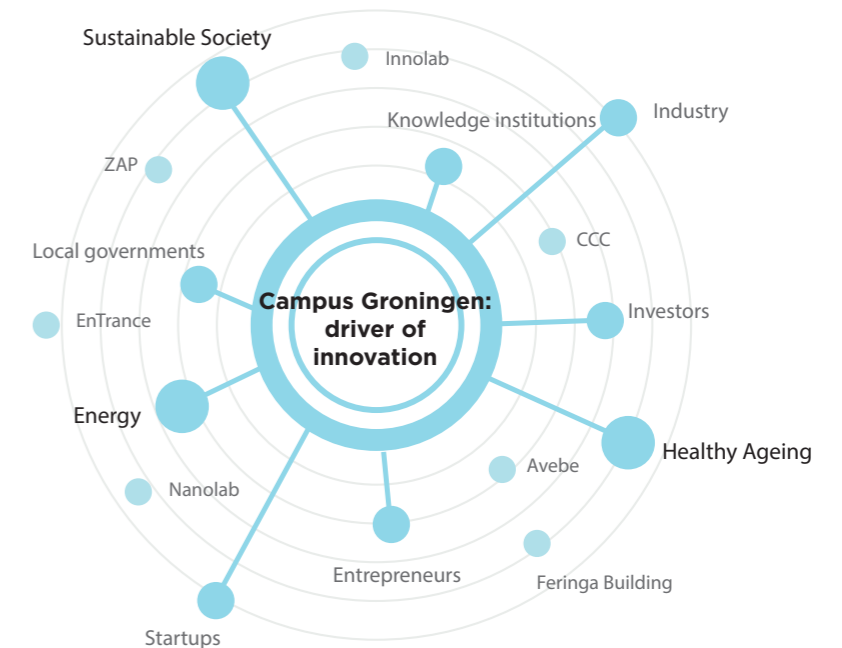


Our biobased proposition

The Northern Netherlands strives to become one of the most sustainable and competitive biobased regions in Western Europe by 2030. We are already well underway, as proven by our status as European example region for sustainable chemistry and biobased economy. To achieve further growth, further innovation is necessary. Campus Groningen plays an essential role here, as the biobased driver of innovation in the Northern Netherlands. For this, we have joined forces with knowledge centres, business communities and public authorities.

Campus Groningen offers the ideal environment for innovative biobased companies. When it comes to content, the Campus excels in the knowledge fields of Food & Feed, Biobased materials, Biobased chemicals and Biobased energy. This knowledge is linked to fundamental and applied research, high-quality education, top talent, state-of-the-art facilities, accessible financing resources and space for development.

This successful biobased ecosystem is propelled by close-knit collaboration at all levels, intrepid entrepreneurship, and the northern no-nonsense attitude. Groningers like working together to tackle challenges, share knowledge, and create added value. Networks such as the Bio Economy Region Northern Netherlands (BERNN) and the BIO Cooperative, and parties like the NOM ensure short lines to other biobased hotspots in the Netherlands. Being solidly embedded in the Northern region also results in access to agricultural raw materials, international infrastructure and large-scale industry.



supporters of this bid book:



Campus Groningen: Boosting the biobased economy

Reading guide

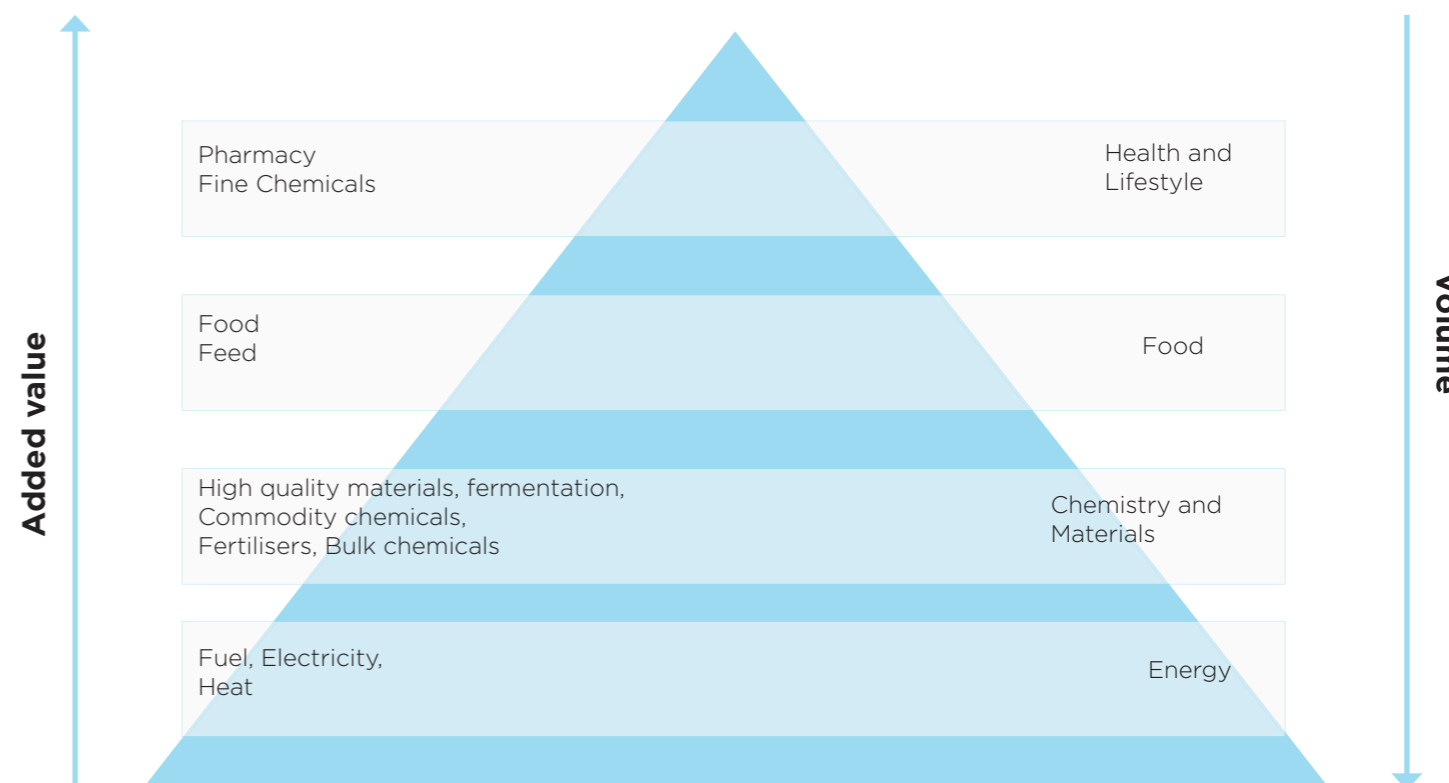
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1.1. Opportunities for people, planet and profit

The growing global population, increasing prosperity, depletion of natural raw materials, and the increasing pressure on environment and climate are important societal challenges, now and in the future. The development of a biobased economy offers opportunities for tackling these challenges. Also, the commitment and focus on 'greening' the economy safeguards the retention and creation of economic growth and employment.*

Campus Groningen excels within the knowledge fields of Food & Feed (carbohydrates), Biobased materials (fibres and biopolymers), Biobased chemicals (chemicals building blocks and green catalysis) and Biobased energy (fermentation and biogas). We focus on greening products and production processes, the development of new chains and the valorisation of waste streams, all as high as possible in the value pyramid.

