

Development, growth, and integrity in the Danish organic sector



A knowledge synthesis on the opportunities and barriers for a continued development and market-based growth in production, processing, and sale of organic products

November 2008



International Centre for Research in
Organic Food Systems

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Development, growth and integrity in the Danish organic sector, a white paper

ICROFS, Foulum

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Summary in English

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ICROFS in-house report No. 2/2008

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Publisher

International Centre for Research in Organic Food Systems (ICROFS)
www.icrofs.org

Published

November 2008

Print

Fiil Grafisk, Østergade 25, DK-8830 Tjele, Denmark

Preface

Organics as the future norm for sustainability

In May 2007, the Danish Ministry of Food asked ICROFS (formerly DARCOF) to carry out a "knowledge synthesis", a fact finding work that should clarify the opportunities and barriers for development and a market based growth in the Danish production, processing and trade of organic products.

The background for this request is a growing demand for organic food – both in Denmark and in many other countries. The increasing demand and the rising international trade with organic products provide both new opportunities and a more competitive market.

One of the preconditions for maintaining the Danish organic production is that the quality and supply of organic food meets consumer wishes and expectations. Another precondition is that consumers have confidence in the way the food is produced – that the production lives up to the organic principles.

From this starting point, ICROFS has prepared a comprehensive survey of the Danish organic sector and its future prospects, and an assessment of what barriers are the most important to overcome in order to secure the future of organics. In the course of this knowledge synthesis, two public meetings have been held with a wide range of participants from the whole sector, including farmers, vegetable and fruit growers, processors, financiers, trade organisations and researchers. There has therefore been ample opportunity to contribute viewpoints to the work, and we have benefited tremendously from the great interest and willingness to participate in the debates. But the responsibility for the content of this final synthesis is solely ICROFS'. The work has been knowledge based in the sense that all the information in this synthesis is based on either scientific studies or comprehensive interviews with representatives from the sector. This is all documented in a range of background chapters, which have been available for comments on the homepage <http://ecowiki.org/OekologiskUdvikling>.

This knowledge synthesis has led us far around in the organic landscape of Denmark, and there are many indications that the sector is changing. This provides many opportunities and we sense great enthusiasm among the actors in the sector. The present market opportunities are good – to put it mildly – and many producers and processors face serious challenges in meeting the demand.

But the situation also obliges us to act in order to secure the long term sustainability of organics. In a world where strategic food policy in merely a year has gone for a secondary position to the top of the list in the global political debate, organics is in a unique position to take the next leap forward. Energy efficiency, nature protection and poverty reduction is already a part of the organic principles. Now the task is to incorporate them into everyday organic practice.

Denmark is coming out more and more clearly as an organic pioneer. The "Danish model of organic development" is at the same time modern, innovative and ecumenical – whereas organics in some other countries seems to be a retrospective, low-tech and fundamentalist niche. In this way, Denmark creates a foundation for organic food systems to move from an idealistic mirage to a new global norm for sustainability.

Many thanks to all the contributors, participants in meetings and, not least, the authors of the background chapters.

Thomas Harttung

Chairman of the Board, ICROFS (International Centre for Research in Organic Food Systems)

Summary of the synthesis

A new research based knowledge synthesis recommends five task areas, which are to secure the future of organics in Denmark. The knowledge synthesis was commissioned by the Danish Ministry of Food to investigate the opportunities and barriers for a continued growth in the organic sector. This report synthesises the results of a comprehensive fact finding work, carried out by the International Centre for Research in Organic Food Systems (ICROFS, formerly DARCOF). The purpose of this fact finding work has been to create a synthesis of knowledge about the opportunities and barriers for a continued market based growth in the production, processing and trade of organic products.

A good basis for more organics

The knowledge synthesis shows that organics has a strong foothold in Denmark: the consumers demand organic products, the retail business is very open to organic products, organic production gives good economic results for the producers, and there is room for much more organic agriculture in Denmark.

A large obstacle in the path forward is the conversion to organic production. The demand for organic products is larger than the production in Denmark. The primary producers hesitate in their reaction to the market signals and the conversion is too small. This means that there is an unused potential in both the home and export markets. But there are also other obstacles. The knowledge synthesis therefore recommends five essential, long term strategic efforts that are to secure the future for the organic sector in Denmark. The recommendations are based on a range of grounds or preconditions, which the work has exposed.

The four positive conditions of life for organics

According to the knowledge synthesis, the market based organic sector in Denmark rests on four fundamental conditions.

1. There is a value based market

The market opportunities for organic products are exceptionally good today, and there is a large growth in retail trade. The export has only gone up marginally, while there has been a large increase in import. In Denmark, the latest mega trends in the food area have moved consumption to a focus on value based consumption, away from size and toward 'meaning', 'healthy food' and 'decent food'. The demand for organic food is connected with symbolic aspects and global responsibility by a relatively large consumer segment, which has a fundamental trust in the organic actors.

2. Retailing interest stimulates innovation and product development

The knowledge synthesis shows that many retail businesses now use organics a part of their strategic profile and branding, because organic consumers belong to the trendsetters in food. There has been a positive market innovation that has increased the availability and visibility of organic goods. The new interest and the increased organic sale within the retail business have stimulated the interest in innovation and product development in the processing industry. This has created room for a range of smaller organic companies, but they need to be backed with knowledge in many areas.

3. Organic production gives good economic results

In general, organic production gives a higher operational income than conventional production. On average, organic full time crop farms, dairy farms and pig farms all have higher contribution margin and income than comparable conventional farms. In spite of this, there has been a very limited conversion to organic production in later years. The motivation for conversion has fallen among conventional farmers. In 2007 there has been a slight increase in the organic production area and a net gain of some forty farms, but the supply situation still needs to be substantially improved.

4. There is room for much more organic agriculture in Denmark

Geographically speaking, there are very good prospects for a larger organic production in Denmark. In example, there is room for a quadrupling of the organic dairy production based on the existing dairy farms, and there would still be room for much more meat and crop production. Organic agriculture could contribute substantially to the conservation of natural values and the promotion of biodiversity. There is some overlap between the areas with a large potential for organic production and the areas with particular societal obligations and challenges as concerns nature protection and the development of landscapes and rural areas.

The knowledge synthesis recommends five strategic efforts

Based on the present situation of the organic sector, the knowledge synthesis recommends five important focus areas where an effort should be made, in order to secure the organic market of the future.

1. Strengthen the positive dynamics in processing and sale

The market is ready for more organic products. Value based demand from the trendsetting consumer evokes a response in retailing, and the interest within retailing stimulates processing companies and producers. The present positive dynamics in the market must be continued and strengthened, for one thing, by support of product development.

2. Organic intensification – conversion lags behind demand

There is a pressing need of a targeted, long term effort for increased conversion to organic production. The effort should focus on communicating an attractive and visionary image of organics as a future part of agriculture, and creating better conditions for conversion through long term contracts. In addition, new types of organic farms should be developed, which combine organic intensification with multifunctionality and new forms of cooperation between specialised operations.

3. Maintain and strengthen consumer trust

The knowledge synthesis shows that consumer trust is crucial to the development of the organic market and production system. Trust must be maintained through a continued improvement of methods of production and processing in line with the organic principles. And an open and participatory communication with consumers must be ensured.

4. Create synergy between organics and society

Methods of organic production can contribute to the promotion of nature and biodiversity and the reduction of aquatic pollution and emission of greenhouse gases. A larger distribution of organic farming can have a particular effect on biodiversity in selected areas, where there is a special need of protection. There are also opportunities for combining protection of environment and nature with production of bio energy and development of new special products. More organic farmers could open their farms to visitors in order to combine nature experiences and interactions with farming.

5. Honour the great need for new knowledge

The knowledge synthesis points out that there is a large need for continued research and expansion of knowledge in order to advance the development of organic food production and food systems. Important areas of development are synergies between different organic operations, organic intensification, deliberate use of diversity in and around the fields and improvement breeding, as well as processing and micro processing and the sectors contributions to nature, environment and rural development.

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1 Introduction

1.1 Objectives

In the spring of 2007 the Danish Food Industry Agency under the Ministry of Food, Agriculture and Fisheries asked the Danish Research Centre for Organic Food and Farming (DARCOF, now ICROFS) to carry out a fact finding work based on the ongoing research. The objectives of the work is to synthesise available knowledge on the opportunities and barriers for a continued growth in organic production – including both primary production and processing – in consideration of the organic principles and the satisfaction of consumer wishes and needs together with the desire for high quality.

Specific objectives of the work are to:

1. Identify and evaluate the background for a the current increase of the demand for organic productions
2. Identify and evaluate the essential drivers and barriers for conversion into organic production, processing and distribution
3. Identify and evaluate consequences of an increased import or export
4. Establish and evaluate alternative strategies to further support a continued growth in the organic sector – keeping in mind the importance of maintaining a high consumer confidence, high credibility and high product quality

1.2 Empirical basis

This report is based on a comprehensive synthesis of knowledge carried out by DARCOF/ICROFS in cooperation with researchers in the area and actors within the sector.

The Ministry of Food has, by way of DARCOF, carried through two research programmes in the area of organic agriculture and food systems, and a third, "DARCOF III", is being carried out now. Based on these efforts, Danish researchers play a large role in the EU research within organic and sustainable agriculture. At the same time an extensive development work has been carried out – supported by the innovation schemes, among other things – on private farms, in companies and in trade organisations that are occupied with organic production. In this way, a large amount of knowledge and expertise has been built up in many areas and levels within organic food production, which this knowledge synthesis has utilised.

The work has included meetings in four working groups in May-June 2007 with more than 60 participating researchers and some 20 presentations from key researchers. This initial research based synthesis was supplemented with inputs from actors within the sector at a public meeting in September 2007 with 170 participants. At this meeting the preliminary results were discussed and researchers and actors together identified the main barriers and challenges. Based on the work and the results from this first phase, selected researchers from the four working groups have prepared 16 background chapters that cover de main barriers and challenges. Furthermore, a special scenario group has had the responsibility for clarifying the long term prospects for growth in the organic market. This group prepared four scenarios for the future organic market, which were tested and played out in a workshop in April 2008. Here 70 invited actors from the organic sector participated in a newly developed scenario game, where they contributed with strategic analyses of the situation in year 2020 and how we arrived at this particular scenario, based on their own position in the sector. Three additional background chapters have been prepared based on the scenario work.

A steering committee with representatives from the board of DARCOF and actors in the sector has had the overall responsibility for the implementation of the knowledge synthesis¹. The work has been thoroughly documented on the homepage <http://ecowiki.org/OekologiskUdvikling>, from where the background chapters can also be downloaded. A list of the 19 background chapters can be found in section 4.

1.3 Background

The Danish organic sector has always been market based and has developed in a close cooperation between farmers, food companies and consumers. Since Denmark passed the world's first law on organic agriculture in 1987, the public authorities have promoted and supported this cooperation with the intention to meet consumer demand for organic food. By way of information, advising and professional development, the first law created the foundation for a production that was so large that the products could be sold through selected supermarket chains. After that, consumer interest soon proved to be so strong that demand far exceeded production. The government therefore intervened with an action plan in 1995. In a close cooperation with all sector organisations and companies, the action plan contributed to increased production and stronger market development. There was a strong increase in production, and several small and large food companies established themselves on the very dynamic market. In fact, production became so much larger than the demand, that the government could enter with a new action plan in 1999, with the intention to get product development going for organic food and pave the way for export. Many farmers, companies and organisations seized these opportunities, and through their efforts and cooperation a wider range of organic products was created – something which has contributed to the large growth in the Danish organic market in the latest years.

Comparisons of the complex interactions between organisations, companies, the food policy and the food market in different European markets, carried out by the EU project ORGAP (<http://www.orgap.org>), clearly show that consumer demand for organic food is not enough. There is a need for trade companies, who are interested in making it attractive to producers and processors to try to live up to the wishes of the organic consumers. Furthermore, the conventional agriculture needs to be forthcoming towards organics as a precondition for organic conversion and an increased production of primary produce. Public policy support can contribute to the development, but it will only be effective if companies and farmers are interested in utilising the support – and if consumers demand the products that come out of the support. Finally, it is important that the parties can sit together and solve the problems that come up, since the development often moves in steps.

It is the ability to keep finding new ways of cooperation across the organic value chain that has placed Denmark in a leading international position in the development, distribution and sale of organic food – and this is the background for the appointment of Denmark as Organic Country of the Year 2009. However, globalisation, structural development and increasing international trade create new challenges and opportunities for organics and make new demands in relation to consumer trust and the credibility of organic products.

The development is not only complex and dynamic due to the cooperation between different types of actors within the sector, as described above. The actors also have different views about what organics is, and different, more or less explicit organic goals and strategies. The organic standards secure a fundamental agreement between the organic practice and consumer expectations. But within the rules there is a large

¹ The members of the Steering Committee are: Thomas Harttung, Chairman of the board of ICROFS, Gert Holst Hansen, Danish Agriculture, Paul Holmbeck, Organic Denmark, Michael Stevns, The Danish Dairy Board, Soren Frandsen, KU-Life and Inge Tetens, DTU-Food.

scope to develop the organic practice, and it is evident that the organic actors act very differently. Furthermore, the organic standards themselves are constantly being developed in a balance between promoting growth by improving the conditions for efficient and large-scale operations and safeguarding organic agriculture as a real alternative for consumers, politicians and the agricultural and food industries.

The knowledge synthesis has deliberately addressed this heterogeneity to ensure the coherence and relevance of the results to all the principal interests in the sector. In relation to the revision of the EU regulations on organic production, the EU project Organic Revision (www.organic-revision.org) identified three predominant perspectives on the development of organic agriculture. Based on these perspectives, the knowledge synthesis has worked with three different archetypical actor strategies: mainstream, alternative conservative and alternative innovative. Presumably, no single strategy will be able to secure the future development of organics – a mixture of different actor strategies is needed, like we see it today.

