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for solutions of tomorrow

COLLABORATION

THE BUSINESS CULTURE THAT BUILDS A STRONG FOOD CLUSTER

INSIDE THIS WHITE PAPER:

- **Innovation happens where minds meet**
- **Harvesting the benefits of the digital revolution**
- **Empowered employees are a business asset**

FOOD NATION
Solutions of tomorrow
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Collaboration

The business culture that builds a strong food cluster
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Photo credits

Front page photo: Peter Larsen

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EXECUTIVE SUMMARY

Sustainable food production is one of today's most important challenges. In Denmark, businesses, academia and research institutes and authorities are all working together to develop innovative solutions that will help feed the growing global population.

Cross-disciplinary collaboration is characteristic of the Danish food cluster, which ranks among the strongest centres for food knowhow and innovation in the world. It is also key to reaching the UN Sustainable Development Goals.

> Collaboration is a source of empowerment that sets new ideas free and keeps the wheels of innovation rolling

The roots of our collaborative culture lie in the Danish cooperative movement. Starting in the late 19th century, the first farm cooperatives demonstrated the power of pooling resources and knowhow to mutual benefit. Trust, openness and a willingness to share are still fundamental values. Through collaboration, Danish companies are able to maximise their resources and capabilities and target new opportunities in global markets.

This white paper is all about the Danish approach to collaboration – from its humble origins to the development of an impressive food cluster with a global presence.

By combining knowledge and expertise across the food value chain, Danish companies have developed the highest standards of food safety – influencing the international standards that ensure safe and nutritious food for all. The partnerships behind Denmark's advanced digital technologies are today helping to drive us towards a sustainable future.

For the people working in the Danish food cluster, collaboration is a source of empowerment that sets new ideas free and keeps the wheels of innovation rolling. A proven asset for every business.

We invite you to explore more at www.foodnationdenmark.dk

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SUSTAINABLE DEVELOPMENT GOALS

Supporting the SDGs – how does Denmark contribute?

The UN's 17 sustainable development goals (SDGs) have become an important topic for companies, organisations and stakeholders within the Danish food cluster. Collaboration will be key to their achievement.

Many have pinpointed how they actively support the goals. At national level, we see the SDGs as a guiding light for establishing best food production practices, prioritising research and development efforts and identifying innovation targets that will drive us towards a sustainable future.

FOREWORD

Photo: Steen Brogaard

The Danish food cluster has gained international recognition. Thanks to the culture for collaboration, its global reputation stays strong.

Denmark is a world-leading food nation. The Danish food production can feed almost three times our population. We develop knowledge, ingredients, equipment and solutions that support global food production. And we have a reputation for impeccable food safety, reliable quality and strict controls.

Much of this strength comes from the extensive collaboration that takes place between food industry stakeholders: trade unions, business owners, national authorities and educational institutions.

Our collaborative spirit can be traced back to the late 19th century, when it gave birth to the Danish cooperative movement. Since the Second World War, we have joined forces to revolutionise the quality of our food production, eradicate disease among livestock and drive the Danish food cluster in an ever more sustainable direction.

Denmark has a strong tradition for identifying challenges and enabling the dialogue that leads to solutions. Whether responding to consumer demands for innovative, high-quality foods or cooperating with global business partners, the Danish food cluster continues to develop its culture for collaboration. The flat Danish management structure supports this by inspiring a high level of employee involvement and responsibility and, through that, a spirit of openness and trust.

> collaboration is the most effective means to improved innovation, productivity and compliance with standards and legislation

The extensive collaboration between food industry stakeholders holds the key to solving many of today's global food challenges. And it has an essential role to play in reaching the ambitious goals of the Danish government – to implement the sustainable development goals, to cut greenhouse gas emissions by 70% in 2030, to reduce food waste and to support farms in the transition from conventional to organic production.

The benefits of collaboration extend far beyond commercial gains. In our long experience, collaboration is the most effective means to improved innovation, productivity and compliance with standards and legislation. This is also our experience when sharing, for example, our food safety knowledge and sustainable farming expertise across international borders.

This white paper gives a deeper insight into the Danish culture of collaboration. I am delighted to share it with you and hope you will be inspired.

Jacob Jensen

Minister for Food, Agriculture and Fisheries

CHAPTER 1

TODAY'S COLLABORATION, TOMORROW'S OPPORTUNITIES

FROM FARMER-OWNED COOPERATIVES TO MULTINATIONAL GROUPS

Photo: Arla Foods

Photo: Peter Larsen

Denmark is the land of cooperatives. Since the first cooperative was founded 150 years ago, collaboration, knowledge sharing and mutual trust have made the Danish food cluster one of the most innovative in the world.

Until the second half of the 19th century, Denmark's agricultural economy was based on small, independent farms, which were facing increasing competition from larger farms in other countries. The answer was the cooperative – farmer-owned enterprises where the members pooled their economic resources and built factories that could produce uniform, high-quality products faster and more efficiently. Profits were shared, and Danish farmers soon experienced that their livelihoods improved.

After the first cooperative dairy was established in 1882, the cooperative movement spread rapidly throughout the country, encompassing slaughterhouses, egg exporters and feed mills.

The model completely transformed the Danish farming industry. Before long, bacon, butter and eggs from Denmark enjoyed significant market shares abroad.

Production methods and technology have changed radically since, but the culture for collaboration remains. Denmark's strong reputation on many export markets still depends on knowledge sharing, continuous innovation and mutual trust across the food sector.

> Knowledge sharing, continuous innovation and mutual trust across the food sector

Visionary food technology

Today, the farmer-owned cooperatives are powerful multinational companies with global reach. Visionary Danish enterprises support them by delivering a constant stream of innovative technology to produce world-class foods – advanced knowhow that has become a valuable export commodity itself.