One great example is the carbohydrate chain. It involves sugar beets (Suiker Unie) and potatoes (Avebe) as a source of sugars and starch. With the use of, among other things, specific (biobased) catalysis and fermentation, these biobased raw materials are converted into usable and high-quality chemicals and polymers. These building blocks eventually end up in nutraceuticals, animal feed, plastics and other products, or will serve as an energy source. Within this carbohydrate chain, companies on Campus Groningen collaborate with the knowledge centres on optimisation and new product innovations.



Groningers dissect the potato

Biobased materials

Ed Kraaijenzank, Avebe

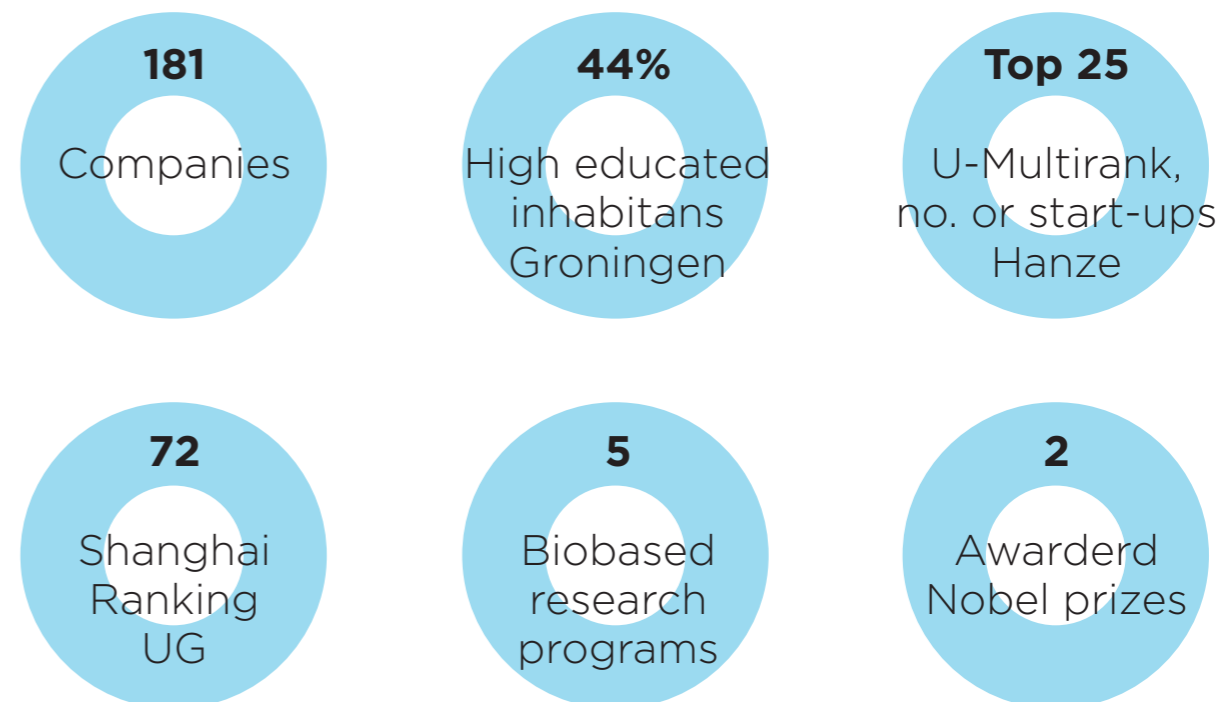
The potato, the cornerstone of the traditional Dutch kitchen. Yes, but much more than that. It contains ingredients for other foods, raw materials for medicines and who knows what else. Potato processing giant Avebe from Veendam is looking into it, together with the University of Groningen and the Hanze University of Applied Sciences Groningen.

Binding agents to keep yoghurt at the right consistency, construction adhesives of exceptional quality, coatings. Avebe extracts a lot from a simple potato. But there are many more possibilities, of this the company is certain. Proteins suitable for human consumption, for instance. And fibres, minerals. "We are convinced that we can make many alternatives for E-numbers", says financial director Ed Kraaijenzank.

The company's large Research & Development department cannot do this alone. There is no need, either. There are short lines between science and education. So short in fact, that Avebe is building an entirely new research institute at the Zernike Campus in Groningen. In partnership with the University of Groningen and the Hanze University of Applied Sciences.

1.2. Campus Groningen as a driver of innovation

You find yourself in the midst of students, entrepreneurs and researchers, all proud of this meeting place. The Campus is the Northern Netherlands driver of innovation and has two neighbouring locations; the Healthy Ageing Campus and the Zernike Campus Groningen. Here, we work on the society of the future by focusing on the societal impact fields of Sustainable Society, Healthy Ageing and Energy, with biobased economy as an important enabler.



At Campus Groningen, entrepreneurs, knowledge institutes, local government and investors work together on innovative solutions. The central aim is to link research with entrepreneurship, and to create impact on people and society.

The characteristics of Campus Groningen

- **Excellent knowledge**, easily accessible
- **Cooperative attitude**, let's roll up our sleeves together
- **Entrepreneurial mentality**, we believe in what we talk about
- **An environment** designed as a Living Lab
- **Transparency** as the key to innovation
- **State-of-the-art** facilities

Knowledge carriers and entrepreneurs meet in **advanced facilities**, such as the Carbohydrate Competence Centre (CCC), the Zernike Advanced Processing (ZAP) facility, the Energy Academy Europe, the Energy Transition Centre (EnTranCe), NanoLabNL, and the Innolab.



