TOWARDS
AN INTERNATIONAL
FOOD CLUSTER IN DENMARK

An analysis of the food sector in Central Denmark Region

Glenda Napier and Henrik Bjerregaard, REG X – The Danish Cluster Academy

CONTENTS

FOREWORD

Since 2007, the Central Denmark Growth Forum has made big efforts to develop strong development environments and boost the innovation competencies of food companies. This has taken place in recognition of the great business-political significance of the food industry for the region and the need for companies to be adaptable and innovative in view of developments on the global market. Public and private stakeholders have supported the initiative. In this, the establishment of Agro Food Park and Future Food Innovation has played an important role in highlighting the innovative power of Central Denmark's food environment.

Now we are getting underway with the next challenge – to clarify, prioritise and develop the areas where we hold a particularly strong position and, as such, global competitive advantage. This is not something the region can do alone. It requires commitment and strong cooperation between the food industry, knowledge environments, educational institutes and authorities – regionally, nationally and internationally.

The agenda is ambitious, but we are ready to accept the challenge and make a real strategic contribution to a strong Danish food cluster. In that connection, we are pleased to note that the Danish Government, via the Growth Partnership Agreement with the Central Denmark Growth Forum, has recognised the special role of Central Denmark within the Danish food innovation environment. The government's Growth Team for Food (April 2013) reiterates this recognition in its recommendations for declaring East Jutland a Danish food powerhouse.

This is fully in line with the assessment of OECD in its review of innovation work in Central Denmark Region and the Region of Southern Denmark (OECD, 2012). Here, OECD calls for a greater division of labour between regions if the business development effort is to make a difference to business, including the food industry.

With this smart specialisation analysis, focusing on cluster development, Central Denmark Region, Agro Food Park, Future Food Innovation and REG X have taken the first step towards developing the future regional action plan for the food sector – an action plan set in a national context with a clear global direction. We will, of course, also participate in the exciting and necessary work underway within Foodbest, which aims to create a strong position for Danish food companies and knowledge institutions within a common European innovation and research network – a Food4Future knowledge and innovation community (KIC).

We believe that smart specialisation is the key to creating regional growth and new jobs within a strong, national food cluster.

Bent Hansen, chairman of the Regional Council and chairman of the Central Denmark Growth Forum

Jan Mousing, chairman of Agro Food Park and managing director of the Danish Knowledge Centre for Agriculture

Lars Visbech Sørensen, chairman of the Future Food Innovation (FFI) steering committee. Consortium behind FFI: Agro Business Park, AgroTech, VIFU (Knowledge Centre for Food Development), Danish Technological Institute and Aarhus University (MAPP and AU FOOD)

Lotte Langkilde, director of REG X – The Danish Cluster Academy

May 2013

TOWARDS AN INTERNATIONAL FOOD CLUSTER IN DENMARK

An analysis of the food sector in Central Denmark Region

SUMMARY

The Danish food industry will face major opportunities for global growth in the coming decades. To develop the strong Danish position within the food sector, it is crucial that Denmark's special competencies within agriculture and food be brought into play in the global competition for innovation, entrepreneurship, growth and employment.

It cannot be expected that future growth in food sector employment will come from areas that have undergone major optimisation in recent years or solely from known nearby markets. For this reason, it is important to strengthen existing areas of food business specialisation and develop new areas of specialisation at the interface between food and climate, environment and health. It is within such new 'hybrid areas' that global demand for innovative solutions is expected to increase.

The quantitative analysis shows that a large proportion of employment, turnover and export within the Danish food industry are concentrated at food companies based in Central Denmark Region. It also shows that there are a number of particularly strong areas of food business specialisation in the region. These include food analysis and advice, processing of dairy products and ingredients, meat processing and ingredient production. As the Danish food cluster is one of the leading clusters in the world, it follows that the business specialisations within Central Denmark Region can be characterised as world-class and with great growth potential.

The qualitative analysis shows that there is a big interest among companies and other cluster stakeholders to develop a strong food cluster. Through entering a close cluster cooperation, large established companies, entrepreneurs, small growth companies and knowledge organisations can, under the right conditions, complement each other's strengths and increase their innovative power.

The region is home to many large, established companies with a strong market position and sales organisation. But they need new input to step up their innovation capacity. The region's high concentration of knowledge organisations includes particular competencies within primary industry and agricultural research, process technology and the market. Knowledge organisations can play a significant role in cooperative initiatives within the cluster by ensuring their unique knowledge gains access to companies, benefiting the food sector's development. New, young enterprises with great growth potential are on the way, working within 'hybrid areas' at the interface between food and climate, environment and health. They bring innovation to the food industry but are in need of closer cooperation with the large, established companies in order to optimise their contribution to innovation and growth.

The extent of the cooperation between food industry players can be further strengthened in a future cluster cooperation. Food companies in Central Denmark Region have a growing interest in increased cooperation with an emphasis on open innovation. Strategic initiatives in a series of larger companies open new opportunities for such cooperation. Large, established companies can secure access to larger markets for small, innovative growth companies, which, in return, supplement the large companies through their innovative power.

Following the identification of areas of business specialisation in the food sector, Central Denmark Region can gain from promoting itself as an active partner in national and international cooperations. Within the identified areas of specialisation, players from Central Denmark Region would be the natural drivers of a Danish food cluster. In other areas, it is important that the region and food stakeholders join initiatives where others have particular business specialisations and core competencies. In this way, the Danish food industry can develop in a number of important areas.

To exploit the potential for business growth and synergies and, at the same time, strengthen cooperation with research and knowledge institutions, the establishment of a formal cluster cooperation and cluster organisation is recommended. This can release the potential and contribute to food industry innovation, growth and employment in Central Denmark Region and the rest of Denmark.

ABOUT THE ANALYSIS

Central Denmark Region, Future Food Innovation, Agro Food Park and REG X have come together in an analysis partnership with the aim of establishing a fact-based foundation for developing the food industry in Central Denmark Region. The analysis has been prepared and managed by REG X - The Danish Cluster Academy.

The purpose of the analysis is a fact-based mapping of food specialisation areas within Central Denmark Region with a view to future cluster development and "smart specialisation". This includes identifying key stakeholders, initiatives and relationships in the field. The idea is to investigate whether the food activities in Central Denmark Region can be developed into the centre of a national and international food cluster. Recommendations for strengthening the area moving forward will be made.

The analysis serves as input for the prospective business-political development of Central Denmark Region's food activities. This includes input for a future adjustment of the strategy, an action plan for Central Denmark's efforts within the food sector and a starting point for the second generation Future Food Innovation Initiative. It also contributes to the work of positioning Agro Food Park in an international context. Finally, the analysis serves as a pilot project for working with smart specialisation in Central Denmark Region.

It is the first time that a survey of regional specialisations and core competencies in the food sector has been conducted. Combined with the story of cluster development, one objective of the analysis is to inspire new thinking about the importance of regional specialisation to the regional and national growth agenda.

REG X works with the development of clusters and cluster analyses. For REG X, it is important to contribute to building new knowledge along with quantitative and qualitative methods that can be used to create a stronger platform for smart specialisation in future cluster development.

ABOUT THE AUTHORS

Glenda Napier is head of research and Henrik Bjerregaard a consultant at REG X - The Danish Cluster Academy.

This report was prepared with professional input from Jan Dalskov, who also helped conduct the interviews, along with Søren Madsen, Gyda Bay, Søren Rosenkrantz Riber, Erik Sejersen and Lars Haahr Jensen.

REG X and Oxford Research have processed the quantitative data from the analysis in cooperation.

INTRODUCTION

DENMARK'S AGRICULTURE AND FOOD CLUSTER

The large Danish agriculture and food cluster is large and of significance both to the Danish economy and to the global competition within the agriculture, farm technology and food sectors. In terms of employment, the Danish agriculture and food cluster is the second largest cluster of its type in Europe - surpassed only by Brittany in France - and the third largest cluster in the Western world.[1]

Export figures tell their own story. In 2011, agricultural and food exports reached almost EUR 16.08 million, corresponding to 20 percent of total Danish exports, having grown more than EUR 4.02 million in the last 10 years.[2] With new growth markets on the way, there is no doubt that the industry represents a large area of business growth for Danish companies. According to the Danish government's Growth Team for Food, the industry has the opportunity to increase exports by about EUR 6.7 million a year, while creating up to 25,000 new jobs in the Danish food sector by 2020.[3]

GLOBAL CHALLENGES CREATE NEW MARKETS

Companies must seek part of the industry's growth on new emerging markets. The global challenges related to increasing populations and greater burdens on the environment and climate require changes in the way we produce our raw materials and process our food. These changes are likely to create growth opportunities throughout the food value chain, especially in new technology areas such as environmental technology, bio-resources and new processing technologies.

Access to raw materials is challenged as populations grow. The Earth's population is expected to grow by over one billion by 2030.[4] Today 40 countries are affected by food shortages. There is a need for a 40 percent increase in food production by 2030 just to maintain access to food products at the 2013 level. A 70 percent increase is necessary by 2070.[5] In addition there are growing challenges for raw materials. From 1940 to 2000 there has been a doubling of the overall commodity price index and, from 2000 to 2010, the price of raw materials has tripled.[6] Growing food production using current production technologies calls for increased access to raw materials. This leads to rising commodity prices, particularly for water, grain, crude oil and fertilisers. Food production today is dependent on a large proportion of today's fresh water resources. If more food is to be produced, the need for water will also increase. According to the OECD, water shortages are expected to increase. By 2030, half of the world's population will live in areas with water shortages.[7]

The challenges related to growing food production are also closely linked with climate and environmental challenges. Pollution is an issue that all countries have to deal with and has great economic consequences. For example, the cost of air and water pollution in China is equivalent to 4.3 percent of China's GNP.[8] In addition, there are health challenges in the West, where a growing elderly population and health-related issues in the general population are increasing the pressure on national welfare systems, placing increasing demands on the foods that we consume.

Many global challenges are closely linked and cannot be solved in isolation. Future access to sustainable and healthy raw materials and food will become a limiting factor for global food production and will determine the growth opportunities for the agricultural and food industry. It is necessary to find solutions that cut across sectors such as health, environment and food production. The major challenges demand new thinking and innovative solutions. In other words, the global challenges will become drivers of innovation in the business world, while different industries will have to work together to solve the closely linked issues.

THE GOOD NEWS FOR THE AGRICULTURE AND FOOD INDUSTRY

The good news is that the agriculture and food industry can help to develop and deliver innovative commercial solutions to address the major global challenges. There is an open global playing field, where the Danish agriculture and food sector can help establish a whole new agenda. This arises from the industry's potential to develop sustainable and consistent food production, based on Denmark's unique, long-standing tradition for ownership and organisation based on the value chain. This is dependent on the existence of companies that recognise the potential and are willing and able to engage in new thinking and innovation in the food sector. Existing businesses and new innovative entrepreneurs will have to work in close cooperation to meet this challenge.

>>

1: FORA, Den danske landbrugs- og fødevareklynge i et internationalt perspektiv (The Danish agriculture and food cluster from an international perspective), 2010.

2: Danish Agriculture and Food Council, Fakta om Erhvervet (Facts about industry), 2012.

3: Growth Team for Food, 2013.

4: National Intelligence Council, Global Trends 2030: Alternative Worlds, 2012.

5: FAO, 2012.

6: World Bank Commodity Price Data, 2013.

7: OECD, OECD Environmental Outlook to 2030, 2008.

8: World Bank, 2012.

>>

**CLUSTERS AND REGIONAL SPECIALISATION
THE COMPETITION PARAMETERS**
Business cooperations are also known as clusters. Clusters are growth engines and innovation drivers.[9] They consist of a geographical concentration of companies, knowledge stakeholders and other relevant players within an area of business specialisation, who enter into strategic partnerships to achieve innovation, growth and competitive advantage that they could not achieve alone.[10]

Many clusters play a major role geographically. Clusters are often based in a geographical area, which in various ways has the capacity to act as a cluster powerhouse. A powerhouse is based on a very strong business specialisation area and the presence of relevant companies. The local element is essential in clusters due to the subsidiarity principles related to employee mobility, the facilitation of meetings between businesses and the development of trust between them – a vital element of innovation cooperation.

BOTH A NATIONAL AND REGIONAL CHALLENGE
The global competition for growth and innovation has both a national and regional perspective.[11]

It is first and foremost a competition between companies working within national business areas such as cleantech. The building blocks for transforming national business areas into exceptionally strong business areas are the presence of Danish companies with global markets and good national framework conditions for innovation and entrepreneurship. It also involves access to close collaboration with world-class universities and research institutions.

On the other hand, it is more specific areas of business specialisation that help to give countries their unique position in the global market. The areas of business specialisation depend on the basic skills and knowledge of the companies within the clusters – and also in the regions. The global competition is, in this way, a competition between smaller geographical areas[12] - a competition to be both one step ahead of other regions, but also to be an attractive partner. As a consequence, there is also a related possibility to influence the growth of business specialisation areas in the regions. In regional business-political work, it is important that the regions focus on moving business from general to specialised efforts that build on each region's areas of business specialisation.

FOOD ACTIVITIES IN CENTRAL DENMARK REGION
Denmark has a food powerhouse in East Jutland.[13] In Central Denmark Region, the food industry contributes significantly to the overall Danish economy. The regional food sector accounts for 55 percent of Danish food exports and a significant proportion of regional employment and gross value added (both about 16 percent). However, due to on-going rationalisation, there has been a number of job losses within the area.[14]

Central Denmark Growth Forum has launched a special food initiative to develop the food industry, increase innovation power and retain and create new jobs. In 2009, the 'Smart Diet' was launched as a special mega venture in the food sector. In addition, a Food Council was established to monitor and coordinate the overall food initiative.

But in order to strengthen their growth potential, it is essential that the region's agricultural and food companies are equipped to move into new markets, recognise growth opportunities in the global challenges and engage in close innovative cooperation with other companies.

**SMART SPECIALISATION
- FROM GENERALISATION TO SPECIALISATION**
The global competition for knowledge and innovation makes new demands of the way we develop and organise our business policy. Work to develop and enhance new and existing business specialisations which foster growth and innovation is described by the European Commission as 'smart specialisation'.[15] Smart specialisation is defined as the reinforcement of regional business efforts in areas where the regions (potentially) have particularly strong professional core competencies or specialisations. It is an attempt to move away from broad business areas to the development of more specific areas of business specialisation. A strategy for smart specialisation is based on an analysis of existing and potential business specialisations and the identification of those stakeholders able to contribute to the development of the cluster and its specialisations.

All EU member regions should have smart specialisation strategies by 2014 to be eligible for structural funds. So smart specialisation has also come to Denmark. A recent OECD study of the innovation power of Central Denmark Region indicates a need for a more comprehensive scan of the region's international position within those industries that are of business-political priority, i.e. the region's clusters -

>>

9: Delgado, Porter and Stern, Clusters and Entrepreneurship, 2010.

10: Porter, The competitive advantages of nations, 1990.

11: Porter, The competitive advantages of regions, 2004.

12: This does not refer to specific administrative regions but to geographical areas/clusters.

13: Growth Team for Food, 2013.

14: OECD, OECD Reviews of Regional Innovation: Central and Southern Denmark 2012, 2012.

15: EU Commission, Regional Policy contributing to smart growth in Europe 2020, 2010.

>>

including the food industry.[16] In this way, the OECD recommends that a strategy for smart specialisation be developed in Central Denmark Region.

It is therefore in Central Denmark Region's interest to base the development of food-related business activities on valid facts in order to support the development of a strong food cluster that can contribute to realising the industry's growth potential. There is a particular need for a coherent mapping of company characteristics, competencies and needs in relation to global trends. The aim is to ensure that business-political initiatives target the specific conditions that exist in Central Denmark Region.

NEW FORMS OF CLUSTER ANALYSIS

Based on the above analysis, it is clear that the preconditions for creating a strong growth cluster are that the cluster focuses on its unique specialisations, providing fertile ground for innovation and business partnerships, and sees growth opportunities in the global challenges. For this reason, this analysis will also examine the food activities in Central Denmark Region in relation to three dimensions: new and existing business specialisation areas, the existence of multi-disciplinary collaborations and global challenges, Figure 1.

New methods of analysis are required to uncover these conditions. Cluster analysis remains an area in development, due to the fact that clusters can be difficult to measure - especially experience with regional quantitative benchmarks is limited to Denmark. Firstly, there is no strong tradition for
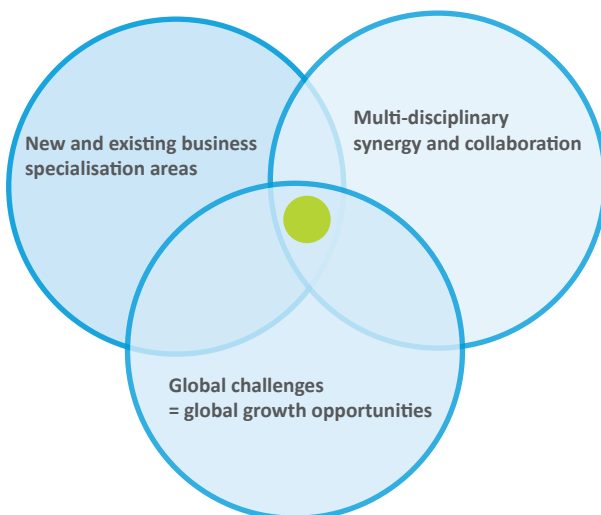
quantitative regional cluster analysis in Denmark. Secondly, the data is limited. Looking at Denmark from the outside, it can be difficult to spot the regional specialisations. One reason is that the methods currently used to map European clusters lack sufficient geographical detail. This is a particular challenge for Denmark, as the country is considered as a single region within the European benchmarking of clusters.

Cluster analysis must also do more than just quantify the clusters. As something new, it must also be able to identify the cluster stakeholders, their collaboration, dynamism and cohesion. Such mapping can be described as identifying the cluster's 'ecosystem'. Smart specialisation requires a strong ecosystem to develop areas of business specialisation. It is necessary to have strong stakeholders who can help to develop existing and new specialisations. A standard model has not yet been developed to describe a cluster ecosystem. This report introduces a new model for a cluster ecosystem, which is used to gain a more specific understanding of the dynamics between agricultural and food businesses in Central Denmark Region. Methods for mapping the presence of relevant stakeholders and their needs are naturally more qualitative in nature.

STRUCTURE

The report starts by presenting a quantitative analysis of the areas of business specialisation characteristic of Central Denmark Region's food activities. This will be followed by an analysis of business development by looking at key figures such as total employment, export and so on. However high employment concentration alone does not create a cluster. It is also necessary to look at the stakeholders, their context and the dynamics between them. In this way, the region's food activities can be examined as an 'ecosystem', where the aim is to identify the key stakeholders and look at their context and dynamics. On this basis a number of recommendations will be proposed for strengthening the regional food activities, as described in the analysis, and developing them into a strong national and international food cluster.

FIGURE 1

CONDITIONS FOR A STRONG CLUSTER

New and existing business specialisation areas

Multi-disciplinary synergy and collaboration

Global challenges = global growth opportunities

A potential food cluster's unique growth opportunities

SOURCE: REG X AND OXFORD RESEARCH BASED ON BOSTON CONSULTING GROUP, 2012.

16: OECD, OECD Reviews of Regional Innovation: Central and Southern Denmark 2012, 2012.

