

# **Development goals and measures (UMV) 2018–21**

**National Food Institute**

## 1. Academic profile and expected performance goals of the department

The National Food Institute, Technical University of Denmark (DTU), (the Institute), researches in and disseminates - through consultancy, innovation and teaching - sustainable and value-adding solutions in the area of food and health for the benefit of society and business. The Institute delivers its outcomes through an interdisciplinary cooperation between the disciplines of nutrition, chemistry, toxicology, microbiology, epidemiology and technology.

The Institute's vision is to create welfare for the future through research into food and health. The Institute makes a difference by producing knowledge and technological solutions which:

The strategic reference points for the institute are:

- 1) academic progress
- 2) one united institute
- 3) dedicated employees
- 4) sound finances.

The vision and reference points indicate where the Institute wants to go by undertaking strategic initiatives which increase the level of ambition and create a visionary, proactive and more competitive institute.

### Academic progress

#### Research

The National Food Institute is an ambitious institute and solves some of the biggest societal challenges facing the world. The Institute's research areas have been selected with a view to solving these challenges. Furthermore, they constitute the Institute's beacons. The strategic objectives for the coming years are to:

- be among the three leading research institutions within the area of food and health in Europe;
- support an ambitious academic climate by focusing research efforts and utilizing the Institute's entirely unique interdisciplinarity, which could attract more research funds and partners;
- ensure a sufficient research infrastructure by sustaining a robust financial position and better utilizing the existing infrastructure in the form of databases, apparatuses and knowledge across the organization.

#### Teaching

The institute teaches and educates students for the food sector, public authorities and the research communities related to the institute's focus areas. In order for teaching to be state-of-the-art it must be research-based. The strategic objectives for the coming years are to:

- establish clearly profiled study programmes which meet needs in society for graduates with strong and relevant engineering competencies in food production and life science;
- focus on innovation and entrepreneurship in teaching;
- create a learning teaching environment with a focus on teachers' didactic development and inspiring physical surroundings.



Figure 1. The National Food Institute's vision

## Scientific advice

The National Food Institute delivers independent and reliable scientific advice to national and international authorities and enterprises. The Institute fulfils its obligation of initiative by ensuring that consultancy is based on research and international partnerships, and that the Institute is a forward-thinking and constructive discussion partner for buying parties.

Consultancy is anchored in one division, thus ensuring that clients benefit from the coordination of interdisciplinary knowledge. The strategic objectives for the coming years are to:

- retain the Institute's position as the preferred supplier of scientific advice within food safety and food technology in Denmark;
- strengthen the Institute's position as the preferred Danish partner for international businesses and authorities within the area;
- develop competitive consultancy services by, amongst others, strengthening cooperation with industries and businesses regarding consultancy within food technology, food safety and nutrition;
- continue sharpening up the Institute's consultancy services by further developing its quality assurance system and consulting its customers even more when balancing expectations.

## Innovation

Innovation is established as an integrated part of the Institute's research and education activities so that the Institute's research results may benefit business and support the knowledge-based development of society. The strategic objectives for the coming years are to:

- position and further develop the Institute as a leading innovation environment;
- contribute significantly to job creation and growth in the food sector;
- integrate innovation in the Institute's research culture in order to deliver value-adding solutions to industry, enterprises and public authorities;
- increase commercialization of patents registered by the Institute.

## **One united institute**

In order to be able to deliver high-level research, consultancy, teaching and innovation services the National Food Institute's organization and activities are permeated by unique interdisciplinary partnerships. The strategic objectives for the coming years are to:

- develop strategic initiatives across the Institute;
- create a sense of community at the Institute where everyone knows each other, makes use of each other and engages in joint professional initiatives across the Institute;
- have managerial consideration for the whole Institute through cross-functional management responsibility for research, education and teaching, scientific advice, innovation, finance and administration.

## **Dedicated employees**

Dedicated employees are at the heart of a knowledge-based organization and are motivated by the difference for society they make. The strategic objectives for the coming years are to:

- maintain well-being with a focus on the sense of being part of a bigger community, get inspiration, knowledge and motivation;
- clearly match expectations with all employees with regard to prioritizations, tasks, career plan, job description, if applicable, and competency development;
- celebrate the success of both the Institute and the individual, thereby acknowledging employees for their goals and results.

Every employee has the opportunity to enter into dialogue with management, and they are involved in strategic decisions affecting their job duties, either directly or through representatives.

## Sound finances

The Institute maintains sound finances by focusing research and innovation efforts on its beacons, developing and targeting its teaching and consultancy services, being resource-conscious at all levels and making job expectations clear to all employees. The strategic objectives for the coming years are to ensure:

- openness in the Institute about the financial situation, thereby increasing resource consciousness,
- happy customers and stakeholders;
- future external funding;
- a robust bottom line which allows for investments and a certain room for manoeuvre by, amongst others, strategically assessing and adjusting teaching services offered by the Institute and the research areas into which the Institute invests;
- continuous improvement of the efficiency by doing things smarter to make time available for development.

## 2. Education and teaching

### 2.1 Education and teaching (BEng, BSc and MSc programmes)

The Institute produces graduates for the food and life science sector, the public sector, and the research world within its focus areas. Through offering teaching at a high academic level, it is the Institute's ambition to continually educate graduates with the newest, relevant engineering skills for the benefit of society and industry both in Denmark and globally.