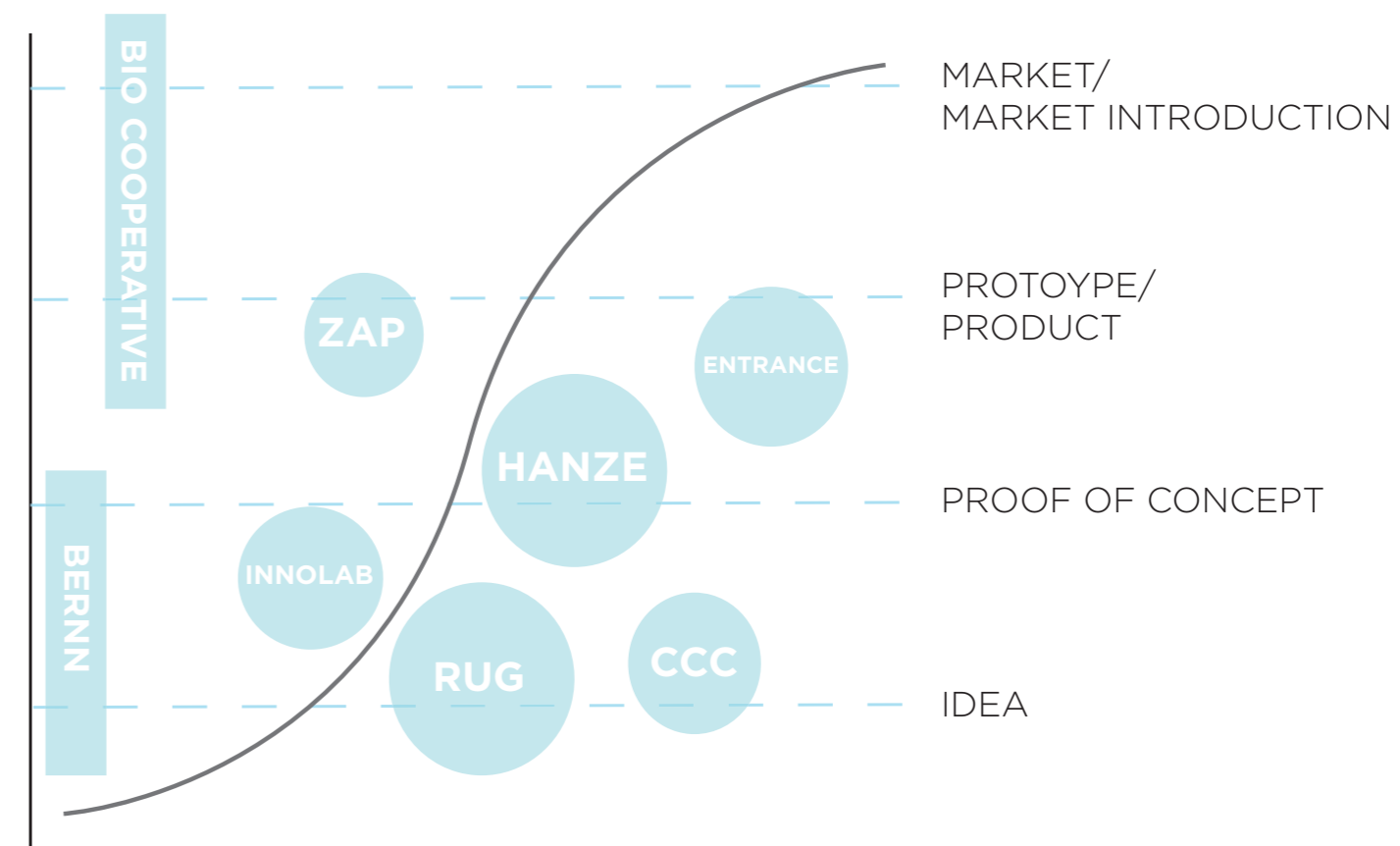
The colleagues, the unrivalled facilities at the Zernike Campus and the opportunities available here, make that we have a strong competitive edge across the world."

- Ben Feringa, winner of the 2016 Nobel Prize for Chemistry.

Campus Groningen will see considerable growth over the coming years, due to the new Innovation Centre, with space for not just Avebe but also other small and medium-sized innovative biobased companies, and the new Feringa Building, a research and education facility for chemistry, physics, astronomy, and industrial engineering.

Campus Groningen strength is in the initial phases of the innovation process. Due to the good mix of knowledge institutes and small and medium-sized enterprises, new ideas smoothly mature from lab-scale to scale-up. Our experience with public-private partnerships and the management of intellectual property is a valuable asset. The emphasis on open innovation ensures an extensive ecosystem of spin-offs and start-ups, creating chances for thematic crossovers.

Campus Groningen at the beginning of the innovation chain



1.3.

Groningen, City of Talent

Imagine finding yourself in a city with 200,000 inhabitants, of which half is younger than 35 years, with all its associated innovation, creativity, talent and industrious bustle. No less than 44% of all inhabitants have a higher education, which is 10% more than the national average.

What's more, this new city is also one of the happiest cities in Europe. This is not just because of excellent facilities and living conditions, it is also a matter of giving space to those who are talented, to do what they are good at.

Groningen is crammed with start-ups and scale-ups that are given all the room and opportunities to do what they do best: innovate, thanks to the partnerships between public authorities, the business community, Hanze University of Applied Sciences Groningen, University of Groningen, University Medical Center Groningen and other initiatives.

This is proving successful: the Deloitte Fast50, a ranking of fastest growing technology companies, consists for 10% of businesses from Groningen, whilst the city has 1.2% of the Dutch population. This makes Groningen a **City of Talent**.

“There is a good business climate in Groningen. And that is not only attributable to the university, but also to the companies and entrepreneurs that work so well in this town”
- Neelie Kroes, ambassador StartUp Delta

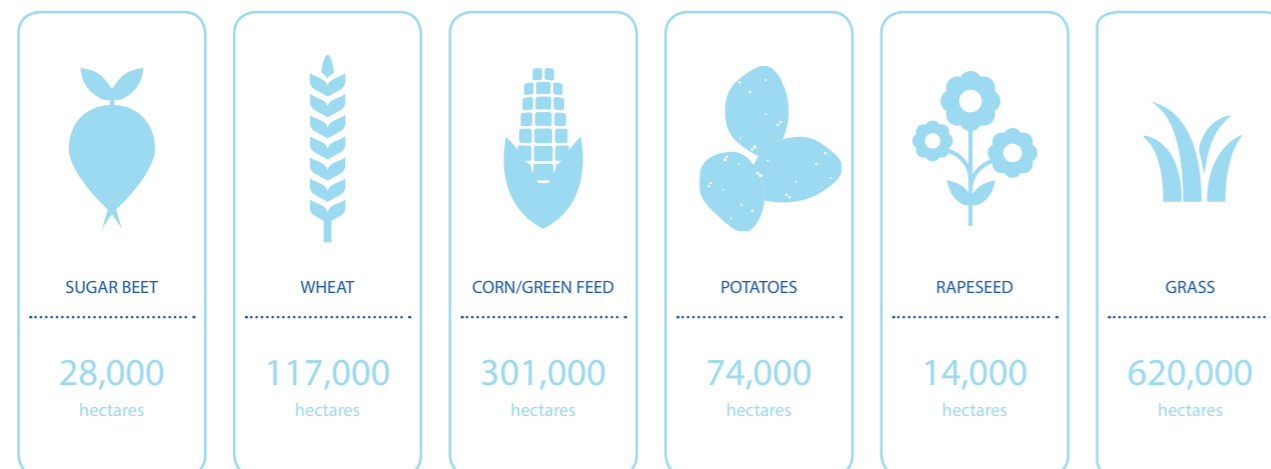


1.4. Campus Groningen embedded in Chempport Europe

Campus Groningen is not an island. We are well-connected with the strong biobased sector in the Northern Netherlands, recently named a European example region for sustainable chemistry and biobased economy. An acknowledgment of our pioneering role within the Netherlands and Europe. This status makes it easier for companies located at Campus Groningen to gain access to European initiatives and subsidy programmes.

