

# Research strategy for the food industry

2018–2025

Finnish Food and Drink Industries' Federation





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# PREFACE

**GLOBAL FOOD PRODUCTION** is facing unprecedented challenges. Food and nutrition evoke great emotions, and strong values are attached to them. Population growth and the economic and nutritional inequalities of the population continue to be strong in the coming years. Ageing and urbanisation are worldwide megatrends that bring about the need to develop new types of products and models for the food industry at an accelerating pace. Despite this growing need, food production must be more durable and must be able to save natural resources better than before. Consumers' awareness of the environmental impact of the food chain is growing and consumers' interest in their own well-being and the transparency of the food chain is increasing.

The Finnish food industry is part of a global system. The Finnish food industry wants to play its part in sustainable growth and the intelligent use of clean raw materials, Nordic production areas and growth conditions as well as high-quality know-how.

As the business environment is changing rapidly, which is also due to technological development, the Finnish Food and Drink Industries' Federation considered it necessary to update the research strategy of the food industry to create guidelines for research emphasis in order to promote the sustainable growth of the sector. The strategy process was carried out in cooperation with research institutes, universities and financiers in the field. The work was started in May 2017 by sending a Webropol survey about the strategy's goals and priorities to key research organisations, companies and authorities. The work was continued with two workshops to determine the objectives and the thematic priorities as well as the proposals for implementation, facilitated by the VTT Technical Research Centre of Finland. The strategy work clearly showed that, in order to grow, the food industry needs to cooperate with other industries. We hope that the research strategy for the food industry will act as a catalyst for joint development and fruitful dialogue. The Federation's research committee wishes to express its warmest thanks to all the experts involved in the work.

Chairman of the research committee of the Finnish Food and Drink Industries' Federation Anu Kaukovirta-Norja, Research and Technology Director, Valio Oy

# SUMMARY

THE FOOD INDUSTRY RESEARCH STRATEGY will guide how research and collaborative research will support the growth potential and profitability of the food industry in the future global business environment and how they will create the conditions for more sustainable food production in Finland. The government's food policy report, Food 2030, sets challenging national goals that can best be met by strong know-how and cooperation between industries.

The strategy identifies four evolutionary forces in the food business environment: 1) pressures caused by global warming and related environmental changes; 2) increased environmental awareness among consumers; 3) opportunities brought about by digitalisation to develop value networks in the food sector, production technologies and consumer-driven food services; 4) development of new production technologies.

## The strategy has been crystallised to the following vision:

Innovative and responsible Nordic food production enables a competitive food industry and consumer well-being, both in Finland and globally.

### THE OBJECTIVES OF THE STRATEGY ARE

- Raise the Nordic dimension by means of research into the competitive edge of the Finnish food industry while strengthening national food safety and self-sufficiency.
- Promote intelligent and sustainable use of resources in the food supply chain.

- Maintain and further develop food safety and contribute to the transparency and traceability of food supply chains.
- Bring added value through research to the development of food innovations that support consumers' well-being.
- Maintaining and developing a high level of expertise in R&D within the Finnish food industry: supporting research and product development cooperation through the entire food supply chain, increasing the interaction between research areas, and developing high-quality food research environments.

To achieve these objectives, four research priority areas have been identified: 1) resource-efficient Nordic food production, 2) digital food consumer services, 3) innovative production technologies and 4) food that is proved to increase well-being. The strategy is made up of key research themes for the focus areas. In the implementation of the strategy, the focus is on building projects promoting research and collaborative product development within the identified priority areas while crossing disciplines and research boundaries as well as building cooperation and piloting forums. The food industry takes an active role in securing funding for research in the field and promotes various ways of communicating and cooperating in the food industry to achieve its strategic goals.



# STARTING POINTS FOR UPDATING THE RESEARCH STRATEGY:

responsible Nordic food  
production as a strength

**THE IMPORTANCE OF THE FOOD INDUSTRY** has a major impact on the national economy. Food industry companies employ 37,600 people directly and 68,800 people indirectly. As a whole, the food industry, therefore, employs a total of 106,400 people, or over four per cent of Finland's total employed<sup>1</sup>. The turnover of the food industry is EUR 10.7 billion, with an indirect value added of EUR 6.1 billion. In addition, the competitive food industry enables Finland to produce significant raw materials and its value added processing. The value added by the whole food supply chain is over EUR 15 billion, covering 9% of total value added in Finland<sup>1</sup>.

Currently, EUR 1.6 billion in food and beverages are exported. The objective is to double exports by 2020. Research and innovation, and the commercialisation of innovations play an important role in achieving this goal.

In 2011, the food industry devised a national research strategy to promote research that supports the competitiveness of the food industry. The main focus areas of the strategy, sustainable and profitable production, and consumers' well-being, are still topical. However, after the 2011 research strategy was drawn up, there have been changes in the food industry's business environment, and, as a result, an update of the strategy is deemed necessary.