The mainstream strategy works in a businesslike manner within the borders set by the present rules of organic agriculture. The key goals are higher economic efficiency, rational marketing, international division of labour and thereby lower prices and a good foundation for market based growth. This strategy is an important reason why Denmark today is one of the world leaders with regard to organic production and sales of organic food. But it also leads to dilemmas with respect to the organic principles, problems of credibility and risk of subsequent backlashes in organic sales. An important question is therefore how this strategy can secure growth in the long run.

The alternative conservative strategy works from tradition-bound norms and rules, with biodynamic agriculture as the prime example. Key considerations are respect for the integrity of life, diversity and the social and cultural life in and around agriculture. This strategy maintains a distance to the conventional food system, which makes it easy to indicate differences in the market and to preserve credibility and consumer confidence. It has remained a small niche in Denmark, in spite of the growth in organics, but food scandals etc. have given cause to a renewed interest. An important question is therefore what role this strategy can play in a continued market growth of the Danish organic sector.

The alternative innovative strategy works towards a dynamic development of organics, rooted in the organic principles, seeking innovations, new alternative developments, new technology and new ways of producing public goods. The explicit focus on the organic principles supports consumer confidence and gives rise to suggestions of stricter rules and the development of rules in new areas. This strategy often has difficulties in succeeding in an established organic market, which is dominated by the mainstream, and where some innovations are picked up and implemented at an early stage by the mainstream or in conventional products. An important question is therefore how this strategy can survive in the short run.

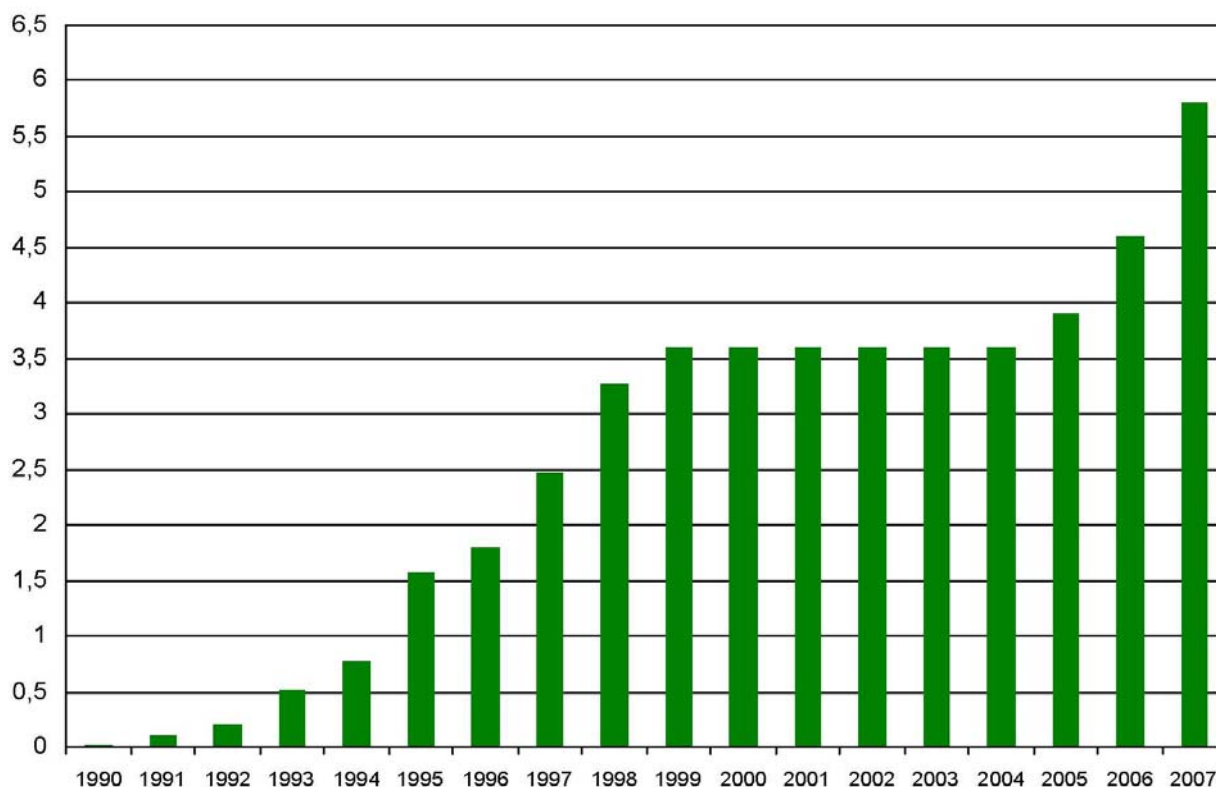
2 Main barriers and opportunities

This section presents the state of affairs, the main barriers and opportunities in key parts of the sector. Each subsection gathers information from several background chapters, and in the individual chapters there are substantiations, documentations and references for each of the points that are brought out and synthesised here.

2.1 Demand and consumer confidence

The market opportunities for organic products are exceptionally good today. In 2006 the growth in retail sales was 18% in money value and 11% in quantity, and the newest figures from Statistics Denmark show that sales went up with an additional 33% in money value and 13% in quantity in 2007. The difference in money value and quantity can be explained with more purchases of secondary produce and high value products and the fact that prices have gone up, particularly on standard products.

Figure 1 The development in organic market share. Percentages of the total food sale in Danish retail trade, 1990-2007



(Source: Chapter 1)

Fruit and meat has had the largest relative growth in sales in the latest years, but from a fairly low starting point. Single products, like organic apples, tomatoes, pork and cold cuts, have manifested themselves in the market, and rye bread has again become a sought after standard product. However, it is still dairy products and eggs that are the most sold organic products in Denmark.

Table 1 The sale of organic products in percentage of household budgets within different commodity groups for 6 consumer segments

Commodity group:	The fully convinced	The logo-focused	The positively inclined	The product-focused	The indifferent	The sceptical
Milk	68	35	35	14	11	4
Eggs	50	27	31	10	8	9
Butter	32	14	15	2	3	1
Flour	31	17	14	4	6	3
Vegetables	25	10	12	3	3	1
Fruit	17	6	6	1	1	0
Coffee	16	10	7	1	1	0
Fermented milk	11	7	7	2	2	1
Bread	9	2	4	2	1	1
Meat	7	4	2	1	1	0
Other products	4	2	2	1	1	0

(Source: Chapter 2)

Exports

The Danish export of organic products has only increased slightly. In 2006 exports amounted to 275 million Danish kroner, which was about 10% of the total organic sales. Worldwide, organic sales went up by 16% in 2006, and Europe has overtaken North America as the largest market. Therefore the opportunities for export are good. The explanation for the weak growth in exports has to be found in the strong demand on the home market, which the companies have made a priority.

Exports have a new and very important role to play. They are no longer primarily drivers of conversion and growth; they are to ensure a continued professionalisation of the sector and a broader business foundation for the companies. This enables an organic growth and a stable basis for continued product development, which the relatively small Danish market cannot provide in itself. In light of this, there is also a shift in export strategy from primary to secondary produce.

Quite a few of the companies that aspire to enter the export markets, are small or middle sized companies with a limited export experience. Work has therefore been undertaken to upgrade their qualifications in cooperation with Organic Denmark and the Trade Council of Denmark. In the same way, there is a joint export promotion in cooperation with, among others, Organic Denmark and the Danish Agricultural Council. The largest export effort yet is to take place in 2009, when Denmark is appointed Organic Country of the Year at the world's largest organic trade fair, BioFach in Germany.

Imports

Imports were nearly doubled from 2003 to 2006, where it reached 587 million Danish kroner or about 15% of the total sales. Imports can have several roles. It can be seen as a positive supplement to domestic production, which cushions seasonal fluctuations, secures supplies when the Danish production fails and expands the retail product range with exotic products. It can also be seen as a competitor to the Danish production that adds to the downward pressure on prices for primary producers.

All in all, there is no substantial competition from foreign organic products today. But in some areas, such as apples and other Danish fruit and vegetables, imports do put pressure on prices and compete with the Danish production. There is, however, a preference for Danish products in these areas, and it will be possible to increase the Danish part of the total sales if barriers in the primary production can be overcome. In the case of standard products, such as feed grain and industrial berries, imports will remain, because these products can be made cheaper in other countries.

The background for the demand for organic produce

Consumer research has identified three long term "mega trends" in the food area, which affect the demand for organic products. By mega trend we understand conditions that over a prolonged period of time influence many people across markets, cultures and national borders. These three trends have been felt for the last three to four decades, and they have moved focus:

- away from quantity towards the meaning of food
- away from good food being just tasty – good taste must also be healthy food
- away from serving square meals toward serving ethical food

This means that the demand for food is coupled with symbolic aspects. Consumers dissociate themselves from mass produced goods and gain interest in authentic and special goods. At the same time, the moral norms that are bound up with food, are expanding from the care of the near and dear to also include the care of distant places and the future state of the Earth. Furthermore, the individual has become more responsible with regard to health. We are ourselves responsible for preventing lifestyle diseases, and this means that the interest in the relation between food and health is increasing.

The organic consumers in particular reflect these tendencies strongly. Their main motivations for buying organic are health, environment, animal welfare and other ethical aspects. They have a positive view of organic production and attach importance to the avoidance of pesticide and medicine residues, but they also believe that organic food is better quality and has a better taste.

The organic consumers are trend setters in relation to the food tendencies of today. They are better educated than average, mainly live in the cities, but their consumption is not directly linked to their income. They tend to believe that their own decisions about purchases are important and that they will have consequences for themselves and for the surrounding world.

This synthesis contains a collection of the newest knowledge about organic consumers, including material that is published here for the first time. Here the consumers are divided according to their involvement in food, their need of convenience in everyday life, their satisfaction with organic products, their confidence in organics and their engagement in far away places and the future course of the world. The three main organic consumer groups, the fully convinced, the logo-focused and the positively inclined, make up 49% of the population and buy 88% of the organic produce. The share of the budget that they spend on organic food varies from 14% for the convinced to 7% for the positively inclined and the logo-focused. There is therefore a large potential for increased sales – if, that is, the retail product range is expanded and product development succeeds both in standard and special products, so that the convinced will stay satisfied, and the availability of a broad range of organic products is increased, to the benefit of the rest of the consumers.

Table 2 The six organic consumer segments and their share of the organic sales as a result of their share of the population and the percentage of the household food budget they use on organic food

	Share of organic sales %	Share of population %	Organic share of budget %
The fully convinced: Involved in food quality. Convinced that organics contribute to a better world and consistently go for organics. Generally highly educated.	46	17	14
The logo-focused: Looks upon the organic label solely as a quality label and ignores the conditions of production behind. Mainly found among the lowly educated.	19	16	7
The positively inclined: Similar to the convinced, but the need for convenience rises above the more idealistic aspects. A large group with different levels of education.	23	19	7
The product-focused: Involved in food due to taste. Direct their loyalty to a few suppliers of particularly good organic products. Mainly found among the lowly educated.	8	24	2
The indifferent: Give priority to convenience above everything else. Mainly single men who don't bother to cook for themselves.	3	11	2
The sceptical: Stand out by their lack of confidence in organics. Mainly elderly people and lowly educated.	2	12	1

(Source: Chapter 2)

It is important, particularly for the convinced consumers, but also for the other two main organic segments, that the key ethical questions are reflected in the daily practice of organic production. The organic producers and distributors must be ahead with regard to the large, pressing challenge of making the world a better place to live in, now and in the future, so that the consumer experiences the choice of organics as "an ethical choice" (cf. the new mega trends).

There is a positive view of organic farmers among the public at large. 63% think they are more involved in their production, and 62% think they care more about the state of the planet. Moreover, support for the organic ideas is the fourth most important motivation for buying organics after animal welfare (78%), better environment (74%) and own health (67%).

"Trust is a mechanism of complexity reduction"
Niklas Luhmann

Labelling and certification is of great importance to how easy consumers find it to pick out organic products among the others. The government controlled organic label, the red Ø logo, has been the predominant label through the last 20 years and it is recognised by 90-95% of all Danes. Most also have confidence in it. There is a tendency, however, that consumers read too much into the label. For one thing, they connect it specifically with Danish products. Less than half of the consumers think that they know a great deal about organics, and when those who think they know most, are asked about specific conditions, they only have the right answer for about half of the questions.

The analysis shows that the fully convinced consumers are less affected by the price of organic products. This and the fact that organics is closely connected with a more fundamental change in food trends, speaks in the favour of stability in buying behaviour. Previous research results show that substantial increases in food prices or an increased price difference between conventional and organic products can lead to a loss of market shares. However, the growth in the organic market in recent years has happened even though prices on some organic products have gone up – more than the conventional prices. Moreover it can be expected that the increased sales of organic produce and the increased competition will lead to a smaller price difference between organic and conventional products – as can already be seen for some products.

Health and safety of organic products

As described above the organic consumers think organic produce is healthier, mainly because of the absence of unwanted substances. In Denmark, 95% of the pesticide intake comes from about 25 crops of fruit and vegetables. According to the Danish pesticide control, there are rarely any pesticide residues in samples of organic fruit and vegetables. There is also a markedly lower usage of antibiotics and lower antibiotics resistance in the organic pig production.

Quite a few consumers are convinced as well that organic products contain more health promoting substances than conventional products. Research projects all over the world are investigating this. According to the background chapter on food safety, preliminary results indicate that organic produce on average contain more secondary metabolites than conventional. There has also been found a higher content of phyto-oestrogens in organic milk, but the present knowledge cannot determine the importance of this difference for health.

It has been made clear that there is no increased occurrence of fungal toxins in organic grain, and studies of the usage of animal manure have not indicated any problems with infectious matter.

Within organics it is required that all animals have access to free range areas. This calls for increased attention to the uptake of dioxins through soil and crops and the transfer of zoonoses through contact with wild animals and birds.