Feedstock in Chempport Europe

The supply of green raw materials, such as potatoes, sugar beet, grass and grain is guaranteed at competitive prices.



The Northern Netherlands biobased chemistry sector unites within Chempport Europe. Due to the presence of Campus Groningen, a unique Dutch environment is formed:

- Excellent knowledge via the available knowledge institutes, with space for pilots and innovations;
- A considerable agricultural sector with large quantities of biomass and organic waste streams as input for biobased products and processes;
- A strong (chemical) industry of sufficient scale, which includes AVEBE, Suiker Unie, FrieslandCampina, Chemie Park Delfzijl and Emmtec Emmen;
- A positive policy environment whereby the three northern provinces display a strong focus on the biobased economy, with European support;
- International infrastructure in the shape of the Delfzijl Harbour and Groningen Airport, for the import and export of products and raw materials, for example.

The Northern Netherlands traditionally had a large and well-organised agricultural sector with efficient production. Nowhere else in the world is the yield per hectare as high as here. This means a constant stream of biobased raw materials. Also there is access to additional biomass from Northern Germany.



Because of the presence of biomass, knowledge, small and middle-sized businesses, industry, and infrastructure, it is easy for biobased products in the Northern region to evolve from pilot to demo to full-scale production.”

- Errit Bekkering, Chempport Europe

Business and entrepreneurship

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World first: 100% biological PET

Biobased Chemicals

Cor Kamminga, BioBTX BV

BioBTX, a spin-off of the University of Groningen and the Groningen companies KNN Group and Syncom, has succeeded, together with polyester manufacturer Cumapol, to produce polyethylene terephthalate (PET) from 100 % biological material. A world first. 3 million tonnes of PET bottles circulate in Europe every year. At the moment, most of these bottles are newly produced from fossil resources, but with the BioBTX technology, they could be produced from biomass.

BioBTX extracts the building blocks for PET from wood and other organic waste streams. The building blocks benzene, toluene and xylene (BTX), as produced by BioBTX, are not just used for PET, but also for many other plastic products. By extracting the BTX building blocks from biomass and waste streams, completely oil-free products can eventually be produced. This means less energy consumption, less waste and fewer CO₂ emissions.

BioBTX is currently working together with its partners on a pilot plant to demonstrate that the technology is not only viable in a laboratory, but also on a larger scale. This new plant should process around twenty kilos of biomass per hour. If they are successful, there is huge potential for this northern technology.

2.1. Northern biobased business community

Campus Groningen is a driver of innovation. Entrepreneurs and businesses at Campus Groningen are in close proximity to the latest knowledge and the best talent. Companies work together with researchers and students at the Campus to bring new innovations to the market. By exchanging and bundling knowledge, new ideas arise which lead to a competitive advantage.

As an entrepreneur, you enter an [open innovation environment](#). The extra value is found at the intersection of the knowledge fields of Food & Feed, Biobased materials, Biobased chemicals and Biobased energy, and the impact fields of Healthy Ageing, Sustainable Society and Energy. Here you find pharmaceutical companies that work on making their waste flows more sustainable and food companies that work on health innovations by using biobased raw materials. The Campus links agriculture, life sciences, chemistry and energy.

Many [new start-ups originate at Campus Groningen](#). These include technological spin-offs from the University of Groningen and Hanze University of Applied Sciences Groningen, or businesses that were founded by (recently graduated) students. Professors and lecturers are very experienced in working with companies and therefore have a good understanding of what is important for business owners.

Shared facilities, such as the ZAP facility, Innolab and EnTranCe, offer small and medium-sized companies the opportunity to plug in to existing experimental platforms and to be in direct contact with researchers and students.

2.2.

2.2. Collaboration is in our DNA

Groningers like working together on sharing knowledge, tackling challenges and creating added value. This is why the ‘triple helix’ model of collaboration between companies, local government and knowledge institutes is commonplace at Campus Groningen. The current valorisation environment is a result of joining forces. Campus Groningen has amassed plenty of experience with setting up partnerships, both in the public and private sectors. This ensures new innovations within the knowledge fields of Food & Feed, Biobased materials, Biobased chemicals and Biobased energy.

Chemport Europe

Chemport Europe bundles sustainable chemistry in the Northern Netherlands. By linking agriculture, technology, science, small and medium-sized businesses and industry, room is created for new innovations. It also creates a dynamic ecosystem for companies that work on a greener chemical sector. Knowledge, networks and facilities are shared within Chemport Europe. This simplifies matters, from building a new factory, obtaining raw materials and energy, to developing new biobased products. It is Chemport Europe's ambition to accelerate the green economy and to put the Northern biobased chemical sector on the global map.

BIO Cooperative

The BIO Cooperative is the partnership of Northern Netherlands small and medium-sized businesses active in the biobased economy. The Cooperation focuses on knowledge sharing and the realisation of cost reduction and turnover increase for its members. Market-led projects are implemented in various domains within the BIO Cooperative, such as Biobased processing and Biobased chemicals. The cooperation supports its members in the areas of financing, laws and regulations, lobbying, marketing and branding, and enables members to do what they do best: be entrepreneurial. At the start of 2016, the BIO Cooperative already consisted of 15 members. It is expected that by 2020 this will have grown to up to approximately 40 members with more than 750 FTE in total.

Bio Economy Region Northern Netherlands (BERNN)

BERNN is a partnership between the four northern Universities of Applied Sciences and the University of Groningen, with the aim of further expanding the leading role the Northern Netherlands plays within the biobased economy. The region's ability to convert knowledge into industrial application is crucial. Demand-oriented and application-focused collaboration between the northern knowledge institutes is essential as well. BERNN focuses on linking knowledge and crossovers between fundamental and applied sciences, cooperation with the (inter)national business community, aligning with national and European ambitions, raising the profile of the northern region as Bio Economy Region, and lobbying with central governments.