## Opportunities for responsible Nordic food production

Food production is an area where pressures from global population growth and climate change have an immediate impact. Global food production is also affected by the anticipated decrease of water resources and the reduction of usable cultivated land. In this situation, the importance of global food safety and responsible, resource-efficient production is further emphasised in domestic food production. Consumer interest in well-being and environmental issues has also increased. The change in consumer behaviour due to the growth of environmental awareness has been reflected in Finland, among other things, in the rapid growth in demand for vegetable proteins.

According to Natural Resources Institute Finland's 2015 Arctic food production report, Northern conditions have saved our domestic production chains from a

number of mass-production problems, such as groundwater and soil chemicalisation <sup>2</sup>. The strengths of Northern food production include the lack of plant diseases, the cleanliness of the cultivation environment and a long history of ensuring the welfare of farm animals. Concrete evidence of responsibility taken with regard to production chains includes the lack of salmonella and the low use of antibiotics in animal production. However, the Northern dimension and the strengths it brings forth have so far been poorly exploited as a competitive advantage for the food sector.

## New production technologies for a changing environment

Reducing food production's strain on the climate and a renewed utilisation of side streams have been raised in Finland as targets of the national bio-industry strategy. In 2015, the European Commission published the union's circular economy package, and in Finland, as the first European country, a circular economy road map by Sitra was published in 2016 <sup>3</sup>, in which a sustainable food system was pointed out as one of five national priorities for the circular economy. The Finnish Food and Drink Industries' Federation has embraced the promotion of the circular economy objectives by commissioning its report on waste and side streams in 2016, for example <sup>4</sup>.

Increasing resource efficiency in the spirit of bio-industry and the circular economy requires companies in the industry to reduce food waste and to make more efficient use of side streams of food production and consumption, possibly in other industries such as the chemical industry or energy production. In addition to the circular economy objectives, the environmental change caused by climate change also requires the development of new production technologies and processes as well as reforms in the raw material base. The development of resource-efficient processes and production technologies combined with the utilisation of the expanding raw material base provide the food industry with a wealth of new innovation opportunities. Many of these opportunities require unbiased collaboration in research and product development beyond industry boundaries.

## Food production in a digitalising business environment

The value networks of future food production are also being shaped by the accelerating pace of digitalisation. As the digital revolution progresses, ICT becomes increasingly seamlessly integrated into the value chains of the food industry, whereby information on foods and their manufacturing process becomes a key factor of production. With digitalisation, new types of data-driven operating models will emerge in food production in the near future, which could greatly alter the competitive situation in the sector, also globally.

We are currently in the process of transition to digitalisation, and so far it is uncertain as to which possibilities offered by digitalisation will prove to be working. The use of large information resources, i.e. big data, in food production is still at an early stage. Emerging tracking technology and automation offer opportunities to develop new types of remote-controlled, modular, near-consumer and consumer-engaging production units. The development of new logistics services is based on traceability technologies (blockchain), smart warehouse management systems and IoT solutions which, in the future, will change the food supply chains' service models and distribution networks. Digitalisation is believed to change the way people consume as well as make the consumer's role in the food supply chain more active than before. The development of food services that take into account various nutritional needs and preferences is currently in progress, and the importance of data-driven, entertaining and individual food services will increase in the future.

The role of digitalisation in the transformation of value chains in food production has recently been the subject of interest to industry players. This topic has been discussed, among other places, in the bioeconomy digitalisation road map <sup>5</sup> jointly drafted by the VTT Technical Research Centre of Finland and the Natural Resources Institute Finland and published in 2017 as well as in the Food Industry 4.0 Vision <sup>6</sup> by VTT in cooperation with operators in the food industry. According to both reports, digitalisation also brings about fundamental changes to food production value chains.

Finland has excellent prerequisites to become a leading country offering internationally competitive, tailor-made food solutions as a result of its high technology know-how, its high-quality basic research into the effects of food and beverages on well-being as well as its internationally unique data records on nutrition and health at the population level. This is an opportunity that should be grasped deliberately. It requires more research collaboration between technology experts, data-driven business experts and food industry experts.

## A research strategy for the food industry as part of the national and European food policy

The government's food policy report, Food2030, seeks to promote a responsible, sustainable food system<sup>7</sup> at the national level, which supports social well-being. According to the food policy report, research in Finland involving the food system is in many respects at a good level. The challenge, however, is the fragmentation of research. The report identifies the need to achieve more multidisciplinary cooperation and networking in Finland, cross the boundaries of various research fields and improve the research field's internationalisation.