In the UMV period, the strategic goals and measures are to create:

#### **Clear, high-profile study programmes that meet society's needs for graduates with strong and relevant engineering skills within food production and the life sciences**

It is an ongoing task to clearly profile DTU's food study programmes, update graduate competences, and promote coherence between the study programmes and the Institute's strong research areas.

In 2016, the name of the BEng programme was changed from Food Analysis to Food Safety and Quality to shift the focus from what students do to the competences they acquire as graduates. During the UMV period, the Institute will assess whether there is a basis for increasing the intake to 60 students a year without winter admissions and duplicating courses.

The Institute is continuing its efforts to increase recruitment to the MSc programme in Food Technology. This is done, among other things, through developing its collaboration with the University of Copenhagen on the joint BSc programme in Food Science as well as through the collaboration with DTU Bioinformatics about the food specialization on the BSc in Human Life Science Engineering and other relevant DTU BSc study programmes.

The MSc programme focuses on both food production and food safety, a combination that gives it a unique profile. In developing existing and new technological specialization courses, in future it must be made clear that the courses contain both production and food-related learning outcomes. By honing the course profiles, it is expected to become clearer for students and employers what the programme offers and which career opportunities there are.

#### **Focus on innovation and entrepreneurship in teaching**

Thanks to DTU Brewery, DTU Blue Dot projects, and the DTU Ecotrophelia product development competition, the Institute has a solid foundation for integrating innovation, entrepreneurship, and creativity in its programmes. In 2017, the national collaboration on DTU Ecotrophelia received financial support from the Danish Foundation for Entrepreneurship, which means that from 2018 there is a real national competition taking place in partnership with the University of Copenhagen, Aarhus University, and Aalborg University. The National Food Institute also supports the students' participation in other innovation competitions such as Green Challenge, and will together with DTU Skylab/FoodLab generally provide students with opportunities to expand their competences within innovation and entrepreneurship through extracurricular activities.

Through new projects targeted at innovation in food companies in Region Zealand (CPH-Food) and in the Capital Region of Denmark (Growing Food CPH), the Institute will promote and match the contact between students and businesses. This will increase the number of students who work with businesses as part of research and company projects.

All BEng programmes have included a so-called innovation pilot, and the Institute has arranged for foods to become a permanently established theme ('laboratory'). For its BEng students, the Institute has established a continuous programme of business contact through an innovation pilots course (fifth semester), an internship (sixth semester) and a diploma project (seventh semester). Such a coherent programme of study will improve the students' opportunities for identifying socially relevant tasks which they can help to solve in the course of their studies and as qualified DTU graduates.

The Institute has laboratories and pilot plants, which together with DTU Skylab/FoodLab play a key role in the development of the student environment and enhancing the Institute's focus on innovation and entrepreneurship in the study programmes. In cooperation with DTU Skylab, the Institute is supporting a student association which—across the food-related study programmes—gives students a platform for both academic and social activities.

### **A learning educational environment prioritizing the teaching staff's didactic development and inspiring physical facilities**

The Institute will continue to develop a strong pedagogical culture among lecturers, where peer supervision and the development of pedagogical and didactic methods become joint practice. The lecturers' academic community is maintained to ensure continued focus on supporting the students' learning and enthusiasm by, among other things, incorporating new pedagogical methods as well as new ways of learning and organizing exams.

The Institute will increase the use of e-learning in the UMV period where it can assist the students during the commencement of studies period, assist their learning, and the Institute's cost-effectiveness. E-learning is centrally integrated in the MSc programme AQFood, and in the international 'One Health' summer university. The Institute will, to an increasing extent, allow these courses to form part of the students' plans for ordinary study programmes, thereby increasing the degree of flexibility and the students' opportunities to study abroad.

The Institute also uses e-learning to build bridges between the Institute's ordinary teaching and the supplementary education and training activities which the Institute offers both in Denmark and internationally. For example, based on its role as EU Reference Laboratory for Antimicrobial Resistance (EURL-AR), the Institute has offered the MOOC/Coursera course 'Antimicrobial resistance—theory and methods', which has more than 14,000 registered users, and three more Coursera courses within this area are in the pipeline in 2017 and 2018.

Now that the Institute is based at Lyngby Campus, it will, in collaboration with students, including the newly established student association 'FOOD TECHIES', develop the physical environment around the students in the life science buildings. In Building 202, the classified teaching laboratories, the adjoining classrooms, the open lounge areas, and the canteen will make it possible to develop an inspiring learning environment. Bringing together the activities at Lyngby Campus is expected to have a very positive impact on academic cooperation and resource efficiency within teaching. The Institute expects to be able to attract more students to its courses and projects, and also expects the students to benefit from greater coherence in their curricula through, among other things, being able to combine courses at the National Food Institute with courses at other departments to a greater extent. The new, large teaching laboratories and adjoining classrooms also make it possible to instruct larger groups of assembled students, which has an important bearing on lecturers' time consumption.

## **2.2 PhD programme**

The National Food Institute will raise awareness of relevant and complementary academic areas at DTU by organizing joint seminars, excursions etc. The purpose is to increase interdisciplinary knowledge and cooperation, and to create a common understanding of the trends in modern technical life science. In addition, the Institute will also offer coveted PhD courses for life science PhD students at DTU.