Photo: Danish Technological Institute

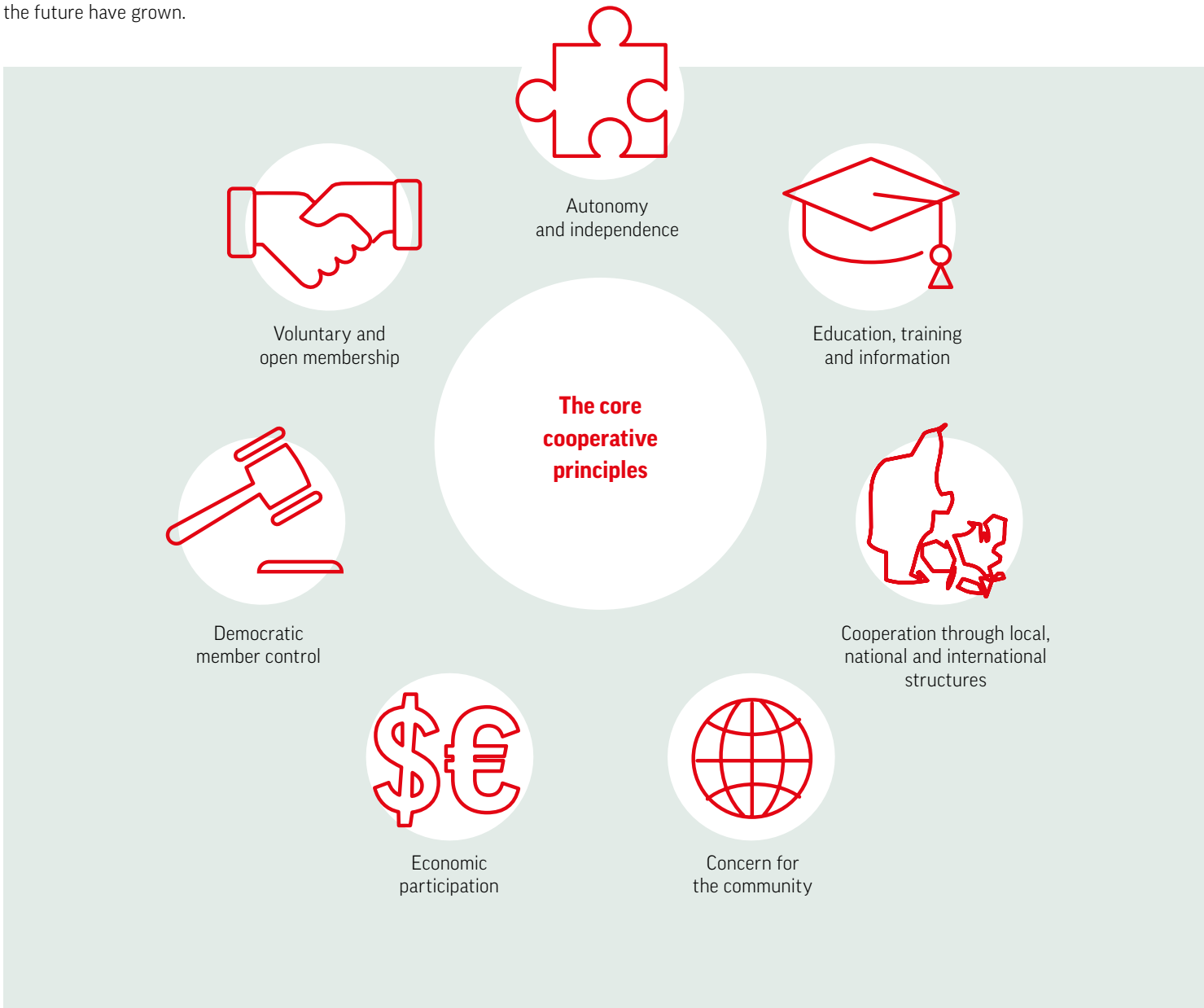
To ensure high standards of environmental protection, quality and traceability, the food cluster has invested further in cross-sector alliances between farmers, industry, trade unions and research institutions, both national and international.

Along with the soil, talented people are Denmark's most important natural resource

The goal is to secure a well-trained and highly competent workforce – on farms, in factories and in laboratories. Along with the soil, talented people are Denmark's most important natural resource.

This farm-to-fork collaboration is behind the constant development and unmatched efficiency of Denmark as a food nation. From the needs of the past, the opportunities of the future have grown.


Photo: Food Nation



PIONEERING FEED ADDITIVE TO REDUCE METHANE FROM COWS

Can bioactive compounds in Nordic macroalgae be used to limit methane production in cow stomachs? Danish researchers are investigating the possibility in a project to pioneer a new methane-reducing additive for cattle feed.

Initial findings suggest there could be potential to cut cow methane emissions by at least 45% with no negative consequences for productivity, animal health or food safety.

Aarhus University is leading the partnership project, which started out by harvesting and cultivating macroalgae species with known anti-methanogenic properties. From them, a handful of promising compounds are being identified through in vitro simulation.

> Macroalgae could cut cow methane emissions by 45%

The ultimate test of the bioactive compounds will be a controlled feeding trial with dairy cows, measuring the impact on methane generation alongside milk production, health and other key parameters.

The plan is to patent and commercialise the additive within five years of the project's completion in August 2025. As no additive for effective methane reduction is currently available, market demand is expected to be high.

Case by Danish Technological Institute, Ocean Rainforest, Lactobio, Novonesis, Vilofoss and DLG.

COOPERATION DEVELOPS A PREDICTIVE MODEL TO KEEP SEAFOOD SAFE

Bacteria control in lightly preserved and ready-to-eat seafood is no longer a global challenge following a long collaboration between the seafood company Royal Greenland and the Technical University of Denmark (DTU). Together, they have produced and tested a refined mathematical model for predicting the growth of Listeria monocytogenes and guaranteeing food safety right through shelf life.

Researchers at DTU began developing the model in the early 2000s by taking measurements from smoked salmon and Greenland halibut samples. This included investigating the effect of 12 environmental factors on listeria growth, such as storage temperature, pH, salt, organic acids and smoke content.

Royal Greenland has subsequently tested the model continuously, implementing the findings in daily operations in the smokehouse and other production units that produce prawns in brine and other ready-to-eat seafood.

Software based on the model now makes new product development faster and easier, eliminating the need for lengthy trials. When environmental data is tapped into the software program, the impact on food safety parameters is evaluated in an instant.

Photo: Arla

> In addition to predicting bacteria growth, the research has shown that, when harmless organic acids are added to lower the ph of a product, listeria is unable to grow

In addition to predicting bacteria growth, the research has shown that, when harmless organic acids are added to lower the pH of a product, listeria is unable to grow.

Today the software growth models are available as open source tools and are also verified for use in the global meat and dairy industries.

The project received funding from the Danish Ministry of Food, Agriculture and Fisheries and the Green Development and Demonstration Programme.

Case by Royal Greenland.

CHAPTER 2

INNOVATION HAPPENS WHERE MINDS MEET

THE TRIPLE HELIX MODEL AT THE HEART OF THE FOOD VALUE CHAIN

Photo: Arla Foods

Knowledge-sharing partnerships between industry, academia and authorities make the route to food innovation smoother and faster.