The research strategy for the food industry lays out how the national targets, which are set out in the food policy report, can best be pursued through collaborative research, while supporting the growth potential and profitability of the food industry in a changing operating environment. The strategy has been drawn up in cooperation with industry players and has been based on the development of responsible Northern food production in cross-sector cooperation networks.

The importance of international research cooperation will continue to grow. At the EU level, EIT FOOD<sup>8</sup> and ETP Food for life<sup>9</sup> are the cornerstones of EU-wide strategic research and innovation agendas. The goal of both institutions is to promote the sustainability of the food system and to promote consumer well-being and health through healthy nutrition and behavioural changes along with the help of research. These objectives are in line with this food research strategy. For an internationally competitive food research and food industry, it is important to continue to consistently support the capacity of Finnish players

to shape the European research agenda, to build international research collaboration and to acquire international research funding.

In addition to aligning the focus areas of R&D, the research strategy aims to promote the emergence of novel food research innovation networks. Industry and research institutes have a long and proven tradition in research collaboration. It would also be important for the development of the industry to create research and innovation platforms to facilitate the agile participation of start-ups and SMEs in research cooperation. In basic research, competitive research environments are a prerequisite for research institutes' ability to attract experienced researchers from international research markets and to bring forth new visionaries in the field.

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# VISION, OBJECTIVES AND PRIORITY AREAS OF THE FOOD INDUSTRY RESEARCH STRATEGY 2025

**THE FOOD INDUSTRY NEEDS** high-quality research as well as collaboration in research in order to foster the vision crystallised in the strategy work: Innovative and responsible Nordic food production enables a competitive food industry as well as consumer well-being in Finland and globally.

## **THE FOOD INDUSTRY RESEARCH STRATEGY HAS FIVE MAIN OBJECTIVES**

- Raise the Northern dimension by means of research as the Finnish food industry's competitive edge while strengthening national food safety and self-sufficiency.
- Promote the food supply chain's intelligent and sustainable use of resources.
- Maintain and further develop food safety and promote the transparency and traceability of the food supply chain.
- Through research, bring added value to the development of food innovations that support consumers' well-being.
- Maintain and develop the Finnish food industry's R&D know-how at a high level of expertise: supporting research and product development collaboration throughout the entire food supply chain, increasing the interaction between research areas, and developing high-level research environments in the food industry.

## Focus areas of the research strategy

To achieve these goals, four priority research areas have been identified and their key research themes have been outlined.

### 1. Resource-efficient Nordic food production

Resource-efficient food production takes into account the special requirements set by the Northern conditions and minimises the environmental burden caused by food production and consumption as well as the emergence of side streams without compromising food quality. The aim in the food supply chain is towards wastelessness by developing new industrial processes that enable more efficient use of raw materials and by looking for solutions for utilising side streams. An essential part of these solutions are packing, logistics and distribution chains and monitoring systems that support the minimisation of wastage. The goal is also to support the consumer in environmentally sound solutions. To build up production chains that work well in terms of the environmental burden, more basic information is also needed on the environmental impacts of production and consumption as well as cooperation between food research, technology research and environmental research.

#### KEY RESEARCH THEMES

- Special needs and strengths of Nordic food production: raw material production taking advantage of northern conditions, optimisation of resource utilisation in the food supply chain and efficient organic production.
- Zero waste production: circular economy in the food supply chain and wasteless production. • Product responsibility trace: sustainable solutions to consumers by combining environmental sustainability and nutrition Information.
- Avoiding new threats to new plant and animal diseases and maintaining high food safety in a changing climate.

### 2. Consumer food services in the digital era

The digital transition has significantly changed the operating environment of food production. Cheapening data collection technology, faster and more stable information networks, available cloud services, and evolving data analytics create opportunities for developing new types of consumer-driven product and service innovations. Digitalisation has also changed the expectations that consumer attach to services and has provided consumers with new ways to gather information and participate in the rendering of services.

Consumer-driven innovations are based on the ability of food production to identify the individual needs of consumers through available data, including in the export market. In addition, competitive advantage can be increased by utilising new food processing methods and technologies that enable flexible, tailor-made solutions to meet the individual needs of consumers. Intelligent user interfaces, combined with new production technologies, enable completely new types of food solutions in the consumer interface. Full utilisation of the opportunities offered by digitalisation in food production requires systematic cooperation between the experts in manufacturing processes, data analysis and digital services as well as between food and consumer research specialists.

#### KEY RESEARCH THEMES

- Data-driven and personalised catering services: the development of personalised nutrition and of itemised mass production.
- Taking into account the ongoing consumer transformation, including the rise of active and participatory consumerism (prosumerism), in the value networks of food production.
- Added value and well-being from service concepts and new technologies based on health data: understanding, verifying and utilising food's diverse impact on well-being in service concepts.
- Traceability of the food supply chain as a service to consumers: interaction from initial production through the value network to the consumer as well as from the consumer experience back to production.
- The opportunities of the Internet of Things (IoT) and artificial intelligence for the food supply chain.