Studies in Denmark and elsewhere show higher occurrences of antibodies against salmonella in organic pigs. Conversely, newer studies indicate that free range fattener pigs release less salmonella at the time of slaughter than conventional pigs. This suggests that other conditions in the organic production more than make up for the higher infection pressure. There are no problems with salmonella in laying hens, either.

In conventional poultry production, campylobacter are controlled by way of a completely closed production systems. This is not possible with organic poultry. The exposure to open air also brings higher risks of exposure to virus infections like bird flu.

In a situation where the conventional animal production moves toward a more secluded production, there is an option to carry out pro-active efforts by way of surveillance of organic farms. The organic animals in themselves do not change the threat level, but they can detect infectious matter if and when there is any. Such a pro-active effort within the organic sector will also make it possible to document a high level of safety in a seemingly risky production form and thereby form a basis for easier terms for free range production with respect to disease prevention.

Rules and labelling

The implementation of the new EU regulation on organic production January 1st 2009 will imply significant changes in the Danish organic standards, since Denmark will no longer be able to have stricter rules on animal welfare. Some of the stricter rules can be maintained, though, if they are expressions of an interpretation of the common EU regulations or if they originate in regulations that apply to all Danish agriculture. But in essence, the development of Danish standards will be even more bound to the common EU regulation. The EU rules themselves will not at first be changed due to the new organic regulation, but the Commission is preparing the ground for an examination of the rules in selected areas over the coming years. The options that Denmark have to make future rule changes, is to get them into coming revisions of the EU regulation, or to implement sector agreements² (unless they want to reconsider the whole field of labelling).

At the same time, EU control system will become more transparent and include required reporting to the national authorities from all certification bodies and required communication between inspection bodies in case of fraud.

During 2010 the EU logo is expected to be redesigned and made compulsory. It is worth noting that, while the Danish Ø logo is an inspection label that cannot be reserved for Danish products, only for products packaged in Denmark, it will be possible to add to the EU logo an indication of the place where the produce have been produced, provided that at least 98% of the ingredients are agricultural produce from the country in question.

Opportunities and barriers

By way of focused product development on all types of organic products and the right mixture of standard products and specialities in the retail trade, there is a large potential for market growth depending alone on those consumers who are positive toward organics today, and a further potential in the rest of the population.

The changes in consumer trends are deemed to be stable, and moreover there is an increased willingness to pay for quality food. Substantial increases in food prices or a considerably larger price difference between conventional and organic products can, on the other hand, adversely affect growth in the organic market.

It is crucial to maintain the trust of consumers through a larger familiarity with the core organic values and what the Ø logo and the EU logo stand for and with the actual production methods and their benefits, communicated, among other things through dissemination of the newest research results. For example, the consumers want more knowledge of how the organic production contributes to the environment, apart from the ban on pesticides.

² That is, an agreement between the parties that are to comply with a certain special rule. In the case of rules for milk production, for instance, this would be the dairies and the relevant organisations such as the Organic Denmark (the main organic association), the organic group in Danish Agriculture (the main farmers association) and The Danish Agricultural Advisory Service.

Trust is of the utmost importance. And we support it by sitting together – companies, consumers and producers – in one organisation, where we are close to each other when a problem comes up that has to be solved, and by not trying to explain it away, but to confront it: what do we do now? (Bo Læssøe, Svanholm, trade organisation, in the Scenario Game).

It is desirable to investigate the suitability and sustainability of existing packaging solutions for organic products, and to draw up directions that can meet consumer expectations.

Focus areas and knowledge needs

Consumer studies show that there is a need for parallel efforts in product development and expansion of the range of standard products as well as product development in specialities and quality products, so that there will be a broader variety of products which can appeal to the different consumer segments.

Producers, process industries and distributors need to relate to the future development of organics on the basis of the core values. This involves challenges such as the amount of imports, climate, local production and an open and fair trade from farm to table, and considerations of what role the Ø logo and other forms of communication may play in this context.

Organics is not a train that runs and which you can just jump on – we are the actors, it is us who are going to move this train. We must create a common consumer policy platform for how we want organics in Denmark to develop (Brian Skov Sundstrup, FDB, consumer representative, in the Scenario Game).

A reinforced development effort is needed in the primary production on issues of value, such as animal welfare and free range production, increased biodiversity on farms, more attention to soil fertility and the influence of cropping on gastronomic qualities, as described in the section on primary production.

Research needs

Research in new and participatory forms of consumer communication.

Research in how a reduction of complexity through labelling and other measures can create consumer confidence.

Research in methods on how to increase communication and put common values into practice in global food chains, and how to communicate this to the consumer.

Catering

On the conventional market, the catering sector account for about 30% of the food market. According to a 2007 Market Note from Organic Denmark, the sales through wholesalers and catering to public kitchens,

school meals, private canteens and restaurants totalled half a billion Danish kroner in 2006, or 7.8% of the total organic food market. This indicates a considerable growth potential.

An analysis of the catering area that was carried out within this fact finding work, shows that the efforts to promote organics in the catering sector in Denmark has so far been recommendatory. Supported by funds from the Danish Food Industry Agency, several non-public actors have stimulated the organic catering market. Organic large-scale kitchen consultants have worked with advisory services and knowledge dissemination, and Organic Denmark has carried out market oriented activities and a strategic effort for more organics in schools and private catering.

In those cases where the public authorities in Denmark have actively promoted organic conversion of the public provision of meals, the motivation has been the public responsibility for securing clean ground water and the connection between environmental management in kitchens and institutions, a green purchase policy (as found in EU regulations, which also make it possible to make requirements about organics in connection with tendering) and the sustainable development goal.

Several county hospitals have experience with using organic produce. The earliest initiatives on public conversion came from local, personal initiatives, but in the latest years it has been mainly top-down strategies. Even where there is a political will, the lack of clear decision making processes and the involvement of many actors can be a substantial barrier to actually implementing the political intentions.

Since 2005 the new large municipalities began making large organic tenders, and the conventional wholesalers had to build an organic product range to be able to bid for the tenders. This formed the basis for a new trend toward more organics in private sector canteens, which was a driver for growth in catering in the following years (Klaus Sall, Sall & Sall Rådgivning, consultant, in the Scenario Game).

There are 3800 private canteens with total purchases of 2.1 billion Danish kroner per year. The users in this part of the catering sector have gained a rising influence on the expectations to the content and service in catering functions. In the canteens of Nykredit and Meyer, it is the interest in culinary qualities, food origins and the way it is produced, which is important, instead of the more nutrition and cost focussed approach that is common in the public area.

The catering sector is very heterogeneous and even though there is a future market potential, it is quite crucial to the long term perspective that tailored strategies are effected, which are directed at selected parts of the sector. They have to be carried out in such a manner that the involved parties take more ownership of organics and regard it as part of their own overall goal achievement.

It is therefore important to identify areas within the sector that share agendas, principles and possible alliances with organics, and, based on this, carry out targeted market and strategic efforts, like the ones carried out in retail business today. In the same way, the efforts carried out on the production side must be based on the rules of the game in the catering sector, including problem concerning public renderings, product standards and purchase policies.

Barriers

Attitude barriers to organics among actors are concrete and context dependent, and should be treated accordingly.

One of the key policies in public catering is food safety. It is unclear how documented self-regulation can be used to ensure the use of safe and sound methods, based on the organic principles.

Rationalisations and cost reductions in connection with investments in larger units in the new large municipalities make it more difficult to implement organics, which comes at a cost, without also implementing dietary changes that reduces costs. On the other hand, such dietary changes can be carried out in ways that actually promote the overall health profile.

Very few of the school meals initiatives that come about in these years, consider organics. In these initiatives, trails are laid out that will govern the provision of school meals for many years to come. The tight demand on low costs is an important barrier to organic school meals.

Efforts

A multi-pronged strategy in selected areas that at the same time:

- considers the conditions and opportunities for an increase of organic products and principles in the catering sector
- develops new organic catering products and product service systems
- provides well-substantiated dissemination of information targeted at the different actors
- ensures a build-up of institutions to anchor the changes

Parts of the strategy can be:

- the development of new concepts where diets, nutrition, health and quality are integrated in the organic dietary changes to offer new, healthier and competitive solutions
- the development of technologies, systems, concepts and methods for the preparation and distribution of processed catering products
- project engineering of demonstration kitchens and catering systems in accordance with organic principles
- work with concepts for gastronomic organic catering
- develop organic concepts for school meals
- work with change management for organics in catering

Research needs

Expansion of the existing research platform and coordination of the activities with ICROFS, with regard to both the product and system oriented research and the actor and policy oriented.

2.2 Marketing and processing

The facts that organic food fits so well into the main mega trend in the food area with its focus on values and health, and that organic consumers are trendsetters and therefore interesting customers, is the foundation for a new positive dynamics in the market place. Chapter 10 describes the revival of the market that has taken place in terms of cooperation with the retail business. The key to this market innovation is that many retail chains now use organic food as a part of their strategic profile and to differentiate themselves from other chains. This results in a positive dynamics that creates demand for more and different products, and which makes it easier to come into operation with new production and processing.

The elements of this dynamics are:

- The availability of organic products becomes better. In the shops, the consumers benefit from a wider choice of interesting products from the organic product line. The broad range of organic products is also tempting to the consumer who has not beforehand chosen to buy organic.
- The visibility of organics and the organic supply of products are strongly increased. The chains' new strategies for organics mean that the organic products are better placed in the shops. They are also more visible in supermarket flyers, television commercials and other forms of consumer communication.
- The individual chains constantly demand new products and product areas where they can profile themselves. This is markedly different from previous years, where the number of products was limited and primarily basic goods. Today the chains want to offer a wider product range and each shop is looking for product areas where they can profile themselves. This also means that retail businesses have opened new ways of purchase. Chain purchases used to be a major and insurmountable barrier to organic goods in retail, but now it is possible only to deliver in season or only to one campaign. Moreover, there is a larger receptiveness to making advance product agreements.
- There is demand for a range of specialities that, apart from being organic, are based on additional product qualities such as taste, packaging design, authenticity, etc. This brings its own synergy, since the connection between gourmet and specialities in general and organics reflects positively on the conception of organics. Furthermore, it renders organics and its qualities more visible to the two large consumer segments, the logo-focussed and the product-focussed.
- The new interest within retail business for differentiated products and the generally growing sales stimulates the interest among producers and processing industries in further product development and innovation, and gives new producers an opportunity to enter the market.

This dynamics is, among other things, the result of a targeted effort by Organic Denmark, which has gained a range of companies as members in the last years. This organic association has been the prime mover in a long range of marketing efforts in cooperation with companies and other organisations such as the Danish Agricultural Council and the Danish Dairy Board. These efforts have been supported through different public funds and on this background they have contributed to the establishment of a strong and unique marketing platform for organics.

In this new dynamics, the marketing department in Organic Denmark has a function both as a facilitator and sparring partner for retail chains at the strategic level and in priming the companies for the demands of retail business. An effort is made to connect producers and companies through matchmaking to create synergy between chain profile and product. In this way, the companies gain access to the market and

enhance their negotiating position. This happens without losing market dynamics, because the companies themselves make the final negotiations about prices and other terms with the purchaser.

Company types and strategies on the market

An analysis of processing industries on the Danish market shows that companies have different strategies with respect to product development and their position in the market. They also play different roles with regard to the marketing of organics to consumers. Four different clusters have been identified:

In the market for basic goods:

The "basic organics" cluster is purely organic and develops new products based on the primary produce, according to the organic criteria of value and in a close cooperation with consumers. Many of the companies in this cluster are well established and it is deemed quite difficult for newcomers to enter this market cluster.

The "organic as niche strategy" cluster can be characterised as conventional companies that have entered the organic market. The strength of this cluster is that they already have an established market position, available shelf space in the shops, a well-developed distribution network and a considerable consolidation powers. The challenge is to hit the mark in their product development and hereby maintain consumer confidence and attention.

In the market for specialities:

The farm cluster is characteristic in that the products are geographically rooted. The incentives to get involved in organic processing are typically that you, as an organic primary producer, want to keep in touch with your primary produce along the food chain or to maintain the added value on the farm (or in the local area), and thereby create a coherent and viable business. The strength of this cluster is that they create authenticity by having a strong connection between product and narrative. Thereby they help maintaining the good story about organics as nearness and connection between producer, place and product. The weakness is that the entrepreneur faces a long range of challenges where professional expertise is needed.

The mark of **the gourmet cluster** is that it produces highly profiled specialities with a focus on quality and product development. Organics is not the main message, but a basis requirement that helps provide the product with the desired qualities. The companies in this cluster are both purely organic and mixed. The cluster is growing and there is a tendency that the companies in the other clusters move toward this cluster, if only with single products or a speciality product line. This cluster is important to organics as it connects taste and new food trends with organics.

Generally speaking, there is a dynamic between purely organic companies and conventional companies with organic production, and a dynamic between the companies that produce basic foods and the companies that produce high-profiled specialities. But it is not clear in details what the importance is of these dynamics to the conception of organics and how they inflict on the relation between the companies. What can be established is that the bulk of the products are sold through conventional companies with organics as a niche production (such as Arla, Friland Food/Danish Crown and Lantmännen), and that it is the other three clusters which are visible in "the story of organics". But in general there is a broad cooperation between the companies on marketing and information.

How will organisations look in 2020, and how is the formation of public opinion? We are moving into a quite different world, and the structures that we are fighting about now may not even exist in 2020. We need a network with room for diversity and broadness, we need to be challenged on the

views that we have, and there must be a place for committed individuals who can break through with pronounced messages. We should not make a fuss over organisations, but concern ourselves with whether a dialogue can be maintained that is of interest to the ordinary consumer and to politicians and others (Jesper Friis, Arla Foods, the processing industries, year 2020 in the Scenario Game).