The ability to gather stakeholders around a table is vital to Denmark's success as a food nation – and envied by many. It is through such collaborative meetings of minds that many mutual interests and challenges are uncovered and the wheels of innovation set in motion.

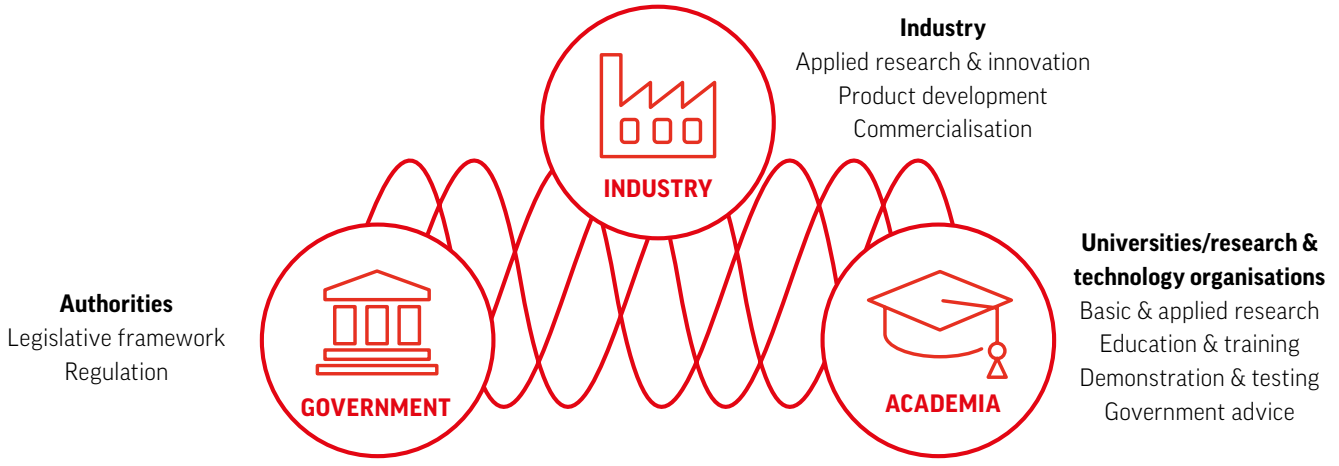
> Denmark is the third most concentrated, food-exporting cluster in the world

Between all stakeholders in the food cluster, there exists a durable interdependency where roles and responsibilities are clearly defined. It runs from primary agriculture and fisheries to manufacturers of ingredients, food, technology and equipment, from local to national authorities and among universities and knowledge institutes. This triple helix model – involving industry, academia and government – is the foundation of Denmark's strongly innovative and coherent value chain.

A supply chain in your neighbourhood

Being a small country devoted to food innovation certainly has its advantages. It means that everything is nearby, whether you are looking for a production site, an export partner or a leading consultant for your next project. Internationally, Denmark is recognised as having the third most concentrated, food-exporting cluster in the world, relative to its size.

Companies in Denmark regularly draw on this easily accessible expertise because they know they can achieve far more together than alone. The high level of trust in Danish society fuels this understanding. When you partner with a Danish company, you gain access to an entire ecosystem of knowledge and innovative power. You will soon find that you are not doing business with just another partner. You are partnering with a mindset – one that has proven highly profitable for many generations.



Source: Danish Industry and Danish Agriculture & Food Council

Drivers of an innovative reputation
This concentration of expertise and collaborative mindset are important drivers of Denmark's strong reputation for innovation – and no. 1 ranking in a benchmark study of the food industry in ten European countries. Here, Denmark received top scores for all innovation indicators, including collaboration, research & development, knowledge, business environment, patents and revenue.

Denmark has bilateral cooperation with a multitude of countries

From scientific research to business value
The strong ties between leading universities, research institutes and companies within the Danish food cluster are unrivalled. So when, for example, the food authorities introduce new legislative requirements, this close collaboration across the research value chain ensures practical solutions are found.

Through the universities and research institutes, companies gain knowledge and access to advanced equipment, databases, lab facilities and pilot plants. This is where a lot of scientific discoveries and developments are made.

Experience shows that collaborative clusters of small, medium-sized and large enterprises are often a prerequisite for successful innovation. One of the research institutes' most important roles is to help companies put the latest research findings into use, solving challenges and adding value to their business.

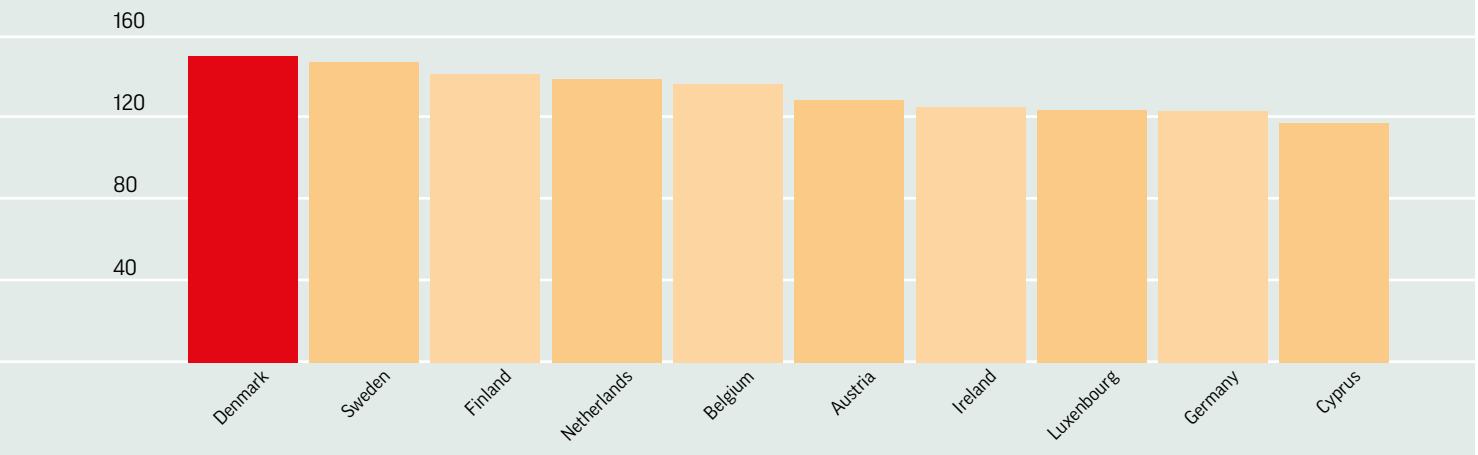
Public-private cooperation on international standards
The close interaction between our public and private sectors speeds up the journey from innovative research to a successful commercial product. Working with farmers and food manufacturers, the Danish authorities ensure strict compliance with relevant national and international rules. This has been a prime factor in eliminating a range of animal and animal-borne diseases among Danish livestock – including the eradication of salmonella in Danish poultry.