METHOD AND SCOPE

CONCEPT CLARIFICATION

The analysis examines the companies that directly or indirectly contribute to the production of food. It includes all items that are directly or indirectly fit for human consumption. Food items include food and beverages as well as commodities that cannot be eaten until processed, e.g. corn. This is the definition that applies with regard to the food activities or food areas discussed in the report.

QUANTITATIVE AND QUALITATIVE DATA

The analysis determines the strength of regional areas of business specialisation in the food sector in order to clarify whether there is sufficient critical mass for a food cluster in Central Denmark Region. The distribution of private employment in agriculture and food is studied across Denmark's regions. This is followed by an investigation of the areas of business specialisation that apply to the food sector. The strength of 14 business areas is compared in order to examine which areas are particularly characteristic of Central Denmark Region's food activities. Employment comparisons are made by an analysis of the location quotient (LQ). The LQ method can be used to measure whether a given type of employment is 'over-represented' in a geographical area compared to other areas. For this purpose, the Experian database was used to provide employment data from 2013.

Following this, key figures such as turnover and export within the food sector in Central Denmark Region are examined in the period 2010-2003. Data for the businesses' figures are drawn from Denmark's Statistics based on 2010 figures. This part of the analysis is a zero analysis, taking 2010 as the baseline year. This means that a group of companies are followed retrospectively. Companies that started up and shut down before 2010 are not measured.

The difference between the data from Experian and Statistics Denmark owes to the fact that it has not been possible to conduct regional LQ analyses based on Statistics Denmark's data. Due to the nature of the method, LQ is industry-based, while key figures are obtained through a manual identification of companies across industries (see Appendix A for further details).

About 40 interviews have been conducted with key experts, stakeholders and businesses from the Central Denmark Region food sector (see also Appendix B for list of interviewees). Input from these interviews provides the basis for the qualitative analysis and assessment of the ecosystem in the food sector. This part of the analysis should in no way be seen as an evaluation of the sector and related stakeholder efforts, but only as input for a progressive development of a food cluster in the food sector.

In the qualitative analysis of the ecosystem's stakeholders, including knowledge institutions and advisors, input from the interviews was used to characterise the stakeholders. It is particularly input from the businesses interviewed that forms the basis for this part of the analysis. To map food-related knowledge and research, input from experts and existing mappings of the sector were used.[17]

In the analysis of the companies, it is their own assessment that provides the basis for the analysis, together with an assessment by the research partnership. The interviews are anonymous, and the research partnership also conducted an ongoing assessment of the interviews' content during the analysis.

SCOPE

Some business areas in the quantitative analysis have been omitted even though they are part of the value chain in the food sector. Wholesalers are included in the quantitative analysis, while retailers and caterers are not. This is because the concentration of retailers largely follows population concentration and does not necessarily reflect an area of business specialisation. The industry typically has a high turnover and many employees, which can easily distort the picture of how many are actually working within food. In addition, the retail sector is very broad, and those that dominate the picture, such as Coop, Danish Supermarket, Reitan or SuperGros, do not represent an area of business specialisation.

Their location is typically not due to the presence of special skills, raw materials and so on, but merely owes to where the customers are - that is in the densely populated areas. If a given area has a lot of employees working in retail, it is primarily due to the population density and not a particular specialisation

---

17: Forsknings- og innovationsstyrelsen, kortlægning af dansk fødevareforskning 2010 (The Danish Council for Research and Innovation, mapping of Danish food research 2010)

>>

or competitive advantage. However, it would have been possible to make an analysis of retail chain head offices (an HQ analysis) to examine whether Central Denmark Region attracts more of them than other regions. For example the position of the Danish Supermarket in Aarhus could have been compared with COOP in Albertslund to examine their position and role in a food cluster.

Gourmet cuisine, catering and restaurants were also omitted from the quantitative analysis. This is because they may to a greater extent form part of a tourist cluster/experience economy. Again, the general rule is that restaurants are situated where there are many people and/or tourists. There is no doubt that some restaurants are highly specialised and closely linked to specific local raw materials and skills. But, among the purely quantitative data, these specialist restaurants will be drowned out by all the others without a local/regional attraction.

Despite the exclusion of retailers and gourmet cuisine from the quantitative analysis, value-chain considerations about food activities in Central Denmark Region will ensure that this important part of the food industry has a strategic involvement in the development of the region's food activities. For example, gourmet cuisine can be an important element of a cluster's value chain, as it can help put 'sustainability' on the consumer agenda by demonstrating what a

sustainable meal might look like. See also Appendix D for detailed description of the food sector's value system.

Other business areas are also omitted in the analysis, for example the fur industry. REG X has chosen to exclude fur farming from the analysis, since, in the context of this analysis, it could be seen as part of a clothing/fashion cluster.

The analysis is also geographically limited, as the subject of the analysis is the food sector in Central Denmark Region. The reason for this is the desire of Central Denmark Region and others in the research partnership to investigate whether there is a particularly strong food business specialisation within the region, which may form the basis for the development of a strong Danish food cluster. It is not the belief that administrative regions should be seen as a limiting framework for business development. It is, therefore, in everyone's interest that the food sector also collaborates across regions. However, as recommended by the OECD and the European Commission, it is a strength if Denmark's regions can base their business policy on more factual evidence and move from generalisation to specialisation in this work. This involves identifying business specialisation areas where they have particularly strong positions. To this end, the analysis is a pilot project that may inspire similar studies in other business sectors.

AREAS OF BUSINESS SPECIALISATION WITHIN CENTRAL DENMARK REGION'S FOOD SECTOR

AGRICULTURAL AND FOOD SECTOR EMPLOYMENT ACROSS THE REGION

The first part of the quantitative analysis is to examine whether there is a strong presence of companies in the food sector in Central Denmark Region. This is achieved by examining the importance of the businesses' employment to the area.

From a value chain perspective, it is a strength to have a close link between the primary industry (agriculture) and the processing element (food manufacturing).

Therefore, the importance of the total agricultural and food production across the five regions of Denmark was examined initially to determine whether the link between agriculture and food manufacturing is particularly strong in Central Denmark Region.

The analysis shows that the overall Location Quotient for the food sector (both food manufacturing and primary production) is highest in Central Denmark Region compared with the other Danish regions, see figure 2.

FIGURE 2

DISTRIBUTION OF REGIONAL EMPLOYMENT WITHIN THE FOOD SECTOR (AGRICULTURE AND FOOD)

Region	Location quotient	Share of total number of jobs in the food sector in DK	Share of total employment in the region
Central Denmark Region	1.72	37 %	6.26 %
Northern Denmark Region	1.58	13 %	5.75 %
Region of Southern Denmark	1.31	24 %	4.76 %
Region Zealand	1.18	12 %	4.28 %
Capital Region	0.34	14 %	1.22 %
Denmark in total	1.00	100 %	3.63 %

SOURCE: REG X AND OXFORD RESEARCH BASED ON DATA FROM EXPERIAN DATA, 2013.

This means that overall private employment in both the primary industry and food manufacturing is highest in Central Denmark Region. In fact, 37% of Danish jobs in the food sector area as a whole are located in Central Denmark Region, which is the highest proportion across all the regions in Denmark. The Location Quotient is 1.72 in Central Denmark Region, followed by North Jutland Region (1.58) the Region of Southern Denmark (1.31), Region Zealand (1.18) and Capital Region (0.34) where private employment in agriculture and food overall is least significant.

When distinguishing between employment in the primary sector and food manufacturing, the relative concentration of employment looks different. Measured individually, Northern Denmark Region and Region of Southern Denmark have a higher concentration of

people employed in primary production than Central Denmark Region. However, Central Denmark Region has the highest concentration of employment in food production compared to other regions.

This means that while the Central Denmark Region as a whole has the highest concentration of employment in both primary production and manufacturing of food, it is especially employment in food manufacturing that means most in the region and, consequently, pushes up the total regional LQ.

>>

**IDENTIFICATION OF SPECIALISATIONS
IN THE FOOD SECTOR**

The above analysis shows that there is a particular concentration of people employed in the food sector in Central Denmark Region. But it says only a little about what especially characterises the areas of business specialisation in Central Denmark Region's food activities.

To get closer to an understanding of areas of business specialisation within these food activities, primary production and food manufacturing have been divided into 14 subsections (specialisations) below. The 14 subsections were identified through interviews with companies and experts. No previous studies have compared how the different sections relate to each other at a regional level.

The importance of private employment is compared across the 14 areas and the LQ calculated by comparing the other Danish regions. By comparing the LQ across the 14 areas of food activity, it appears that there are large differences in their impact on employment in the region, see figure 3.

The figure also shows the number of employees within each region.

FIGURE 3

BREAK DOWN OF FOOD ACTIVITIES IN CENTRAL DENMARK REGION
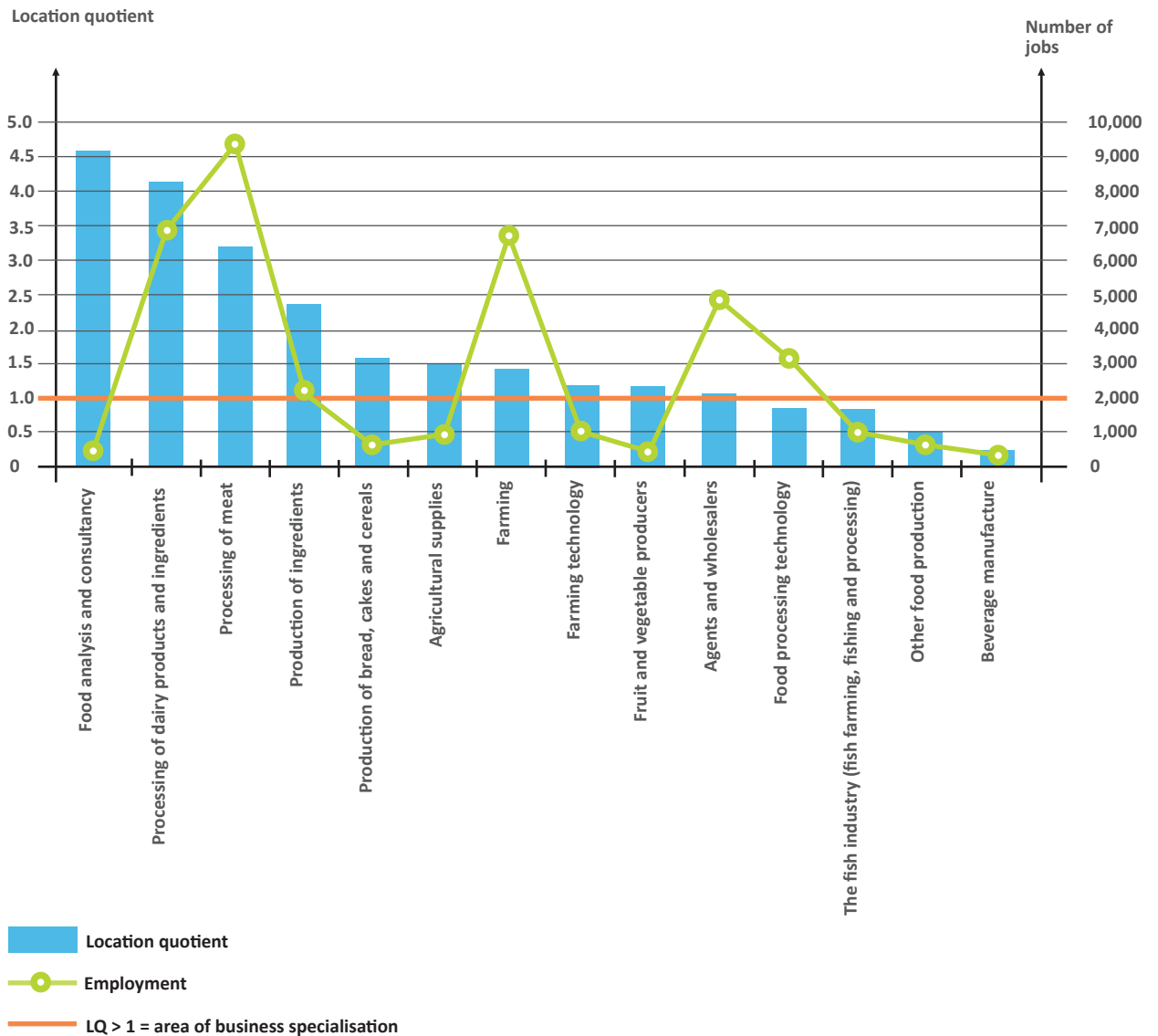
SOURCE: REG X AND OXFORD RESEARCH BASED ON DATA FROM EXPERIAN DATA 2013 FOR LOCATION QUOTIENT (LQ) AND STATISTICS DENMARK 2010 FOR EMPLOYMENT FIGURES.

>>

THE STRONGEST SPECIALISATIONS

There are primarily four strong specialisations: food analysis and consultancy, processing of dairy products and ingredients, processing of meat, and production of ingredients all have particularly high LQ values. These areas all have a LQ greater than 2, which means that these four areas make up much of the region's private employment.

Food analysis and consultancy

The region's strongest specialisation area comprises firms providing food safety consultancy. Although food safety consultancy has a high LQ, it appears that this area only accounts for approximately 400 jobs. It is primarily companies that advise other food sector companies, particular processing companies and public authorities, on food safety and control. Firms in this category include ISI Food Protection, Eurofins Steins Laboratory and Højmark Laboratory.

The reason why a relatively low employment can lead to a high LQ is that the sector as a whole employs a small number of people across the regions, and the majority of them are located in Central Denmark Region.

While food analysis and consulting are relatively small employers, they still represent a very important competence area. In Denmark, the strong tradition for food safety and traceability means Denmark can act as a role model for other countries. For example, new, tougher food safety legislation is on the way in China's dairy sector. This tighter legislation will extend not only to China's own milk production but also imported dairy products. As Danish dairy exports to China are growing, the new rules are important for Danish dairies.

China has identified Denmark as a partner country and a role model for the development of food safety in their products. One of the reasons that food safety has developed in Denmark is that the entire value chain in the food industry is located within a small geographical area, where a lot of experience has accumulated when it comes to optimising the quality and safety of food. It is possible to track and trace food ingredients back to the raw materials. This is particularly well developed in Central Denmark Region, where agriculture and food are closely linked and localised in the value chain.

Processing of dairy products and ingredients

The region's second strongest specialisation is in the processing of dairy products and ingredients. The category of dairy and other milk processing includes the dairies located in Central Denmark Region. The processing of milk products and ingredients is largely dominated by Arla, but also covers a number of other interesting and innovative companies such as Thise, Mammen Dairy and Them Cooperative Dairy.

Meat processing

The region's third strongest specialisation is within meat processing. This category includes companies involved in processing meat from, for example, pigs, cattle and poultry. The group consists of large international companies such as Danish Crown with approximately 7200 employees, Tulip

with approximately 1200 employees, and Rose Poultry with approximately 950 employees in Denmark. The industry has recently been hit by a wave of bankruptcies. For example, Jutland Meat and Born Poultry have been hit. These have been caused by a combination of increasing competition and falling pig deliveries.

Ingredient production

Central Denmark Region's fourth strongest specialisation is food ingredients and their production. This category consists of companies that develop and produce ingredients for the food industry. Companies such as Arla Food Ingredients, AarhusKarlshamn, DuPont Nutrition Biosciences and KMC are well-known names within the national and international food industry.

MEDIUM-STRONG SPECIALISATIONS

Next the analysis shows that six areas: production of bread, cakes and cereals, agricultural supplies, farming, farming technology, fruit and vegetable production, and agents and wholesalers all have an LQ value of or around 1.0. This means that these areas only slightly or to some degree reflect a particular specialisation or core competence in Central Denmark Region. This is the case even though employment in two of the areas (primary agriculture and agents and wholesalers) is relatively high. The fact that the two areas can have a relatively high employment and still not result in a high LQ is because this form of employment is higher in the other regions.

Production of bread, cakes and cereals

Manufacture of bread, cakes and cereals is a joint category for industrially produced bread and cake products. The category does not include retail bakers, since retail is not included in this study. Lantmännen Unibake Denmark, which covers the brands Schulstad and Hatting, is the largest company in the category with approximately 550 employees. Their primary products are freshly baked bread and pastries. Bake-off is also a big part of their business.

Agricultural supplies

Farm supplies for agriculture consist of compound feed, fertilisers and pesticides for the primary production of food. This category includes companies such as Cheminova and Hamlet Protein. Cheminova produces pesticides and active ingredients for primary producers globally. Last year the Group had a turnover of EUR 804 million. Many of the final compounds contain a high proportion of raw materials. Therefore, a location close to the primary producers is optimal, in part due to high transport costs.

Farming

This area covers primary agriculture and the development of raw materials for food production. Approximately 7000 people are employed. Quite a number of organic farms are included here.

>>

Farming technology

Farming technology covers companies that develop products and solutions that relate directly to food production. This includes machines for agricultural production and processing of products. It is a secondary industry to primary production and, thus, highly dependent on the development of primary producers. One of the major companies in this category is SKOV, which is a world leader in climate control and surveillance of animal production. SKOV dates back to 1954 and has roots within chicken farming, where it was necessary to control ventilation in chicken houses. They have continued to innovate and, today, have 275 employees and products that are used worldwide.

Fruit and vegetable producers

This sector covers commercial gardeners that produce food. This means that greenhouses mainly concerned with the production of decorative plants are not included in the analysis. Fruit and vegetable growers experience an increasing degree of specialisation, with a bigger focus on fewer varieties but a wider choice within the whole sector. Consequently, plant production and innovation has a major impact on individual producers. Some of the major companies working with fruit and vegetable production are Denfood, Yding Grønt and Tange Frilandsgartneri. Denfood is a new company established in 2010 and specialised in producing convenience carrots, Yding Grønt produces special salads and herbs, while Tange Frilandsgartneri specialises in root crops.

Agents and wholesalers

Agents and wholesalers are included in the quantitative analysis and are the closest the analysis comes to distribution and retail. This category consists of a wide range of companies engaged in wholesale trade within agriculture and food production. In this way, it is primarily a supporting industry for the food production industry. Different kinds of agents and wholesale traders exist. Grene Denmark is a medium-sized company with around 190 employees, selling spare parts and components to the agricultural industry. Reitan Distribution is another major company in this category. Their primary market is produce to grocery chains in Denmark.

AREAS WITH NO STRONG SPECIALISATION

Four areas in Central Denmark Region – food processing technology, the fishing industry, other food production and beverage production – have an LQ below 1. This means they are not over-represented in the region's employment figures, although together they employ just below 5000 people.

Food processing technology

Food processing technology consists of companies that manufacture machines essential to food production. Major companies in this category are SPX Flow Technology Denmark, Marel, Tetra Pak and Faerch Plast. They produce machines for food processing or food handling. There is a clear specialisation of knowledge in this field. In connection with the acquisition of APV by SPX, the region was described as "food technology's Silicon Valley" because of the specialised know-how and expertise in the field.

The fishing industry (fish farming, fishing and processing)

The fishing industry covers everything connected to fish and seafood. This includes sea fishing, fish farming and producers of fish feed - the entire value chain from 'sea to table'. One of the major companies is Biomar, which produces feed for fresh water farming, marine farming and recirculation. The industry also includes many small businesses working primarily with fishing.

Other food production

Other food production covers a number of food manufacturers producing preservatives, confectionery, ready meals, convenience food and other foods. Two medium-sized businesses in this category are Carletti with 140 employees and Go Snacks with 65 employees. This is a broad category that covers many of the smaller businesses.