PhD students at the Institute work with innovation perspectives for each new project as a fixed element on the internal, mandatory PhD course.

The work of the Institute to expand its network and grow the number of major collaborative projects with industry is also aimed at increasing the number of industrial PhDs.

### **2.3 Further and continuing education**

Like the rest of DTU, the Institute will develop the supplementary education it offers towards 2020. In 2017, a strategy process has been initiated to determine the Institute's ambitions and objectives within this area. Development needs and wishes with respect to further and continuing education will be assessed in dialogue with employers and the Institute's Advisory Board. Considerable focus will be directed at raising the level of knowledge within the industry about food safety in relation to the development and production of food products. Previously, the Institute has offered extensive training activities for international authorities in particular, but these will be downgraded where there is no sustainable business plan or significant strategic aim.

In collaboration with the University of Copenhagen and international partners, the National Food Institute is applying to establish an Erasmus+ project as a framework for the development and implementation of some of the further and continuing education which was originally included in the Food KIC application. In dialogue with players across the food sector, the Institute wishes to contribute to the industry's further and continuing education, and is therefore involved in considerations concerning the establishment of a food academy.

## **3. Research**

The National Food Institute is an ambitious Institute where all the research groups are or will be on their way to becoming world-leading within their particular field. The research groups maintain a constant focus on increasing the quality of their research, on being of benefit to society by providing relevant knowledge, and on being able to communicate this knowledge. They do this by maintaining close contact with businesses, the public authorities, and funding bodies.

The Institute's research is focused on 12 research groups:

### **Research Group for Analytical and Predictive Microbiology**

The group's research seeks to address the productivity challenges faced by the food industry. The group develops and uses new and innovative methods for the rapid detection, typing, quantification, as well as the prediction of the growth and survival of microbes in food and water. New mathematical models and software for predicting microbiological growth and survival rates will be developed for risk assessment, as well as the improved development, processing, and distribution of food products. Overall, the group will create tools and knowledge that can be used to improve safety, quality, and traceability in food production.

### **Research Group for Bioactives—Analysis and Application**

The group's ambition is to gain knowledge and develop technologies and processes which can contribute to increasing the population's intake of healthy foods by improving eating quality and the oxidation stability of food products. The group will achieve this by producing new and groundbreaking knowledge about the biological activity of vitamins and the underlying mechanisms for lipid oxidation in foods as well as by developing new strategies for optimizing the durability and eating quality of vitamins and fats in foods. The group is also engaged in optimizing the content of bioactive substances in algal biomass and developing innovative technologies for ensuring the exploitation of new resources, especially from the fishing industry's residual products and from seaweed and algae.

### **Research Group for Food Production Engineering**

The group's ambition is to contribute to sustainable and efficient food production, to optimize resource consumption, and to design and develop processing technologies and food products for special needs. The research is based on a mechanistic understanding of the interactions between food processing and raw materials, as well as on mathematical modelling and monitoring of food production processes at all levels from unit operations to complex systems.

### **Research Group for Genomic Epidemiology**

The aim of the group's research is to monitor, predict, and prevent the spread of infectious diseases among people and animals, both globally and in Denmark, with special focus on antimicrobial resistance and food-borne diseases. In the coming years, the research will focus on:

- where to conduct sampling
- sample analysis in the laboratory (e.g. metagenomics)
- bioinformatics and sharing large data volumes
- statistical modelling and visualization of large and complex data
- epidemiological and predictive models with explanatory variables
- international standards and building capacity.

In future, attempts will be made to expand the concepts with web-based access to analysis and information infrastructures with epidemiological data and tools, food authenticity studies, and chemical analyses. Efforts will be made to develop the partnership with DTU Compute.

### **Research Group for Risk Benefit**

The aim of the group is to establish and develop models within health assessment which can be used for risk-benefit assessments, risk and benefit ranking, assessing disease burden, and quantifying health effects. In further developing existing models, the group will use mathematical models and include aspects such as substitution, genetic variation, and uncertainties. In the long term, the models will involve economic aspects and possibly sustainability, which can contribute to assessing socio-economic consequences.

### **Research Group for Analytical Food Chemistry**

The ambition is for the group to supply the relevant chemical data which are crucial for our confidence in foods and their healthiness through the development of reliable, efficient, and detailed chemical analyses. The group's activities are divided into three areas: monitoring and metabolomics, authenticity and quality, and food contact materials and new risks.

### **Research Group for Microbial Biotechnology and Biorefining**

The research group works to improve quality, efficiency, and sustainability in brewery and dairy processes. The research also focuses on the sustainable production of food and feed ingredients, biochemicals and biofuels, as well as microbial production based on sustainable industrial materials from dairies, breweries, agriculture, etc. One example is the development of tomorrow's sustainable protein sources via biorefining, including microbial protein production.

### **Research Group for Microbial Food Safety**

The group's ambition is to predict and improve microbiological food safety. The aim is to shed light on and analyse the quantitative population dynamics of food and water-borne organisms and their antimicrobial resistance in traditional and innovative production chains, and to develop new methods and models for determining, predicting, and improving food safety in support of food businesses' HACCP-based own control systems and public food inspection.