When it comes to food and veterinary safety, the national authorities are responsible for policy development and risk management. Universities and research centres provide the independent scientific knowledge and risk assessments required for this purpose.

Involving industry, academia and government is the foundation of Denmark's strongly innovative and coherent value chain

Denmark has bilateral cooperation with a multitude of countries and is an active participant in the work of international standard-setting bodies, such as the World Organisation for Animal Health (OIE) and Codex Alimentarius. Through Strategic Sector Cooperation (SSC) projects, the Danish government deploys sector counsellors at foreign embassies to share experiences, ideas and solutions that can solve specific challenges in a partner country. Food-related SSC projects are currently underway in China, Indonesia, Vietnam, Kenya, Mexico, Nigeria and South Africa for example.

Top 10 EU Countries based on Index of Food Innovation



Source: European Innovation Scoreboard 2024

BISCUITS AND BEER MAKE PERFECT PARTNERS

A good example of how collaboration can create more value with less input and support the circular economy

Spent grain leftovers from beer production can be a tough challenge for a small brewery with sustainable ideals. On the small Danish island of Møn, the local brewery has come up with an innovative solution in collaboration with biscuit producer Bisca.

Instead of sending grain waste to local farms for cow or pig feed, Møn Brewery now sends the by-product of its beer production to its partners at the Bisca factory. The outcome is a delicious new line of Møn biscuits – great for serving with fine cheese and a glass of the local brew.

The brewery produces 66,000 gallons of beer a year. That provides enough spent grain for Bisca to maintain steady production of its biscuit line, which has rapidly become a hit with consumers. A good example of how collaboration can create more value with less input and support the circular economy.

Case by Bisca

Photo: Bisca

SUSTAINABLE WATER TECHNOLOGY SAVES A VALUABLE RESOURCE

Photo: Food Nation

A public-private partnership aims to reduce water consumption by 15 to 30%

The food industry consumes a lot of water – both in Denmark and around the world. But perhaps not for much longer. A public-private partnership aims to reduce water consumption by 15 to 30% in Danish food companies by 2025.

The Danish Partnership for Resource and Water-Efficient Industrial Food Production (DRIP) is developing new sustainable technology to reduce groundwater consumption and increase the use of purified recycled water – without compromising food quality and safety.

All solutions are tested in pilot or full-scale at the food production plants. At the Carlsberg soft drinks plant in Fredericia new water treatment technology has reduced wastewater discharge from 130 million litres a year to almost zero from the water pre-treatment step.

The five-year partnership consists of several food companies and technology suppliers, three universities and an Advanced Technology Group (GTS) institute.

Case by Danish Agriculture & Food Council

WHOLE GRAIN PARTNERSHIP COMBINES BUSINESS WITH HEALTH

Danish consumers have increased their intake of whole grain considerably since 31 partners from food authorities, health NGOs and the food industry got together and formed the Whole Grain Partnership in 2008.

In 2024, Denmark raised the recommended daily intake of whole grains from 75 grams to 90 grams. This change coincided with a growing demand for wholegrain products in the country. Prior to the campaign, the lowest 25% of wholegrain consumers in Denmark averaged 12 grams per day. Currently, the minimum consumption has risen to 34 grams, with the average Dane now consuming 82 grams daily.

Collaboration gives new opportunities to expand the market for whole grain products

The partnership not only contributes to better public health. For food manufacturers, it has created a new opportunity to expand the market for whole grain products.

In other words, the partners have successfully combined health and business objectives. An inspiration for other organisations to pursue the partnership option.

Case by The Whole Grain Partnership

Photo: The Whole Grain Partnership

KITCHENS PUT DENMARK ON THE ORGANIC DINING MAP

Organic food is an attractive selling point for Danish restaurants, canteens, cafés and caterers. Since the introduction of the Organic Cuisine Label, kitchens have taken organic food to new heights.

The turning point came in 2009 when the Danish government presented a new state-controlled labeling programme. This awards professional kitchens with a gold (90-100%), silver (60-90%) or bronze (30-60%) label, according to the percentage of organic products on their menu.

Today, more than 3500 kitchens have joined the programme, which set out to meet the growing demand for organic food and has encouraged even more consumers and chefs to make organic choices.

Denmark is the country in the world that buys most organic products per capita

For consumers, the labels have made it much easier to find organic restaurants and cafés when eating out. The food service sector has gained a new marketing opportunity and helped Denmark become the country that consumes more organic food per capita than anywhere else in the world.

This success is largely due to close collaboration between wholesalers, the food service sector and the public sector.

Case by The Danish Veterinary and Food Administration

Photo: Niclas Jessen

The Organic Cuisine Label

The state-controlled Organic Cuisine Label shows the percentage of organic food and beverages used in a professional kitchen

The label has three levels:

COLLABORATING IN THE COMBAT AGAINST PATHOGENS

In a major collaboration project between University of Copenhagen and the Danish ingredient company Novonesis, the Danish collaborative culture has come up with innovative solutions to fight against pathogens in meat products.

Pathogens is a major issue in modern day meat production is the existence of pathogens that can serve as a risk to human health and often survive in meat under conditions where other bacteria do not.

A testament to private-public collaboration

Sometimes the best strategy for eliminating pathogenic bacteria is to fight them with other bacteria. Called bioprotection, it's a strategy that Danish ingredient company Novonesis has refined over the past two decades, specifically to protect against harmful contaminants in bacon and fermented meats.

Research at the University of Copenhagen was the initial inspiration. In collaboration with the Danish Technological Institute (DTI) and the meat industry, a study found antimicrobial activity in some of the lactic acid bacteria already naturally present in meat products.

The findings led to the identification and development of specific lactic acid bacteria for effective elimination for Listeria monocytogenes. As a result, Novonesis now offers an extensive portfolio of lactic acid bacteria cultures that both inhibit food spoilage and protect against harmful contaminants. Used in bacon or salami, for example, they improve colour, flavour and texture development at the same time – completely naturally and without need of other additives.