Opportunities and challenges

The dynamics of market and product innovation and greater visibility of organic products has only really been running for the last three years, and the last retail chains have hardly implemented their strategies yet. Hence, it is assessed that there is a considerable potential for increased market growth through this effort. It is, however, essential that the individual chains are continuously motivated with new products and new marketing initiatives that match their strategies.

It is likely that organic basic goods will be more dominated by conventional companies with organics as a niche production, and that the market for specialities will show stronger growth and form a basis for far more purely organic companies. It is a future challenge to ensure a continued positive dynamics between the different company types and make sure that new companies hit the mark with their products and messages when they first enter the organic market, to the benefit of both themselves and the whole market. This will strengthen the interplay between the archetypes that have been identified in this fact finding work: the mainstream, the alternative conservative and the alternative innovative.

We envision that the farm shops will move into our shops as shop-in-shop solutions (Katrine Milman, COOP, the retail trade, in the Scenario Game).

There is a substantial development potential in on-farm processing of primary produce and in close cooperation between the evolution of primary production and processing – both on large and small scale and for established producers as well as for coming organic farmers to whom this is an attractive possibility.

The value based demand goes beyond the core areas that consumers normally connect with organics, such as health, environment and animal welfare. In particular, there is a new attention to climate aspects, including locally produced food and fair trade, world food security and products with specific health properties. So far, these new value based trends have successfully been connected to organics in Denmark, but this will be a continued challenge.

Efforts

The sector has to actually be able to deliver. There is shortage of a long range of primary produce today, and this may stop the development and launch of new products. With the growth rates we see today, attracting new primary producers is one of the greatest efforts to ensure a continued growth and development of the sector.

An effort should be made to establish a new growth layer of organic companies, in particular primary producers who want to finish their products on farm and other micro-companies. They need a broad consulting service anchored in a marketing environment.

The powers of product development and innovation must be supported, for instance by small and large companies creating inspiring networks and share new knowledge. There is also a need for development of the technological aspects of organic processing. Grass-root research, like the kind known from primary production, will advance minor innovation leaps.

There is a need for strengthening the "food educations" in relation to organics and coupled to the whole food service sector.

The concrete, short term development efforts that the industry carries out with support from the innovation schemes, agricultural funds and rural development schemes, need to be coupled to a more long term research effort.

Cooperation is needed along the whole organic value chain in order to solve the challenges that organics face. In particular within the fresh food area, there are a range of challenges that can only be solved if they are addressed in a coordinated way where all the actors share the risk of the new initiatives. An example is the effort for organic poultry where the producers, the slaughterhouse and the retailers have made a coordinated common effort to start a production and get a product in the shops.

There is a need for continuous market innovation that supports the use of organics in profiling and differentiating retail businesses, and a well organised and creative processing sector that can deliver products in demand.

Organic food must be positioned strategically in relation to competing value based trends such as climate and fair trade, unless this position in the market is to be taken over by conventional products with these qualities.

There is a demand for dissemination of knowledge about the organic market and its potential to the decision makers in the financial sector. A major stake on organic processing as a future Danish business growth area can be further supported by way of a kind of Organic Business Development Finance with venture capital, financial advice for companies and investors and governmental backing.

Research needs

Applied food research targeted at the needs of the industry, including process innovation based on organic values and micro food processing.

Research into the advantages and disadvantages of different forms of ownership in the organic niche strategy cluster, which can ensure an optimum of integrity as well as economics from both a Danish and an international perspective.

Consumer research targeted at how the dynamics between the clusters influence the consumer conception of organics. Or, put differently, how the three archetypical actor strategies, mainstream, alternative conservative and alternative innovative, can contribute to the development and marketing of organics in a positive dynamics or creative conflict in stead of being competitors that damage each other.

2.3 Conversion to organic primary production

The fact finding work points out that lack of conversion to organic operation in the primary production is an important hindrance to more organic production in Denmark. This section is primarily based on chapters 6, 7, 3 and 17.

State of affairs and prospects

A continued growth in the organic market can be based on imported or Danish products. However, many actors in the sector think that a growth which is not based on a substantial Danish production will be a major challenge to the credibility of organics. Moreover, it is not clear to what degree a growth in the Danish market can actually be based on imports, since the market is growing as well in many other countries. In any case, the societal benefits that are connected to organic production will benefit Denmark only, or primarily, if the production takes place in Denmark.

There is room for much more organics in Denmark. Geographical analyses of the farming structure show that there is a large potential for growth in the organic primary production. The dairy production can potentially be quadrupled based on existing dairy farms with sufficient area to comply with the fertilizer restrictions (see Figure 2, Figure 3 and Table 2). It should be noted, though, that local factors such as the layout of land on the individual farm and recent large investments in stables can reduce this potential.

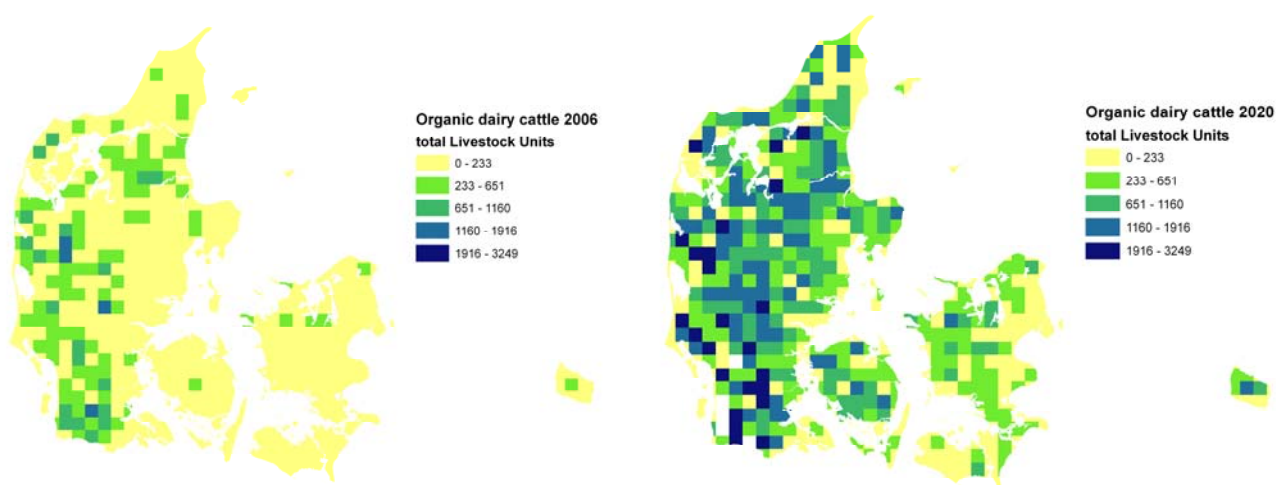


Figure 2 Modelling the geographical distribution of a quadrupled organic dairy production based on the conversion of conventional farms with sufficient area to comply with the fertilizer restrictions in organic production. Prepared on the basis of the scenario work (chapter 17)

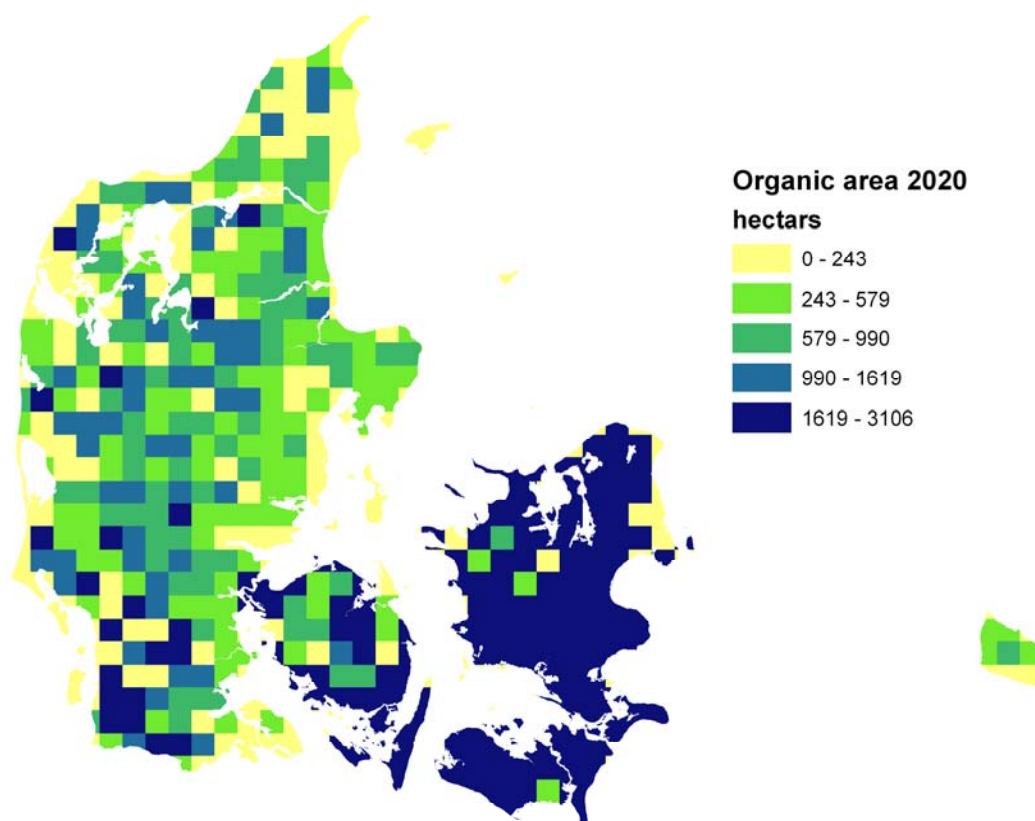


Figure 3 Modelling the distribution of the organic production area after a quadrupling of the total organic area. Every grid cell is 10,000 hectares, and the colours indicate the proportion of each cell that is organic

Table 3 An example from the scenario work that shows the organic share of the total production for different types of production in Denmark in 2005 and in 2020 where the organic production area has been tripled. The organic dairy production has been doubled and all the beef from here is produced and sold as organic. The table indicates that there is a potential for a manifold increase of the minor organic productions. The need for organic areas for fodder production has been calculated in, except that a third of the organic feed is imported

	Production in 2005	Share in 2005 %	Production in 2020	Share in 2020 %	Increase 2005-2020, in %
Milk	404,000 tons	9	808,000 tons	18	100
Eggs	189 million	14	378 million	28	100
Broilers	100,000	0.1	2 million	2	1,900
Fruit	2,5 ktons	4	6,3 ktons	10	150
Fattener pigs	52,000	0.2	500,000	2	900
Vegetables	2,000 ha	8	10,000 ha	40	400
Beef	10,000	3	86,000	26	760
Bread grain	30,000 ha		90,000 ha		200
Total area	150,000 ha	5.6	490,000 ha	20	260

(Sources: Data from 2005: The institute of Food and Resource Economics (FØI) and the Danish Institute of Governmental Research (AKF) based on GfK GeoMarketing data, Friland Food. Data for 2020 are based on the scenario work described in chapter 17.)

The areas that show great potential for increased organic production from a structural perspective, also to a large degree overlap with areas where there are special societal obligations and challenges with regard to nature protection, landscape development and rural development. The growth potential of organic production and the utility value for society depend on to what extent synergy can be attained between organic growth and the elaboration of action plans for nature, aquatic environment and rural districts in Denmark (see further in section 2.5).

In general, organic operations show better economic returns than conventional operations in Denmark. This holds for crop, dairy and pig production (there are no comparable data for egg production). On average, in the years 1999-2006, the labour income for organic dairy farms was 96 Danish kroner per hour compared to 76 kroner for the conventional farms. For the organic full time crop farms the labour income was 40 Danish kroner per hour compared to 12 kroner for the conventional (only data for 2006). In spite of the better economic results, there was only a very limited conversion in 2002-2006 and an overall decline in the number of organic farms and area. The better economy did not in itself lead to conversion as one would expect according to economic theory.

The incentive to convert among conventional farmers has apparently fallen. In 2005, 91% said they had not at all considered conversion to organics, compared to 78% in 1993. Recent questionnaire studies show that between 3 and 10% of the conventional farmers indicate that they consider converting to organics.

There is appreciable research based knowledge on the conversion dynamics in Denmark in the 1990s, but not much research based knowledge on the current opportunities and barriers for conversion of conventional farms. Nevertheless it is quite certain that things have changed. The composition of the group of conventional farmers and farms is presumably not the same today as it was in the 1990s. First of all many converted in 1996-2002 so that 6% of the farms were already organic in 2006. Secondly, the structural development has led to elimination and specialisation.

In 2007 there was a rise in area and a net gain of some 40 farms. A prognosis prepared by the Organics department at the Danish Agricultural Advisory Service, based on reports from the advisers from Danish Agriculture and Organic Denmark, estimates a net gain of 15.000 ha in 2008. So, since 2007 conversion has been rising again, but the overall supply situation has not been substantially improved. Conversion still lags behind demand.

Barriers and challenges

While the organic pioneers to some extent came from outside, the conversion wave in the 1990s consisted of professional, conventional farmers. But the results of this fact finding work indicate that conventional farmers are far less inclined to convert today.

There is a range of economic, structural and sociological barriers that may explain why conventional farmers have not converted in 2002-2006.

First and foremost there has been stagnation in the market up until 2005, which has restrained the conversion of some production types, and which can explain why some farmers still hesitate. For a while, it was not possible for new organic dairy farms to become suppliers to Arla, and there was some insecurity whether an organic premium for milk could be sustained in a situation where there was a large surplus of organic milk. Generally, there was insecurity concerning the future premiums for organic products, and this insecurity was aggravated by the 5 year minimum contract period that is laid down in the EU regulations, and which prevents re-conversion if the premiums turn out to be lower than expected. At the same time,

sharp increases in the conventional milk prices have improved the economy of conventional operation. Finally, the conversion subsidies for dairy producers was taken out for a period and only reintroduced in 2007.