### **Research Group on Molecular and Reproduction Toxicology**

The group's ambition is to prevent human reproductive diseases which may occur as a result of exposure to the chemical substances which are found in foods and the environment. The group's research focuses on generating knowledge about the undesired reproduction effects that arise as a result of exposure to chemical substances or mixtures thereof as well as about the underlying mechanisms. More specifically, the group conducts research into the toxic effects (for example of endocrine-disrupting chemicals) which occur during foetal development. The research output is primarily related to male reproduction, but also includes female reproduction as well as the effects on thyroid hormones which can lead to brain dysfunction. The group is aiming to contribute to the development of a new paradigm for the human-relevant risk assessment of chemicals.

### **Research Group for Nano-Bioscience**

The objective of the group is to promote health and prevent disease by focusing on nano and micro-structured materials and ingredients as well as trace elements in foods. The group works throughout the entire value chain from food production to the synthesis of functional ingredients and delivery systems via food processing and intake by humans and animals.

### **Research Group for Gut Microbiology and Immunology**

The group seeks to contribute to understanding the interaction between diet and the development of immunological and allergic reactions, including an understanding of how the body's bacterial populations (in the intestine and on the skin) contribute to this interaction. 'Diet' covers both whole foods, food ingredients, additives, and contaminants. In addition, the group aims, together with the business sector, to develop new products for preventing and treating allergies, and to develop new ingredients and food products which have a beneficial effect on gut bacterial population. Finally, the group wants to reveal and predict which factors can influence the risk of immunological 'defective reactions', including the significance of the skin as a sensitizing path for food allergies.

### **Research Group for Nutrition and Health Promotion**

The group conducts population studies, and the ambition is to identify the social challenges in relation to Danes' dietary habits and 'DSAP' (diet, smoking, alcohol, physical activity) behaviour, to increase knowledge about the importance of dietary food composition and nutritional content for health and disease prevention, and to contribute to the Institute's risk assessments. In addition, the group conducts interventions with a view to suggesting solutions that promote healthy dietary habits and healthy behaviour within different population groups.

## **4. Scientific advice**

It is the Institute's ambition to maintain its position as the preferred supplier of scientific advice within food safety and food technology in Denmark, and to strengthen its position as the preferred Danish partner for international businesses and authorities within the area. These ambitions are being realized by focusing the research in important areas which are of significance for human health or food supplies, and by drawing on the research results to issue relevant advice and guidance.

The Institute undertakes international consulting tasks, especially for the EU, WHO and the OECD, but also for the Nordic Council of Ministers. Most tasks are performed under the auspices of the European Food Safety Authority (EFSA), where the Institute is an EFSA collaboration centre in Denmark (focal point), with seats in EFSA's advisory forum. Many employees participate as independent members in several of the EFSA panels, working groups, and networks. This means that the Institute's research has a bearing on the European food safety agenda. The close contact with EFSA and the Institute's sister organizations in Germany (BfR) and France (ANSES) provides access to knowledge and the most recent thinking about food safety in Europe, and thereby benefits those receiving scientific advice from the Institute.

The most important focus areas for the scientific advice include:

#### **Professionalized advice where the Institute will:**

- develop new paradigms and research-based methods with a view to increasing the quality of its advice and decision-making support, especially within the following areas:
  - assessing the significance of combining chemical substances to better advise on the potential risk to human health
  - risk/benefit analysis in order to consider the potential harmful effects versus the beneficial effects of the food in which they occur
  - the significance of gut bacteria for human health, including in relation to lifestyle diseases and the effect of being exposed to chemicals
  - common formats for recommendations on dietary composition in different institutions and eating venues, and innovative solutions for disseminating more differentiated and targeted dietary recommendations.
- further develop the Institute's quality assurance of the scientific advice and improve the collaborative processes with national authorities, especially as regards the reconciliation of expectations when ordering assignments and improving how the Institute's responses are communicated to improve dialogue with the requisitioner
- quality-assure data management to create transparency in the validation processes

- develop cooperation on food data with the food industry and businesses as well as with feed industry organizations with a view to exchanging information about feeding practice and its significance for the nutritional content of meat and milk
- engage in international collaboration to document scientifically based reference doses for allergens in foods in the EU, which may make it possible to prepare accepted risk assessments for food allergens
- contribute to making the Institute's monitoring data available through a shared user interface, and make the data available to employees at the Institute, researchers at other research institutions, and to the public
- develop and implement a new method for studying Danes' dietary consumption in order to provide more detailed information about the food composition of our diets and to handle data in the same way as other European countries, among other things to obtain improved data for the fight against lifestyle diseases
- strengthen and develop the Danish Veterinary and Food Administration's and the Danish Environmental Protection Agency's knowledge of the Institute's advisory capacity as a supplement to the existing fora (the Danish Veterinary and Food Administration's interdisciplinary groups and the Danish Environmental Protection Agency's discussion forum)
- strengthen the strategic partnership with the Danish Veterinary and Food Administration's laboratories. The objective is to assure analysis quality on a research-based foundation as well as access to high-quality data.