Photo: Novonesis

> Lactic acid bacteria cultures both inhibit food spoilage and protect against harmful contaminants

Becoming world-class by working together

Denmark's rise as a leader in bioprotection is partly due to the collaborating environment of Danish food production, as seen in the collaboration between Novonesis and leading Danish universities. Today Denmark is a leader in biosolutions within food production with many of the world's leading ingredient companies.

Case by Novonesis

CHAPTER 3

FOOD SAFETY MADE BY TEAMWORK

INTERNATIONAL STANDARDS WITH A DANISH HALLMARK

Photo: Arla Foods

Ensuring the highest standards of food safety and quality is a joint commitment. Danish and international partners work together to minimise foodborne hazards.

Every food manufacturer has an interest in ensuring the highest standards of food safety in their production plant. Therefore, many manufacturers and their customers seek the stamp of approval that international food safety standards provide.

International food safety standards have become more important than ever in an era of growing food imports and exports all over the world. The priority is to prevent, eliminate and control foodborne hazards, from the production plant to the point of consumption. As food safety can be compromised at many stages in a product's lifecycle, it is vital that all companies in the food supply chain work together.

> In Denmark, representatives of food safety authorities, the industry, research institutes and consumers all contribute to the effort to keep our global food supply safe

In Denmark, representatives of food safety authorities, the industry, research institutes and consumers all contribute to the effort to keep our global food supply safe. The fact that Danish chicken meat and eggs have a special salmonella-free status in the EU is one example of that. Another is ISO 22000 – the internationally recognised food safety standard that today bears the influence of Danish collaboration.

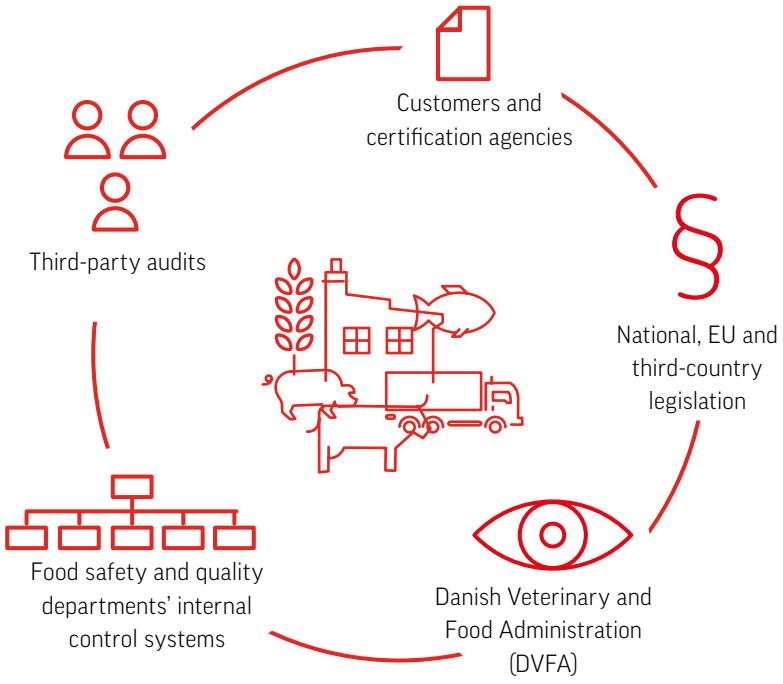
A new approach to risk

The latest revision – ISO 22003-1:2022 – sets out the requirements for a food safety management system and how to avoid food safety hazards. It also introduces a new approach to risk, distinguishing between risk at the operational and business levels of the management system. This includes more dynamic control of food safety hazards by combining interactive communication, systems management, prerequisite programmes (PRPs), and the principles of Hazard Analysis and Critical Control Points (HACCP). ISO 22003-1:2022 is based on the Codex Alimentarius principles for food hygiene, which help public authorities ensure food safety criteria are met.

Securing a human right

Access to nutritious, wholesome and safe food should be a basic human right. As the global population grows and food supplies come under increasing pressure, the collaboration behind standards like ISO 22003-1:2022 is essential to ensure the highest standards of food safety and quality.

Core elements of the Danish approach to quality and safety control in food production



LAB WILL RETHINK THE FUTURE OF FOOD WITHOUT WASTE


Photo: Niels Hougaard

A consortium of Danish universities and companies are behind a new open innovation food and health lab, which is to rethink food production and consumption and develop new systems for a more sustainable food supply with much less waste.

Called FOODHAY, the 13.8 million Euro research centre is jointly funded by the Danish Education and Research Ministry and the consortium partners – Aarhus University, Copenhagen University, Danish Technology University, Arla Foods and Danish Technological Institute.

From raw material to consumer

The whole food value chain is in focus: to deliver new knowledge and solutions for utilising the side streams of food production; develop processes that increase the nutritional value of foods; identify new, healthier ingredients; create more sustainable packaging solutions, reduce food waste during distribution and consumption; and ensure food products match consumer needs and preferences.

> FOODHAY will lead the way in delivering healthier foods and increasing the sustainability of our food systems

In the years ahead, the FOODHAY partners will support research initiatives with a direct impact on Denmark's ability to deliver new knowledge, technology and food and ingredient solutions to the global consumer.

The ultimate goal is to facilitate the production of innovative, healthy and more sustainable foods. Strengthening business, creating more value for consumers and reducing the negative impact of today's food systems on the climate.

Case by FOODHAY

SHARED KNOWLEDGE MAKES CAMEL MILK SAFER

Since the first cooperative dairies were founded in the 19th century, Denmark has been a world leader in safe and efficient dairy production. That expertise is now being shared with Ethiopian partners to improve the production and quality of camel milk.

In Africa, 9% of the continent's total milk production comes from camels. However, as the milk is unpasteurised and has a high level of bacteria, it is a frequent cause of illness when consumed.

The Technical University of Denmark and bioscience company Novonesis are working with Ethiopia's Haramaya University to transfer knowledge about Danish technology and production methods that can make camel milk safe and healthy to consume.

By building local expertise in microbiology and efficient dairy production, the goal is to strengthen businesses in the developing region.

Case by Novonesis and Technical University of Denmark

> Knowledge about Danish technology and production methods can make camel milk in Ethiopia safe

Photo: CS

COLLABORATION SECURES HEALTHIER HERDS AND SAFER FOOD

A united effort between Danish farmers and authorities is setting new standards in animal health. Through the National SPF Programme, Denmark tackles pig diseases with transparency and shared responsibility.