Beverage production

Beverage production includes the primary producers of grapes for local breweries. The category is one of the smaller food industry categories in Central Denmark Region. There is no longer a major producer of beverages in the region, a trend that was reinforced when Ceres was relocated outside Aarhus.

>>

BENCHMARKING OF CENTRAL DENMARK REGION'S SPECIALISATIONS

In view of the above, it is clear that Central Denmark Region has some specialisations that characterise its food activities. But it is unclear whether these specialisations are particularly strong compared with other regions and countries.

Benchmarking is always difficult due to lack of comparable data. We have collected comparable data from the other Danish regions to compare the strength of the Central Denmark Region specialisations within the food sector, see figure 4.

As the figure shows, the concentration of employment within food analysis and consultancy, processing of dairy products and ingredients, meat processing and ingredient production is significantly higher in Central Denmark Region compared with the rest of Denmark. This means that the four specialisations identified as particularly strong in Central Denmark Region (LQ values >2) are also very strong in relation to the same areas in the four other regions. In other words, within these four areas of specialisation, there is a

particular concentration in Central Denmark Region.

In areas identified as having medium specialisations (LQ value of 1-1.5), the difference in the concentration of employment is balanced across the other regions in Denmark. This confirms that there is not a particularly strong regional specialisation in these areas compared to other regions.

**The specialisations from an international perspective**

In evaluating the strength of a business area, it is useful to benchmark with similar areas in other countries. Internationally comparable data in this sector is limited, and it is not possible to obtain comparable data from other clusters for use in this analysis. However, a previous quantitative analysis of Denmark's food cluster has shown that Denmark's global strength does lie within the meat and dairy areas.[18] This study compares employment in Denmark's agriculture and food cluster with other major agriculture and food clusters in Europe, North America and Australia. The analysis was the first of its kind, showing that the total Danish agriculture and food industry is the third largest

>>

FIGURE 4

CENTRAL DENMARK REGION'S FOOD SECTOR SPECIALISATIONS

Location Quotient
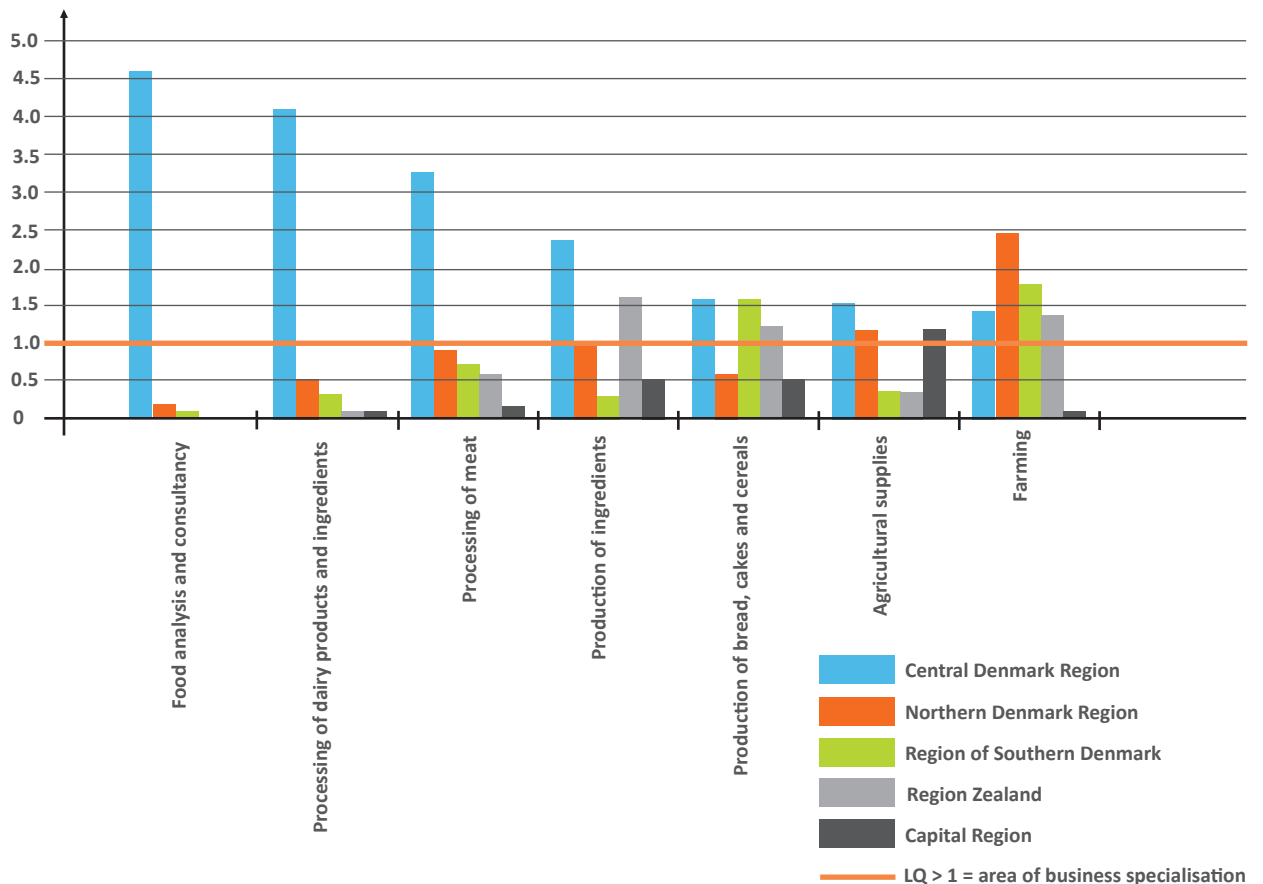
SOURCE: REG X AND OXFORD RESEARCH
BASED ON DATA FROM EXPERIAN DATA, 2013.

18: FORA, The Danish agriculture and food cluster from an international perspective, 2010.

cluster with approximately 175,000 employed, in line with comparable clusters in North America, Europe and Australia, and the second largest agriculture and food cluster in Europe. So, despite the lack of internationally comparable data in this analysis, the above-mentioned evidence enables us to conclude that Central Denmark Region's specialisation within dairy and meat processing has significant global strengths.

The geographical location of the specialisations
The analysis examined whether the occupational groupings and specialisations within the food sector have a particular geographic concentration in Central Denmark Region, or whether the specialisations are spread evenly in the region.

For this purpose, the distribution of jobs is compared in the east and west of the region respectively.

It appears that all the areas with the highest LQ values, with

the exception of food analysis and consultancy, are concentrated in the eastern part of the region, i.e. the Aarhus area, see figure 5.

The vast majority of work places within the processing of dairy products and ingredients, meat processing and ingredient production are located in the east of the region, while the west of the region is particularly characterised by companies within agricultural supplies, beverage production and the fishing industry. Then there is a relatively large middle group of business areas and work places that are located in both the east and west of the region - including food analysis and consultancy.

FIGURE 5

THE GEOGRAPHIC DISTRIBUTION OF SPECIALISATIONS IN CENTRAL DENMARK REGION
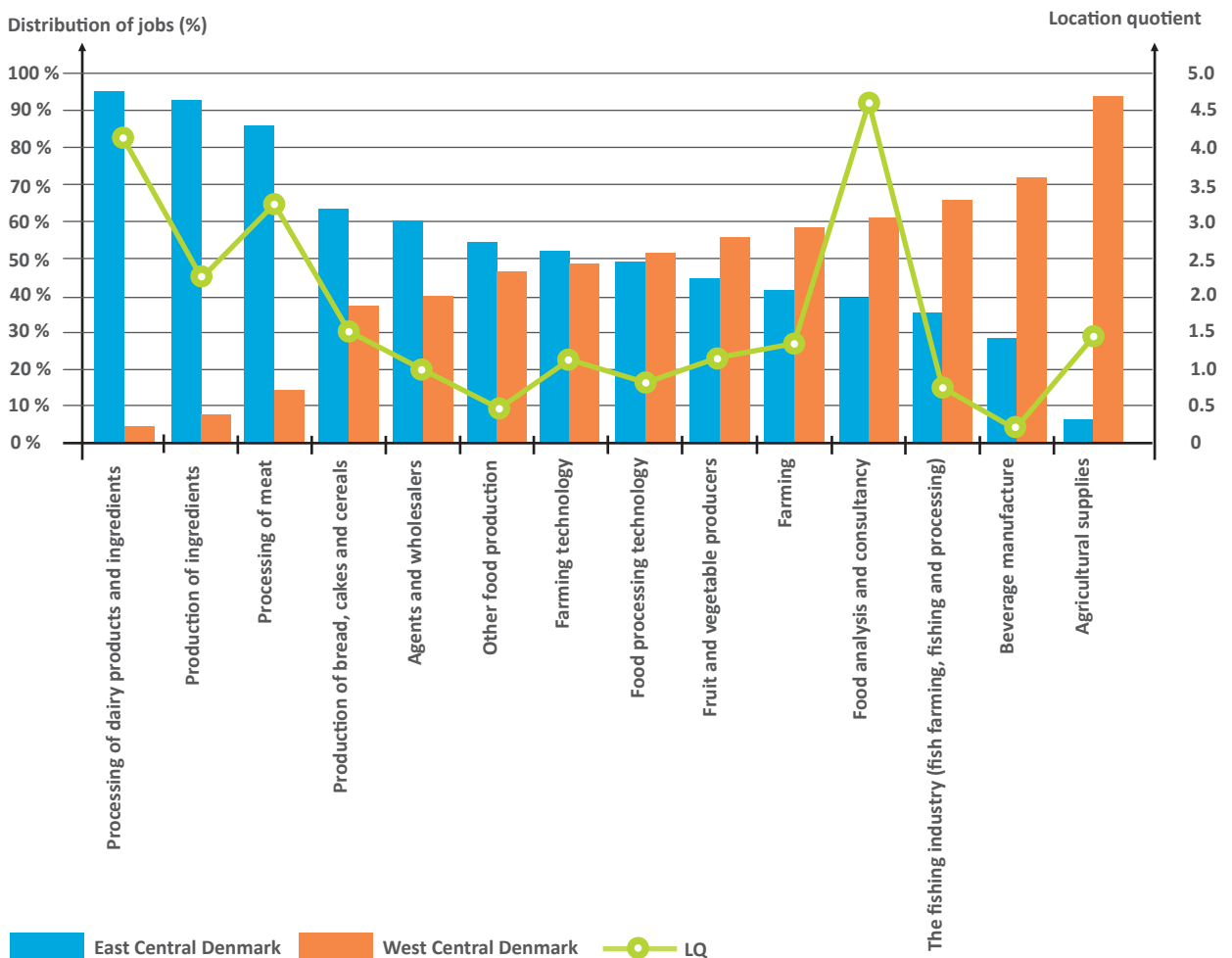
Note: East Central Denmark includes Hedensted, Horsens, Odder, Skanderborg, Favrskov, Aarhus, Syddjurs, Norddjurs, Randers and Samsø. West Central Denmark includes Herning, Holstebro, Lemvig, Struer, Silkeborg, Ikast-Brande, Viborg, Skive and Ringkøbing-Skjern.

SOURCE: REG X AND OXFORD RESEARCH BASED ON DATA FROM EXPERIAN DATA 2013.

KEY FIGURES FOR FOOD ACTIVITIES WITHIN CENTRAL DENMARK REGION

KEY FIGURES FOR FOOD ACTIVITIES WITHIN CENTRAL DENMARK REGION

Another major part of evaluating the strength of a business area is the businesses' contribution to growth. To investigate this further, the development of activities in Central Denmark Region's food sector was studied from 2003 to 2010. The baseline year for the analysis is 2010. This shows that the food sector is characterised by many companies.

In 2010, there were 9169 companies in the food sector, which can be seen across the value chain and includes companies in both the primary industry and food processing, see table 1.

TABLE 1

TOTAL KEY FIGURES FOR THE FOOD SECTOR

	2003	2005	2007	2009	2010
Number of businesses (agriculture and food)	9550	9927	9791	9176	9169
Number of businesses (only food)	1654	1768	1856	1906	1950
Employment (total number of employees)	48948	46818	46728	40124	40091
Turnover (billion EUR)	15.04	17.09	18.8	19.4	20.01
Export (billion EUR)	5.59	6.39	6.4	6.27	6.98
Import (billion EUR)	1.15	1.63	2.23	2.26	2.66
Export intensity	37 %	37 %	34 %	32 %	35 %

SOURCE: STATISTICS DENMARK 2013 WITH BUSINESS DATA FROM 2010.

- Decreasing number of active farms. Although the businesses have been identified in 2012 and despite the fact that 2010, from which the most recent data is available, should be the year with most active companies, the number of active agricultural businesses has fallen from 2007 to 2010. The explanation for this appears to be that, after the crisis, many of the very small 'hobby' farms, typically without any employees, have been at a standstill with no activities/turnover, even though the company has not been officially closed (VAT number).

- Export intensity is calculated as the cluster's total exports relative to the cluster's total revenue.

A GROWTH AREA

The food sector in Central Denmark Region is an area of growth. Excluding the primary industry, there were 1950 companies in the food sector alone in 2010. Since 2003, 300 new food businesses have entered the market. The turnover of these companies as a whole has also increased during the period. The companies had a combined turnover of EUR 20 billion in 2010, an increase of almost 25 percent since 2003. Total imports also grew during this period.

INCREASED INTERNATIONALISATION

The food industry contributes significantly to Danish export. The Danish food industry accounts for approximately 20 percent of total Danish exports and 2/3 of Danish food exports.[19] Primarily Denmark's neighbouring countries, such as Germany, the UK and Sweden, account for the largest part of total Danish exports. Overall the Danish food industry exports 63 percent of its products to EU countries.[20] However, in the future, it will pay the Danish food industry to seek out new markets outside the EU. The emerging economies of the BRIC countries, for example, represent a growing potential for food exports combined with an increasing demand for innovative solutions related to global challenges (in food, climate, environment, health, etc.).

>>

19: Danish Agriculture & Food Council, Facts about Business, 2012.
20: This includes animal skins

>>

Companies in the Central Denmark Region food sector exported over EUR 6.9 billion in 2010 and had an export intensity of 35 percent, i.e. exports accounted for 35 percent of the food sector's total revenue. From 2003-2010, export intensity has declined, because growth in export has not corresponded to the increase in turnover in the sector as a whole. It is especially during the financial crisis that exports have fallen. However, the food sector has become more internationalised during this period, as all the specialisation areas have experienced an increase in exports, with the exception of agricultural supplies and meat processing. Meat processing, though, has experienced export growth after the crisis.

While the food sector's average export intensity was 35% in 2010, there is great variation in export intensity across the specialisations, see figure 6. In other words, there are big differences in how much export means for each of the specialisations. Strategic choices of export markets, export market sizes, revenue opportunities and capacity are some of the factors that influence export intensity.

Production of bread, cakes and cereals has the highest export intensity followed by ingredients, ingredient produc-

tion, meat processing, farming technology (machinery, high-tech farm equipment) and agricultural supplies. In the field of farming technology, it is estimated that exports of technological solutions represent a growth area in emerging markets. The processing of dairy products and ingredients lies far below the cluster average, due in part to the large national market for milk.

AN OVERALL FALL IN EMPLOYMENT
Overall, there are about 40,000 employees within the food sector in Central Denmark Region.[21] Of these, the vast majority are employed in food processing, equivalent to approximately 33,000. But even though the food sector is growing in sales and exports, businesses have experienced a decline in employment. The food sector's total employment has fallen by 19 percent and employs approximately 9,000 fewer workers in 2010 than in 2003.

The decline in employment is not surprising. Figures show that the majority of the decline in employment lies in meat processing, which relates to the optimisation and automation especially within slaughterhouses. Employment in meat processing has fallen from about 18,000 to about

>>

EXPORT INTENSITY OF THE SPECIALISATION AREAS (AVERAGE 2003-2010)

Export intensity   Export (billion EUR)

■ Export intensity of the specialisation areas

─○─ Export 2010
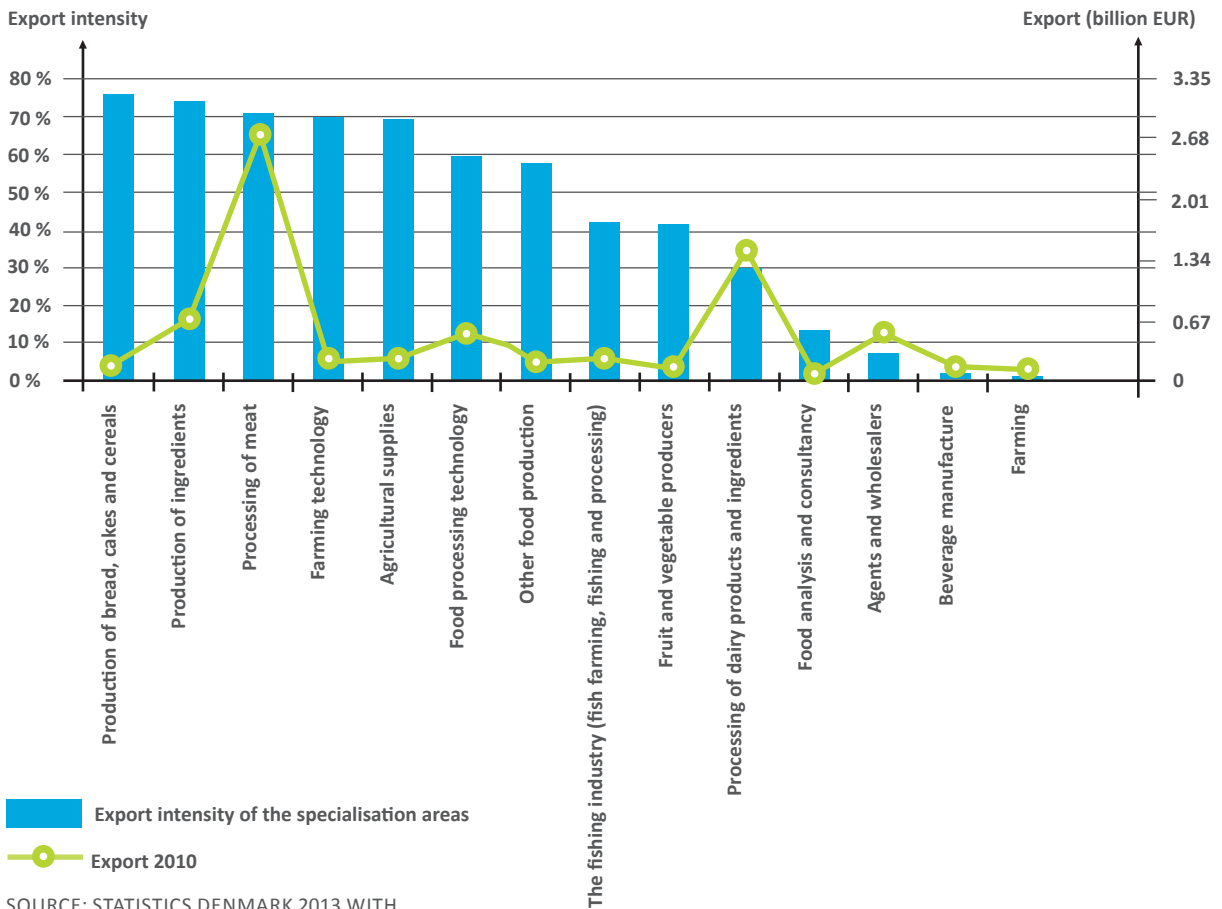
SOURCE: STATISTICS DENMARK 2013 WITH BUSINESS DATA FROM 2010.