There may be a need for large investments in production machinery and stables when converting to organic operation, if the existing production facilities do not fulfil the requirements for organic production. This increases the costs of conversion and it can be a barrier, which often results in a delay in the decision to convert until they will have to invest in the production facilities anyway. However, the costs of conversion are very different for different production types.

Another possible reason for the present scepticism toward conversion is insecurity about the future development opportunities and competitiveness of the farm. Some perceive organics as a "blind alley" where you will lack behind with respect to structure and size and securing production rights in the area in relation to environmental regulations. The reality is, nevertheless, that the organic farms so far have been at least as big as the conventional.

An important barrier can be found in the knowledge, competencies and attitudes toward organics among farmers and in the social and professional networks that they are a part of. The conventional professional and economic advisers do not always have the professional qualifications to present the economic and professional potential of organic production to their clients.

Moreover, the average age of farmers is rising, which means that many farmers lack the personal and professional surplus that is needed to carry through a larger conversion of the operation.

Locally, the increased area requirements for organic animal production due to fertilizer restrictions and the demand for a better layout of land in order to enable grazing can be a barrier for conversion, even though there is generally no shortage of land. Other local barriers can be the access to resources like manure and straw and opportunities to sell roughage and thereby attain a sustainable rotation. Some productions, like organic fruit and berries, have essential unsolved professional challenges.

When food prices go up, the competitiveness of organic operations compared to conventional will generally go down. This is important both to the economic incentive to convert and to the local "fight for land". Currently, the most concrete and significant barrier is the high prices on conventional plant products, which make organics a less attractive choice from a financial point of view. Furthermore, the EU area payments, which are important to farm economy, tend to slow down conversion since they are paid without consideration for whether the farmer adapts the production to consumer preferences, such as organics.

The significance of the different barriers change as the market grows and global conditions, such as food prices, change. But some of the most important barriers are: the farmer's attitudes, age and faith in the market; professional and attitudinal barriers in the advisory services and challenges related to area requirements and inappropriate layout of land.

Possible solutions and knowledge needs

The group of conventional primary producers is presumably composed differently today than it was in the 1990s. This means that there may be a need for other, or more, types of efforts than those that were effective in the 1990s, to promote the conversion to organic production. But we need to know more about the current potentials and barriers in order to be able to decide what efforts are needed.

Promotion of conversion

An important lesson from the recent work with promoting conversion is that farmers must be motivated individually. The advisers "conversion check" has proved to be an efficient tool to uncover strategic considerations on the farm and professional challenges in organic operation based on the farmers' own business, values and misgivings. It is an easily accessible first step that addresses barriers such as lack of knowledge and myths of organic production and marketing, and which often motivates the necessary calculations of available funds, investments needed and operational requirements.

Safer economy

The financial barriers could be reduced through efforts that safeguard the farmer against uncertainty about future premium prices, and which can provide capital for conversions and the establishment of new organic operations in primary production.

The financing could come from funds within the agricultural sector, larger companies, banks, investment funds and the like, which offer ethical investments, or from public authorities.

In this market it is clear that we need to make long term contracts with the producers in order to secure volume (Henrik Rendbøll, SuperGros, wholesaler, in the Scenario Game)

We want to congratulate the sector, because this is really a success which we want to be a part of. It seems like a good business and there is a coherent business plan behind production and sales (Poul Erik Jørgensen, Nykredit, financier, on the regional scenario year 2020 in the Scenario Game).

With further modulation of the Danish agricultural policy, the resources for environmental reorganisations and market adaptations in agriculture would be considerably increased (for instance by way of the general "MB" scheme for environmentally conditioned subsidies and the "OM" scheme for conversion to organic farming). Any further modulation funds should be targeted at selected efforts with regard to climate change, the aquatic environment, bioenergy and biodiversity. There are indications that there will be more focus on general environmental efforts in agriculture in the future development of the EU agricultural policy, but at the present moment it is not clear what the regulatory opportunities and barriers are. The administration of existing and coming subsidy schemes on organics, as well as in relation to promotion of business, environmental or nature considerations, could be made more flexible, within the provisions of the EU regulations, so that it will be possible to combine more schemes and reduce the costs of leaving the schemes again if something goes wrong. Some individual companies have started giving an additional payment during the conversion period (Arla), and some water companies want to give additional subsidies to organic production in water catchment areas. However, such subsidies must currently enter into the calculation of the public subsidies, which are meant to cover surplus costs due to the operational changes. There is a need to clarify the opportunities for interaction between the different incentives.

The organic primary production can be made less insecure in relation to global conditions such as food and energy crises through (even) greater self-sufficiency with feed and energy. For example, insecurity concerning the supply of organic feed has been a hindrance for conversion to organic meat production. However, apart from setting objectives within the trade, greater self-sufficiency requires a better

implementation into practice of the knowledge that we have today, through information, demonstration and advice, and a larger effort on development and research.

Improving the distribution of farm acreage

The layout of land around the individual farm can make up a very tangible barrier to conversion, even though there is a demand, because organic production requires a balance between livestock and crop production. When converting for instance a conventional dairy farm, it can be difficult to attain a better layout of land due to the local competition for land as a precondition for expanding animal production and the larger requirements for land area in organic production. Efforts to achieve a more efficient distribution of land that fits the development in the food market, and which can enable participation in the environmental schemes of rural district programmes including conversion to organic production, could be advisory services, regulations and new incentives to land consolidation.

Network dynamics and targeted dialogue

Efforts that support social and professional networks, and which increase the knowledge, competencies and interest in organics among existing and coming farmers, are obvious possibilities to promote conversion to organic production. This can for instance be efforts that promote a positive dynamics between advisory services and farmer networks in specific areas or in specific sectors such as fruit growing and pig production, and which utilise the knowledge and competences of skilled farmers and advisers in a targeted, network oriented effort. The individual dialogue has proved important to conversion and a wider usage of conversion check is also needed.

Our joint operation is centred round a village. One has maintained his conventional pig production, but all the land has been converted. We have involved the citizens in the village in managing nature, establishing paths etc. And we have attracted several conventional farmers to this kind of operation (Lars Skytte, Dømmestrup, vegetable grower, year 2020 in the Scenario Game)

Visions for the future and education

Today, there are strong and simple visions for the future conventional agriculture, which speak to the young and the ambitious farmers. In parallel, there is a need for efforts that create corresponding strong visions of the future organic agriculture and food trade, based on modern business models and ways of collaboration, which combine options for specialisation and organic integrity; organic streamlining and intensification; advanced technology, such as weed robots; and a value based development that matches the key objectives of the Danish society.



Figure 4 "Hortibot" is an autonomous plant nursing robot that can control weed efficiently
(Source: www.hortibot.dk)

There is a need to show that there is not merely one possible way to keep up with the structural development, through large scale operations, specialisation and streamlining, but that there are alternative ways based on increased addition of value and vertical integration in the value chain, which for instance combine the development of primary production with product development and marketing.

I live right next door to the national park, and in 2020 I have converted my farm to organics. I have bought all the land that I could get my hands on within the national park, since the land prices dropped to the floor. I have farm tourists, 250 heads of cattle and 500 ha out in the marshland. I make "Tidal milk" that is rich in micro minerals, in a concept production for Arla. I have eight windmills and all my technology is based on electricity (Mikael Nørby Lassen, conventional dairy farmer, year 2020 in the Scenario Game).

Our largest challenge is to develop our growth potential by making all the inhabitants of the country, indeed all the inhabitants of the world, ambassadors for the movement that organics has been, and which it must continue to be. Therefore we made our biggest challenge our biggest strength, and as early as 2008 we hired our first communicators. We established a large communication business where people could come and see how our farm worked and how we developed, and made the development much more important than how big we had become. It was a huge success, and in no time it became clear that quite a lot of people had the energy and the passion to be a part of the project. They were willing to pay to get close to a farm and become part of it and be allowed to be a part of the development of Danish agriculture. What we thought would cost us money turned out to be part of a movement, because we opened our doors and gave the consumers an opportunity to influence our evolution (Svend Brodersen, Gram og Nybøl, year 2020 in the Scenario Game).

Another effort, which is expected to have considerable impact in the long run, is to bring more organics into the ordinary vocational agricultural education. This effort will benefit as well from strong visions for organics as the modern agriculture of the future. The experiences with short courses on organic agriculture indicate that the meeting with organic agriculture and organic farmers eliminates a wealth of myths about organics among the agricultural students, and spurs their interest and openness.

Who are the new organic farmers?

Conversion of primary production does not necessarily start with a conventional farmer. There are other ways and other driving forces, where the initiative does not come from conventional farmers who convert their own farm to organics.

- This can be new companies that are based on a vertical integration that contains several links along the organic food chain, from small farm shops and dairies to large companies such as Aarstiderne (the largest Danish box scheme company). Organic primary producers, who become producers of finished goods, create a strong alternative to the traditional structural development. The added value makes the farm stronger in the competition for land; creates a basis for the conversion of more land in the local area and makes the operation more attractive to the next generation, which want's more than primary production. This trend can be supported by way of advisory services, development of new technologies for micro food processing and simplification of the food legislation for farm based food operations.
- There is a large potential in retail chains and larger catering companies, public kitchens and processing companies, which make long term contracts with producers who want to start organic production or expand their production. The companies can also assist with support for "conversion checks" (as e.g. SuperBrugsen has done). It may also be large municipalities or water companies, which create new and more secure options for conversion out of consideration for nature, environment and rural development (this presupposes a clarification of the relation to the public subsidies, however).
- It can be new horizontal forms of cooperation across farms, where e.g. larger crop producers collaborate with livestock producers, perhaps with capital from a third party, or new "cross-farm" forms of operation where existing organic livestock farms with good rotations invite specialised operations to grow special crops as a part of their rotation.
- Or it can be existing organic farms that expand and diversify their operation, perhaps by hiring managers for specific productions. Advice and the solution of land problems are decisive here.
- Under the right circumstances, for instance by way of a period of paid work, young newly qualified organic farmers could contribute the professional and personal reserves that is needed for a conversion effort, to elder farmers who, due to their age, lack the energy for a larger conversion.

Research and development

There is a need for more research based knowledge on the current drivers, opportunities and barriers for conversion of conventional farms. This can be attitudes, networks, visions, etc., but also farm structure, risk assessment, strategies in relation to the structural development, financing, etc.

Organic efficiency and intensification

The conversion of organic operations is not the only road to more organic production in Denmark. The production can also be increased through higher organic efficiency and organic intensification on existing organic operations, which will improve the competitiveness relative to conventional operations as well. In

the next section there is a more detailed analysis of how organic efficiency and intensification can be promoted.

2.4 Development of the primary production

There is a need to improve organic primary production for three reasons:

- to meet the demand in a growing market for organic products through more and more efficient production
- to maintain integrity, credibility and consumer confidence by addressing the remaining problematic aspects of organic production
- to improve the ability to produce the public goods that are demanded by citizens and their representatives in the political system

This section is based mainly on chapters 4 and 5.

State of affairs and prospects

Organic egg and milk production make up a considerable share of the Danish production (15 and 10%, respectively) and specialised crop production somewhat less (figure 5), while pig and broiler production amounts to very little, far below 1%. The production of organic vegetables make up 10%, and organic fruit and berries make up around 4% of the total production in Denmark.

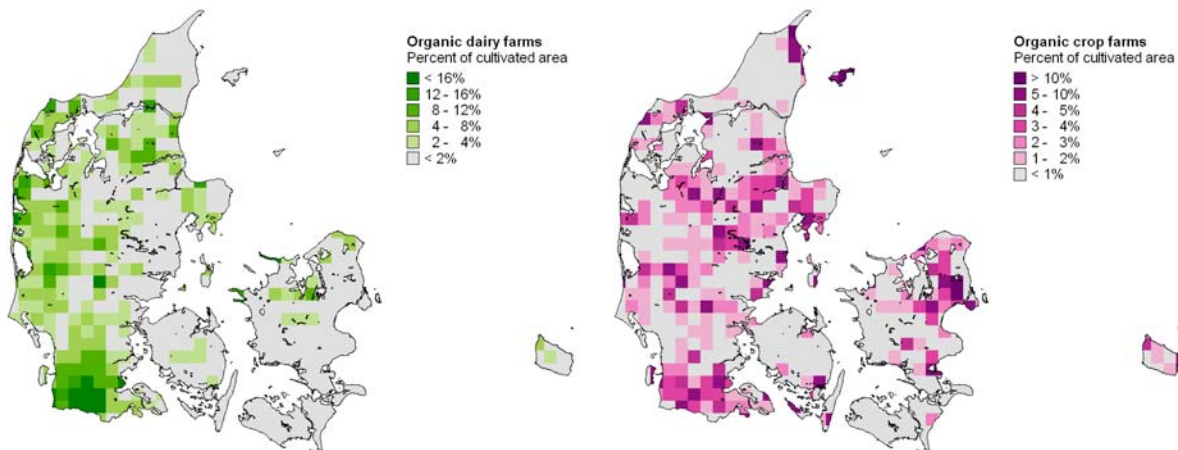


Figure 5 The distribution of organic dairy farms and crop farms in 2002, calculated in percentage of the cultivated area in 10 km x 10 km grid cells (Source: Chapter 3)

The organic dairy production, which is the economically most important, is a well established production without substantial barriers in terms of production technique or economics. It has lower environmental costs than conventional production, both per area and per litre milk. In terms of animal welfare, it is particularly the requirements on free range areas and summer grazing that makes it stand out in comparison with most conventional operations.

Organic crop production is dominated by grass clover, grain, permanent grass and other forage crops, which together amounted to more than 90% of the organic crops in 2006. The production of high value crops and ripe grains and seeds compete with imported produce more than livestock and roughage production. When the requirement of 100% organic feed was enacted in the Danish organic dairy sector, the share of pulses in organic crop production soared, but it went down again when it became possible to buy cheap organic soya from abroad.

There is a large untapped potential for organic beef production based on the calves from organic dairy operations, since most of them are sold to conventional production today. There is also a potential for more organic beef production based on fattening of culled dairy cows.