The Carbohydrate Competence Center (CCC)

The CCC in Groningen is the ultimate carbohydrate knowledge centre in the Netherlands. Here excellent knowledge on carbohydrate research converges. The CCC is a partnership between University of Groningen, Wageningen University & Research Centre, other knowledge centres and a large array of companies. The CCC mainly focusses on the synthesis, modification and/or breakdown of carbohydrates within two key areas, 1) Carbohydrates for food and health; and 2) Carbohydrate conversion and processing, with a focus on carbohydrate extraction from biomass and the conversion into biobased chemicals, biobased materials and biobased fuels.

The Protein Competence Centre

The Protein Competence Centre (PCC) carries out innovative protein research at the frontiers of knowledge, for the purpose of a healthy and sustainable society. This happens in collaboration with Food & Feed companies and knowledge partners such as Avebe, Darling Ingredients, DSM, Duynie, FrieslandCampina, Nutricia Research, VanDrie Group, Hanze University of Applied Sciences Groningen, NIZO Food Research, University of Groningen, TNO, University Medical Center Groningen and Wageningen University & Research Centre.

The Groningen Engineering Center

The Groningen Engineering Center (GEC) unites teams of engineering researchers at the University of Groningen working on engineering science for the development of industrial processes. In the area of the biobased economy GEC researchers provide unique expertise in both fermentative/enzymatic as well as chemo catalytic conversions. Examples are the design and optimization of biotechnological processes and conversion of aquatic biomass for novel carbohydrates and polymers. Chemo-catalytic biomass conversions for biofuels, biobased chemicals, and biobased materials are also actively pursued. Examples are second generation biofuels based on pyrolysis technology and biobased monomers for bioplastic synthesis. Research activities are aimed to reduce the manufacturing costs of these processes and hereby aid the transition from our fossil based economy to a more sustainable biobased economy.



Carbohydrate capital of the Netherlands

Food & Feed, Biobased Chemicals

Lubbert Dijkhuizen, University of Groningen

Groningen is the carbohydrate capital of the Netherlands. A result of the large amount of potatoes and sugar beets, and the considerable dairy livestock. It also has to do with the large industry that surrounds these resources and with the many breakthroughs by the Carbohydrate Competence Centre (CCC).

Health is a major theme for the CCC researchers. For instance, they adapted carbohydrates in such a way that they are no longer broken down in the mouth, but only once they get to the gut. The result? The potato eater ingests fewer calories. Adapting sugar is also a hot item. By utilising specific enzymes, the sugar polymers change shape. This leads to a full feeling after eating. In other words, a biological gastric band based on adapted carbohydrates.

Within the last ten years, the CCC has carried out 30 million euros worth of research in partnerships with companies such as FrieslandCampina, Danone, Royal Cosun, Agrifirm, Aviko and Avebe. The researchers decipher carbohydrates, search for new properties and adapt them in such a way that they behave differently. This results in better food, for example. And by extension, in better health. By working together like this, companies and scientists extract even more value from the abundant carbohydrate-rich biomass.

Research & Expertise

3

3.1.

University of Groningen

The University of Groningen (UG) is listed in the top 100 of universities worldwide and enjoys an international reputation as leading research university. The UG is unique in the Netherlands due to its combination of the technical science & engineering disciplines with classical disciplines such as law, the social sciences and business administration. Top-level researchers carry out both fundamental and applied research at the frontiers of knowledge. This presents unique opportunities for collaboration, innovation and improvement of the competitive position.

The UG works on further reinforcing their biobased research. Recently, the Faculty of Science and Engineering appointed three additional professors in order to provide a boost to biobased research:

- Associate or full professor Host-Microbe Biology at the research institute for Biotechnology
- Assistant professor Carbohydrate Biochemical Engineering at the research institute for Engineering
- Assistant professor Green and Smart Biomass Processing at the research institute for Engineering

University of Groningen facts & figures

Societal themes: Energy, Sustainable Society & Healthy Ageing

Founded in 1614

28.500+ students

5608 FTE staff

404 professors

2019 doctoral students

48 bachelor courses

167 master courses

120.000 alumni

1 Nobel prize for Chemistry (2016)

1 Nobel prize for Physics (1953)



Research institutes

The UG's biobased economy research is clustered within the five research institutes, each with its own focus. The researchers concentrate on fundamental issues, in collaboration with the business community, the medical world and other societal partners. By looking over the confines of disciplines and working on shared topics, excellence can grow.

Biotechnology

Groningen Biomolecular Sciences and Biotechnology Institute

The institute carries out top-level research in the field of biomolecular sciences and has strong roots within chemistry, biophysics, molecular biology and genetics. As a response to the societal and industrial demand for sustainable biobased processes in which microbes play an important role, the institute focuses on two key areas: Molecular Mechanisms of Bioprocesses and Physiology and Systems Biology.

Adaptive life

Groningen Institute for Evolutionary Life Sciences

The institute integrates mechanical, ecological and evolutionary knowledge on biological processes in its research and education, with a focus on the adaptive potential of life.

Engineering

Engineering and Technology Institute Groningen

The institute works on designing and analysing new (sustainable) technologies by integrating fundamental knowledge with engineering sciences. In this, the institute concentrates on the processing industry, high tech and discrete production industry and interface industries. In addition, the institute works together with the Faculty of Economics and Business on smart industry applications.

Chemistry

Stratingh Institute for Chemistry

The institute carries out excellent research into molecular and supramolecular chemistry. Core areas are bio-organic chemistry, organic chemistry, molecular inorganic chemistry and molecular materials science. The focus is on synthesis, catalysis, functional materials, chemical biology and complex molecular systems. The institute is a global frontrunner when it comes to (green) catalysis and molecular engines.

Materials

Zernike Institute for Advanced Materials

The strength of the institute is in the combination of physics, chemistry and biology in the advanced materials field. Challenges within materials science are approached in a holistic manner from all aspects of the development chain. The research into functional materials is aimed at two key areas: Biomolecular and Bio-inspired Functionality and Nanostructured Materials for Electromagnetic Functionality.

3.2.

Hanze University of Applied Sciences Groningen

As a 220-year old institution, the Hanze University of Applied Sciences Groningen has ensured that applied research and education are well-rooted in the Northern Netherlands. As a University of Applied Sciences, the institute focuses on applied research. Together with companies the institute works on issues that demand new solutions and innovations. This way, the research contributes to knowledge development and new applications in both the professional sector and society.

Research Centre Biobased Economy

The Research Centre Biobased Economy is the place where knowledge on and experience in the biobased economy converge. By carrying out applied research in collaboration with small and medium-sized businesses and larger companies, concrete new biobased products and processes are developed. The Research Centre Biobased Economy encompasses the three professorships of Biobased Chemistry, Ingredient Development and Transition Bio-Economy.