21: The head office issue should be taken into account.

10,000 during the period. It is the largest decrease across the business areas within the food industry. It cannot be expected that future growth in employment will come from the areas that have undergone optimisation. It is therefore important to examine which other areas growth can come from – and it will be interesting to look at the types of jobs that have declined and grown among the food businesses.

The analysis also examined the educational level of employees within food companies. The proportion of employees that only have a secondary school education decreased in 2004-2011, while other education areas have grown - in particular the proportion of employees with higher education. This development is due to efficiency improvements and is a trend that corresponds with overall developments in Denmark.

THE LARGEST COMPANIES WITHIN THE SPECIALISATIONS
The distribution by company size is interesting from a cluster perspective. The presence of large established compa-

nies can help strengthen a cluster's development due to increased knowledge within the sector, strong export, access to markets, talent and level of knowledge as well as being potential partners for smaller companies.

The size of the companies in the food sector in Central Denmark Region is compared across the specialisations, distinguishing between firms with more or less than 50 employees, see figure 7.

For a number of well-established food areas such as production of ingredients and processing of dairy products there is a high proportion of large companies with more than 50 employees. This means that there is potential to involve some large companies from these areas in cluster development going forward. But also the area of production of bread, cakes and cereals has many companies with over 50 employees. On the other hand, areas such as beverage manufacture, fruit and vegetable producers, farming and the fish industries, are exclusively characterised by small enterprises with fewer than 50 employees.

FIGURE 7

DISTRIBUTION OF BUSINESSES IN THE CLUSTER BY SIZE

Distribution of businesses

■ 1-50 employees　　■ More than 50 employees
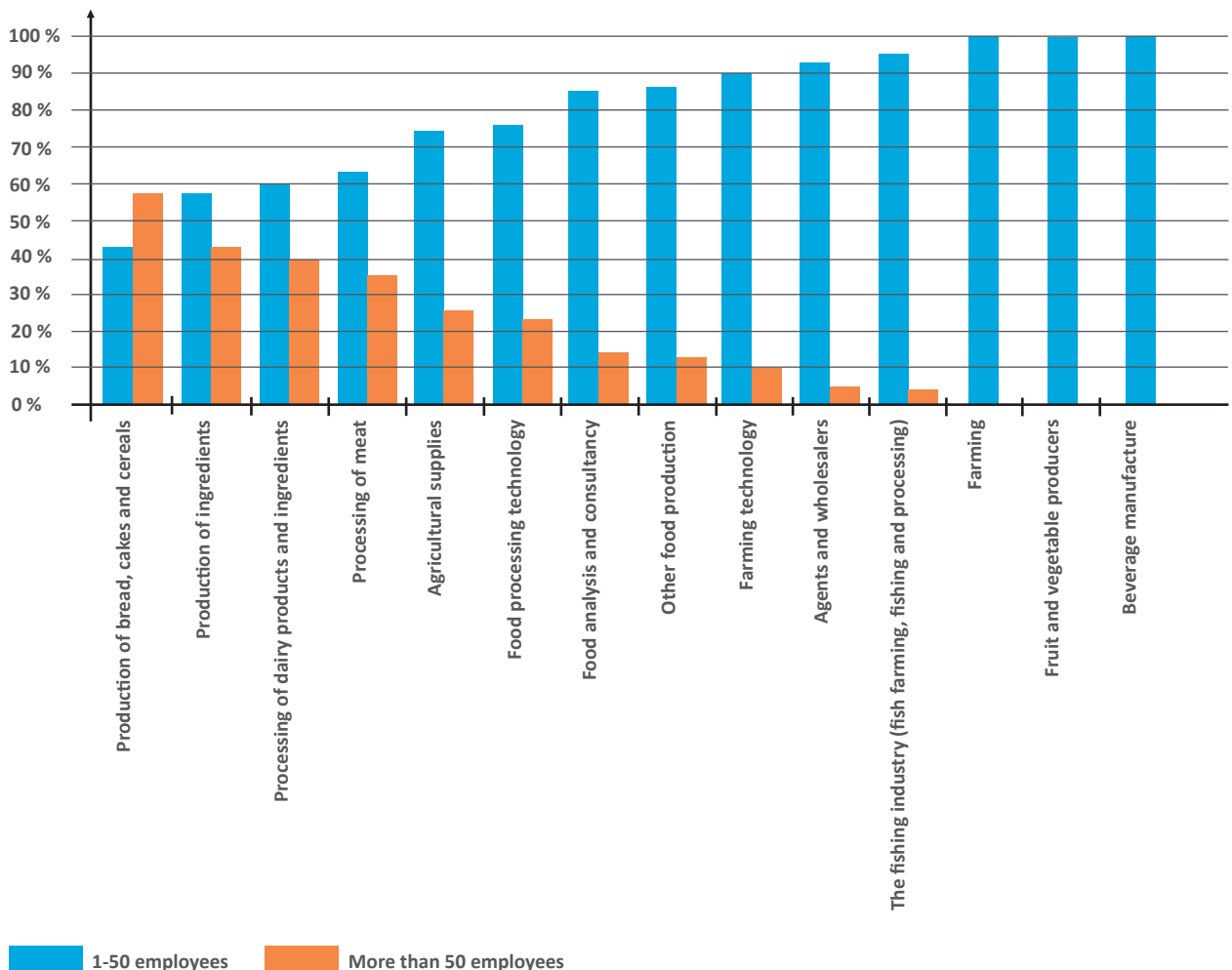
SOURCE: STATISTICS DENMARK 2013 WITH BUSINESS DATA FROM 2010.

THE FOOD ACTIVITY ECOSYSTEM AND STAKEHOLDERS IN CENTRAL DENMARK REGION

INTRODUCTION

When the number of food companies and their importance in terms of employment is examined, the above quantitative analysis shows that the food sector in Central Denmark Region has a good quantitative basis for being a strong cluster.

However, cluster analysis is more than quantifying a possible cluster. It is also important to identify cluster stakeholders, their cooperation, dynamics and cohesion. Such a mapping can be described as the mapping of the cluster's 'ecosystem'. A common analysis model has not yet been developed to describe a cluster ecosystem. Therefore, the following new model of a cluster ecosystem has been introduced. This is used to understand the dynamics between food businesses in Central Denmark Region more specifically.

Methods for mapping the presence of relevant stakeholders and their needs are, by their nature, a more qualitative process. The following qualitative analysis examines food sector stakeholders and their interaction and ecosystem. The analysis is based on interviews with approximately 40 key stakeholders in the food sector inside and outside Central Denmark Region, including a range of companies with various specialisations and of different sizes and age. The qualitative analysis is based on an overall assessment of the input and opinions of the interviewees, along with existing reports and material in the field by the authors and the research partnership.

The following analysis examines the stakeholders' strengths and development potential in terms of helping to create a strong Danish food cluster with a possible epicentre in Central Denmark Region.

ANALYSIS MODEL FOR AN ECOSYSTEM

According to current cluster theory, clusters are comprised of 'business, academia and government', often described as a 'triple helix model' for clusters.[22] Today it is widespread in cluster thinking to consider clusters as close collaborations between companies, knowledge and educational institutions and the public sector. Such collaborations are also described as open innovation, where business innovation is externalised and developed in collaboration with other stakeholders.[23]

But how do the various cluster stakeholders contribute more specifically to cluster development, and which dynamics between stakeholders are characteristic of strong clusters? For a deeper understanding of cluster dynamics and the roles between stakeholders in a 'triple helix perspective', we have developed a model for a cluster ecosystem. The ecosystem's stakeholders are established companies, knowledge stakeholders, consultants, investors, entrepreneurs, network organisations and 'dealmakers', see figure 8.[24]

FIGURE 8   A CLUSTER'S ECOSYSTEM
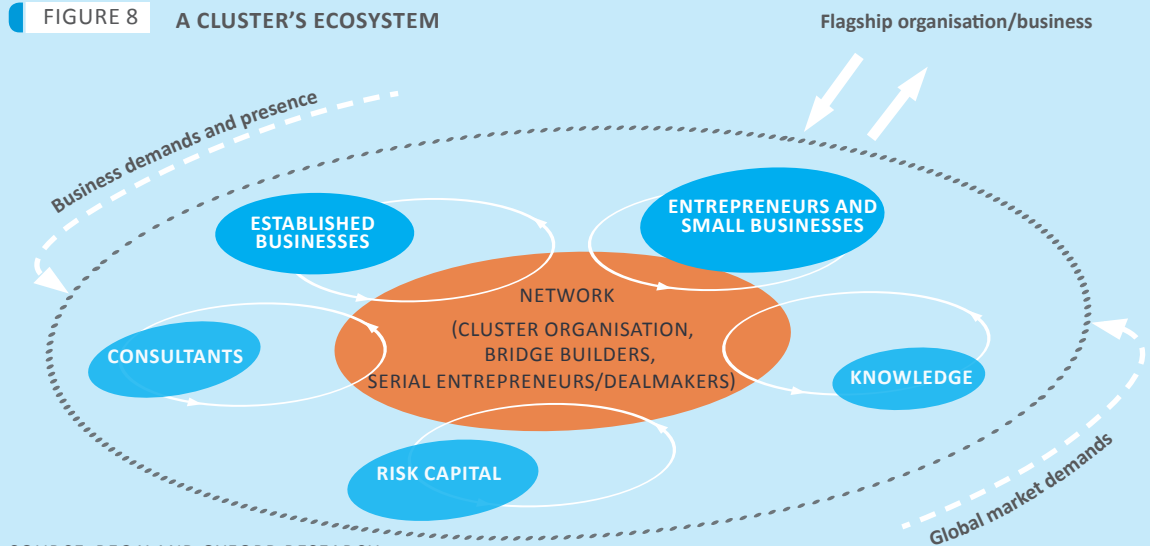
SOURCE: REG X AND OXFORD RESEARCH

22: Porter, The Competitive Advantages of Regions, 2004; Etzkowitz and Leydesdorff, The Triple Helix as a Model for Innovation Studies, 1997.
23: Chesbrough, Vanhaverbeke and West, Open Innovation, 2006.
24: The ecosystem model was developed on the basis of empirical studies of ecosystems in the USA (see also Napier, 2012 for Danish Business Authority) and developed further by REG X for use in cluster analysis.

>>

The following qualitative analysis examines the stakeholders in and around the food activities in Central Denmark Region based on the view that a strong, open ecosystem requires the presence of:

- Large established companies that act as flagships and reinvest their success in a cluster
- Entrepreneurs and small innovative companies who create innovation in a cluster
- Relevant knowledge stakeholders that bring new knowledge to a cluster
- Advisors who can support companies in their development and innovation cooperation
- Venture investors who are willing to invest in innovation
- Network facilitators in cross-disciplinary fields.

THE ESTABLISHED COMPANIES

As revealed by the quantitative analysis, there is a high concentration of large established companies in the food sector in Central Denmark Region. There is a particularly high proportion of large companies within the business specialisation areas of ingredient production and dairy processing.

According to the interviews, the large established companies previously had a more closed culture. They have not always seen the benefits of engaging in close innovation collaboration with other companies - and have focused on more traditional customer-driven cooperation, with incremental adaptation of products. But, in recent years, there has been a development in the way the large established companies engage in collaborative projects with other companies. A small group of large companies are particularly active - including Arla Foods and DuPont Nutrition Biosciences in relation to open innovation.

According to the interviewees from the large established companies, the companies are increasingly open to cluster thinking and open innovation. This is expressed in different ways. Arla Foods has re-formulated its growth strategy to move from a primary focus on acquisitions to also include creating growth through open innovation. Arla Foods' new five-year growth strategy envisages that growth will come from emerging markets such as Russia, China, the Middle East and Africa.

To realise this potential for growth innovation, development and enhancement of new products are key elements - and it may very well be achieved in collaboration with other companies. On top of that, the future of the food industry should have a greater focus on sustainability in relation to a surge in demand for commodities. This means that there will need to be closer collaboration between processing companies and primary producers, also in relation to innovation.

The global challenges in the areas of climate and environment mean that there is a huge development potential for the food industry in this area, and the link to primary production is central to this process. It is estimated that, in the future, agriculture could have a lead role in innovation development – to the benefit of Denmark and the rest of the

world. The larger firms' incentive to be part of a strong food cluster is primarily based on an understanding that strong clusters and open innovation collaboration can help to realise their growth potential. There is no doubt that the large established companies think and act globally. But there are well-considered strategic reasons to enter into a strong food cluster, which may be based on a strong regional 'epicentre'. The interviews showed that, for the large, established companies, the benefits of a strong cluster were primarily opportunities for increased talent attraction and development from Denmark, internationally and between businesses located nearby. Moreover, they can benefit from the strong marketing and profiling of the food sector's stakeholders, which allows for the possibility of co-branding in the sector. For companies with foreign owners, it is particularly important for them to be able to show that they are geographically located within a strong cluster that has a global competitive advantage in order to retain and attract new investment from the parent company. And, finally, cooperation and open innovation activities with other enterprises, entrepreneurs and knowledge stakeholders in the food sector can boost business innovation and, thus, economic growth.

It is estimated that established companies, particularly Arla Foods, have a unique opportunity to play a key role in developing a food cluster. They can play an essential role as flagships and drivers for cluster development by seeking collaboration with the cluster's other businesses. In particular Arla Foods' plans for a "food universe" (see box 1) have the potential to be a driving force in the development of a food cluster.

>>

BOX 1

A 'FOOD UNIVERSE' BASED WITHIN THE CLUSTER

In a partnership driven particularly by Arla Foods, the idea of a new platform shaped like a 'food universe' is taking shape.

The idea is to create a physical platform to facilitate knowledge sharing within food development, green technology, sustainability and solutions to global food challenges. The new universe would be a national initiative, based on the strength of the Danish food cluster and the cluster competencies present in Central Denmark Region.

The idea was created by a growing need in the industry and is driven by the cluster's businesses. In the global race against time for food innovation, there is a need for a common physical platform that boosts ideas and works together to develop new, innovative products, services and technology that can be marketed and sold globally.

The aim is to support the growth of global commercial success and job creation within the Danish economy. Using a unique architectural concept, a living environment will be created with application centres that represent the entire value chain from 'farm to fork' and the transition to an agro-industrial age. This will be created hand-in-hand with food businesses, retail chains, research, education and consumers.

The aim of the food universe is to develop innovative solutions to the future global challenges of resource scarcity, food shortages, energy challenges and health problems. There is also a growing need in the community for consumers and citizens to know where their food comes from and how it is produced.

Such a coherent system and chain, with a concrete infrastructure for open innovation in agriculture, food and the bioeconomic sector, does not currently exist in Denmark or elsewhere. This will increase the sector's international competitiveness significantly and create growth and employment through production, export and increased international investment in Denmark.

by itself. There is a need to highlight the opportunities and synergies of open innovation to the food sector and develop a strong business culture around it. There is a shortage of physical meeting places where companies can engage in new innovative projects across the divide between business size and areas of business specialisation. For these reasons, it is estimated that there is great potential for involving established businesses as drivers in developing a food cluster. It is also estimated that there is a real risk of large international food companies cutting jobs in the food sector due to a lack of visibility of cluster synergies.

TABLE 2

SUMMARY OF THE ANALYSIS OF ESTABLISHED COMPANY STRENGTHS AND DEVELOPMENTPOTENTIAL FROM A CLUSTER PERSPECTIVE

Strengths	Development potential
Large volume of established businesses in the region that are willing to act as drivers for the sector.	The businesses have a history of acquisitions and, from a cluster perspective, must see opportunities to collaborate with other companies on innovation development, especially with young entrepreneurs.
Strong position in the global market, which can create growth opportunities for the cluster.	From the outside, the larger businesses are perceived as businesses with that, to some extent, have closed cultures.
Stakeholder-driven interest in involvement and development of cluster activities, which can promote innovation and growth in new ways.	Some of the larger companies are of the opinion that there is a lack of opportunities to create and engage in radical innovation projects with other companies.

ENTREPRENEURS

Strong clusters have high entrepreneurial activity.[25] Entrepreneurs contribute new knowledge, technologies, talent and innovation that the other companies in a cluster often lack.

The food industry has not traditionally been an industry with a large degree of entrepreneurship. There are simply fewer new businesses started in the food sector than in other sectors.[26] This may be due to several factors. Entrepreneurship, innovation and first movers have been costly in the food sector. The industry has been a highly regulated profession, is capital intensive and often requires access to large processing facilities and agricultural products. In addition, new ideas have often been bought by the established industry within the food sector, while consumers are generally characterised as conservative with regards to trying new products. However, this trend seems to be shifting.

>>

Despite the growing interest from the large established companies to engage in close cooperation with other companies, a strong open innovation culture does not develop

25: Delgado, Porter and Stern, Clusters and Entrepreneurship, 2010.

26: Vækstteam for Fødevarer (Growth Team for Food), 2013.

>>

Although it has not been possible to conduct a quantitative analysis of the development of entrepreneurs in the food sector, it is estimated on the basis of the interviews with food entrepreneurs that entrepreneurship is playing a new role in the food sector.

According to the interviews, there is a growing influx of new entrepreneurs who are not "traditional" food businesses. The new food entrepreneurs are inspired to establish synergy across the areas of business specialisation in the food sector. They help to develop new niche areas - often based on a cluster's large companies and their markets - and deliver new technologies/solutions to them. This is beneficial to the growth potential of both entrepreneurs and established businesses.

The new food entrepreneurs operate at the intersection between food, climate, environment and health and are focused on cultivating new hybrid areas around the food sec-

tor. Entrepreneurial companies working in the new 'hybrid areas' include:

- LetFarm, which develops IT tools for documenting consumption in fields
- Soy4you, which develops alternatives to meat products
- GenoScan, which works on the identification of DNA in animals and plants
- Bovisoft, which develops IT equipment for stables
- AgroSoft, which develops IT for pig production
- Webstech, which develops apparatus for measuring the temperature of grain.

See also box 2 for further case descriptions of entrepreneurial food businesses that operate in new hybrid areas within the food sector.

>>

BOX 2

EXAMPLES OF ENTREPRENEURIAL FOOD COMPANIES IN 'HYBRID AREAS'

Inomega3 - health food
Inomega3 is an ingredients venture that develops new ingredients within fish oil, especially omega-3 ingredients. The company was established in 2012. The vision is to develop food products and ingredients that can help consumers take 'medicine', i.e. healthy omega-3 ingredients, through their intake of food.

The market is particularly strong in the USA and Asia, but the demand is not yet widespread in Denmark.

The entrepreneur was previously employed in AarhusKarlshamn (then Aarhus Olie), and has worked with ingredients for over 10 years. She has a large network in the sector. She relocated to Norway in 2003, when Aarhus Oil sold its maritime oil division to a Norwegian dairy. In 2011, the Norwegian dairy closed down the oil division. Against this background, the entrepreneur decided to start her own business with the idea of producing new ingredients, which enable the development of healthier foods with a high content of omega-3 fats.

LetFarm – IT application for reduced spraying of fields
LetFarm is an entrepreneurial IT company established in 2008 to provide farms with a handheld technology platform. This is used to simplify the documentation related to farmers' field work and spraying of fields. Documentation in agriculture has, until now, been carried out manually. In 2010, LetFarm introduced a prototype of a new application and won an AgroTech prize due to the product's innovativeness. The product was launched in 2012.