#### **Competitively robust advice, where the Institute will:**

- attract advisory tasks from industries and businesses, among other things through the establishment of stakeholder groups within nutrition and food chemistry
- improve the basis for sharing risk assessments with strategic partners (BfR and ANSES) and thus contribute to risk assessment and scientific advice at a European level
- contribute to the development of food safety emergency preparedness and response, including the national reference body collection and the national reference laboratory functions within chemistry and microbiology
- develop the collaboration with the European Food Safety Authority (EFSA) through joint projects and through a more active role in EFSA's Advisory Forum
- further develop monitoring based on sequencing methods and work for their international acceptance.

The initiatives are being coordinated with the framework agreements' activities in DTU's Office for Innovation and Sector Services (OIS). In connection with DTU's activities for cultivating new markets for scientific advice, the Institute's activities may be relevant for, for example, the Danish Health Authority and the Danish Working Environment Authority as well as several sectors and businesses.

## **5. Innovation**

The National Food Institute wishes to be the leading innovation centre for the food sector through research-based innovation activities. It is the Institute's ambition to be a leading player in terms of giving the outside world access to infrastructure, analysis equipment, knowledge, competences, data, or resources that can contribute to testing and new development.

The Institute will also look at more ways of enabling businesses to access its research infrastructure and thereby contribute to the overall agenda regarding growth and job creation in the sector. This will primarily take place via collaboration with students, through innovation projects supported by, for example, Greater Copenhagen, or through collaborations which are implemented through Open Innovation Challenge activities under the auspices of DTU Skylab.

The Institute wishes to maintain and strengthen its extensive network of contacts with the business community. Each year, the Institute enters into more than 100 new research-related cooperation agreements with companies, as well as a wide range of contracts of a more commercial nature. The Institute will handle all these business relationships systematically and professionally.

The Institute sees innovation as new knowledge-based products, processes, or services that provide new value for businesses, the public authorities, and society. At the Institute, technology-driven and user-driven innovation interact, and in future data-driven innovation and digitization will also play a role.

The Institute will also augment the integration of innovation and entrepreneurship in its educational activities, as the students' knowledge and student start-ups can contribute to lifting the entire food sector.

Based on the above ambitions, the National Food Institute's strategic objectives and initiatives for the coming year are to:

**Position and further develop the Institute as a leading innovation environment, whose knowledge is used actively in society**

The National Food Institute will work to be an outgoing and highly profiled Institute that actively seeks to make its knowledge available to businesses, state and regional authorities, municipalities, corporate networks, and civil society. The aim is for the Institute to be perceived as a preferred and trustworthy partner by all stakeholders looking for research-based knowledge.

The Institute will seek to generate good coordination between the various knowledge environments in the Danish food sector by participating actively in relevant innovation networks, including the Danish Food Cluster.

Within the field of ingredients, the Institute will head the efforts to ensure that DTU can take a leading position. This will happen by gathering the relevant expertise, and by describing unique bioengineering, biorefining, modelling, and production factors for DTU.

The focus will also be on the opportunities for European cooperation through EIT Food by continuing to seek cooperation with relevant businesses and universities in Europe, and by maintaining our involvement in the consortium behind the Food NEXUS initiative.

**Contribute significantly to job creation and growth in the food sector through increasing the innovation potential of businesses, authorities, and in civil society**

The National Food Institute will contribute to promoting the innovation potential of businesses, authorities and civil society in order to maintain and develop job creation and growth in the food industry. This will happen by continuing and developing efforts targeted at small and medium-sized enterprises by providing research-based knowledge which is significant for business development at these enterprises. The Institute will also focus extensively on new start-ups which can inspire and revitalize the sector, among other things in cooperation with DTU Skylab.

Special focus will be on further developing the Institute's collaboration with the regions, particularly the three regions behind Greater Copenhagen which all prioritize food and gastronomy highly as part of their respective growth strategies. This will take place by participating in projects and by increasing our involvement in many of the small initiatives which are flourishing in the regions without coordination—the participation will emphasize the values that research-based knowledge can feed such initiatives.

**Integrate innovation in the research culture at the Institute, so that new talents create innovation and established researchers spot innovations in their research**

The Institute will work to ensure that PhD students create innovation, and that this is supported by supervisors and other senior employees who see innovation as a part of making research relevant. This will mainly take place by 1) increasing the extent to which researchers across the Institute are involved in projects in direct cooperation with a broad circle of customers (needs-driven research-based innovation), and 2) recognizing the fact that innovation springs from research, and that DTU centrally and the Institute decentrally have support systems in place for further developing the utility of such innovations for the benefit of society at large (technology-driven and data-driven innovation).

### **Increase the commercialization of patents in order to fully exploit the research portfolio**

The National Food Institute will seek to ensure that the potential for innovation throughout the entire research portfolio is fully utilized with commercialization in mind. The number of patent applications has stabilized at about seven a year, and the focus now is on optimizing the utility value of the patents which have been granted for businesses.

## **6. Partnerships**

The National Food Institute cooperates with the most important authorities, organizations, research institutions, and companies worldwide within the Institute's key focus areas. In general, the Institute will develop and coordinate the dialogue with potential partners within education, research, innovation, and consultancy, and enter into and maintain partnerships which can positively influence the frameworks within which the Institute operates.

In order to count among the leading research institutions, and to maintain its position as one of the leading national food institutes in Europe supplying independent scientific advice to public authorities, the Institute is part of a number of strategic partnerships which it expects will spawn further activities in future.