The organic consumers buy very little meat, bread and fruit compared to milk and eggs, which indicates a potential for increased sale of these products. This is supported by the fact that the organic livestock productions are very different from the dominating conventional productions due to the requirements to free range areas, roughage, etc., which has a marked influence on animal welfare. There is a continuously rising attention to animal welfare among consumers and citizens, and they largely equate animal welfare with the animals' opportunities to perform natural behaviour. Furthermore, the production of cage eggs in its present form will be prohibited within the EU in 2012. These things indicate that a considerable growth in the organic production of meat and eggs is possible.

Vegetables only make up a small part of the Danish rotations. This means that there are good opportunities to deal with a range of problems concerning nutrients, weeds, diseases and pests, and thereby a possibility of increasing production substantially, enabling for instance an export of certain types of vegetables. Vegetables are high value crops that can compete efficiently with for example grain and fodder crops on fertilizer resources and the best positions in the rotations. There are well-established and skilled organic vegetable producers in Denmark and knowledge on how to grow many species of vegetables, and this is decisive for the possibilities for a relatively rapid growth in the organic production.

Barriers, challenges, and dilemmas

Barriers and challenges of production in the different organic primary productions

The possibilities for growth are good in dairy production. The main barrier is that there is so little interest in conversion among conventional farmers, and it is a challenge to get sufficient land and a layout of land that is in keeping with grazing, in the still larger farms (many conventional farms have discontinued grazing).

The barriers for increased meat production are rather different in different productions:

- in beef production the main barriers are low earnings compared with dairy production and a lack of efficient systems for fattening of dairy calves in separate operations
- in broiler production, a large barrier is the slaughtering and processing of the rather small quantities

- organic pig production is so different from conventional production, that there are large barriers to the conversion of existing farms

On specialised crop farms the main barriers are:

- very large price fluctuations on grain and pulses because of alternating oversupply and shortage
- low soil fertility and low yields in pure grain and oilseed crops due to insufficient N-supply in the growing season
- poor crop rotations, among other things owing to the lack of opportunities to sell roughage from green manure crops
- a build-up of root weeds (this has caused several farms to all together give up organic production)

For potatoes the main barriers are:

- potato blight and black scurf fungus
- a lack of professionalism among some growers

There are good prospects for growth in vegetable production. The main barriers are that:

- setting up a vegetable operation requires large investments, and it implies confidence in a continued premium for several years ahead
- vegetables are made up of many different crops with very different problems, and each vegetable crop production is very knowledge intensive and there are only few specialists, which makes the access to knowledge difficult for new producers

In the production of fruit and berries there are large barriers to growth. The main barriers are:

- small cultivation reliability, which constitutes a restraint on establishing and expanding operations
- unequal competition because plant protection products that are approved within the EU, are not allowed in Denmark due to the heavy procedures for environmental approval
- large establishment costs and large labour needs
- a lack of resistant varieties and organic propagation material

Structural barriers and overall challenges

It is a widespread barrier that development of technologies especially for organic productions and breeding of crops and livestock targeted for organic production is not attractive or profitable for large companies because the target group is relatively small. Due to this barrier, it has not been possible to get plant protection products that are approved according to the EU regulation, tested and approved according to the Danish environmental legislation. This means, for one thing, that a large proportion of the apples consumed in Denmark are imported from other European countries. Unlike these countries, the use of for instance some types of pheromones, baking powder, Quassia bark and Neem tree oil, which can limit the attacks of serious pests, is not allowed in Denmark. Here, a company must apply for the approval of such spraying agents and follow the ordinary procedures for the approval of pesticides. This is expensive, and since for instance baking powder is freely available on the market, there is no economic incentive to do this.

We must have common rules to maintain confidence. Foreign fruit growing operations are for instance much more productive (10 tons/ha in Denmark, 20 in Germany and 30 in Italy) and this is largely due to fact that they are allowed to use more adjuvants. This is hard to communicate to the consumers (Jon Krabbe, Fejø Forsøgsplantage, in the Scenario Game).

The general development toward large scale operations and specialisation in agricultural primary production is not just a barrier to conversion, as discussed in section 2.3, it also leads to large and growing structural barriers to the development of organic production due to the close interaction with conventional production and the competition for land, layout of land, managers, workers, etc. This development brings with it some central dilemmas, as discussed in the next section.

We are not in need of people with ideas, but of people in the production. We have to create interesting and attractive workplaces (Fie Graugaard, Hanegal, in the Scenario Game).

In the larger circles of production and consumption, the way that society has organized its waste management, makes it less feasible to implement the seemingly obvious solution to recycle nutrients from consumers to organic plant production.

Challenges and dilemmas with regard to integrity, credibility and consumer confidence

There are some "internal" dilemmas with regard to integrity and credibility, which are due to the fact that it is difficult to fulfil all the organic objectives at the same time. For instance, even though the organic pig production has a range of strengths with respect to animal welfare, there are still some dilemmas between animal welfare and environmental concerns. In general, free range pigs have a high welfare, but there is also a larger environmental load with ammonia emission and nitrogen leaching than in conventional production, and conversely there is a dilemma in the ringing of sows to prevent them from uprooting the grass cover so that the risk of nutrient leaching increases. Similarly, there is a dilemma in organic beef production in that the more extensive steer production has a higher CO₂ load. These dilemmas must be solved through specific developments of the organic production systems.

There are also a range of "external" dilemmas between the organic objectives and the conventional surroundings in which the organic production takes place. In particular, the competition with the conventional agricultural production on the food market, on business opportunities, on managers, labour and land, puts a pressure on the organic production for higher efficiency, rationalisation, specialisation, globalisation and large scale operations.

Generally, this has resulted in specialised crop and livestock farms in the organic sector, like in the conventional, and a concentration of livestock production in the western and southern parts of Jutland, which makes it difficult to establish balanced and sustainable rotations. In dairy production there is a dilemma between meeting the structural development and securing sustainable rotations; the still larger farms mean that the cows cannot circulate on all the fields and this puts a pressure on the otherwise well functioning grazing systems. In egg production there is a reverse dilemma, where the organic regulations ensure high animal welfare, but reduce the possibilities for scaling up and reaping the advantages of large scale operations in order to keep the premium price for organic eggs down. Other examples are the limited free range areas for fattening pigs, the sale of organic bull calves to conventional production, the use of heavy, efficient agricultural machines with a risk of permanent soil compaction damage, the use of fossil energy, the establishment of large, uniform organic fields with efficient weed control and limited biodiversity and the import of organic protein feed from far away.

Furthermore, the competition with the conventional agriculture is generally measured according to the conventional standards, and it is up to the preferences and purses of the consumers to value the consequences to nature, environment, animal welfare and health. It is also a dilemma that consumers are

used to conventional products with "conventional" qualities, while the organic products have other qualities. For example, the consumer preference for brown eggs from brown breeds, which were not very well suited to organic production, and differences in the looks of organic and conventional fruit.

A particular challenge to credibility is the current dependency on the conventional system with regard to feed, manure and straw and the use of conventionally improved plant varieties and (some) livestock breeds. The latter challenge can be exacerbated if conventional breeding becomes more dependent on GMOs.

In the longer run there is a challenge in dealing with the planned detachment from conventional production. The trade has decided to phase out the use of conventional manure and straw in the period from 2015 to 2021. Phasing out manure is a big challenge for the specialised crop production, which increases the need for alternative sources of fertilizer and improved cropping systems, while the phasing out of straw mainly affects husbandry systems and winter coverage of carrots. In the egg production there is a special challenge in ensuring the supply of essential amino acids in the transition to 100% organic feed from 2012.

It may be a problem of credibility that organic production is deemed to be inferior to conventional in some respects, such as mortality in hens, leaching in pig production and land area needs. When assessing the use of resources and environmental load in terms of single factors, the conventional production can often be optimised to be better than organic, since it can use more means. This is for instance the case for feed efficiency and yield per area. The strength of organics is in comprehensive solutions that take many and wide considerations at the same time. The lower feed efficiency of pig and poultry production must therefore be weighed against the marked benefits to animal welfare. And lower yields must be weighed against benefits to nature, landscape, environment and carbon sequestration. There are also extensive possibilities of developing better organic systems.

Possible solutions and knowledge needs

The available solutions to these barriers and dilemmas depend on what strategies the organic actors follow. Generally, there are fewer dilemmas in the alternative conservative strategy, where the focus is on organic values in a wide sense, except from the basic dilemma that this strategy has difficulties establishing a large production for a large market. Most dilemmas are found in the mainstream strategy, where a market oriented production with effective large scale operations is established within the borders set by the existing organic regulations. The alternative innovative strategy points out new routes of development, which make it possible to reduce the number of dilemmas and still maintain or increase the production, but often the establishment phase is very difficult.

Organic intensification and increased resource efficiency

The productivity and stability of the organic yields can be improved through "organic intensification" including increased resource efficiency. This is a form of intensification that, based on the organic principles, seeks to improve yields and health through diversification, more efficient utilisation of natural resources, renewable energy and recirculation of nutrients in such a way that consumer confidence and societal benefits are maintained.

Examples of strategies to organic intensification are the usage of nitrogen fixing crops; cultivation of mixed crops and catch crops; the use of crops that can efficiently catch nutrients from greater depths and improve the physical soil qualities; efficient usage of manure from livestock productions, from other crops

and from natural areas; efficient integration of livestock and crop production; promotion of beneficial animals through better living conditions; targeted organic breeding based on varieties and breeds that are suited for organic production and the use of smart technologies such as sensors, robots and information technologies, which can support the organic intensification.

My property is not a property that I own alone any more, it is part of an extended collective operation together with other organic properties in the area. By way of this cooperation we have maintained the many-sidedness that is necessary to organic operations and at the same time achieved a specialisation and rationalisation that makes us competitive. We have also hired an engineer to look after our robots, so we don't have the problem of finding employees that we feared earlier on (Lars Skytte, Dømmestrup, vegetable grower, year 2020 in the Scenario Game).

As an example, the same breeds and lines have been used in conventional and organic egg production up to now. In the latest years there has been some interest in using breeds with lower egg yield in organic production. Such breeds are expected to contribute to a more integrated and sustainable production, where the requirements to, in particular, protein and amino acids in the feed can be reduced, and where it is possible to also produce a meat product after the egg-laying is over.

In potatoes it is possible to prolong the organic growing season by breeding more resistance against potato blight and improving the methods of presprouting to allow for an earlier start in the fields. Breeding for more resistance to black scurf fungus can improve both yield and quality.

There is a range of production-technical options to improve the production of fruit and berries, for instance through resistance breeding, development of biological control methods, promotion of natural enemies and improvement of quality by means of better production and storage. More generally, there are opportunities in new collaborations such as collective operations with poultry productions, (re-) establishing variety trials, professionalisation, networking, advisory services and research and, on the societal level, in an adjustment of the environmental legislation so that the agents that are approved according to the EU organic regulations, can also be approved for usage in Denmark, which would enable the growers to compete with imported fruit on equal terms.

Much successful research has been carried out in organic crop production, and robust systems have been developed based on combinations of livestock and crop production. However, in practice there is a structural development that results in geographically separated, specialised crop and livestock farms, which impairs the integrity and reduces the yields in the organic crop production. With respect to root weeds, for instance, there has been a good deal of research and trials with a view to develop efficient and rational methods of control, but common to most of the methods are that they use fossil fuel, increase leaching and compact the soil. There is therefore a need to rethink the treatment of root weeds as well as a range of other areas in specialised organic crop production.

The development of a robust and sustainable organic crop production, which enables a larger production of high quality produce, requires an effort in developing technologies such as the use of green manure for the production of energy and mobile fertilizers in biogas plants and the use of sensors and robots to control weeds. There is a need to develop varieties that are adapted to organic conditions and to develop quality products based on the crops that are best suited to organic production. Furthermore there is a need to develop cropping systems with a high degree of biodiversity at all levels in order to advance robustness

and productivity. For example, growing mixed crops of grain and pulses can reduce the infection pressure, increase the competitiveness toward weeds and increase the yield in comparison with monocultures.

Ultimately, the development of organic crop production depends on 1) the support for innovation and technological development that can form a basis for the development of organic crop production in general, 2) that companies can see an economic advantage in investing in breeding, technology development and product development that fits the organic form of production, 3) the build-up of more knowledge about the productivity and robustness of cropping systems in a wholeness oriented perspective and 4) an even larger effort in the education and further training of organic farmers.

There is a need for research and development concerning increased organic efficiency and organic intensification, including studies of the synergy effects in compound organic production forms and the development of systems that integrate livestock, crop and bioenergy production in innovative and economically, ecologically and resource efficient ways.

Animal welfare and landscape aesthetics

Animal welfare is a characteristic of organic production that is of interest to a great deal of consumers and citizens. The continued development and differentiation from conventional production in this area, for one thing through a continuance and development of free range production, is therefore a distinct opportunity to support a sustainable growth in the organic livestock production. This also brings opportunities for the organic livestock production to contribute to landscape aesthetics, for instance by steers grazing on nature areas and green manure area, which can increase the preferences for organics. There is also a possibility for synergy in the collaboration between free range producers and crop growers, in keeping with the trials with hens in fruit orchards. The development and implementation of new technologies to control and monitor free range operations, and to carry out work tasks, is expected to contribute to the increased realization of these societal benefits in economically competitive ways. For instance, the development of mobile automatic milking systems is a possible solution for the large dairy farms to combine grazing with a continued growth in farm size.

In 2020 the diversity has become really widespread, and this means greater efficiency. Many are involved in permaculture with many different types of crops and livestock, with which they make the operations more economical and efficient in relation to the price of land. And this affords good stories and really interesting nature or culture experiences. Paths have been made and little shelters and you can experience beautiful mornings where you can look out at the free ranging animals, vegetables and much else (Mette Meldgaard, Organic Denmark, year 2020 in the Scenario Game).