### 3. Innovative production technologies

The cornerstone of the development of sustainable food production is the combining of unbiased science and technology. Development is grounded in cooperation in food science, life sciences and technology research. Production and growth solutions are diversified, and their demand is also seen in the export markets. Alongside technological advances, we need to develop methods, refine them, and secure and clarify the safety of new solutions. Utilising data in decentralised production and monitoring traceability of production is an area where collaboration between food research and technology research can significantly enhance the functioning of the food chain and provide a basis for new, networked production methods.

#### KEY RESEARCH THEMES

- Research on production technologies required by sustainable development and new raw materials: development of process- and material-technical know-how, development of energy efficiency, development of packaging technology.
- Accelerating refinement with the help of new biotechnology tools - genomic refinement and new plant breeding technologies (NPBT)
- Research on new production and growing technologies: development and study of the growing conditions, methods and technologies for 'food without fields' (closed systems, future greenhouses/fields, vertical cultivation) and new production organisms (insects, microbes, plant cells and algae)
- Distributed, remote-controlled modular production solutions and the technologies that enable them.
- Ensuring and managing the safety and acceptability of new production processes.

### 4. Food that is proved to promote well-being

Finland has internationally high-quality expertise in nutrition research, and Finnish companies have been pioneers in developing functional food. This foundation provides excellent conditions for the development and production of foodstuffs that support consumer health and well-being, which are competitive in the export market.

The development of health-promoting foods developed for the needs of different consumer groups should be based more strongly than ever on studied and clearly verifiable information on the health effects of food.

Success requires well-functioning cooperation between nutrition research, medicine, food technology and research into consumer well-being. By strengthening cooperation, it is possible to better productise the know-how in Finland of foods which impact well-being and to create new products for export.

#### KEY RESEARCH THEMES

- Raising Nordic food, which promotes well-being, as an export strength: innovative, nutritionally high-quality raw materials and products
- Research and productisation of the correlations between food and impacts on well-being, health promoting foods as well as research into special diets and productising and exploiting that know-how in export.
- Research on the impacts of food regimes on public health and the national economy.
- Utilising the One Health concept of common health for humans, animals and the environment in Finnish food production.
- Nutrition as part of the new Healthtech services.



# EXECUTION, COMMUNICATION AND MONITORING OF THE RESEARCH STRATEGY

THE FOOD INDUSTRY'S RESEARCH STRATEGY lives with its time and is regularly reviewed in key forums, such as the Food Week. The strategy guides the activities of the Finnish Food and Drink Industries' Federation in relation to research.

Various ways and suggestions for action to implement the strategy's goals are summarised below:

## COOPERATION AND NETWORKS

With regard to the priority areas laid out in its research strategy, the food industry promotes cooperation across sectors and research boundaries, and builds cooperation forums. The need has been identified in particular in

- a. combining food know-how and health technologies to develop new services and products
- b. promoting cross-disciplinary research in support of the competitiveness of the food sector, together with operators in the forestry and packaging industry, and the trade and distribution chain
- c. safeguarding and developing the prerequisites for major pilot platforms
- d. explaining the opportunities opening up to the food supply chain by digitalisation (IoT, artificial intelligence and big data), together with technology experts
- e. the opening up of public information resources supporting research and development in the field for research purposes, and
- f. clarifying standards, privacy protection standards and access rights supporting data recoverability.

## **PUBLIC RESEARCH AND DEVELOPMENT FINANCING AND INTERNATIONAL ACTIVITIES**

The food industry plays an active role in ensuring research funding in the field.

- a. The Finnish Food and Drink Industries' Federation (ETL) and its member companies actively inform decision-makers of the importance of the food industry and the significance of research on innovation and competitiveness in the field.
- b. The ETL cooperates closely with the Finnish Food Research Foundation to target research funding to the themes highlighted in the strategy.
- c. ETL is actively involved in providing information about the funding and cooperation opportunities provided by EIT Food, and in shaping collaboration networks to take advantage of funding opportunities.
- d. ETL takes part in promoting Nordic cooperation through, for example, the Nordic Food Nexus network.
- e. In its lobbying, ETL emphasises the importance of the industry and the significance of research funding as a prerequisite for the success of the food industry.

## **FOOD INDUSTRY COMMUNICATION AND COOPERATION**

- a. The research strategy for the food industry is discussed in key forums for its operators.
- b. The food industry promotes (national) coordination of food research.
- c. The food industry communicates about new technologies and thus promotes the social acceptance of innovations.
- d. The food industry contributes to the transition to the bio- and circular economy by participating in cooperation between industry federations.

Finnish Food and Drink Industries' Federation



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