Hanze University of Applied Sciences Groningen facts & figures

Strategic themes: Energy, Healthy Ageing and Entrepreneurship

Founded in 1798

27.000+ students

100+ nationalities

3100+ staff members

54 bachelor courses and **19** master courses

50 professorships

Awarded **third place** in Higher education guide 2016 and 2017 (Large Colleges category)

First four places in the national list of top courses

Top 25 positions in U-Multirank 2016: number of spin-offs and joint regional publications

The knowledge center for Biobased Economy covers the following three professorships:

Biobased Chemistry

Within this professorship, work is on-going on (bio)chemical modification of a diverse range of biomass streams; from agricultural crops to (animal) residual materials. These could serve as raw material for green (bulk) chemicals and bioplastics. The research is aimed at two important themes: Modifications of biopolymers and monomers, and Bioactive natural materials and optimisation towards medicine.

Project examples: Valorisation of Chitin; Pharmaceuticals from Glycoalkaloids

Transition Bio-Economy

The professorship stimulates entrepreneurship within the biobased economy by carrying out interdisciplinary practical research into new products and business concepts involving green process technology and green ingredients. After making natural ingredients available through, for example, biorefinery of vegetable-based compounds, vegetable fibres, proteins and oils, the focus is aimed at new applications for the pharmaceutical, cosmetic, food, and energy industries.

Project examples: Lupine for biomass from marginal lands (LIBBIO H2020); substances from biomass cuttings

Ingredient Development

The professorship concentrates on translating knowledge on ingredient development and characterisation into practical applications. This is done in active collaboration with the northern business community. The focus here is on the application of ingredients (especially carbohydrates) in a nutritional diet that contributes to a healthy lifestyle.

Project examples: Aquammonia lab-on-a-chip; Smart starch products

Talent & Human Capital

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4.1.

Linking of educational levels

For more than 400 years, the Northern Netherlands are known as a source of first-rate knowledge and expertise: Nobel Prize winners, the first female student and the first female teacher, the first Dutch astronaut and the first president of the European Central bank were all educated in the Northern Netherlands.

An important priority for Campus Groningen is to ensure that the Human Capital Agenda is aligned with the requirements of biobased companies. A broad range of secondary vocational education, higher professional education and scientific educational programmes are offered at Campus Groningen. This provides opportunities for attracting motivated and well-educated staff and for further training of current staff.

Within the biobased economy, University of Groningen, Hanze University of Applied Sciences Groningen and Noorderpoort offer education at every required level. This includes a focus on mechanical, chemical and biotechnological knowledge. At Campus Groningen, we educate the green process engineers of the future for the biobased and chemical industries.

Educational institute	Organisation	Education	Education programmes
Alfa-college		MBO (secondary vocational education)	Mechanic, Engineer, Mechatronic Technician
Noorderpoort	School for Laboratory & Process Engineering	MBO (secondary vocational education)	Laboratory technician, Biological Analyst, Chemical Analyst, Process Operator, Process Engineering
Hanze University of Applied Sciences Groningen	Institute for Life Sciences & Technology	HBO (higher professional education)	(Bio)informatics, Chemistry & Chemical Technology, Biology & Medical Laboratory Research, European Master in Renewable Energy, European Master in Sustainable Energy System Management, minor Food Ingredients and Health
University of Groningen	Faculty of Science and Engineering	WO (scientific education)	Biology, Life, Science & Technology, Molecular Biology and Biotechnology, Biomolecular Sciences, Energy and Environmental Sciences, Chemistry, Chemical Engineering, Physics, Industrial Engineering and Management, Nanoscience, High Tech Systems & Materials
	Research institutes	Ph.D.	Individual doctoral thesis

At Campus Groningen, we ensure that the various educational levels speak the same language and that the acquired skills are aligned. This is stimulated through joint projects where students from the different educational levels work together, for example in the Zernike Advanced Processing facility.

4.2.

Interaction between business and educational institutes

At Campus Groningen, businesses come into contact with students, and therefore with potential new employees. Businesses can actively contribute to the education programme through guest lectures or real-life case assignments, by offering internships, supporting theses and by collaborating with students and researchers within different experimental platforms.

Employees can also continue their learning journey by following relevant courses or taking part in shared activities. Campus Groningen offers plenty of opportunities to join in with workshops (for example the Industrial Biocatalysis workshop), Summer Schools (Glycosciences), round table sessions (Starch), lectures and conferences. Additionally, there is the option of participating in 'post-graduate' courses and 'tailor-made' training programmes for professionals.



ZAP must ensure that new processes and technologies are scaled up, so that it becomes practically applicable within companies.

- Derwin Schorren, Project Manager



Zernike Advanced Processing facility already needs first expansion

Biobased Chemicals, Biobased Materials

Derwin Schorren, Hanze University of Applied Sciences Groningen

In September 2015 the first students started working in the Zernike Advanced Processing (ZAP) facility at the EnTranCe grounds on Campus Groningen. This fulfilled a long-standing dream of the business community and the knowledge institutes. Within ZAP, the different educational levels work together on practical assignments from the business community. This results in a win-win for both the businesses and educational institutes.

At ZAP companies can work on the first phase of valorisation; the conversion of knowledge to commercially viable products, processes or services. For instance, the ZAP facility serves as a scale-up factory for the production of new biobased products, including those from biological waste streams. Companies can also work on process optimisation. Together with knowledge institutes the companies can work towards better results, at lower costs, in less time and with less energy consumption and waste.

Project leader Derwin Schorren: "Thanks to the success of the ZAP facility, we are already looking at expansion. The aim is to create more room for companies to work on scaling up. This new environment also links the physical results to smarter processes. Hereby the step towards the first experimental factory is even further reduced."

The physical Campus

5

5.1. Facilities at the Campus

The Campus has two neighbouring locations; the Healthy Ageing Campus and the Zernike Campus Groningen. We believe in the power of collaboration for finding innovative solutions. By sharing facilities at both locations, a physical connection is made and partners are able to work on joint themes. By providing access to state-of-the-art facilities and space for development we support innovative entrepreneurs.

Innovation Centre

The Innovation Centre is a completely new complex, with a laboratory, an experimental factory, offices and a customer innovation centre. The centre, due to be built, has space available for several companies and start-ups and is being built to maximise crosspollination. Moreover, there is close collaboration with the knowledge institutes regarding education and research. This presents opportunities for students and innovators to further develop their own initiatives. The first occupant has already been found: Avebe will house a hundred R&D and Marketing employees in the new Innovation Centre.