The company uses access to official data about spraying of fields, which has recently been made available to the

public. The new data makes it possible for LetFarm to improve farmers' productivity, e.g. time spent on spraying depending on weather and road conditions. At the same time, it reduces the environmental impact by monitoring and optimising farmers' use of pesticides and chemicals.

LetFarm's vision is to internationalise the product for the global market and, although environmental considerations were not part of the original product development, they are an essential aspect of the product today. The company operates at the interface between agriculture and the environment/climate.

Soy4you – the reduced CO2 meat alternative
In 2011, Soy4you was established by a serial entrepreneur within the food industry. The company has developed a vegetable alternative to meat proteins. It has the same taste as meat, but costs less, pollutes less and has a long shelf life. The venture was established on the principle of producing "more food for less". Areas planted with soybeans can produce food for 30-50 times more people per hectare than areas that produce protein through beef cattle. Water consumption for cultivation is reduced by 95% and CO2 emissions by 90% compared to the farming of traditional beef cattle.

Soy4you has a global view of pollution, thinking not only of the local impact but also the wider social consequences of pollution.

The entrepreneur has worked in the sector for 30 years and started several companies before Soy4you. According to the entrepreneur, there is increased demand for sustainable and healthy food, and it is this demand that Soy4you addresses.

The potential for entrepreneurs within the food industry is estimated to be significant within the new hybrid areas. Here, entrepreneurs can act as agents for change and help companies step up their efforts towards the global societal challenges faced by the existing agricultural and food sector. To this end, the entrepreneurs are dependent on the large food companies' existing logistics and access to global markets.

Although entrepreneurs play an increasing role in the cluster, it is estimated that the food sector is not yet at a stage of 'entrepreneurial readiness'. According to the entrepreneurs, the food sector in Central Denmark Region is strong, but is dominated by large companies. New companies fear that their ideas will be swallowed up if they enter into a close cooperation with the large companies. Some of the new food entrepreneurs feel challenged by the prospect of entering a market that has not been traditionally accustomed to innovative entrepreneurs who confront the market with new solutions. The more experienced entrepreneurs, i.e. serial entrepreneurs, do not see it as such a big challenge due to their larger relevant network within the sector. More can be done to make room for new players to enter the food sector and contribute to innovation and dynamism.

Moreover, the entrepreneurs believe that the ecosystem for food growth entrepreneurs could be stronger. It is difficult to raise capital for their innovative products and gain access to affordable development and test facilities, and they lack the skills to estimate the international market potential. There is a need for the cluster's companies to make more effort to work with entrepreneurs, establish joint test/development facilities where entrepreneurs can meet and collaborate with large companies, and, potentially, establish an investment fund for new food businesses.

KNOWLEDGE STAKEHOLDERS
Access to new knowledge and research of high quality and relevance is essential for a strong cluster. Knowledge institutions are an important element of a well functioning cluster. They support the areas of business specialisation and, at the same time, create an academic foundation for the development of entrepreneurship and innovation.

In Central Denmark Region, a range of knowledge stakeholders develop new knowledge and research in the food sector (see Appendix C for a summary of the knowledge stakeholders). The largest knowledge institution is Aarhus University (AU), which, along with the University of Copenhagen (KU) and the Technical University of Denmark (DTU), is responsible for 95 percent of all Danish public food research. This makes AU a significant regional and national stakeholder.[27]

Relevant research is also carried out at other universities in Denmark, for example at Aalborg University and the University of Southern Denmark. According to international rankings of universities, Danish universities perform well in the sector.[28]

TABLE 3

SUMMARY OF THE ANALYSIS OF ENTREPRENEUR STRENGTHS AND DEVELOPMENT POTENTIAL FROM A CLUSTER PERSPECTIVE

Strengths	Development potential
New non-traditional entrepreneurs are appearing in the food sector.	Entrepreneurs experience that the ecosystem around them is not used to entrepreneurial ventures.
They operate at the intersection between food, climate and health - the so-called hybrid areas - and develop solutions that are closely linked to the challenges in global markets.	Entrepreneurs are perceived as focusing on their own ideas and do not necessarily engage in dialogue/networking with other businesses.
They bring competition and innovation to the food sector and have expressed (cautious) interest in cooperating with other companies.	According to the entrepreneurs interviewed, experience of internationalisation among new entrepreneurs is not always high and can be positively strengthened by collaborating with established businesses.

Based on interviews with knowledge stakeholders and experts in the food sector and a bibliometric survey of food-related research, we have tried to produce a summary of the food-related knowledge within the three universities.

It is estimated that AU, KU and DTU specialise in food-related knowledge in the following way:

- **AU:**
  Primary production, raw material quality and consumer behaviour
  AU specialises in knowledge about primary production, from animal and vegetable processing systems to the raw material quality of milk, meat, vegetables/cereals and milk-based ingredients. Additional areas include knowledge of the market and consumer behaviour (within the internationally recognised MAPP Centre), engineering, environmental technology and bioresources. AU also has environmental competencies in relation to agricultural and aquatic environments and engineering competencies in relation to bio-energy.

- **KU:**
  Product characteristics and human health
  KU's food activities specialise in the quality of animal and vegetable products, including sensory and advanced analytical methods. KU also specialises in health-related clinical nutrition and veterinary science

27: Forsknings- og Innovationsstyrelsen, Kortlægning af dansk fødevareforskning, 2010. (Danish Agency for Science, Technology and Innovation, Mapping of Danish food research, 2010)
28: QS WORLD UNIVERSITY RANKINGS BY SUBJECT 2013 - AGRICULTURE & FORESTRY

>>

in respect of livestock production and plant genetic resources.

- **DTU:**
Food safety, bioprocesses and aquatic products
DTU specialises in food safety research and consultancy and has research competencies in fish-based products and ingredients. DTU also has competencies in bio-process modelling at the interface between food, enzymes and pharmaceuticals.

The effort to map the availability of food-related knowledge across the three universities suggests that access to knowledge across the value chain is strong. Together, the three universities develop knowledge and research on issues ranging from primary production, raw materials, products and process technology to markets and consumers. Strong access to food-related knowledge and research across the value chain requires effective knowledge communication between the institutions and towards companies – also across the regions.

AU has taken the initiative to create a multidisciplinary platform for institutions working with food-related research and knowledge. The new initiative is called AU Food Platform and is intended to strengthen businesses' access to the knowledge environment and coordinate the many research activities, see box 3.

From the interviews with large established companies, it is estimated that large firms have sufficient access to relevant knowledge across the Danish universities. It is the smaller companies that experience challenges around cooperation with the universities. The interviews reveal that universities can be difficult and cumbersome to work with for businesses that often need to test or develop new ideas at a faster pace. According to interviewees, many researchers are a long way from understanding what businesses actually need with regards to new knowledge, although there are exceptions where the collaboration is flexible and responsive. Furthermore, many companies are of the opinion that the university Technology Transfer Offices could do more to focus on growth development by and of companies, rather than focusing on the number of patents, licenses and related university-based revenue. It is estimated that, particularly in relation to the intersection between food and other disciplines, there is great potential for entrepreneurship and growth among businesses in the food sector. This potential could be developed through cooperation between research and industry, strengthening the revenue opportunities for both sides.

Apart from the universities, VIA University College, for example, also plays a role in supporting the talent building of food businesses. They offer two educational programmes focusing on health and diet. These programmes, along with AU, agricultural schools and business colleges, provide a solid talent pool for food cluster companies. The interviews with the companies highlighted the need for educational institutions to support the development of the educational competencies required by food businesses in the future.

>>

BOX 3

AARHUS UNIVERSITY FOOD PLATFORM
AU FOOD Platform was launched in 2012 with the aim of increasing food research collaboration between university faculties and with external partners. The common platform provides a better opportunity for interdisciplinary coordination between different departments that conduct food-related research. This means, for example, that it is increasingly possible to establish project teams comprising members with a range of competencies.

AU FOOD Platform provides the opportunity to strengthen internal research collaboration, but also makes AU more accessible to companies that want closer collaboration with the university. One way to increase collaboration with businesses is through the establishment of a single contact point for businesses interested in food research or education. This makes it easier to enter into dialogue with the university and helps to increase the amount of knowledge disseminated to businesses.

AU FOOD Platform currently has four focus areas: the establishment and consolidation of AU FOOD Platform, EU FOOD KIC, AU European Expert Group and the formation of an interdisciplinary centre for food, health and nutrition.

AU FOOD Platform is managed by a steering group that includes members from four faculties and relevant representatives from other interest groups.

TABLE 4

SUMMARY OF THE ANALYSIS OF KNOWLEDGE STAKEHOLDER STRENGTHS AND DEVELOPMENT POTENTIAL FROM A CLUSTER PERSPECTIVE

Strengths	Development potential
There is a high concentration of knowledge institutions in the region (and in the rest of Denmark)	Particularly the smaller enterprises perceive knowledge institutions as not always relevant to their innovation needs.
There is access to food-related knowledge and research at the highest level in the region, particularly within primary production, process technology, consumer behaviour, proteins, enzymes and, increasingly, also in health.	Smaller companies want a stronger model for the commercialisation of food-related research.
A new initiative has been created, which will strengthen the businesses' access to knowledge across institutions working with food-related knowledge.	On the basis of all the interviews, it may be worth considering the possibility of bringing knowledge of the global market, consumer behaviour and global challenges together within the cluster.

>>

CONSULTANTS

A number of Approved Technological Service Institutes (ATSI) are located in Central Denmark Region. The Danish Technological Institute (DTI) has chosen to place their food technology centre in Aarhus as part of the Life Science department.

DTI focuses on food safety, sensory science, ingredient formulation and product development. The ATSI institute AgroTech, based in Agro Food Park, focuses on agriculture and food innovation, targeting suppliers to the agriculture and food industry, particularly in the areas of feed solutions, food waste, sustainable production and the link with bioenergy. In addition, the ATSI institutes DELTA, FORCE and DHI are represented in Aarhus in the fields of health and welfare electronics, material testing and flow simulation, which are relevant to technology's intersection with food.

Overall Central Denmark Region possesses ATSI competencies across the value chain from farm to table. The primary role of ATSIs is to disseminate research-based knowledge to SMEs, build up complementary professional consultancy skills within innovation and carry out the certification of technologies and products. According to the institutes' own employees, their close cooperation with businesses has, as a side effect, contributed to entrepreneurship, The institutes have played an important role in inspiring both small and large companies to change their mindset in relation to, for example, sustainability and the link between commodities and health, etc.

In a prospective cluster venture, it is important that stakeholders work together to optimise their contribution to supporting existing and start-up companies to create growth, innovation and entrepreneurship. There is potential for the advisers to make an active contribution to "game-changing" within the food industry by creating and developing joint projects designed to tackle global challenges. This could, for example, involve participating in the development of customised test facilities to support entrepreneurial businesses.

There are also a number of business and science parks in Central Denmark Region that have a special focus on agriculture and food businesses. Agro Business Park is a research park that focuses on entrepreneurship and innovation in agriculture, raw materials, bio-energy and environmental technology. Agro Food Park is a business park that focuses on communicating and supporting the development of innovative solutions for food businesses. In addition, Incuba Science Park in Aarhus focuses on ICT and medical and health technologies. Aarhus University also has its own research and spin-off parks in relation to ingredients and food biotechnology. This close link to high-intensity knowledge gives the parks the opportunity to innovate and create new jobs to the benefit of both new and established businesses.

Central Denmark Region also benefits strongly from the Knowledge Centre for Agriculture, which by means of collaborative projects disseminates knowledge to regional advice centres for the Danish agricultural sector. In line with the increased concentration of farms in Denmark and

abroad, business demands for increased access to sustainable raw materials represent both a major challenge and opportunity. The opportunity is for agricultural consultancy to play an active role in assessing the practical possibilities for meeting this demand from food businesses, working in close collaboration with the research institutions and other consultants.

Some of the businesses interviewed also indicated that the companies have access to some industry-specific experts or so-called "dealmakers". These are private experts with subject-specific knowledge and networks who sit on several boards and work with strategic business development. Some of the established food businesses in the region are involved in the development of young enterprises by offering them professional advice on growth and innovation. This can provide a good basis for the so-called 'glue' in the cluster ecosystem, but should be strengthened further by involving more of the large companies in the development of young businesses.

TABLE 5

SUMMARY OF THE ANALYSIS OF CONSULTANT STRENGTHS AND DEVELOPMENT POTENTIAL FROM A CLUSTER PERSPECTIVE

Strengths	Development potential
● The large concentration of strong ATSIs that have moved to the region.	● According to some businesses, some of the innovation benefits provided by general business services are of limited value, and the programmes are perceived as bureaucratic and difficult to use.
● Many experienced, competent people (dealmakers) from established companies where the management wishes to engage in the development of other companies	● Small and medium-sized enterprises tend to prefer long-term collaboration with consultants rather than shorter counselling programmes.
● From the cooperative movement, the food sector has a tradition for involvement in the development of industry and businesses.	● Some of the small and medium-sized businesses perceive access to consultants as costly.

NETWORK

REGIONAL NETWORK

At Central Denmark Region level, the food sector was selected as one of four so-called "mega ventures". This means that a number of initiatives are underway, such as Future Food Innovation (FFI), Central Region Food (FØDEVAREmidt), Central Denmark Region's Food Growth Forum etc.

FFI focuses on finance, innovation, competence building and the internationalisation of entrepreneurs and new products.

Central Region Food is a business development programme that aims to create more innovation within the food businesses. By providing targeted advice, Central Region Food assists businesses with clarification of goals, action plans,

>>

subsidy schemes and making contact with external partners and consultants.

The Growth Forum has established a food council, which functions as an expert adviser. The council's role is primarily to ensure quality, relevance and effectiveness in the implementation and facilitation of initiatives related to the Growth Forum venture "Smart everyday food".

In addition, the council supports the coordination of food ventures in relation to cross-regional, national and international initiatives. The council consists of representatives of business organisations such as the Danish Agriculture and Food Council, Food DI, the Danish Chamber of Commerce, Horesta (Association for the Hotel, Restaurant and Tourism Industry in Denmark) and LO (The Danish Confederation of Trade Unions) and a number of select individuals with a pro-

file that matches the food strategy. The council also includes a number of representatives from the food initiative's key operators, such as FFI and Central Region Food.

There are also a number of industry associations located in the region such as Danish Aquaculture, National Organic Association, and the Danish Dairy Board/Danish Agriculture and Food Council. This demonstrates that the food industry has strong support in Central Denmark Region. But it also underlines the need to bring together the different networks and organisations to support their coordination and collaboration.

Based on the above analysis and interviews, we mapped the presence of knowledge workers located in the Central Denmark Region food sector, see figure 9.

>>

FIGURE 9

THE GEOGRAPHICAL DISTRIBUTION OF PUBLIC KNOWLEDGE WORKERS IN CENTRAL DENMARK REGION

Note: The figure shows the concentration of public employees and Danish Agricultural Advisory Service employees that work with the development of food-related research and knowledge.

SOURCE: REG X AND OXFORD RESEARCH BASED ON INTERVIEWS AND MAPPINGS OF RELEVANT KNOWLEDGE CENTRES.
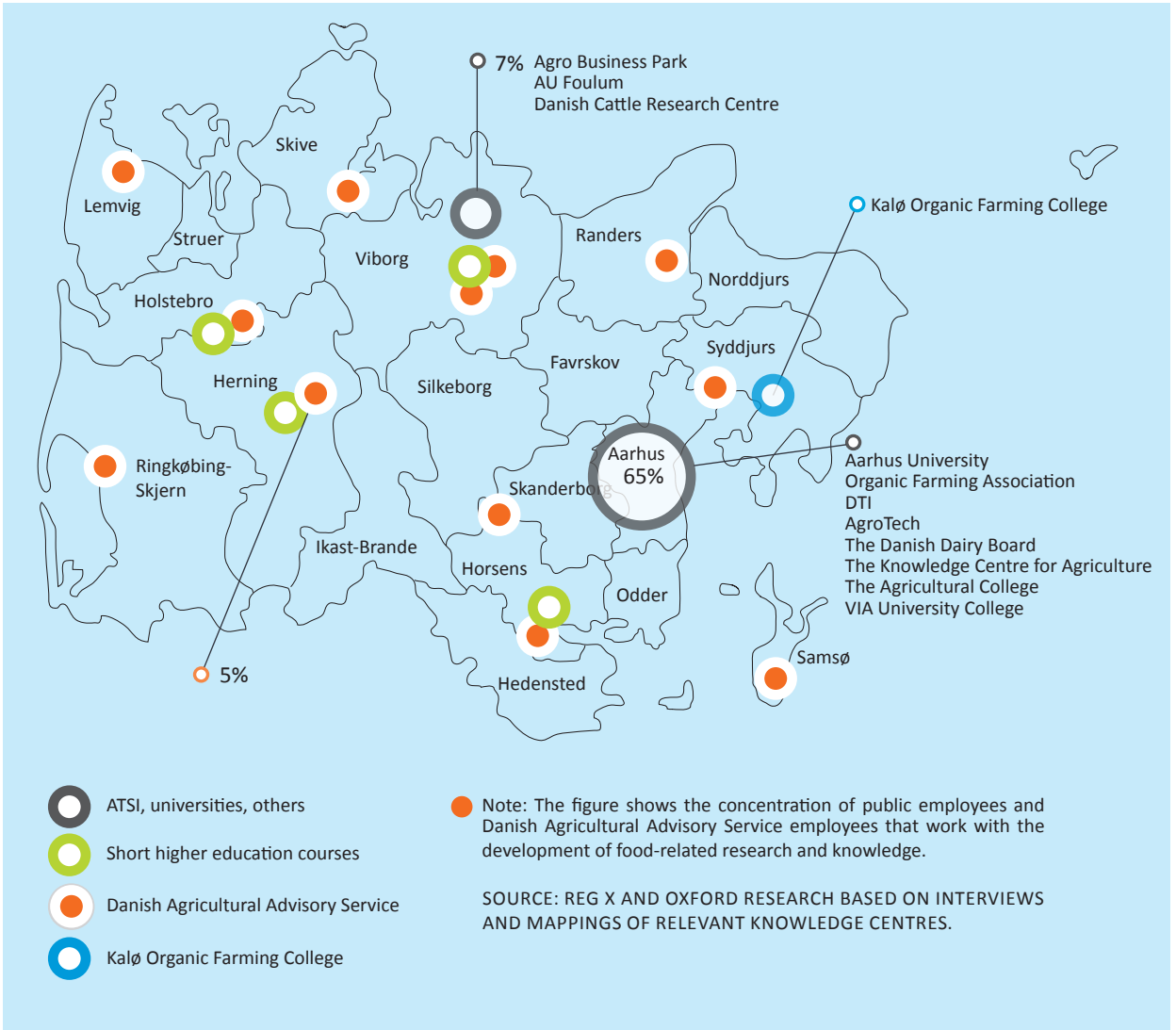
There is a large concentration of food-related knowledge workers present in Central Denmark Region. The vast majority of public knowledge workers are situated in the eastern part of Central Denmark Region around Aarhus. Within clusters, networks and business cooperation often depend on the degree of proximity between partners. There is talk of a 'cluster hour', which corresponds to the time cluster stakeholders are willing to spend on everyday transportation within a cluster. There are different methods for calculating commuter concentration - among others, personal preference for driving distances is important. But, even though driving distance is important for cluster cooperation, it does not mean that companies and other cluster stakeholders located beyond a given distance cannot also participate in the cluster collaboration.