Organic food quality and gastronomy

The organic animal food production has hitherto aimed at producing the same foods, with the same qualities, as the conventional and only to a limited extent aimed at adding special gastronomical qualities. While this strategy has worked well in dairy and egg production, where the retail prices for organic products are only moderately higher than conventional – 20-30% – it has not been possible to reach the same high market share for organic meat, where the retail prices are (and probably will continue to be) much higher. In light of the heightened quality consciousness around food and the heightened consciousness about the use of resources and environmental impacts connected with the consumption of

meat, it seems relevant to investigate a development strategy that matches these trends – not much, but good.

Export of organic know-how

Denmark has a large amount of research based and experience based knowledge on modern market based organic production and organisation, which can form a basis for export of organic know-how.

The Danish position of strength in organic know-how has resulted in a situation where there are Danes in leading positions in many of the multinational organic companies and Danish farmers cultivate the land organically everywhere in the world (Johannes Nebel, Chair of the EU Commission's Advisory Group on Organic Farming, year 2020 in the Scenario Game).

2.5 Nature, environment and society

State of affairs and prospects

The objectives of organic agriculture contain elements of societal interest in that they potentially match public objectives on the improvement of nature and environment in the open country and reducing the discharge of nutrients to the aquatic environment and the emission of green house gasses. The principles applied by organic agriculture to promote soil fertility and plant and animal health through the use of natural processes and diversity, and to reduce the consumption of energy and other dependencies on limited and polluting inputs, potentially enables organic production to support a range of considerations at the same time. However, not all the objectives and principles are supported by the regulations for organic production, and therefore it is not certain that organic agriculture, as it is practiced today, can meet the needs for protection of nature and environment in every way. But there is much that points in the right direction, and in general there are positive effects on biodiversity and nutrient management.

Nature and biodiversity

- It has previously been well documented that the absence of pesticides and the use of organic manure in organic cultivation has a positive effect on flora and fauna – in the different habitats on the ground as well as in the soil.
- Many Danish and international studies show that for a wide range of common plants and animals the number and the diversity are higher on organic farms than on conventional. Recent international reviews and meta-analyses confirm the general conclusion. For instance, a comparison of 63 studies showed that the species diversity was on average 30% larger on organic farms compared to conventional.
- The benefit of organic cultivation is different for different taxonomical groups and species. For instance, there were clearly more plant species, insect predators (which eat pests) and birds in all the 12 international studies.

- The interpretation of the results of pairwise comparisons between organic and conventional farms depends on what are considered system properties – in other words, whether you adjust for differences in rotations, crop choices, uncultivated areas and small biotopes, etc.

However, recent results show that, even if only the cultivation aspects are compared (and not for instance the crop selections and small biotopes), there is a larger diversity of wild species and that this effect can be traced even on the adjacent conventionally cultivated fields. The positive effects of organic cultivation will be larger in landscapes with a high share of cultivated fields, such as most Danish agricultural areas, than in heterogeneous landscapes with many uncultivated areas where the effects of organic cultivation can be "drowned". Furthermore, Danish studies of organic and conventional farms show that the organic farms have a larger diversity of crops and smaller field sizes, which also improves the conditions for wild flora and fauna.

New results from the DARCOF III project "Refugia" thus show that hedgerows on organic farms have higher species diversity than do conventional. There were nearly twice as many flowering species as an average of 19 organic hedgerows compared to conventional in two observation areas in Jutland, and the density of the plants was higher as well in the hedgerows along organic fields. Moreover, the number of years that the fields have been cultivated organically are also significant – the longer a farm has been organic the larger the difference in flora between the organic and the conventional hedgerows.

The subsidies for organic production today are constructed as general, environmentally conditioned subsidies requiring certain restrictions on the cultivation of the area, such as restrictions on fertilizers and pesticides. But the results indicate that the effect of organic agriculture on flora and fauna is not only due to the cultivation methods but also to the overall form of production, including diversity and choice of crops, etc. We may conclude that in an intensively farmed landscape like the Danish, there will be a positive effect on biodiversity from organic production as a horizontal policy measure to promote nature in general.

Recent research results, which are relevant for the support of areas with vulnerable nature, indicate that conversion on landscape scale (that is, increasing the density of organic farms) has a further effect – both in terms of higher species diversity and the presence of less common species – in excess of conversions of single farms. In Germany, for instance, in an area similar to Danish agricultural areas, the results indicated that the difference in the number of bee species between organic and conventional farms was larger in areas with a predominance of organic farms compared to areas with predominantly conventional farms. Thus, an increase in the percentage of organic land from 5 to 20 in a certain landscape would potentially increase the bee species by 50%. There was also a larger species diversity and number of bees in the rim zones of the organic landscapes and even in conventional fields surrounded by organic farms. Equally, a Swedish study found that a range of species were exclusively found in organic landscapes. It is therefore assumed that measures that are targeted toward spatial concentrations of organic farms (establishing organic landscapes proper) will be able to contribute to maintaining and improving biodiversity in areas with special needs of protection (Natura 2000 and the like). The positive landscape effects of organic management are not credited to the farms under the current policies. In spite of the recommendations from the so-called Wilhjelms committee on supporting the development of precisely organic agriculture in order to promote biodiversity in the agricultural landscape, the subsequent action plan for biological diversity did not include organic agriculture as a measure, only the general Agri-Environment Measures.

There is some geographical overlap between areas that are deemed worthy of protection by the authorities and areas with organic agriculture, and this makes it possible for this form of operation to contribute to societal objectives. Therefore, it was emphasized in connection with the midterm evaluation of the previous rural development programme in 2003 that organically cultivated areas made up about 30% of the

total area in especially sensitive nature areas (SFL areas) that was enrolled in the environmental protection schemes to the benefit of flora and fauna (about 11.000 ha out of a total area of 37.000 ha). Organic agriculture has been listed as a measure in the pesticide action plan, though there was no specific reference to the consideration for nature protection. Furthermore, organic areas along watercourses made up a substantial part of the areas protected under another pesticide action plan scheme, "Establishing no-spray rim zones", which was only used by few conventional farmers. Hence, organic agriculture constituted a considerable contribution to the public regulation of the environment and the protection of areas designated as "Highly prioritized nature protection areas".

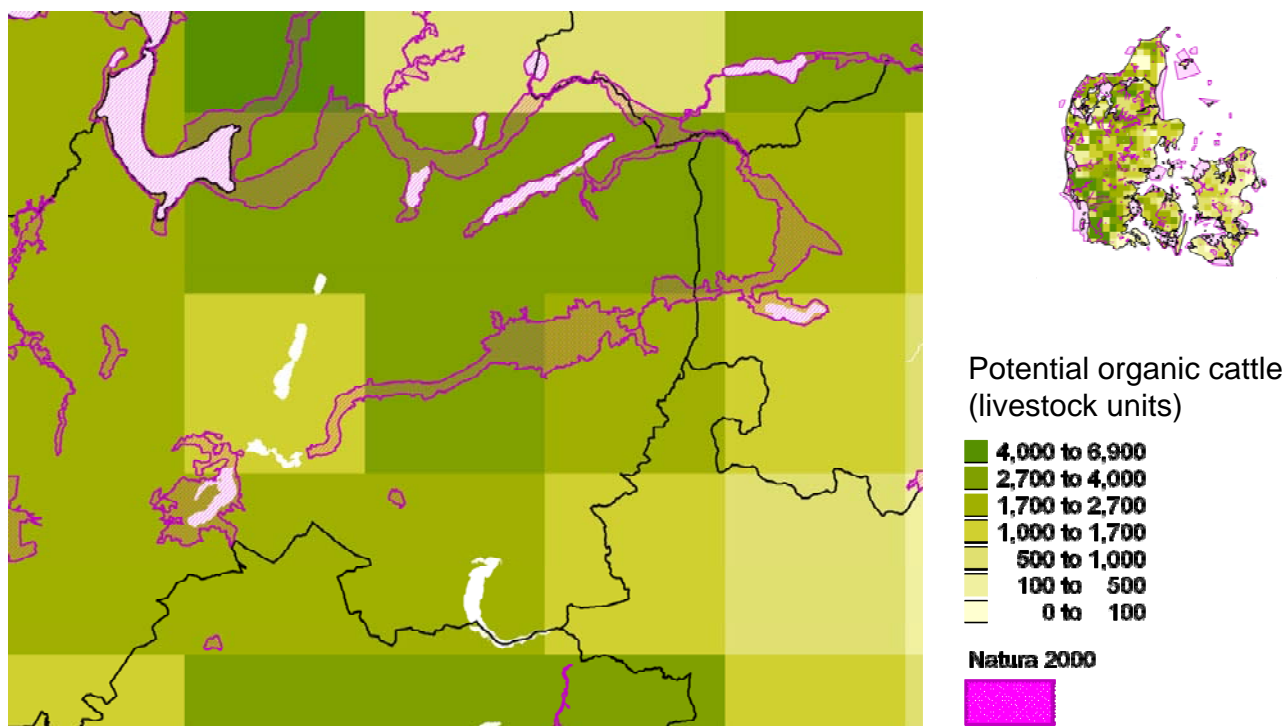


Figure 6 In this example from the Nørreådal near Viborg, it is clear that the Natura 2000 areas are placed in an area with relatively many organic farms and a potential for further conversion. Conversion to organic agriculture can be a good option to make the production in these areas more extensive and contribute to the necessary management of nature areas through grazing and haying. Harvesting biomass on the selected nature areas and using this biomass in biogas plants is another option for removing excess nutrients from nature areas

Moreover, many of the environmental schemes, including the support to preserve semi-natural grasslands, have had difficulties in securing continuity on the areas in question. All reports indicate that continuity over time is crucial to nature values and that it takes a long time to re-establish nature values that have been ruined. Therefore, it is a big problem when so-called permanent or semi-natural grassland is managed more intensively or ploughed over, as it was pointed out in the midterm evaluation of the rural development programme. From this perspective, organic agriculture will probably, when the conversion is done, be a more permanent form of cultivation over time on any given area, compared to other schemes, and thus better at securing nature values in a long term perspective. However, this should be verified, and it is a future challenge to the organic movement to commit itself more clearly to a continuing effort to conserve nature values on each individual property.

The benefits of a continuous nature friendly cultivation also apply to the diversity of the adjacent rim zones and small biotopes (hedgerows, ponds etc.), where the diversity will increase with time, as shown above. The potential of organic agriculture as a long term strategy to conserve and promote nature in the agricultural landscapes is especially evident in comparison with fallow areas. After a large part of the fallow areas have been taken under cultivation from 2008, it is relevant to look for an increased contribution from organic agriculture in maintaining and improving the biological diversity in the open country. The fallow areas are often considered a valuable part of Danish nature, which should be secured by taking them permanently out of production. This has proved difficult after the EU requirements have stopped, and there is an expressed need to find alternative possibilities for promoting nature values in a long term perspective.

Discharge of nutrients

In order to meet the requirements to water quality that are specified in the EU Water Framework Directive, one of the objectives is to reduce losses of nitrogen from cultivated areas to the inner waters of Denmark. In connection with the preparation of the Action Plan for the Aquatic Environment III (VMP III), the available knowledge on leaching in organic versus conventional agriculture was compiled and supplemented with new analyses of green accounts from farms. The results were that there is less leaching from organic dairy farms compared with conventional (about 25-40 kg N per ha). This is attributable to a combination of lower stocking rate (less cows per ha) in the organic animal husbandry and a more efficient usage of the nutrient resources due to better recycling and smaller losses. The leaching from organic crop production is at the same level as conventional, while the leaching from organic free range pig production in some cases is higher than the typical conventional pig production. Other types of production make up too small a share of the area to be relevant to the reduction of nutrient discharge.

In reports to VMP III and the planning of efforts to meet the Water Framework Directive, conversion to organic dairy production enter as one of the political measures to reduce leaching; but in these "measure reports" there are different assessments of the potential for conversion of conventional dairy farms and thereby the possible scaled up effect in tons reduced N leaching. The previous estimates of the expected conversion have been conservative due to the stagnating market in recent years and because only dairy farms with less than 1.4 livestock units (LU) per ha were expected to be able to convert. However, this knowledge synthesis has shown that, with regard to structure, there is enough room for other dairy farms to convert as well, if only the economical incentives are strong enough. In addition, the market has changed so that there is now a shortage of organic milk. Hence, there is a potential for organic dairy production to be utilised to a greater extent in the reduction of nutrient leaching and thereby combine environmental considerations with productive and market oriented activities on the same areas. A prognosis for the development in organic production till 2015, made by Danish Agriculture, implies that the milk production will rise to 700.000 tons or 15% of the total Danish milk production, which will require a conversion of 67.000 ha. As indicated above there is room for a doubling or even a quadrupling of organic milk production, and a doubling will require a conversion of additional 92.000 ha in relation to the current situation. Based on the conservative estimate of 25 kg N per ha reduction in leaching by organic conversion from the "measure reports", these two projections amount to reductive potentials in the area of 1.7 and 2.3 million kg N respectively. Using the assumptions in the "measure reports" on the relation between leaching from the root zone and the discharge of nitrogen to the surface water, this corresponds to a potential reduction in the surface water load of 400-600 tons N, or 10 % of the reduction needed in the western and middle parts of Denmark in the most realistic scenario.

However, it is not a foregone conclusion that the current average organic practice on dairy farms is sufficiently environmentally friendly with respect to the regional and local environmental goals that will be set for, for instance, water ways and catchments in order to meet the Water Framework Directive. There may be a need to develop even more environmentally friendly organic operations tailored to specific purposes, perhaps as a kind of "organics plus". A relatively simple way of doing this would be to lower the stocking rate to for instance 1 LU per ha compared to the current 1.4, either through voluntary agreements or requirements within certain water catchments. This pertains as well to organic crop production, where the combination of positive effects on nature and environment, including the absence of pesticides, can make it attractive to develop and implements forms of operations that combine organic cultivation with low stocking rate with grass or perennial crops for bioenergy and thereby reduce nutrient losses. The advantage would again be the ability to combine income from a market oriented but environmentally friendly form of operation with the coming stricter requirements for environmental protection due to the Water Framework Directive. The welfare economical costs of using organic agriculture as a measure are set to zero in the "measure reports" (while the cost is 3.600-6.800 Danish kroner per ha for setting aside ordinary farmland), and there is thus apparently a certain margin that can be used to support the development of "organic plus" operations. There is, however, a need for new studies.