Healthier animals, safer food

Livestock diseases are a major global challenge, affecting food safety, animal welfare and sustainability. When pigs fall ill, productivity drops and mortality rises – leading to unnecessary food loss and more antibiotic use. One key threat is Porcine Reproductive and Respiratory Syndrome (PRRS), a highly contagious virus that spreads between farms. Many farmers have been hesitant to invest in long-term solutions, fearing quick reinfection even after herds are cleared.

A national effort driven by farmers

Denmark responded by establishing the National SPF (Specific Pathogen Free) Programme – a partnership between farmers, represented by the Danish Agriculture and Food Council, and the Danish Veterinary and Food Administration.

The system categorises herds by health status and enforces ongoing PRRS monitoring across all farms, not just those already in the SPF network. Transparency is key: herd status is publicly available, helping farmers and buyers make informed choices.

> Infections among previously PRRS-free herds dropped from 7% in 2021 to 3% in 2024

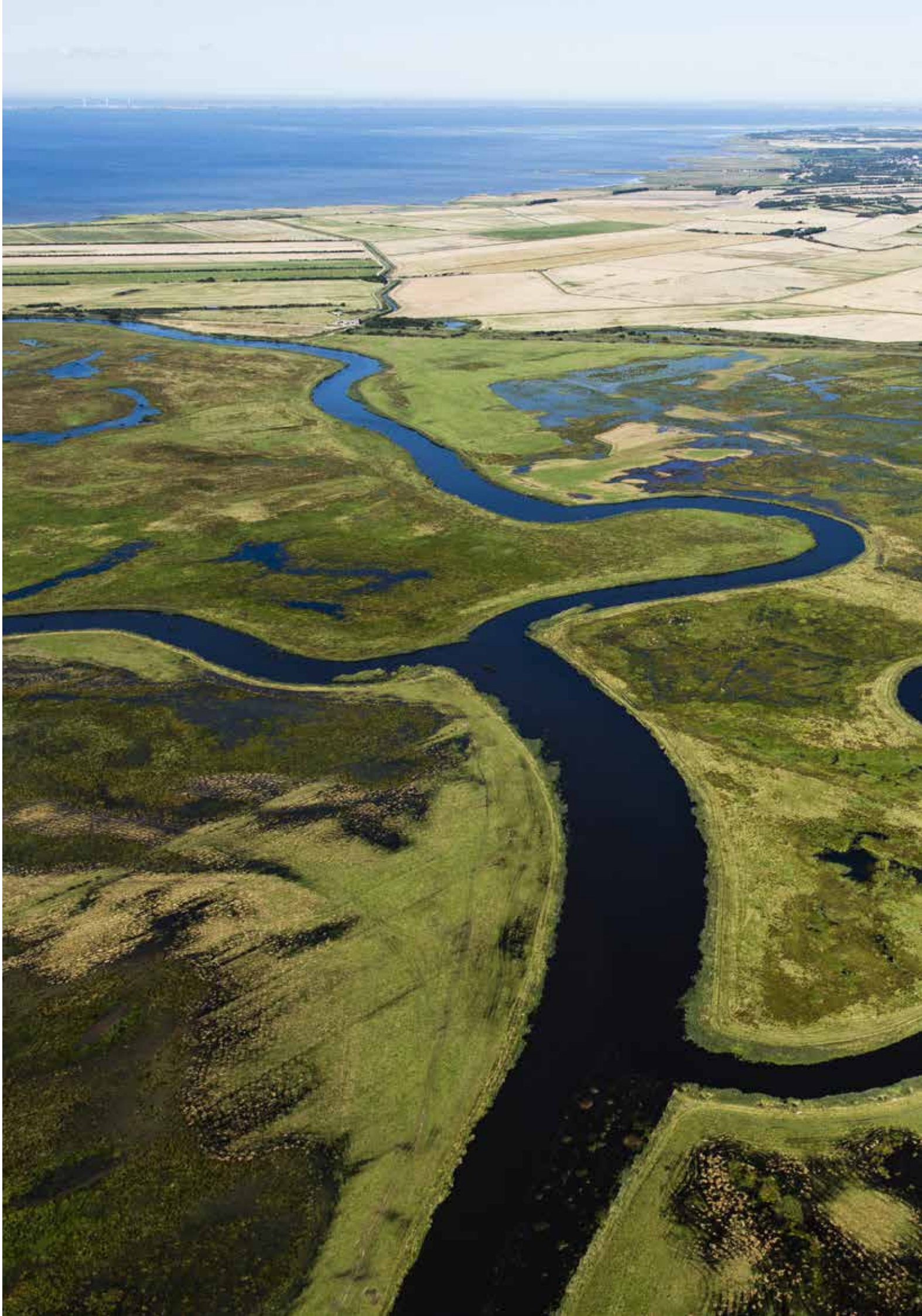
At the core is biosecurity. Farms include entry rooms where staff change clothes and disinfect, reducing the risk of introducing infection. Farmers also coordinate in local clusters, planning eradication efforts together and sharing costs.

Strong results for farms and food systems

International buyers now rely on the Danish system to source pigs from herds with verified health status – reinforcing Denmark's reputation for safe, sustainable food production.

Through close collaboration, Denmark has created a model that protects animal health and welfare, prevents food loss, and raises the bar for productivity and food safety

Case by Danish Agriculture and Food Council



CHAPTER 4

HARVESTING THE BENEFITS OF THE DIGITAL REVOLUTION

DIGITAL PARTNERSHIPS MEET THE DEMAND FOR TRACEABILITY AND TRUST

Photo: Food Nation

Data is a powerful commodity. Cross-sector collaborations are exploring the potential to take efficiency, sustainability and control to the next level in farming and food processing.

Globalisation has created vast opportunities for consumers to buy the food products that best fit their wants and needs. At the same time, demand is growing for traceability, transparency and trust in the supply chain. Digital partnerships are helping to satisfy those expectations.

We are currently in the middle of the fourth industrial revolution – the digital revolution, where the physical and digital world are increasingly merging. A myriad of technologies – drones, satellites, sensors, artificial intelligence and machine learning – produce and process vast amounts of data. This empowers us to make better decisions, produce more smartly and sustainably, and track and control the entire food supply chain.