NATIONAL NETWORK

InSPIRe started in 2011 as a strategic public-private platform between five universities, ATSIs and 23 businesses. InSPIRe's focus is to initiate and coordinate innovation projects, research, education and dissemination of results to the food industry with particular emphasis on productivity optimisation. In Central Denmark Region, inSPIRe works in partnership with Arla Foods, DuPont Nutrition Biosciences, AarhusKarlshamn, AgroTech, Danish Technological Institute and Aarhus University.

FoodNetwork is an innovation and development network funded by the Danish Agency for Science, Technology and Innovation (Forsknings- og Innovationsstyrelsen). With a grant of EUR 1.6 million, it is the largest Danish initiative to develop and strengthen innovation within the country's food industry. FoodNetwork's aim is to create networks and innovations across the educational institutions and industry. It focuses particularly on industry activities within processing equipment and the fishing industry with an emphasis on innovation and development, coordinating with other initiatives, such as Forum VIFU in Holstebro, which is involved with local food culture, networking events, etc.

Despite the many networks, there is a demand for a physical venue or a platform where businesses can meet across the areas of business specialisation, and where entrepreneurs can meet with the large established companies, develop new ideas, test new innovations and collaborate to develop new business areas.

INNOVATION PARTNERSHIPS

In strong clusters, there is a strong network between the cluster's businesses and the other stakeholders. This takes the form of innovation partnerships.

In the qualitative analysis, businesses were asked if they were part of innovation partnerships with other businesses. From the interviews, there are many examples of collaboration on incremental innovation, where businesses focus on customer-driven innovation (B2B) or product development in collaboration with customers (B2C). There are also many examples of collaboration between knowledge institutions and the whole industry. The presence of innovation partnerships between many businesses, where the aim is to develop completely new products, is more limited.

TABLE 6

SUMMARY OF THE ANALYSIS OF NETWORK STRENGTHS AND DEVELOPMENT POTENTIAL FROM A CLUSTER PERSPECTIVE

Strengths	Development potential
● Overall many of the relevant food-related industries are represented in various networks and present in Central Denmark Region ● National networks are also present in Central Denmark Region in various ways	● For the businesses, the many networks can be seen as too widely spread. This can be strengthened by cluster development. Despite the many networks, the region lacks a venue that facilitates open innovation networks and partnerships between different types of business across the areas of business specialisation.

TABLE 7

SUMMARY OF THE ANALYSIS OF INNOVATION PARTNERSHIP STRENGTHS AND DEVELOPMENT POTENTIAL FROM A CLUSTER PERSPECTIVE

Strengths	Development potential
● A variety of examples of incremental product innovation Businesses are significantly oriented towards customer-driven innovation (CDI). ● More examples of collaboration between knowledge institutions and individual businesses	● According to the interviews, it has been found that there is limited experience of innovation collaboration where businesses collaborate on 'radical' new products. ● The interviews show there is limited experience of co-operation across the areas of business specialisation. This can be addressed to advantage in a cluster process.

There may be several reasons for this. Primarily, it can be difficult to find a basis for bringing several companies together in a project because of the businesses' intellectual property rights (IPR), competitive conditions and shared versus different interests. It is a challenge that many companies see as greater than the benefits of cooperation.

Another reason is that it can be difficult to collaborate across business areas. Much (radical) innovation occurs most often when companies work across business areas. The interviews give the impression that collaboration across the areas of business specialisation is not particularly widespread among businesses. The reason is that the businesses find it difficult to see the potential and might even have difficulty finding the businesses with which it would make

>>

sense. Other reasons include the bureaucracy associated with funding opportunities.

FUNDING

Access to funding and venture capital is essential for the development of businesses in a cluster.

For the analysis, it has not been possible to obtain data specifically for venture investment in food activities. But, based on the interviews, it appears that venture capitalists have not traditionally had an interest in investing in the 'classical' food businesses such as food processing and agriculture. The funds that have focused on this area (including the Growth Fund (Vækstfonden) and Danisco Ventures) have had difficulty finding relevant entrepreneurs to invest in. Among the surveyed entrepreneurs, the opinion is that the food sector has limited access to development capital.

But there seems to be a growing interest among investors. For example the European Food Venture Forum has now been held twice in Aarhus in both 2012 and 2013. The challenge is that businesses, and particularly the new entrepreneurs in the hybrid areas, must demonstrate that the sector has commercial potential for start-ups and exciting investment opportunities.

TABLE 8

SUMMARY OF ANALYSIS OF FUNDING STRENGTHS AND DEVELOPMENT POTENTIAL FROM A CLUSTER PERSPECTIVE

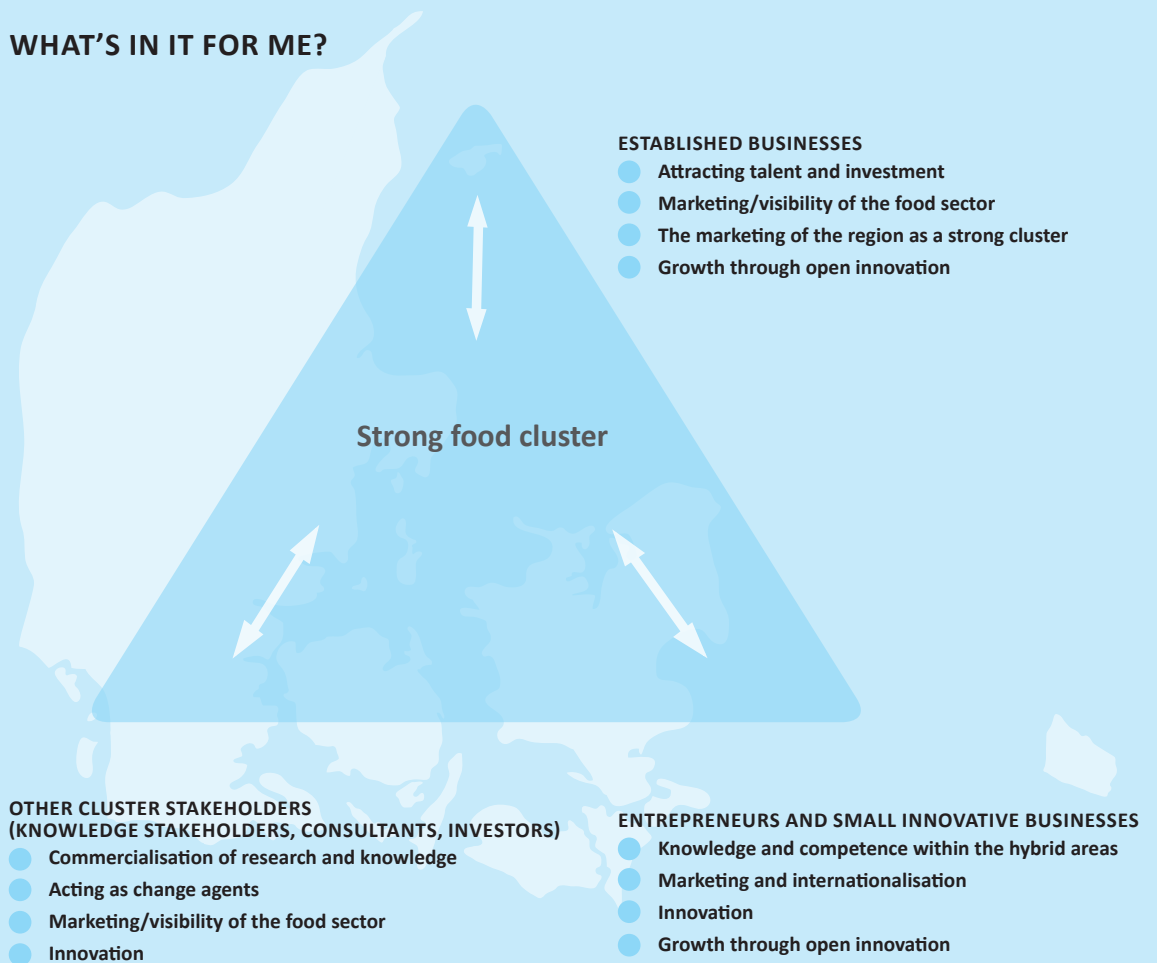| Strengths	Development potential
● Growing interest by the venture environment in businesses in the food sector	● The food industry has not traditionally attracted much venture capital.
● The new 'hybrid entrepreneurs' help give the food industry a new and more venture-oriented reputation	● There is a perceived need to create success and value among new growth entrepreneurs so that investors will see positive returns in this sector. Collaboration within a cluster can help to support this.

DEVELOPMENT OF A STRONG CLUSTER

THE BUSINESS INCENTIVE TO BE PART OF A STRONG CLUSTER

Based on interviews with a number of food businesses in Central Denmark Region, there is no doubt that the interviewed companies have an interest in being part of a strong food cluster. They also have some clear incentives, which may be realised in any future cluster development.

The companies are very specific about what they want to get out of being located in a strong cluster, and their incentives need to be considered if a cluster is to be developed, see figure 10.

FIGURE 10

WHAT'S IN IT FOR ME?

Strong food cluster

ESTABLISHED BUSINESSES
- Attracting talent and investment
- Marketing/visibility of the food sector
- The marketing of the region as a strong cluster
- Growth through open innovation

**OTHER CLUSTER STAKEHOLDERS
(KNOWLEDGE STAKEHOLDERS, CONSULTANTS, INVESTORS)**
- Commercialisation of research and knowledge
- Acting as change agents
- Marketing/visibility of the food sector
- Innovation

ENTREPRENEURS AND SMALL INNOVATIVE BUSINESSES
- Knowledge and competence within the hybrid areas
- Marketing and internationalisation
- Innovation
- Growth through open innovation

SOURCE: REG X AND OXFORD RESEARCH BASED ON INTERVIEWS.

According to the interviews, it is clear that businesses have both common and diverse incentives for engaging in a strong cluster. For the large established businesses, attracting talent is very important. It is easier to attract talent from home and abroad if they are located in a strong cluster, where there are good opportunities for talent spotting. The big companies also see a strong cluster as a way to market the region. It is especially important for the companies with foreign owners to demonstrate that their presence in Central Denmark Region makes sense – also on the bottom line. The interest in open innovation activities is also a growing argument for a strong cluster. The big businesses cannot depend on their own innovation capacity alone to deliver the necessary growth. This will be achieved through collaboration with other business and stakeholders in the area of innovation.

>>

FIGURE 11

CLUSTER DEVELOPMENT

| Clutter | Potential cluster | Cluster under development | Mature cluster | Spin-off clusters |
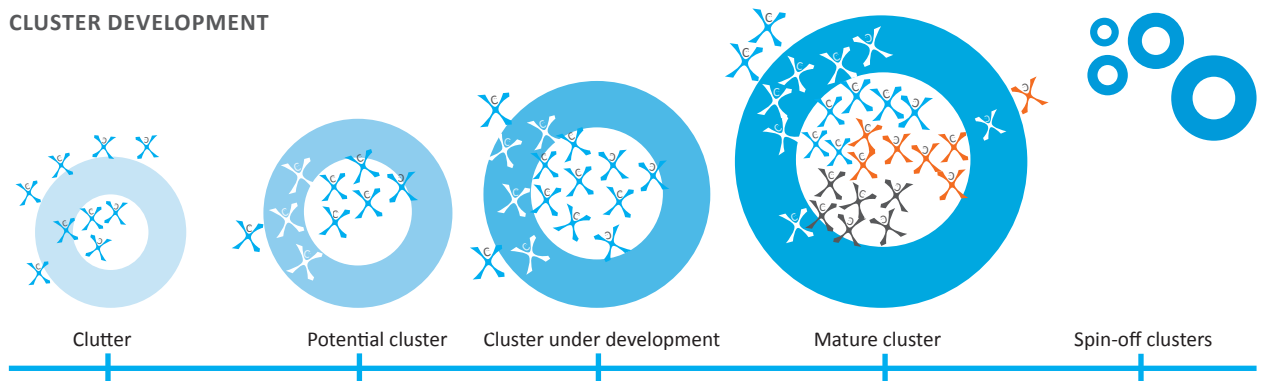
SOURCE: UNIVERSITY OF SOUTHERN DENMARK AND REG X, 2011.

>>

For entrepreneurs and SMEs, a strong cluster is useful because it can provide access to new innovation partners and other companies that can help them gain access to emerging markets. The motivation for entrepreneurs is much the same as for SMEs, except that they are often a little more experimental and innovative but lack input from the larger and more experienced companies. For the other cluster stakeholders, cluster collaboration is an opportunity to commercialise their knowledge and research through business partnerships.

DEVELOPMENT OF A STRONG CLUSTER
Cluster development often occurs gradually and is a complex process that requires many resources. Clusters can be at various stages of development, depending on how many companies are in the cluster and how actively they cooperate with each other, involve research institutions and develop innovation, see figure 11.

In the first phase of its development, a cluster is characterised as a clutter. This is the period when the cluster consists of scattered businesses, which are not yet organised in a cluster. At this stage, there are not yet any cluster activities such as innovation collaboration.

When businesses start identifying cluster specialisations and network and engage in informal collaborations, a potential cluster is formed. Cluster knowledge is developed, e.g. by analysing which companies and other business partners could be members of the cluster. If there is a cluster facilitator or a facilitator team, they may undertake a special training course for facilitators. Project leaders take special courses in directing cluster projects. Network meetings are held with presentations relevant to the cluster. A cluster strategy is formed. This should all take place with a focus on the companies in the cluster, along with their motives and business interests in the cluster.

The cluster may then be under development, which occurs as knowledge is spread between companies. Study tours to other clusters are held, for example, and relevant joint seminars and workshops conducted. Companies visit each other and engage in relationship building. The cluster is marketed externally. Training programs may be run for the cluster's own employees and members. Collaborative projects start being developed by businesses across the cluster.

When the cluster is mature, the cluster organisation begins to conduct market intelligence and trend analysis to track the cluster's specific market. This helps to develop the cluster further and realise the cluster's growth potential. In this phase, businesses work closely with R&D and engage in open innovation projects with each other. There is also a focus on developing new businesses – of value both within the cluster and in cooperation with other clusters. Documentation and evaluation of cluster activities are also important tasks as the cluster matures in order to follow its success.

Typically, spin-off clusters will develop out of mature clusters. For example, from a mature cluster that works with wind energy, a spin-off cluster that specialises in a particular technology or service to the wind energy industry might develop. Spin-off cluster development starts from the emerging cluster stage.

CLUSTER ORGANISATIONS
Formalised cluster work does not necessarily happen by itself. Cooperation between the businesses in a cluster can be facilitated and strengthened through a strong cluster organisation. The cluster organisation can act as the 'glue' in a number of ways.

A cluster organisation with one or more strong cluster facilitators (the person/s who work in the cluster organisation) plays a significant role in bringing together the cluster's businesses - both within individual specialisations and across specialisations. A cluster organisation is not the same as an industry association. While industry associations must meet the industry's interests and focus on general business frameworks, cluster organisations work with and for busi-

>>

>>

nesses that want to participate in cluster projects around business partnerships and innovation.

Studies have shown how strong cluster organisations and cluster facilitators are essential for the development of strong competitive clusters throughout the entire cluster lifecycle.[29] Strong cluster facilitators help bring together the cluster's businesses and build a consensus around the clus-

ter and a shared vision that businesses can unite around. This happens faster and more efficiently in clusters with a strong cluster organisation and facilitators. Studies also indicate that clusters without cluster facilitators often either fail to realise their development potential or see their development stagnate due to a lack of cluster consensus and common vision.[30]

BOX 4

BENEFITS OF A FORMAL CLUSTER ORGANISATION

- A cluster organisation gives a cluster a 'window' to the world. Cluster organisation can ensure national and international marketing of the unique competencies and knowledge in the cluster, including the companies' areas of business specialisation. In this way, the organisation can contribute to attracting new businesses, talent and investment to the cluster.

- A cluster organisation serves as a meeting place for businesses across their size and areas of business specialisation. A cluster organisation can help to facilitate collaboration and innovation projects between the companies, between the companies and other relevant cluster stakeholders, and across the business specialisations. In this way the organisation also acts as the network/glue in the ecosystem.

- A cluster organisation can help create a common vision and 'cluster themes' across the businesses, knowledge stakeholders and other stakeholders in the cluster.

- A cluster organisation can explain the value of innovation collaboration between businesses and 'demystify' innovation partnerships.

- A cluster organisation can facilitate collaboration with businesses in other clusters – even crossing business specialisations (cross-cluster collaboration). It can also work with other cluster organisations to ensure relevant knowledge sharing in various contexts.

- A cluster organisation can be a 'one-stop shop' in relation to foreign businesses, knowledge stakeholders, students and others who want to know more about the cluster.

- In practice, a cluster organisation also helps with internationalisation, market analyses of the cluster field, etc.

29: Ingstrup, 2013, Aziz & Norhashim, 2008; Ketels, 2003, Sölvell et al. 2003.

30: Ingstrup, 2013, Aziz & Norhashim, 2008; Ketels, 2003, Sölvell et al. 2003.

RECOMMENDATIONS

The following recommendations aim to provide input to the stakeholders in the analysis partnership, i.e. Central Denmark Region, Agro Food Park and Future Food Innovation, with a view to strengthening and exploiting the business potential involved in the development of a smart specialisation strategy and a strong food cluster in Central Denmark Region.

The intention is that the recommendations will contribute to a strong, competitive and growth-oriented food and agriculture industry in Denmark, which can, in turn, contribute to increased innovation, exports and employment – also in the long term.

The recommendations are made on the basis of the analysis. They should also be seen in the context of the work that has just been done by, among others, Growth Team for Food and The Danish Nature and Agricultural Commission. The recommendations are presented at three levels: cluster organisation, businesses and the public sector.

A: CLUSTER ORGANISATION

1: A STRONG CLUSTER ORGANISATION SHOULD BE ESTABLISHED

As the first step towards future work with cluster development in the Central Denmark Region food sector, it is primarily recommended that a cluster organisation is established. A strong cluster organisation can act as the glue and facilitating driver in a cluster. A cluster organisation with one or more strong cluster facilitators can play a significant role in bringing together the food cluster businesses - both within individual areas of business specialisation and across the specialisations and the food cluster value chain.

A cluster organisation is not the same as an industry association. While industry associations must meet the industry's interests and focuses on the general business environment, cluster organisations work with and for the businesses that want to join cluster projects and engage in business collaboration and innovation.

In a cluster organisation, there should be one or more strong cluster facilitators. A cluster facilitator's role is complex and involves facilitating business cooperation and helping the businesses to gain an interest in starting to work with new business models. A cluster facilitator must not advise businesses or decide on behalf of the companies what they should collaborate on. Such decisions must be steered by the companies. Strong cluster facilitators should be able to spot new political trends in the sector, such as regulations, and have an understanding of how new regulations can be a driver for innovation and innovation partnerships in the cluster. Additionally, they can act as a bridge for the public sector by spotting opportunities for 'intelligent public demand' in areas relevant to the cluster, for example, health.

In addition, a strong cluster organisation can provide a food cluster with a window to the outside world. The cluster organisation can help to develop and define Central Denmark Region's food sector and particularly strong areas of business specialisation, acting as the epicentre or heart of a Danish food cluster. It can act as a window to global markets and other possible collaborative clusters abroad, and help attract talent from home and abroad.