The Institute has a strategic partnership with the other two most important independent food institutes in Europe: the Federal Institute for Risk Assessment (BfR) in Germany and the French Agency for Food, Environmental and Occupational Health & Safety (ANSES). The American Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA), the European Food Safety Authority (EFSA), and the European Centre for Disease Prevention and Control (ECDC) as well as the Dutch National Institute for Public Health and the Environment (RIVM) are also strategically important partners within the fields of research and scientific advice. DTU also works with the China National Center for Food Safety Risk Assessment (CFSA), while Nanyang Technological University in Singapore looks set to be a promising partner for the Institute in future. The Institute also participates in the Med-Vet-Net, a network comprising 13 countries which focuses in particular on research and consultancy about zoonoses, and also in the Danish Food Cluster, which covers the work being conducted by Danish universities within food. In the Danish Food Cluster, the Institute is able to increase its visibility and cooperation vis-à-vis all the main players in the food products network, including the Danish regions and municipalities.

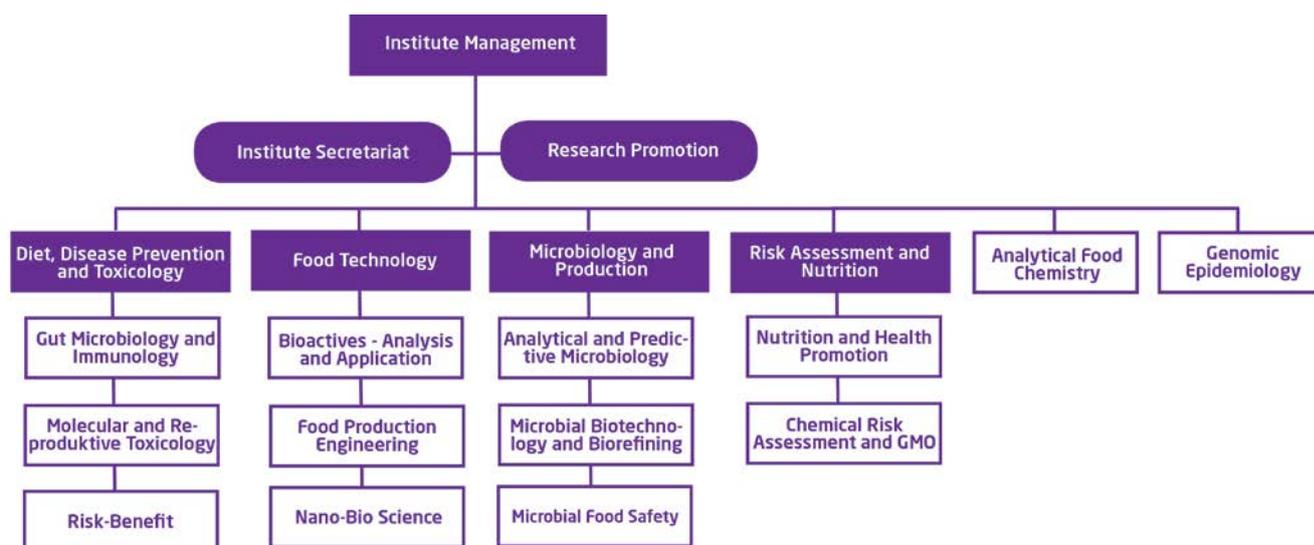
The Institute has set up the international Joint Centre of Excellence in Food Safety together with the Hong Kong Polytechnic University in China, Lund University in Sweden, and the University of Bologna in Italy. The centre can lead to greater cooperation and access to the Chinese market in particular as well as student exchanges.

## **7. HR**

The National Food Institute's strategy supports its ambition of being a leading, excellent institute with strong research groups and research beacons. An ambitious and value-creating strategy contributes to maintaining staff commitment. Commitment and motivation are driven by academically exciting projects which are aimed at solving the challenges facing society. The work is meaningful, and takes place in an environment in which the individual employee is able to enter into dialogue with the management and is involved in the strategic work which is relevant for the execution of the task.

### **7.1 Organization**

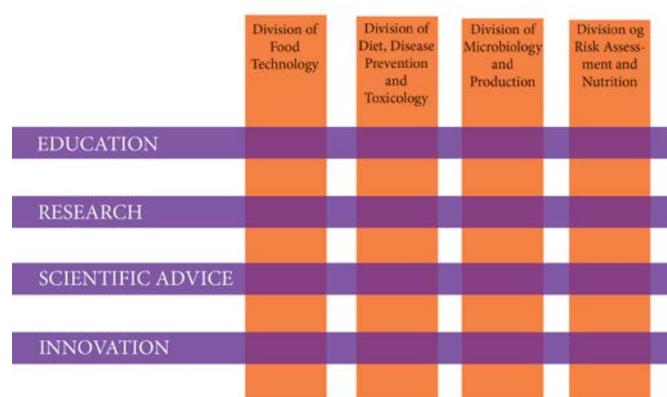
The organization is structured around four academic departments and 13 groups. The aim is to have a few, focused research teams which support the vision and the strategic goals. See Figure 2.



**Figure 2: Organization chart**

The focus of the 13 groups creates the foundation for an ambitious and competitive academic environment, with the interdisciplinary collaboration being supported by the fact that the employees are part of research teams across the former academic departments.