Zernike Advanced Processing (ZAP) facility

The ZAP facility offers knowledge centres, small and medium-sized businesses and large companies an infrastructure for working together on biobased product development and process optimisation. It forms the link between lab scale and production scale. Because of the close links with the Research Centre Biobased Economy from the Hanze University of Applied Sciences Groningen, the ZAP facility serves as an innovative learn-work environment. Companies, researchers and students work together on issues from the business community. Biobased companies that supply equipment for the ZAP facility are, among others, Suiker Unie, Royal Cosun and Avebe. Project plans with companies are currently being drafted for the following research topics: Bioconversion for green chemistry, Biorefinery with a focus on green extraction, and Smart Processing.

Energy Transition Center

EnTranCe has been located at the Zernike Campus since October 2015. It is an energy innovation workspace where new sustainable energy technologies are tested. EnTranCe is an initiative from Hanze University of Applied Sciences Groningen, University of Groningen and the Energy Academy Europe. It is an accessible organisation, where students from the knowledge institutes collaborate with the business community on innovations within the energy industry.



Innolab Chemie Groningen

Innolab Chemie, an initiative by Syncom B.V. and University of Groningen, offers (starting) businesses in the chemical sector laboratory facilities such as fume cupboards, lab tables, some general laboratory facilities, office space and rooms for meetings and presentations. Innolab has already welcomed six companies within the first quarter, including for instance the experienced Lab Ofichem.

Zernike NanoLab Groningen

Zernike NanoLab Groningen, part of the Zernike Institute of Advanced Materials, boasts state-of-the-art equipment for nanofabrication, deposition techniques, lithography, microscopy and scanning probe techniques. Within the Zernike NanoLab, there is the capability for processing (organic) semiconductors and metals, among other things. The facility contains various measuring technologies and clean rooms for prototype manufacturing. Experienced technical staff offers professional support for all available technologies.

Start-up facilities

The start-up scene in Groningen is a hotbed of new ideas and passionate entrepreneurs. This is boosted by Campus Groningen with accessible facilities such as the Start-Up City, the Launch Café and the Big Building. (Student) Entrepreneurs are guided and supported by the incubator and accelerator programmes from Cube050 and Venture Lab.



Andes Lupine as alternative to soya

Food & Feed

Rob van Haren, Transition Bio-Economy,
Hanze University of Applied Sciences Groningen

More and more land is needed to meet the increasing demand for biomass in Europe. The most fertile ground is already being used, however. Expansion to less productive lands is needed as a result. The challenge is to increase the yield from these marginal lands. For this, lupines are extremely suitable.

The Andes Lupine (*Lupinus Mutabilis*) thrives in marginal soil: it produces its own fertiliser as it is a leguminous crop. “The Andes Lupine is downright special”, according to Rob van Haren. “It is a real multipurpose crop, crammed full with high-quality raw materials. Because of its combination of oils and proteins, it is a product that has the potential to compete with the soya business case, yet is a lot less taxing on the environment.”

As the scientific coordinator of the LIBBIO project from Horizon2020, the Hanze University of Applied Sciences Groningen contributes to the maximisation of the yield, the profitability and the biorefinery of this crop. They aim to develop a semi-industrial biorefinery with super-critical CO₂ technologies. In addition they work on techno-economical evaluation of the supply chain. Part of the activities takes place at the Zernike Advanced Processing (ZAP) facility.

5.2. List of available research techniques*

Fabrication techniques

- Polymer synthesis
- Solid phase nucleic acid synthesis
- Solid phase peptide synthesis
- Recombinant protein synthesis
- Various bioconjugation strategies

Chemical engineering facilities

- High pressure equipment (batch and continuous, up to 2L, 300 bar, 450°C)
- Chromatography (HPLC reverse phase, process intensification lab (micro-reactors, centrifugal contactor separators, high throughput equipment))
- Refractive index
- Thermochemical conversion lab (4 pyrolysis set-ups, up to 1 kg/h, supercritical gasification set-up)

Surface patterning techniques in high end clean room facility

- Photolithography
- E-beam lithography
- Focused ion beam
- Soft molecular landing deposition

Nuclear imaging

- Positron emission tomography (PET)
- Single-photon emission computerized tomography (SPECT)
- Magnetic resonance imaging (MRI)
- Computed tomography (CT)
- Multispectral optical and optoacoustic imaging
- Small animal imaging tools

Surface characterisation

- Elemental composition:
 - o X-ray photoelectron spectroscopy
- Hydrophobicity and surface free energy
 - o Sessile drop (captive bubble)
 - o Axisymmetric drop shape analysis by profile (ADSA-P)
 - o Axisymmetric drop shape analysis by contact diameter (ADSA-CD)
 - o Wilhelmy plate method
- Surface charge
 - o Zeta potential
 - o Streaming potential
- Molecular composition
 - o Fourier Transform Infrared Spectroscopy
- Friction
 - o Tribochemist (wear tester combined with an ATR-FTIR)
- Coating thickness/ protein adsorption
 - o Ellipsometer
 - o Quartz Crystal Microbalance
- Softness
 - o Low load compression tester
 - o Tensiometer
- Surface roughness/Surface structure
 - o Atomic force microscopes
 - o Profilometer

Cell and bacterial interaction

- Bacterial adhesion and biofilm evaluation
 - o Fully equipped Microbiology lab (various biofilm models)
 - o Flow chambers (real time bacterial adhesion; race for the surface between cells and bacteria)
 - o Optical coherence tomography
 - o Macroscopic fluorescence imaging (IVIS)
 - o Confocal laser scanning microscope
- Genomics
 - o Fully equipped DNA lab
 - o PCR
- Cell and histology lab
 - o Microtome
 - o Fluorescence microscope
 - o Various cell culture systems (different oxygen content)

Optical and non-optical visualization methods

- Fluorescence microscopy
- Super resolution microscopy (including PALM, STET, STORM)
- Fluorescence correlation spectroscopy

Surface characterisation techniques

- Transmission electron spectroscopy (TEM) (including cryo)
- Scanning electron microscopy (SEM)
- Atomic force microscopy (AFM)
- Scanning tunneling microscopy (STM)

Preparative separation techniques

- Field flow fractionation
- Super Critical CO₂ extraction (and reaction) facility
- Spray drying installation
- Freeze drying
- Cell disruption

Chemical characterisation techniques

- NMR
- Mass spectrometry (MALDI, ESI, APCI)
- Chromatography (HPLC reverse phase, ion exchange, gel permeation, advanced 2D gas chromatography)
- UV, VIS, IR, Fluorescence, Raman spectroscopy
- Refractive index
- Evaporative Light Scattering
- Dynamic Light Scattering
- Differential Scanning calorimetry

In-vivo evaluation

- Murine soft tissue infection and inflammation models
 - o In-vivo fluorescence and bioluminescence imaging tools (IVIS Spectrum, FMT2500)
 - o Intra vital imaging with 2-photon microscopy (Zeiss MP7)
 - o Bone infection models

5.3.