The development of a strong cluster organisation should both take place by involving the existing infrastructure in the food sector and by giving the cluster organisation a separate name and identity, which can help draw together businesses from inside and outside the cluster.

2: A FOOD CLUSTER SHOULD BE BASED ON THE UNIQUE VALUE CHAIN THAT EXISTS IN THE REGION AND THE REST OF DENMARK

The development of the food cluster should be based on its future competitive parameters and should gather members from all parts of the value chain both in and outside Central Denmark Region. It is recommended that the food cluster be established on the basis of the strong potential for value-chain integration between raw material production and food processing, which have a tradition for presence in the region. This should be combined with new technological opportunities, particularly within sustainability and health.

In light of the global challenges and growth areas (food shortages, climate, environment and health), radical innovation within today's traditional food industry requires a close link between agricultural production and food processing.

The strong potential for increased resource optimisa-

>>

>>

tion and sustainability exists in primary raw material production, but must be coordinated with the other links in the value chain to ensure the quality, safety and health of the processed foods. The food industry's growth is limited by its access to raw materials - especially in growth markets. It is also during primary raw material production that the quality of the finished food product is defined. If the food's quality and properties are to be developed and innovated, close collaboration with primary production is required early in the process, including new forms of innovation cooperation.

3: FACILITATE THE DEVELOPMENT OF ONE OR MORE MAJOR STRATEGIC CLUSTER PROJECTS
A cluster consists of companies and stakeholders that cross-cooperate and attain greater competitive advantage through their cooperation than if they worked alone. For this reason, innovation collaboration between the businesses is an essential part of cluster activities.

The cluster organisation should help to facilitate one or more major strategic innovation projects that can help to kick-start and formulate the cluster and closely involve several businesses in close partnership. The strategic innovation projects can help to shape the development of a new food cluster, create awareness and serve as inspiration for the cluster's other businesses.

The cluster's strategic innovation projects should be related to the cluster themes, as in the recommendation below for the development of overlying themes for the cluster's companies. They should involve companies across the value chain and specialisations to raise the innovation capacity and growth potential.

An example of a possible major strategic development project in the cluster could be a food safety project between businesses and the hospital sector – such as the development of new proteins that can be used in hospital food to improve the intake of food by the sick and elderly.

4: GATHER AND ATTRACT BUSINESSES STEP-BY-STEP: REGIONALLY, NATIONALLY AND INTERNATIONALLY
As shown in the analysis, a new food cluster in Central Denmark Region has great potential to act as a centre and powerhouse in a national food cluster. However, this development should take place stepwise.

It is recommended that a food cluster is developed by the businesses in the cluster's centre (the region) joining together and forming a cluster themselves. The cluster should then quickly invite businesses from other regions to join them in business innovation partnerships and networks, thereby creating a link with the food industry in the rest of the country.

As a result, the region's and Denmark's competencies in the food sector should be made much more visible internationally than today - causing businesses and skills from abroad to be naturally attracted to the cluster.

In order to strengthen the development of the cluster secretariat (i.e. the employees in the cluster organisation), it is also recommended that the secretariat facilitates 'talent/

job swaps' between its own employees and employees of related international cluster organisations and, if possible, between employees in the cluster's businesses and other related clusters. Finally, the cluster organisation, together with the businesses, should involve the public sector in the cluster's development in areas such as innovation and the strengthening of entrepreneurship's role in the cluster.

B: BUSINESS DRIVEN DEVELOPMENT OF CLUSTER SPECIALISATIONS

1: IDENTIFY 'OPPORTUNITIES' WITHIN INDIVIDUAL AREAS OF BUSINESS SPECIALISATION AND OUTLINE A GROWTH STRATEGY FOR EACH AS WELL AS ACROSS THE SPECIALISATIONS
One of the first steps is to define the cluster's areas of business specialisation and future growth areas. This analysis is the first step in this direction. However, there is a need to understand the global market opportunities further in each of the existing and new specialisation areas to ensure that global growth potential is realised.

Based on specialisations and global market opportunities, strategies must be developed to ensure the exploitation of the growth potential within each specialisation. In addition, it is essential that the combination of knowledge present along the cluster's value chain and the interaction of cluster businesses ensure increased market shares in emerging markets. The cluster's entrepreneurs should also be incorporated in the strategies so that the realisation of growth potential also happens in the 'hybrid areas'.

To obtain input for this process, one or more leading international experts in the sector may be called upon to provide businesses with professional insight into future global markets in the cluster's specialisations and potential growth areas.

2: DEVELOP A SERIES OF OVERLYING IDENTITIES AND INSPIRATIONAL THEMES FOR THE CLUSTER
Based on the strategies for each of the individual specialisations, two to four overlying themes should be developed to inspire and drive the businesses' work with innovation in the cluster.

The themes should be based on the cluster's business and knowledge-related specialisations and new areas that have the potential to develop into a specialisation. The themes should be formulated so that they help to develop a common identity and create incentives for businesses and other cluster stakeholders to cooperate and innovate across the cluster's value chain and specialisations. Themes should be visionary, broad and inclusive, and should also include the organic part of the cluster.

An example of an overlying theme could be 'a sustainable platform for the future raw material supply'. Here, future raw material shortages, the development of sustainable production concepts in emerging markets such as China,

>>

>>

Russia and India, and the subsequent environmental and resource aspects involved can act as drivers of innovation among companies in the food cluster. The food cluster's research competencies in areas such as resource optimisation and nutrient flow in agriculture and aquatic environments can be brought into play in cooperation with the businesses in the cluster, creating the breeding ground for crucial new ventures that can facilitate future global food production.

Another example of a theme could be 'food and health'. The growing global population and the increasing polarisation of the malnourished and starving places new demands on food innovation in solving the challenge to produce sufficient, healthy foods. Innovation must be based on the entire value chain from early primary production towards new kinds of healthy foods that can ensure a sufficient supply of nutrients and prevent lifestyle diseases. The region has Aarhus University Hospital and other hospitals with a focus on diet-based recovery. Here, there is huge potential for increased research and innovative cooperation with the cluster's agriculture and food sector in relation to health. Closer cooperation between Aarhus University Hospital and the cluster's food businesses could potentially enhance the development of new solutions in the health area.

3: USE THE STRONG STAKEHOLDER-DRIVEN INTEREST BETWEEN THE CLUSTER'S LARGE ESTABLISHED BUSINESSES TO CREATE NEW BUSINESS AREAS AND BUSINESS MODELS IN PARTNERSHIP WITH ENTREPRENEURS AND SMALL BUSINESSES
The implementation of food cluster growth strategies should be driven by the large established international companies in new close symbiotic working relationships with entrepreneurs and small innovative companies. The fact that established companies are becoming increasingly aware of the benefits of a strong food cluster and starting to act as flagships and drivers of open innovation projects is a strong basis for the development of a food cluster. But the established food businesses must, at the same time, consider new ideas and business models from entrepreneurs and innovative small businesses that have potential as collaborative partners and not only as possible acquisition targets.

In this way, the cluster's established businesses contribute to an environment where innovative entrepreneurs and small businesses can flourish, especially in the hybrid areas. There is an emerging ecosystem for entrepreneurs within the food sector, which is part of the mapped ecosystem. This should be built upon through the development of new growth tools, for example in relation to growth capital.

4: DEVELOP A LARGE PHYSICAL OPEN INNOVATION PLATFORM FOR CLUSTER BUSINESSES
For the development of a strong cluster, a symbiotic relationship between the established businesses and the entrepreneurs and small innovative businesses is essential. Many businesses have expressed a need for development-driven meeting places – a physical platform where partners can meet and be challenged in informal and innovative surroundings.

Many of the large businesses have expressed an interest in

contributing to the creation of a new platform for innovation. A physical platform based on an open cluster approach should include flexible test and laboratory facilities that the individual business can afford, are located away from the businesses' capacity-optimised production facilities, and which can be used as a 'playground' for cluster companies - both existing and new entrepreneurs.

At the meeting place, companies can interact and serve as mentors and networks for each other. They can develop and test new raw materials and finished products in close cooperation with the cluster's knowledge stakeholders and professionals and across the cluster value chains. It is also possible to invite businesses and ecosystem stakeholders from other clusters and relevant industries, such as the energy sector and ICT, in order to create multi-disciplinary innovation partnerships. The meeting place should incorporate existing flexible infrastructure in order to cost optimise and establish a link with the existing ecosystem, stakeholders and research environment in the cluster.

In close, flexible collaborations between 'product chain-owners' and new entrants, new knowledge can be developed and technological solutions tested fast and efficiently. In this way, existing businesses and entrepreneurs can contribute to the development of new products and business models. This requires close geographical proximity within the value chain - and is the food cluster's strength.

Students, specialist business developers, and expert entrepreneurs should also be linked to the physical platform. The existing infrastructure, such as Agro Food Park, FFI and other facilities, should also contribute to the platform where possible. The platform must also have a large international window to the world outside the region and Denmark.

5: INNOVATION WORK MUST BE DRIVEN BY CLUSTER COMPANIES AND SUPPORTED BY RELEVANT CLUSTER STAKEHOLDERS
A cluster's success is no greater than the companies behind it and is best measured by the degree of innovation and collaboration between the cluster's businesses, the businesses' involvement in the cluster, the number of emerging entrepreneurs and the ability to attract new investment capital etc.

Development and implementation of these recommendations and activities should largely be driven by the companies themselves and be supported by the cluster's other stakeholders. The businesses' commercial perspectives and incentives must be at the heart of the cluster's activities, with a strong focus on greater integration of value-chain stakeholders and the growth of new interface areas.

>>

>>

C. THE ROLE OF THE PUBLIC SECTOR

1: CONTINUE STRATEGIC REGIONAL LEADERSHIP
The public sector's role is to ensure the traditional framework conditions for business development and develop them favourably. It is the state that carries out this task.

At the same time, opportunities to influence and exploit the development of the business specialisation areas are increasingly tied to the regions. Regional growth and development strategies have a greater focus on competitiveness and innovation today than in the past.

Central Denmark Region may be a pioneering region in relation to new thinking about cluster development and the development of smart specialisation strategies that provide space for co-creation of the food sector by businesses and knowledge stakeholders. A good regional, stakeholder-driven cluster case may inspire other public sector stakeholders in their future work to develop, for example, overall framework conditions.

The region can also help to highlight the importance of clusters in a business-political context and ensure that there is a relationship between national and regional initiatives in the sector and a connection with other regional initiatives in Denmark. It is also recommended that Central Denmark Region enter a close dialogue with the other regions around cooperation in the food sector.

2: HELP TO SUPPORT CLUSTER FORMATION, NETWORK ANALYSIS AND THE OVERLYING THEMES FOR THE CLUSTER
The public sector cannot and should not try to guide the development of a cluster, see above for stakeholder-driven cluster development. The public sector can, however, underpin and support cluster formation, networking and development of the cluster themes at a strategic level.

The agricultural and food sectors are regulated by law, and opportunities for new innovation may conflict with these regulations. In an innovation context, the public sector can play a proactive role as a 'collaborator' in cluster innovations, creating effect-based input - particularly in respect of resource use, water technology and food safety – in order to influence rational changes to existing legislation at national and EU level. Against this background, providing basic data and analysis can inspire the development of regulations in the sector.

In the development of the cluster's themes, the public sector can support a focus on the global challenges and contribute to developments in those areas where it makes sense.

3: STRENGTHEN THE DEVELOPMENT OF A STRONG ECOSYSTEM FOR THE CLUSTER'S GROWTH ENTREPRENEURS
It is recommended that the ecosystem around the new food-growth entrepreneurs in the hybrid areas is reinforced with a special focus on internationalisation, up-scaling and financing. Growth entrepreneurs working with global challenges and growth areas, such as food supply in relation to resource and raw material scarcity, climate/environment and health, should be targeted. The establishment of a growth process targeting the new hybrid entrepreneurs in the food sector could be considered.

The creation of an open innovation environment is recommended, with an integrated and flexible physical infrastructure where ideas and new technologies from young companies can be catalysed and developed in collaboration with the established industry. This will enhance the innovation power of the established food industry and create growth opportunities for the young entrepreneurs, as described above in relation to the need for a meeting place. The public sector can actively co-finance an open innovation laboratory, including a focus on entrepreneurial advisers and in close collaboration with established companies in the cluster. Such an open innovation facility should be consistent with other relevant open infrastructures in Denmark and neighbouring countries.

4: CREATE MORE VISIBILITY AND DIALOGUE BETWEEN KNOWLEDGE INSTITUTIONS AND BUSINESSES
The region has a well-established and relevant knowledge sector within agriculture and food. But the businesses have expressed a need for more flexible and relevant cooperation between cluster businesses and knowledge institutions.

One way in which the stakeholders can strengthen their role is to support businesses in thinking across the areas of business specialisation in order to create new cluster knowledge in some of the hybrid areas. There should also be a focus on strengthening the skills that businesses will require from the newly educated in the future. Further, it is possible to enhance knowledge about the market and consumer behaviour in emerging markets and bring this knowledge into play among cluster businesses, especially small businesses, making it relevant for innovation cooperation.

5: STRATEGIC USE OF PUBLIC SECTOR DEMANDS
Another possibility is to develop a strategy for how the public sector can contribute to innovation in the food cluster through a more strategic use of public demand. Today the public sector (e.g. regions and municipalities) demands organic products and foods in their canteens. This has helped to increase the demand and drive innovation development in the organic sector.

In preparation for such a strategy, the public sector should enter a close dialogue with the businesses and, potentially, the ecosystem's stakeholders within the cluster.

Examples again include Aarhus University Hospital and the link between food and health. The region may consider using its own needs to generate future innovation in the sector. For example, a multidisciplinary team could be invited to address nutritional issues at the hospital. The cluster's food businesses should be an important element in such an interdisciplinary innovation team.

APPENDIX

APPENDIX A: METHOD

LOCATION QUOTIENT (LQ)

Cluster analysis often uses Porter's (1990) "Location quotient method" or location quotient (LQ) to measure the business concentration in a geographical region.

LQ is used to compare employment significance in an area of specialisation relative to the national total employment in the same specialisation.

An LQ greater than 1 means that employment in a given specialisation has a greater significance in the region in question than in the regions as whole.

An LQ less than 1 means that employment within the specialisation has less significance than in the regions as a whole.

In this analysis the location quotient is based on Experian data on employment in the regional areas of specialisation compared to Statistics Denmark's figures for the country's total employment at workplaces in 2010.

A limitation of LQ analysis is the 'headquarter' problem. This problem relates to the fact that all of a business's employees in Denmark are registered at headquarters. For example all Arla employees are register at Sønderhøj 14 in Viby, which results in a disproportionate number of employees located in Viby. There is no way to avoid this problem when working with registration data. This study attempted to address some of the headquarter problems by manually moving the jobs to/from the region. But this has only been to a limited extent since the headquarter problem also applies to the other regions and is, thus, offset to some degree.

The LQ is more than 1 if the average of the 5 regions is taken. This is not an error. The reason is that a given specialisation has a higher employment impact in specific regions than its employment impact across all the regions. Since LQ is calculated by looking at (in this case) national employment, a number of smaller regions with a small number of people employed can have a high LQ, while the country's total LQ will be 1. So for this reason, it is inappropriate to 'just' measure the average of the 5 regions.

Statistics Denmark measures the number of jobs in the regions within a specialisation. This figure is used to calculate the specialisation's share of total employment in the region. In the same way, the proportion of total employment for the whole of Denmark within the specialisation is calculated. The LQ is then calculated by taking the specialisation's regional employment and dividing it by the specialisation's national employment.

KEY FIGURES

For the analysis of key figures from businesses, data is

$$LQ = \frac{Employment\ sr\ /\ Employment\ s}{Employment\ r/Employment}$$

$$r = Region\quad s = Specialisation$$

pulled from a manual mapping of the companies. The analysis is based on the assumption that clusters cannot necessarily be categorised using traditional industry definitions. There may be companies that play an important role in a cluster but are not apparent from a conventional industry analysis. An industry analysis can often contain 'too many' or 'too few' businesses from a cluster perspective. To accommodate this, the analysis is based on a manual mapping of businesses that directly or indirectly contribute to food production and which are located in Central Denmark Region. The businesses were identified by REG X in collaboration with Oxford Research and the research partnership's other parties. Although the list has been developed using the snowball method[31], where the cluster's own businesses and stakeholders have recommended other cluster businesses, the possibility cannot be excluded that there are a few companies from the cluster who are missing from the final business list.

ECOSYSTEM ANALYSIS

The qualitative part of the analysis is based on interviews regarding Central Denmark Region's food activities. About 40 interviews have been conducted with companies and other food-related stakeholders within and outside the Central Denmark Region. First of all, a series of interviews were made with experts, who helped to identify the food activities and describe the area of business specialisation of which they have expert knowledge.

Then there are interviews with businesses. Businesses are identified according to their business specialisation, age, size and geographical location. Examples of businesses in various sectors include Arla, DuPont Nutrition Biosciences, SPX, Skov, LetFarm, Tange, etc. See Appendix B for a detailed list of all interviewees. The interviews were used to understand the dynamics, collaborations and cohesion of food-related activities.

Since this analysis the preliminary results have been discussed with some of the same interviewees in small groups in different contexts.

31: The snowball method can be used to identify and map the respondents that are not readily available from existing data or statements. In this analysis, the method is attractive because the objective is to identify the companies that directly or indirectly contribute to the production of food. So, this is about a group of businesses that cannot be identified through the traditional industry statistics.

>>

AREAS OF BUSINESS SPECIALISATION
The analysis has identified 14 areas of business specialisation that consist of companies from the following industries, all of which have been subject to LQ analysis:

The total arrived at is then divided into the following sub-clusters:

AGENTS AND WHOLESALERS
Commission sales of agricultural advice, live animals, textiles, fish auctions, other commission trade with food, beverages and tobacco, wholesale of grain, unprocessed tobacco, seeds and animal feed, wholesale of live animals, wholesale of hides, skins and leather, wholesale of fruit and vegetables, wholesale of meat and meat products, wholesale of dairy products, eggs and cooking oils, wholesale of beer, mineral water, fruit and vegetable juices, wholesale of wine and spirits, wholesale of sugar, chocolate and sugar confectionery, wholesale of coffee, tea, cocoa and spices, wholesale of fish and fish products, specialised wholesale of miscellaneous food products, non-specialised wholesale of food, drink and tobacco, wholesale of agricultural machinery, equipment and preparation

OTHER FOOD PRODUCTION
Processing and preserving of potatoes, other processing and preserving of fruit and vegetables, manufacture of cocoa, chocolate and sugar confectionery, processing of tea and coffee, manufacture of prepared meals, manufacture of homogenised food products and dietetic products, manufacture of other miscellaneous food products

THE FISHING INDUSTRY
(FISH FARMING, FISHING AND PROCESSING)
Sea fishing, freshwater fisheries, aquaculture, freshwater use, manufacture of fishmeal, processing and preserving of fish, crustaceans and molluscs

PROCESSING OF MEAT
Processing of pork, processing of other meat, processing and preserving poultry, production of meat and poultry products

PRODUCTION OF BREAD, CAKES AND CEREALS
Manufacture of mill products, manufacture of bread, cakes, etc., manufacture of rusks, biscuits, packaged cakes, pies, etc., manufacture of macaroni, noodles, couscous, etc.