The interdisciplinary coordination of teaching, research, consultancy, and innovation is anchored in the management group. The departmental managers each have a coordinating leadership task, which extends across the Institute. The leadership task thus lies both in the line organization (staff) and across (academic) in a matrix which is illustrated in Figure 3.



**Figure 3. Matrix-organized leadership responsibility**

## 7.2 Leader and leadership development

The Institute continues to focus on exercising dynamic and strategic management in order to support continuous progress. The management recognizes the importance of ensuring there is room for academic passion and commitment while at the same time prioritizing academic content for the benefit of the Institute's competitive profile.

Managers—both heads of department and group leaders—play a key role in realizing the strategy and tackling the accompanying changes. The managers translate and communicate the purpose of the strategic goals, and thus act as culture-bearers.

## 7.3 Employee development

The National Food Institute maintains a constant focus on the academic and personal development of all staff groups. During the development goals and measures (UMV) period, the Institute will continue to focus on strengthening its employees as regards future requirements. This includes, among other things, initiating activities that improve the Institute's possibilities for being granted research funding, ensuring continued focus on competitively robust advice over the long term, supporting the employees in thinking in terms of business-oriented innovation, strengthening the lecturers' pedagogical development, and creating a joint teaching culture in continuous dialogue with the lecturers.

For the employees, it entails being actively and jointly responsible for supporting an academic, proactive environment where their expertise is employed throughout the department, the Institute, and beyond, and which further develops the individual and the Institute to be among the best.

To support DTU's elite development, the Institute will continue to offer a network for ambitious young project managers at the Institute. After completing a course with the most talented senior researchers,

the focus will be on younger researchers and assistant professors with the greatest potential for contributing to the Institute's and DTU's elite development. The course comprises eight structured meetings, and includes inspiration and discussions on how to build up your own research field, apply for external funding, develop a network, and prepare a personal plan of action. The employees are also encouraged to take steps that support the elite and talent development. One example is the establishment of an Early Career Researcher (ECR) Committee, which brings together the younger employees and supports their career paths.

#### **7.4 Attracting and recruiting**

The Institute expects that attracting new employees will be supported by the clear, prioritized, and ambitious strategy and Institute profile—supplemented with academic visibility in the research.

The recruitment of new employees must contribute to strengthening the Institute culturally, academically, and internationally as regards becoming an 'elite Institute' with a healthy degree of diversity that supports the Institute's international orientation.

The Institute goes out of its way to spot the brightest talents among its MSc students, and encourages them to do a PhD as part of the work to establish an excellent research environment.

The Institute often receives visiting researchers, and still regards this as one way of enriching the research environment and establishing contacts with leading universities with which the Institute can exchange students and researchers.

### **8. Material resources**

#### **8.1 IT**

The National Food Institute's strategy for IT infrastructure concerns the general IT workplaces, databases, and laboratory and research systems which are continually being developed in parallel. This happens while giving due consideration to IT security, including the implementation of ISO 27001 (formerly DS 484) and the quality assurance system, with particular focus on mobile units and laboratory IT.

**General workplaces:** The personal IT workplace has a crucial role to play with regard to flexibility and job satisfaction. For this reason, the Institute wants personal workplaces to be as flexible as possible. Mobile units (laptops, tablets and smartphones) will play an increasingly important role.

**Databases:** The Institute's databases contain the most significant research capital. It is therefore important to ensure data management and accessibility on an ongoing basis. The Institute collaborates with, among others, DTU Compute and DTU Bioinformatics on databases and skills development as well as with WHO and EFSA on dietary and food data. An urgent need to upgrade the Institute's dietary database to a new platform has been launched in collaboration with IT Service (AIT), and the Institute will work to improve the possibilities for merging information about dietary intake with information on exposure to chemical and microbiological food contamination as a basis for improved scientific advice—for example through an analysis platform that collects food data. This platform must convert monitoring data within nutrition, pollution, and microbiology to knowledge that can be used for both research purposes and for public use. Furthermore, the Institute is planning to build up a database of monitoring data for pesticides and other chemical pollutants for the last 10 years which is searchable and which will hopefully be accessible to the public.

It is a significant challenge that the Institute's bioinformatics pipeline (together with DTU Bioinformatics) has been developed for research purposes, but must now be used in connection with daily operations and contingency plans. This places completely new demands on uptime and support.

**Laboratory and research systems:** A large part of the Institute's IT infrastructure is to be found in the laboratory environment, where many specific requirements exist with regard to hardware and the IT environment. The objective is for data and instruments to be accessible from all workplaces, and for raw and meta-data to be captured centrally in the Institute's database environment. Strategic partnerships have been established with other departments on joint LIMS development, and the Institute is likewise working on specialist software—SAS, Origin Pro and ACD, for example—with other DTU departments.

## 8.2 Laboratory equipment/scientific infrastructure

The National Food Institute's research infrastructure has been developed to supply and maintain data about foods, health and production processes, and it is a key hub for all the Institute's activities, including participation in international partnerships, and for attracting skilled researchers from Denmark and abroad. In particular, the Institute will highlight:

**Chemical profiling and metabolomics:** The platform is part of the national food-chemical preparedness system and is incorporated in the national and EU reference laboratory work. The backbone comprises a range of modern mass spectrometers selected to provide sensitive, detailed and accurate chemical data about the contents of foods and other biological matrices. One aim is to develop a coherent analytical DTU network in partnership with DTU Bioengineering and DTU Chemistry.