Pioneering big data

Today, Danish companies are among the most digitalised and automated in the world. To maintain this leading position and continue to offer world-class products, food companies and sectors are discovering new opportunities through data collaboration. One example of this is the Food Supply Chain Data Project under the Danish Centre for Big Data Analytics-driven Innovation (DABAI). Established by Innovation Fund Denmark, the aim of DABAI is to give Denmark a pioneering role in exploiting the potential of big data.

Precision by satellite

On farms, the use of digital technology and automation has grown tremendously in recent years. Today, Danish farmers have satellite pictures at their fingertips to assess the precise need for fertiliser in their fields. Field robots are also available to remove troublesome weeds. These technological advances have paved the way for the Partnership for Precision Agriculture and Smart Regulation – a public-private collaboration that is exploring how technology can optimise production, limit environmental impact and support easier farm inspections by government agencies.

> A myriad of technologies produce and process vast amounts of data

The word is that 50 billion devices will be connected to the internet within the next few years. As the world becomes more digital, cross-sector partnerships will support the global need for an efficient and sustainable food supply.

ARLA TECHNOLOGY AIMS TO SPEED UP CLIMATE ACTION


Photo: Niels Hougaard

Achieving ambitious climate goals in a dairy requires scalable tools and strong collaboration. At Arla Foods, farmer owners are taking decisive steps, having reduced scope 3 GHG emissions per kilo of milk by 13% since 2015.

To accelerate further progress, Arla developed FarmAhead™ Technology—a data-driven toolbox supporting its target of a 30% reduction in scope 3 emissions by 2030 (baseline 2015). The system integrates emissions tracking, incentives, and advisory support, empowering farmers while aligning sustainability with business value.

> For the first time in history, all dairy companies in a single country are using the same tool to document and drive reductions in emissions from milk production

At the heart of the model is the FarmAhead™ Check, a standardized digital survey completed by 99% of Arla's milk pool. It collects over 200 data points per farm, verified by third-party advisors and compiled into a robust cross-country dataset. This ensures data quality and comparability across seven Northern European countries.

This comprehensive dataset enables actionable insight into emissions hotspots and best practices. Analysis has identified the 'Big Five' emission levers—the key categories that explain performance differences between farms. These include feed efficiency, fertiliser use, land use, animal robustness, and energy inputs.

Based on this insight, Arla launched the FarmAhead™ Incentive, a point-based payment system tied to sustainability improvements. Farmers earn points—and additional payments—for taking measurable action in high-impact areas such as manure management, biodiversity, renewable electricity, carbon farming, and more. Participants can earn up to 3 eurocents more per kilo of milk, depending on their performance.

Although voluntary, the widespread farmer engagement shows the strength of Arla's collaborative model. By aligning business incentives with environmental goals, Arla is turning data into action—and shared progress.

Case by Arla

DATA COOPERATION OPTIMISES PIG PRODUCTION

Pig production in Denmark is getting a digital lift, thanks to the Food Supply Chain Data Project which is collating big data from farms, feed companies and slaughterhouses.

Big data and machine learning are providing new insights into sickness in pigs

The Danish Centre for Big Data Analytics-driven Innovation (DABAI) partnership is leading the project, which aims to automate processes, reduce errors and increase production control.

Several projects are on the way. For example, one project is using big data and machine learning to gain new insights into sickness in pigs. The aim is to use data to predict illness and take action in good time - improving animal welfare and cutting costs.

In another project, the authorities are collaborating with a slaughterhouse to share data. Via big data analysis, the objective here is to gain new insights that can help optimise logistics and production planning.

DABAI comprises several companies and three Danish universities - the Technical University of Denmark, University of Aarhus, University of Copenhagen – and the Alexandra Institute. The Danish Agency for Digitisation, the Danish Business Authority and Central Denmark Region are the public authorities involved.

Case by Danish Agriculture & Food Council and Technical University of Denmark

Photo: Danish Agriculture & Food Council

CHAPTER 5

EMPOWERED EMPLOYEES ARE A BUSINESS ASSET

THE DANISH MODEL FOR STABLE LABOUR RELATIONS

Photo: Food Nation

Collective agreements between employers and employees are an outstanding feature of the Danish labour market – based on trust, collaboration and mutual respect.

Denmark's labour market provides unmatched advantages for all employers and employees in the country, not just within the Danish food cluster. Unlike most other countries where the labour market is regulated by legislation, our trade unions and employer organisations make collective agreements without government involvement. Any disagreements are typically settled through mediation or arbitration. This approach has gained international renown as 'the Danish model'.

> Trust, collaboration and a flat structure are key to the Danish model's long-standing success

Today's collective agreements cover 83 percent of all employees in Denmark and regulate, for example, working hours, pensions, sick pay and overtime. Agreements are reached through negotiation.

An agreement for every workplace

Not every detail is covered by the collective agreements. Employers and employees often work together at local level to translate the national collective agreements into local agreements that apply to a specific workplace. Employees can choose a shop steward to represent them. Most workplaces are characterised by an informal approach to collaboration. Here, negotiations often take place in an ongoing dialogue between the employer and employees or shop steward.

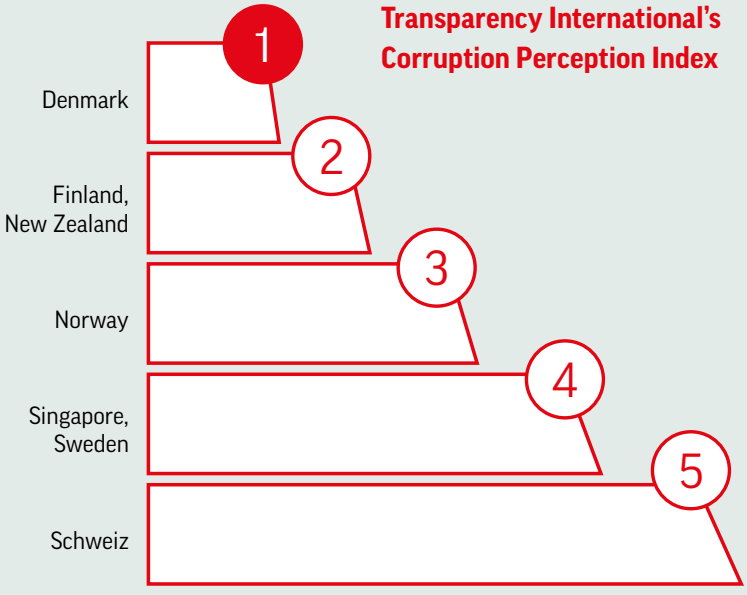
Trust, collaboration and a flat structure are key to the Danish model's long-standing success – and among one of the reasons why Denmark ranks as the least corrupt country in the world, according to Transparency International's Corruption Perception Index. For more than a century, the model has ensured the rights and interests of all parties.