BEVERAGE MANUFACTURE
Cultivation of grapes, cultivation of plants for beverage manufacture, manufacture of fruit and vegetable juices, distilling, rectifying and blending of alcohol, manufacture of wine from grapes, manufacture of cider and other fruit wines, manufacture of other non-distilled fermented beverages, manufacture of beer, manufacture of soft drinks, mineral waters and other bottled water

FRUIT AND VEGETABLE PRODUCERS
Cultivation of vegetables, melons, roots, tubers, cultivation of tropical and subtropical fruits, cultivation of citrus fruits, cultivation of fruits with seed and stones, cultivation of other tree fruits, berries and nuts, cultivation of oil rich fruits, cultivation of spices, herbs and medicinal plants

FOOD PROCESSING TECHNOLOGY
Production of machinery for the food, beverage and tobacco industry

FOOD ANALYSIS AND CONSULTANCY
Control of food products

AGRICULTURAL SUPPLIES
Manufacture of finished feed mixes for farm animals, manufacture of fertilisers and nitrogen products, manufacture of pesticides and other agrochemical products

FARMING
Cultivation of cereals (except rice), vegetables and oil crops, cultivation of rice, cultivation of other perennial crops, breeding of dairy cattle, breeding of other cattle and buffaloes, breeding of sheep and goats, breeding of piglets, pig production, poultry production, mixed farming, services for crop production, service benefits associated with animal farming, processing of harvested crops

FARM TECHNOLOGY
Production of farming and forestry machinery

PROCESSING OF DAIRY PRODUCTS AND INGREDIENTS
Dairies with cheese manufacturing, manufacturing of ice cream products

PRODUCTION OF INGREDIENTS
Manufacture of oils and fats, manufacture of margarine and similar edible fats, manufacture of starches and starch products, processing of sugar, manufacture of flavourings and seasonings

APPENDIX B: LIST OF INTERVIEWEES

NAME	TITLE	ORGANISATION
Anne Maria Hansen	Innovation Manager	Danish Technological Institute
Bjarne Langdahl Riis	Director of development	Agro Food Park
Bolette van Ingen Bro	Director	Navigators
Brian Thomsen	Director	Danish Aquaculture
Claus Bo Andreasen	Senior Consultant	Danish Centre for Food and Agriculture, Foulum
Claus Thorsen	Director Systems Technology	SPX
Dorthe Storper	Director	VIFU
Greta Jakobsen	Director	Højmark Laboratory
Gyda Bay	Innovation Manager	Agro Business Park, Future Food Innovation
Hans Elbek Pedersen	Senior Vice President	DuPont Nutrition Biosciences
Henrik Jørgen Andersen	Head of Research	Arla Foods
Henriette Winther	Food Consultant	Organic Farming Association
Jan Mousing	Director	Knowledge Centre for Agriculture
Jens Møller Povlsen	Director	Caviart
Jørgen Rosted	Owner	Rosted Consulting
Jørgen Yde Jensen	Director	SKOV
Karen Søndergaard	Head of Education	VIA University College
Kim Kjølhede	Investment Manager	Østjysk Innovation
Klaus Vestergård	Director	Tange Frilandsgartneri (Tange Outdoor Market Garden)
Kristin Munksgaard	Associate Professor	University of Southern Denmark
Lars Esbjerg	Associate Professor	Aarhus University
Lars Visbech Sørensen	Director	Agro Business Park
Lone Honoré	Director	Inomega3
Markus Bjerre	Specialist Consultant	Ministry of Business and Growth, Growth Team for Food
Martin Møller	Director	LetFarm
Michelle H. Williams	Centre Manager	Aarhus University
Nicolai Hansen	Chief Executive Officer	KMC
Niels Halberg	Director DCA	Danish Centre for Food and Agriculture, Foulum
Niels Alsted	Executive Vice President	BioMar Group
Ole Zinck	Vice President, Human Resources	Cheminova
Paul Holmbeck	Director	Organic Farming Association
Poul Agger	Director	Soy4you
Rene Damkjer	Director	AgroTech
Søren Madsen	Inspiration Manager	Agro Food Park
Søren Rosenkrantz Riber	Innovation Manager	Foodbest DK/SE
Tine Skriver	Food Manager	HORESTA
Torben Friis Lange	Vice President	AarhusKarlshamn AB

APPENDIX C: ALPHABETICAL OVERVIEW OF FOOD-RELATED KNOWLEDGE INSTITUTIONS IN CENTRAL DENMARK REGION

AARHUS UNIVERSITY (AU)

Food and agricultural research at Aarhus University takes place primarily in the following departments: Department of Agroecology, Department of Food Science, Department of Animal Science, Department of Engineering and Department of Molecular Biology and Genetics. In addition, AU has a number of institutions, networks and organisations that support the food cluster in the Central Denmark Region. Below are the other main players in addition to AU.

AGRO BUSINESS PARK

Agro Business Park is a research park with a strong focus on entrepreneurship and innovation within agriculture, food, bioenergy and environmental technology. The benefits to the companies located in the park are business development, capital raising and networking activities. Agro Business Park is also involved in development, innovation and network projects designed to support entrepreneurship and innovation. There are 16 people employed in the science park, which is located next door to AU's research facility in Foulum (east of Viborg). Central Denmark Region's mega venture in the food industry, Future Food Innovation, is also located in Agro Business Park.

AGROTECH

AgroTech is an Approved Technological Services Institute (ATSI) dedicated to research-based consulting and technology services in the agriculture and food industry. AgroTech has a particular focus on biomass and bio-efficiency, food innovation, green living environments, environmental technology and plant technology. AgroTech is located in Agro Food Park but also at Copenhagen University's Faculty of Science in Taastrup. It has a total of 90 employees.

AU FOOD PLATFORM

AU FOOD Platform was established in 2012 and aims to increase collaboration on food research between AU faculties and also with external partners. The common platform provides a better opportunity for interdisciplinary coordination between diverse areas of knowledge. This enables the establishment of more project teams comprising members with a range of research skills. AU FOOD Platform provides the opportunity to strengthen internal research, but also makes AU more accessible to companies that want closer collaboration with the university on food activities.

AU FOOD Platform is managed by a steering committee consisting of members from four faculties and relevant representatives of other interest groups. AU FOOD Platform is led by Michelle Williams, who is also the institution leader for food. She has a long experience of research in food both in Denmark and internationally. The platform has 120 associated employees ranging from lecturers to technical administrative staff.

DANISH AGRICULTURAL ADVISORY SERVICE (DLBR)

Danish Agricultural Advisory Service develops skills, products and knowledge. DLBR consists of 32 independent compa-

nies with a total of 3,500 employees, organised into a trade association with headquarters in Agro Food Park in Aarhus. Of these companies, 31 primarily provide advice directly to customers, while the Knowledge Centre for Agriculture acts as a shared knowledge and innovation centre.

The consulting businesses within DLBR advise on all agriculture disciplines such as cattle and pig production, crop production, poultry farming, fur production, horses, construction/engineering, economics, law, planning and environment, and rural development. Of DLBR's 32 consulting firms, 13 are located in Central Denmark Region with approximately 1,600 employees between them.

DANISH AQUACULTURE

Danish aquaculture is a trade association for the Danish fish producing industry, with headquarters in Silkeborg. Members are the primary producers in the form of fish farms, breeders, sea fishermen, and eel and mussel breeders, along with processing factories and fish exporters. They cover the entire value chain from "sea to table".

Danish Aquaculture works to commercialise knowledge, participate in scientific projects and raise awareness of the industry. It represents around 150 members, which in 2008 produced 42,000 tonnes of seafood with an initial value of EUR 114 million. The vast majority of the products are exported to many countries with total exports amounting to EUR 147 million.

DANISH CATTLE RESEARCH CENTRE

The Danish Cattle Research Centre is a high-tech dairy farm with 210 dairy cows. It was established by the cattle farmers' organisation in 2000 as a combined agriculture and research centre next door to AU Foulum.

Today the centre conducts a wide range of research projects in close collaboration with Aarhus University, gathering experience from practice and translating theories into practice. The centre acts both as a showcase for the latest Agro Tech and as a research centre. There are 12 employees associated with the centre.

DANISH CENTRE FOR FOOD AND AGRICULTURE (DCA)

The Danish Centre for Food and Agriculture was established on 1 July 2011 following a restructuring of Aarhus University. DCA is located in Foulum, which is the university's academic doorway to government, businesses and organisations seeking advice and collaboration in food and agriculture. DCA coordinates and assures the quality of national and international research-based regulatory consultancy for food and agriculture.

The centre is responsible for AU's agreement with the Ministry of Food for the provision of consultancy services and six specialised thematic areas in which DCA must ensure that AU conducts first-class international research. The Ministry's six thematic areas are climate and natural resources,

>>

environment and bioenergy, organic farming, food quality, animals and plants.

DANISH TECHNOLOGICAL INSTITUTE (DTI)
The Danish Technological Institute is an independent ATSI established to address the industry's need for access to new knowledge and technology. DTIs food department is located in Aarhus. However, the Danish Meat Research Institute (DMRI), which is a knowledge centre for research and innovation in animal-based foods, is located in Roskilde.

DTI assists Central Denmark Region's food industry by offering consulting services, laboratory assistance, cooperating with development projects, and organising and participating in professional networks, including the Food Network, inSPIRe and Biopeople. DTI has 200 employees across Denmark that work with food, which generates a turnover of EUR 26 million. EUR 3.6 million comes from businesses located in Aarhus.

EUROFINS STEINS LABORATORY
Eurofins Steins Laboratory is authorised and accredited to carry out analysis within agriculture, dairy and food products. Eurofins Steins helps to ensure the quality of raw materials, processing and finished products.

HØJMARK LABORATORY
Højmark Laboratory is a privately owned company that has worked with consulting and laboratory assignments for companies in the food industry for more than 20 years. The company's specialised knowledge is primarily within the fishing industry, in the field of raw materials characterisation, process optimisation, food quality and safety. There are 20 employees in the company, which is located next to Marinova company, which is owned by Højmark Laboratory. The laboratory has a specific focus on combining different types of interdisciplinary knowledge.

INTERNATIONAL CENTRE FOR RESEARCH IN ORGANIC FOOD SYSTEMS (ICROFS)
ICROFS is an international research centre for organic farming and food systems located at Aarhus University. In 2008, the former Research Centre for Organic Farming was expanded and converted into the current ICROFS with an international mandate and international board. ICROFS's goal is to become an international reference centre for sustainability and food systems that can help to set new standards in the light of the latest research in ecology and sustainability.

ICROFS' secretariat consists of eight academic staff that coordinate and undertake national and international research in organic food and farming systems.

KALØ ORGANIC FARMING COLLEGE
Denmark's only organic agricultural college is located in Kalø in Central Denmark Region. The agriculture school has a history that dates back more than 100 years, when it was founded as a high school. After becoming an agricultural college, it launched the first course for organic farmers in 1982. In 2012, 70 new students started in Kalø, which in recent years has experienced increasing interest from the media and politicians as well as new students.

KNOWLEDGE CENTRE FOR AGRICULTURE (VFL)
The Knowledge Centre for Agriculture is part of the Danish Agricultural Advisory Service and works to process and disseminate researchers' knowledge to Danish Agricultural Advisory consultants. The centre focuses on gathering knowledge from research both nationally and internationally so that agricultural consultants and, in turn, farmers can gain access to the latest scientific knowledge concerning farm operations, environment, economy and animal welfare. There are approximately 550 employees at the information centre, which is located at Agro Food Park, Skejby.

KNOWLEDGE CENTRE FOR FOOD DEVELOPMENT (VIFU)
The Knowledge Centre for Food Development is a centre of excellence in the food sector with a focus on food, food development and food innovation. It has existed since 2006 and aims to create a network of "unconventional" stakeholders and, through that, combine research with experience in the food industry.

The Knowledge Centre's vision is to combine knowledge about food development with good contact to external partners. It wants to be an attractive partner for research institutions and businesses. Therefore, the consortium behind the Knowledge Centre is a combination of knowledge institutions, ensuring that business advice is closely linked to the latest research. The centre has six employees and is located close to companies in Nupark, Holstebro.

MAPP - CENTRE FOR RESEARCH ON CUSTOMER RELATIONS IN THE FOOD SECTOR
The MAPP Centre at Aarhus University researches consumer behaviour in respect of food. The research deals with development and product innovation, marketing and distribution of food. The MAPP Centre has been in existence since 1991 and has a staff of 30, seven of whom are professors.

The MAPP Centre works closely with businesses to make them more market-oriented and to test their research. Their approach to collaboration and expertise attained international recognition in 2008, when the MAPP Centre was noted for its "international excellence" with the following statement: "A strong group that has its own fairly unique established position in Europe and perhaps globally".

ORGANIC FARMING ASSOCIATION
The Organic Farming Association has been the trade association of organic farmers since 1981, and works to promote the organic philosophy and ways of working. The goal of the Organic Farming Association is to enhance organic farming both by increasing the knowledge of the farmer and by educating consumers and giving them more opportunities to choose organic products. Organic Farming Association is located in Aarhus with 54 employees and has a unique opportunity to develop organic farming in Central Denmark Region
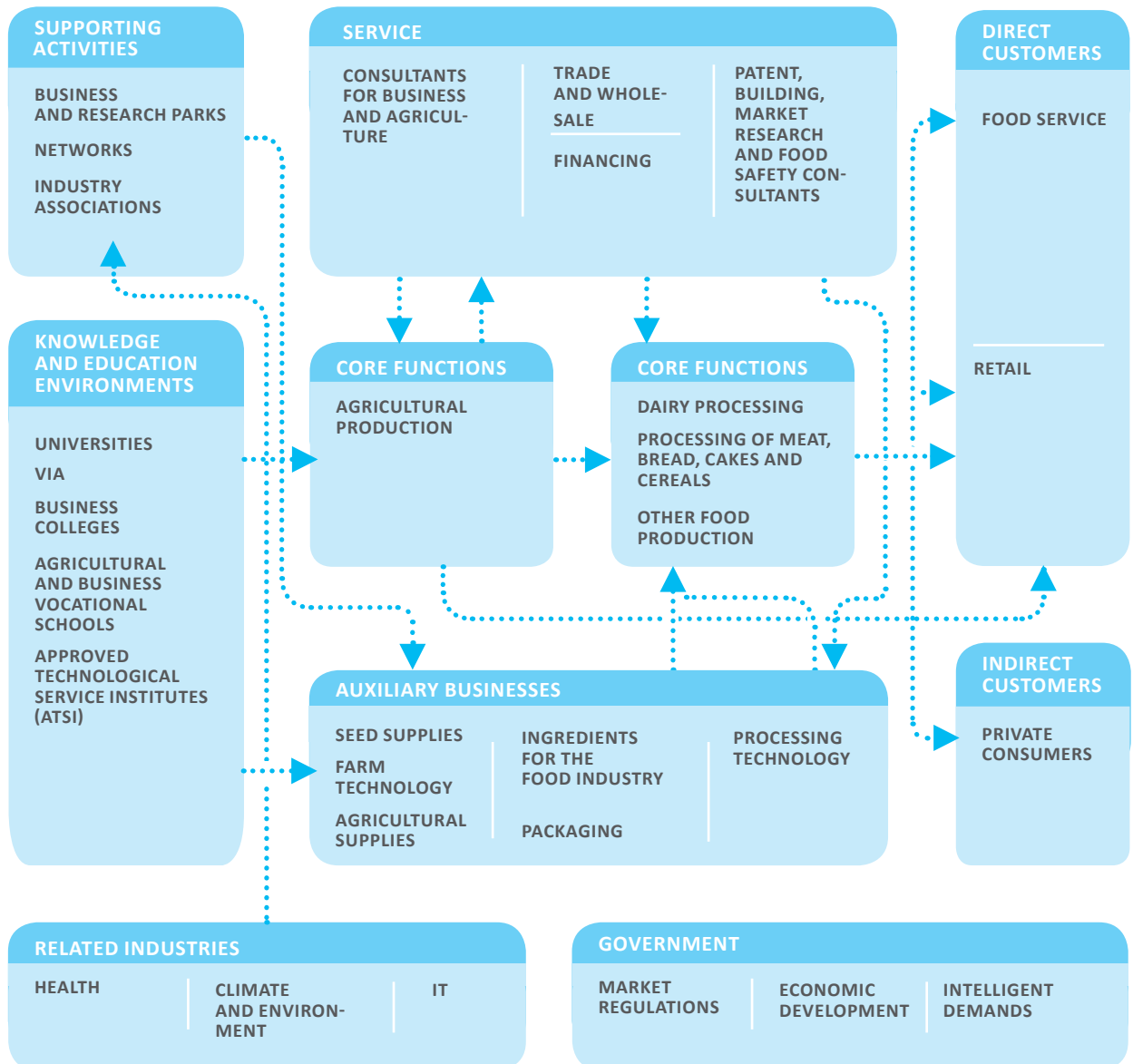
>>

VIA UNIVERSITY COLLEGE

VIA University College is Denmark's third largest educational institution and the largest university business college with 2,100 employees and 17,000 students based at seven campuses.

VIA University College campus in Skejby is a practically oriented educational institution, which educates employees for the region's businesses and public sector at the health/food interface. VIA University College's programmes for the food sector in Central Denmark Region comprise two bachelor degrees: 'Nutrition and Health', and the new programme from 2009 - 'Global Nutrition and Health' which is taught in English.

The two programmes' 250 students are particularly focused on sustainability, an area that VIA University College in Skejby is known to work with. In recent years, the VIA University College has experienced a growing interest from abroad and has started to export programmes to China.

APPENDIX D: THE VALUE SYSTEM OF THE FOOD INDUSTRY IN CENTRAL DENMARK REGION

SUPPORTING ACTIVITIES

BUSINESS AND RESEARCH PARKS

NETWORKS

INDUSTRY ASSOCIATIONS

SERVICE

CONSULTANTS FOR BUSINESS AND AGRICUL-TURE

TRADE AND WHOLE-SALE

FINANCING

PATENT, BUILDING, MARKET RESEARCH AND FOOD SAFETY CON-SULTANTS

DIRECT CUSTOMERS

FOOD SERVICE

RETAIL

KNOWLEDGE AND EDUCATION ENVIRONMENTS

UNIVERSITIES

VIA

BUSINESS COLLEGES

AGRICULTURAL AND BUSINESS VOCATIONAL SCHOOLS

APPROVED TECHNOLOGICAL SERVICE INSTITUTES (ATSI)

CORE FUNCTIONS

AGRICULTURAL PRODUCTION

CORE FUNCTIONS

DAIRY PROCESSING

PROCESSING OF MEAT, BREAD, CAKES AND CEREALS

OTHER FOOD PRODUCTION

AUXILIARY BUSINESSES

SEED SUPPLIES

FARM TECHNOLOGY

AGRICULTURAL SUPPLIES

INGREDIENTS FOR THE FOOD INDUSTRY

PACKAGING

PROCESSING TECHNOLOGY

INDIRECT CUSTOMERS

PRIVATE CONSUMERS

RELATED INDUSTRIES

HEALTH

CLIMATE AND ENVIRON-MENT

IT

GOVERNMENT

MARKET REGULATIONS

ECONOMIC DEVELOPMENT

INTELLIGENT DEMANDS

NOTES

NOTES

NOTES

REG X – THE DANISH CLUSTER ACADEMY

UNIVERSITY OF SOUTHERN
DENMARK
ENGSTIEN 1
6000 KOLDING
DENMARK
WWW.REGX.DK
INFO@REGX.DK
TEL: +45 6550 1319

REG X