Real estate developments at Campus Groningen

Campus Groningen offers innovative companies [the perfect base for settling](#), because of access to research, education and entrepreneurship. Campus Groningen has two neighbouring locations; the Healthy Ageing Campus and the Zernike Campus Groningen.

The **Zernike Campus Groningen** will undergo significant growth over the next few years. The new Energy Academy Europe opened recently. Various developments will gain further shape throughout 2017, including the second phase of the ZAP facility and the new Innovation Centre with space for several (R&D) companies. Also, Start-Up City will be launched soon, which will be a flexible community for entrepreneurial education, start-ups and established companies. The new Feringa Building, a research and education facility for chemistry, physics, astronomy, and industrial engineering, will be constructed over several phases between 2017 and 2022.

The **Healthy Ageing Campus** has various options for business accommodation. Laboratory and office space is available in the R&D Hotel, the Meditech Centre and the Biotech Centre. The development of the north side of the University Medical Center Groningen will gain shape over the coming years.

If you are interested in establishing your business at Campus Groningen, we are happy to work with you and discuss your requirements and wishes.

Funding

6

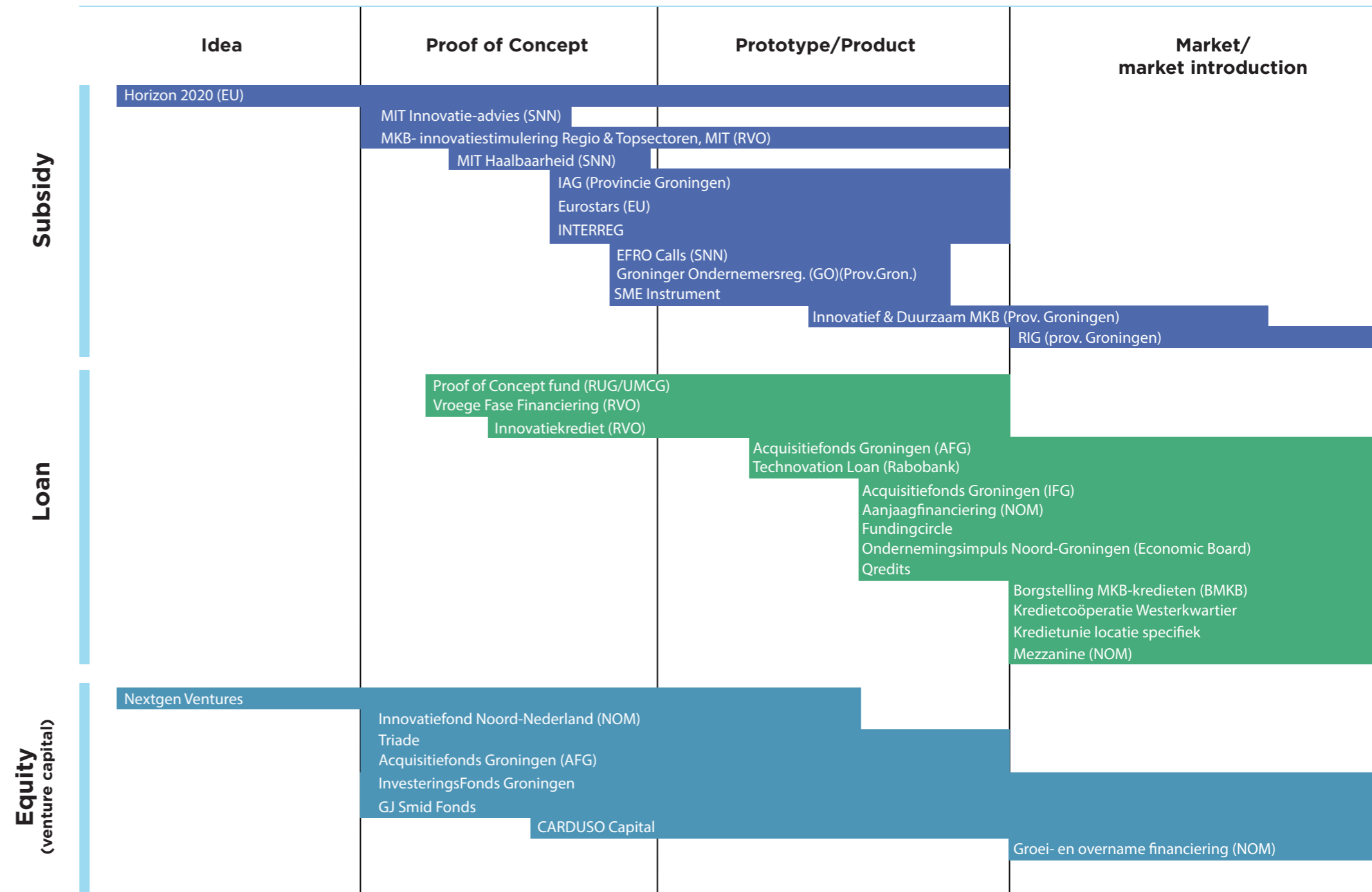
6.1 Funding

Access to funding is essential for growth. Campus Groningen and the Northern Netherlands have various options and facilities to this end. Thanks to our extensive network, suitable solutions can be found for any financing requirement.

Financing of biobased innovations can occur through direct investment, by using various funds and/or via several (regional) subsidies. The options range from small sums at the start of the development chain to million-euro investments for production scale-up. Intermediaries such as the Noordelijke Ontwikkelingsmaatschappij (NOM, Northern Development Company), Fliinc and Triade help entrepreneurs to match their ideas with the available financing options.

Unique in the Netherlands is the Regionale Investeringssteun Groningen (Regional Investment Support Groningen). This investment support is especially for companies looking to locate to or expand in the Eemsdelta and the Zernike Campus. Companies can receive up to 30% investment subsidy upon purchasing land, buildings and company equipment. Large companies are more likely to receive subsidy when the intended project is aimed specifically at green and sustainable investments. The maximum investment subsidy is €7.5M.

Financial Ecosystem



*This figure is not exhaustive

Would you like to know more about the possibilities at Campus Groningen?

Do you work on biobased innovations? Are you interested in working on biobased impact together with other entrepreneurs and knowledge institutes? Are you considering expansion or establishment in a highly technological environment? With access to diverse biobased raw materials and connected to a strong infrastructure? Are you looking for the latest knowledge? And the best top-level talent? Do you require access to state-of-the-art facilities? Are you looking for appropriate funding?

Then contact Campus Groningen to discuss your requirements and wishes. We work with you to find the best solution.

Contact



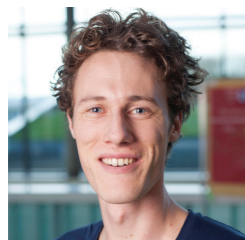
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