Employee involvement

Employees are frequently involved in solving important issues. Many sustainable business solutions come about in this way, effectively developing both the company and employees.

This widespread collaboration has created a culture of empowerment that gives employees a sense of ownership. The result is stable and fair relations with few workplace conflicts and a high level of innovation.

Transparency International's Corruption Perception Index



Source: Transparency International - the global coalition against corruption. 2022

COLLABORATION WILL BAKE THE FIRST CLIMATE-NEUTRAL BREAD

Danish consumers could become the first to buy climate-neutral oats and ryebread when the results of a cross-sector project arrive in supermarkets in a few years' time. Led by SEGES Innovation and involving partners from the entire food value chain, Project Zero is combining exsisting technologies to bring climate-neutral food products from farm to table.

One of the key objectives is to demonstrate that climate neutrality and profitability can go hand in hand in food production.

The three-year project has three primary tools in focus – biochar, green ammonia and nitrification inhibitors. Biochar will be produced from oat and rye straw by pyrolysis, providing a stable carbon source when returned to the soil. Green ammonia, produced from wind and solar energy, will serve as a nitrogen fertiliser, while nitrification inhibitors will be used to suppress emissions of nitrous oxide, reducing the climate impact of fertilisation.

Life cycle assessments of the oats and ryebread will be conducted to verify their climate neutrality.

> Project Zero is combining existing technologies to bring climate-neutral food products from farm to table

In addition to SEGES Innovation, the project partners are COOP, Kohberg, Valsemøllen, Aarhus University, Stiesdal SkyClean, Skovgaard Energy, BASF, Bureau Veritas, Fjordland and Innovation Centre for Organic Farming. The Green Development and Demonstration Program under the Danish Agricultural Agency has provided funding for the project, which runs until December 2025.

Case by SEGES Innovation

BIOINFORMATICS REVEALS BUSINESS POTENTIAL IN SIDESTREAMS

A collaborative project between research institutes and Danish companies has developed an innovative method for extracting valuable compounds from food side streams—unlocking new commercial opportunities while advancing sustainable production.

As global demand for sustainable food grows, the industry is under pressure to maximize resource use and minimize waste. Traditionally, leftovers from processing ingredients like potatoes and seaweed—rich in starch, alginate, or carrageenan—have ended up as animal feed or fertilizer, leaving untapped value behind.

Now, using advanced bioinformatics, researchers have created a technique to scan these side streams for hidden proteins and convert them into functional peptides. One key result: identifying peptide emulsifiers from potato protein that can encapsulate oxidation-sensitive fish oil, extending its shelf life. Similar applications for flavourings and preservatives are emerging.

This innovation not only optimizes resource efficiency, but can increase side stream value up to a thousand-fold. Importantly, the extracted additives are derived from proteins long used in food, aligning with consumer demand for natural, functional ingredients.
The method applies broadly—beyond potatoes and seaweed—to any protein-rich side stream, including those from fish processing. It represents a scalable, science-driven solution with strong commercial and environmental appeal.

Photo: Niels Hougaard

> A part from optimising raw material utilisation, protein extraction makes excellent business sense – increasing the value of side streams a thousand-fold

The project was made possible through the joint efforts of researchers from the Technical University of Denmark (DTU) and Aalborg University, in close collaboration with five Danish companies. Together, they have demonstrated how academic expertise and industry engagement can drive innovation toward more sustainable and profitable food systems.

Case by Danish Industry

CHAPTER 6

THE PROVEN POWER OF STRONG COLLABORATION

GET TO KNOW MORE FROM THE FOOD NATION TEAM

Danish companies are known around the world for their innovative products and solutions. Collaboration is the foundation of their success.

The Danish food arena is built on a strong collaborative mindset. Interdisciplinary, cross-sector partnerships continue to deliver new innovative opportunities and play a leading role in our successful exports to international markets. It has also helped create some of the best international food producers in the world.

The tradition for sharing knowledge and expertise has not only enabled the Danish food arena to take great innovative strides. Guided by the UN sustainable development goals, broad public-private partnerships are taking innovation from Denmark around the world. A growing number of these projects support the development of local food supply chains in countries where safe and healthy food is not yet accessible to all.

Today, it is widely acknowledged that collaboration is the key to securing a safe and reliable global food supply for the future – through the development of sustainable, efficient and increasingly digital solutions. Denmark is at the forefront in all respects.

Food Nation

Food Nation is a non-profit partnership established by the Danish government and leading private organisations and companies. It is your gateway to information about the Danish food cluster and knowhow that can accelerate the growth of international businesses through better solutions, innovative products and trusting cooperation.

The Danish food cluster encompasses everything from primary production in agriculture and the fishing industry to the food products consumers buy in stores. Companies, universities, research institutes, local and national authorities and other private and public organisations belong to the extensive, collaborative network. Together, they work hand-in-hand with international partners to maintain and improve food quality and safety along the value chain.

Take an interactive tour

Food Nation's Visitor Centre in central Copenhagen welcomes international delegations, providing them with an introduction to Danish capabilities within food and agriculture. An interactive installation at the centre gives visitors an up-to-date overview of the food value chain based on their individual interests. It is the ideal starting point before visiting Danish food producers and production facilities.

An inspiring preview is also available from the Food Nation digital universe. Here, inspirational publications, webinars, videos and talks provide insights into how Denmark can contribute to the green transition.

Today, it is widely acknowledged that collaboration is the key to securing a safe and reliable global food supply for the future

Food Nation is a great place to start learning about how Denmark can support sustainable development through collaboration. Find out more about our services, the Danish food arena and arranging a visit to the Food Nation visitor centre at foodnationdenmark.com

INGREDIENT INDUSTRY

Producers of enzymes, cultures and other ingredients

PRIMARY PRODUCTION

Agriculture, fishing & horticulture

PROCESSING INDUSTRY

Producers of food, beverages & animal feed

The Danish food cluster

Denmark is home to countless large, medium and small companies, research institutes and other organisations that make the country a European hotspot for innovative food products, services and technology.

RESEARCH & INNOVATION

Research, education & counselling institutions

INNOVATIVE TECHNOLOGY

Producers of machines, technology & equipment

GASTRONOMY & THE CONSUMER

Retail, consumers, restaurant, authorities, tourism & other related industries

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