**Microbiological diagnostics:** Microbiological diagnostics technology based on modern molecular biological methods forms part of the national food safety preparedness system, which supports the authorities and reinforces enterprises' self-monitoring and control at national and international levels.

**Animal facilities:** The Institute's laboratory animal facility is essential for studies of the effects of chemical substances, diet and probiotics—and its work with embryo-free animals is unique. The facilities and the Institute's expertise in the area are made available to all DTU researchers. The facilities are part of the national authority preparedness system for the Ministry of Environment and Food of Denmark.

**National food databases:** The Institute's databases constitute its most significant research capital, and comprise a range of internationally unique data that contain long time series and feature high methodological consistency. Going forward, the databases provide the opportunity to acquire much better epidemiological descriptions of foods and health of great interest to enterprises, authorities, and consumers alike. The central databases focus on:

- aromas and the evaluation of plants, mushrooms, and parts of same in dietary supplements and herbal teas
- the dietary and nutritional intake of the Danish population
- the nutrient content of foods (frida.fooddata.dk)
- chemical pollutants in foods (currently under establishment in partnership with EFSA and WHO GEMS Food)
- QSAR-predictions for the health effects of chemical substances on the basis of their structures
- zoonoses, bacteria and antimicrobial resistance.

**Food technology pilot plant:** The pilot plant has been designed to operate on a relatively small scale, where systematic studies of product/process interaction and the design of production processes can be carried out as controllable trials with minimal ingredient requirements, including what are known as proof of concept studies in collaboration with industry.

**DTU Brewery** demonstrates a polytechnic approach to biotechnological processes with a view to minimizing the resources used in the brewing process and developing new processes and products. The running of the brewery is to a very large extent based on the students' efforts and activities. The Institute collaborates with other departments at DTU on better utilization of the pilot plant and DTU Brewery for teaching and innovation.

**DTU Centre for Hygienic Design** is located at the National Food Institute in cooperation with IPU, Staalcentrum and EHEDG Denmark. The centre combines research, education, and consultancy for the biotech and food industry within hygienic design, and also has the same status as the official EHEDG test centre in Denmark with DANAK accreditation for the hygiene certification of production equipment.

The Institute wants a joint DTU infrastructure cooperation within open science and the utilization of the Institute's data, animal facilities, a chemical centre of excellence, a fermentation platform, innovation hubs, and several other initiatives. In connection with joint localization at Lyngby Campus, much of the Institute's infrastructure is being upgraded.

### **8.3 Premises**

In 2017, the Institute was placed together at Lyngby Campus, in particular in Buildings 201-205 together with DTU Aqua and DTU Vet.

The three Institutes cooperate closely, and have set up a number of interdisciplinary working groups in order to explore the possibilities for using laboratories, equipment, and competences across the Institutes—among other things within the fields of microbiology, histology, immunology, and gut health.

## **9. Communication**

The National Food Institute's communication goals in the coming years are focused on:

- raising awareness of how the Institute's research results and consultancy within food and health make a difference by leading to knowledge and technological solutions that prevent illness and promote health, making it possible to feed a growing world population, as well as developing sustainable food production
- rendering visible the life sciences and bioengineering at DTU
- communicating the importance of scientific advice for the food safety authorities in particular and how they handle food safety and nutritional information in Denmark
- marketing DTU's food study programmes to potential students and employers of BEng and MSc Eng graduates
- supporting internal communication, especially through DTU Inside and the use of info screens.

The Institute will continue to prioritize news and press work in Danish and English at a level that supports the above goals via the Institute's website, [food.dtu.dk](http://food.dtu.dk), the Institute's international Twitter and LinkedIn profiles, as well as PR activities.

In this connection, the Institute will continue to coordinate the communication of messages which are important for food safety and nutritional health in Denmark with the authorities. The Institute will also communicate the results of risk assessments and other news from the European Food Safety Authority (EFSA) in Denmark, which is part of being an EFSA focal point in Denmark. Finally, sections on the Institute's website on selected topics of particular strategic importance or general interest will be further developed.

The Institute will also implement the communication plan which has been prepared in 2017 to highlight DTU's food study programmes, promote admissions, and strengthen collaboration with employers in connection with internships and project collaborations.

## **10. Process and employee involvement**

The National Food Institute's development goals and measures (UMV) have been prepared on the basis of a long process, in which the Institute's employees have been involved in many ways.

The Institute's heads of studies and lecturers have contributed to preparing Chapter 2 on education and teaching. In connection with the UMV process, all the research groups have, in Chapter 3, updated the description of their strategic focus for the next UMV period. The cooperation committee's B side has had the opportunity to provide input to Chapter 7 on employee development. A coordinator for the management team has been appointed to prepare individual parts of the UMV, and the management team has discussed the Institute's development goals and measures at several management meetings. All the development goals and measures have been finally edited by the Institute's secretariat and approved by the Director of Institute.

Following the presentation of the development goals and measures (UMV) to the Executive Board of DTU, the respective heads of departments will present an outline at open staff meetings.