In order to fulfil the Water Framework Directive, it is a requirement that the discharge of phosphorus to surface freshwater is reduced. In the scientific proposals of measures in this respect, one of the options mentioned is sub-optimal fertilizing with phosphorus on risk areas to reduce discharges to the aquatic environment. Organic operations use less phosphorus than conventional, and targeted conversion of risk areas, perhaps after adapting the requirements to the environmental subsidies, could contribute to reduced fertilizing. Investigations show that organic dairy farms usually have very little or no phosphorus surplus as a result of lower stocking rates, less purchases of concentrate feed and less use of phosphorus minerals for the livestock compared to conventional farms.

Another solution with a large potential for reduction of phosphorus discharges to lakes is, according to the "measure reports", to extensify the cultivation of lowland soils in river valleys that can be submerged a couple of times each year (called "Periodic flooding and extensification of farming in river valleys"). Thereby, phosphorus that is dissolved in the watercourses can be retained in vegetation and soil on the flooded areas, which under the right conditions can result in an effective reduction of the amount of phosphorus that ends up in lakes. The method will work best if the periodic flooding can be combined with cutting and removing the vegetation, so that phosphorus is removed from the areas and to avoid overgrowth of shrubs and trees. Cutting could be replaced with grazing, where there is livestock available, but this is not widespread anymore. The "measure reports" estimates a potential of 100,000 ha that could enter the scheme. But previous schemes to support the establishment of wet meadows under VMP II and III gained only limited interest, and it will probably take a targeted effort to establish sufficient extensified meadows, in case there are no other advantages than a compensation for the yields loss. However, there could be a greater incentive for such and extensive use of the areas if they were part of a larger context in form of integrated nutrient recycling and bioenergy production. New types of integrated organic operations, as described in section 2.4, could utilise such areas in a combination of energy and green manure production, and thereby create value from the extensified areas. This would require closer considerations of the right way of organising and developing the proper infrastructure, but the prospects would be a more future-proofed environmentally friendly land use than potential environmental support schemes for extensification of individually managed meadow areas.

Energy production and discharge of greenhouse gasses in organic agriculture

The ideals of organic agriculture have from the beginning included an aim to reduce the dependency on fossil energy, and the rejection of artificial fertilizers entails that the energy consumption per ha is usually smaller in organic fields compared to conventional. Repeated Danish and international analyses show that the direct energy consumption per ha in form of diesel and other fuels is usually at the same level in organic and conventional systems, but up to 10% more is used on organic crops due to the handling of organic manure. On the other hand, mechanical weeding plays a relatively small role (typically in the order of 4-5 litre per ha out of a total of 100-120 litre per ha of annual crops, compared to 2-3 litre per ha for spreading commercial fertilizers and 20-25 litre diesel per ha for ploughing). The indirect energy consumption – mainly in the form of 80-150 kg N in fertilizer in conventional crops – is commensurate with the diesel consumption, as the production of 1 kg nitrogen in commercial fertilizers requires the energy of about 1 litre of diesel. In crops where the organic yields are at the same level as the conventional or up to 30% lower, the energy consumption per kg product is lower in organic production. Thus, the energy efficiency is higher in organic crops like spring cereal and grass and also in dairy production. In other crops with significantly lower yields in organic production, such as potatoes and greenhouse vegetables, the energy efficiency is higher in conventional systems.

However, there has not been a sufficient effort to reduce the energy consumption in organic agriculture, let alone develop systems that are self-sufficient in terms of energy. Modellings in connection with a previous knowledge synthesis under the DARCOF II programme showed that there was a potential for developing organic cropping systems that were net energy suppliers and at the same time had an improved rotation and nutrient recycling. Using an average Danish cash crop farm as the baseline, the possibilities for energy self-sufficiency were tested in a model. If the area with grass clover was increased from the average 10% to 20% of the total area, the harvested grass taken to a biogas plant and the nutrients returned to the cash crop fields, the farm would be able to produce considerably more energy than it consumed, including the diesel used in transport of grass etc.. At the same time, value would be added to grass clover as a green manure crop on cash crop farms without any livestock to utilize the crop for fodder. Practical experiences from Sweden and Germany confirm that this is feasible, and new Danish calculations from the organic advisory service show that organic biogas plants, which are supplied with energy crops from 250 ha of organic fields and a commensurate meadow area, can be profitable due to the sale of fertilizer to organic crop production and the sale of energy (electricity and heat). Still, there is an immediate barrier in procuring sufficient organic biomass within a local area to feed a plant, so that the returned nutrients can be accepted as organic manure. In addition to such relatively new biogas plants based on crop production, the mentioned knowledge synthesis showed that the existing organic cattle manure makes up a large potential resource for the production of biogas. Current investigations under the DARCOF III programme will clarify the potential of organic bioenergy production.

As shown above, there is a case for organic agriculture being able to play an important role in connection with promotion of nature quality through the maintenance of permanent grassland areas along lakes and streams. This is desirable with regard to both nature protection and the wish to reduce phosphorus discharge to the aquatic environment. Generally speaking, it has become increasingly difficult or costly to maintain semi-natural grasslands by grazing, because there is a lack of livestock for grazing and the rising grain prices carry a risk of increased cultivation of permanent grassland and lowland soils. It is estimated that there are about 300,000 ha of grassland today that, from a nature protection viewpoint, should be better managed, and of which many are disused. By way of combining organic management of such meadow areas with mechanical cutting of grass for use in biogas production, both nature and the need for so-called mobile green manures, to benefit the nutrient supply in organic crop production, could be considered.

New analyses of this potential, which are described in a background chapter to the knowledge synthesis, show that the use of 100,000 ha meadows in this way would double the current biogas production in Denmark and at the same time give an nitrogen input to organic fields in the region of 10,000 tons N; that is, about twice the amount of N that organic farms currently purchase in the form of conventional animal manure. In addition, this can in some of the areas be combined with environmental objectives on reducing phosphorus impacts on the aquatic environment (see above). There is a need to develop such integrated management systems, by which synergy between the different considerations can be created, and include them in the coming nature measures and environmental measures. Hence, both nature and energy considerations speak in favour of an effort that can create organic landscapes with clusters of farms that are all converted to organic production, perhaps including nature areas that are disused on other farms.

Agriculture as a whole is a substantial contributor to the Danish discharge of greenhouse gasses, and the contribution to the greenhouse effect from the discharge of nitrous oxide (N_2O) and methane (CH_4) is considerably larger than the contribution from CO_2 due to the energy consumption. Moreover, there is the net exchange of carbon, and thereby CO_2 , from soil metabolism, which can either increase or reduce the greenhouse effect. In relation to the global character of climate impacts, it seems most relevant to assess the discharge of greenhouse gasses per kg product and not per ha as for the other emissions with more local or regional impacts. On the other hand, it is necessary to include all the substantial discharges of greenhouse gasses connected to the production of a given food product, in order to make a meaningful comparison of products and production methods. For instance, the emissions from the production of imported feed are equally important as the emissions from locally produced feed. Analyses based on life cycle assessment (farm to table analyses), have shown that organic dairy production in Denmark discharges about 10% less greenhouse gasses per kg milk compared to similar conventional production. The same holds for a range of field crops such as cereal and rape, whereas crops with significantly lower yield in organic production than in conventional, such as tomatoes and carrots, have a higher discharge of greenhouse gasses in the organic systems. As will appear from figure 7, the difference between the different food items is larger than the difference between organic and conventional production of a given food. Moreover, animal products and greenhouse vegetables discharge 5-20 times more greenhouse gasses per kg product compared to cereal and field vegetables, so the classical nutritional advice roughly corresponds to equivalent "climate advice". On average, organic produce is a fine choice from a climate point of view, but the differences to conventional products are limited based on the present methods.

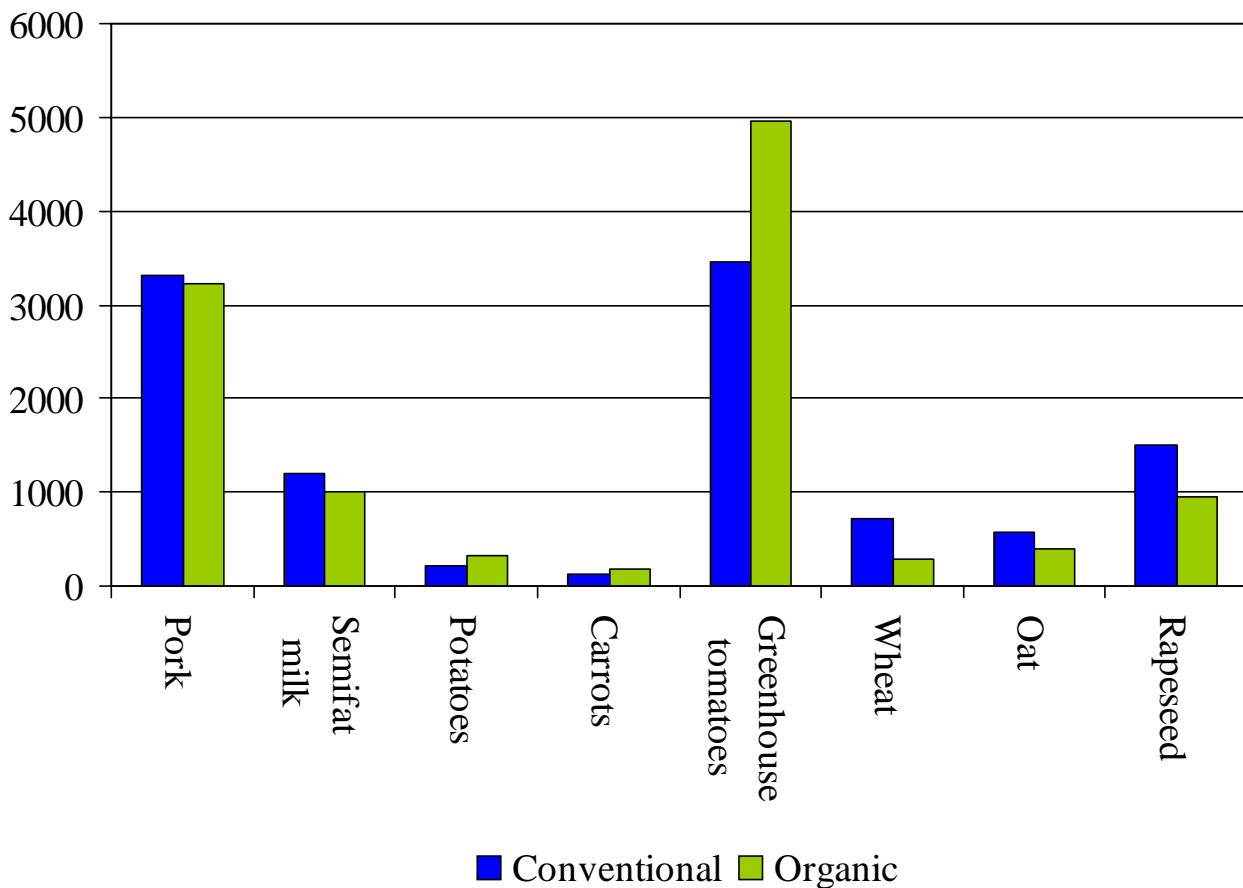


Figure 7 Emission of greenhouse gasses per kg product for selected organic and conventional foods

These results are, however, calculated without considering any net accumulation of CO₂ in soil or release of CO₂ through deforestation. Conventional livestock production uses concentrate feed based on soya beans that to some extent originate from areas where the primary vegetation has been recently cleared. In case the CO₂ discharge connected to this is calculated in, as it should be in principle, this would increase the total discharge of greenhouse gasses considerably from especially conventional animal products. For instance, this would make the discharge of greenhouse gasses from imported soya beans approximately five times as large in CO₂ units per kg feed (CO₂ units weigh together the effects of methane, nitrous oxide and CO₂ in one unit, which takes into account that the first two have a substantially stronger impact on climate than CO₂). In addition, there is larger share of grassland in the rotation on organic livestock farms, and this means that, other things being equal, there is a larger net accumulation of CO₂ in the soil. This can be exemplified with new results from comparisons of organic and conventional pig production. Life cycle assessments of different systems for organic pig production show that the discharge of greenhouse gasses from raising and fattening pigs on the farm were between 2.8 and 3.3 kg CO₂ units per kg live weight pig compared to 2.7 for conventional pigs. But if the organic systems were credited with the carbon sequestration in the grass fields that are part of the system, this would diminish the discharge of greenhouse gasses per kg pig with about 300-500 g, whereby the total discharge would be about 5-10% lower than conventional. In general, the potential in carbon sequestration in the organic production systems has not been calculated, and there is a need for further development of the methods and further

data to make an accurate quantification that may be used in a national action plan to reduce the climate impacts of agriculture.

We still buy organics, because the requirements to organic certification are greater and include climate, energy and transport (consumer representatives, year 2020 in the Scenario Game).

There is a great interest in different trades to develop methods to quantify the discharge of greenhouse gasses per product and to establish labelling schemes for good practices in relation to climate impacts. The British super market chain Tesco, for instance, is developing a label together with the UK ministry of environment, DEFRA, under the heading "the Carbon Trust". This label is to build on life cycle methods, though this has resulted in methodological challenges. In Sweden, the Swedish farmers brand "Svensk Sigill" in collaboration with the organic certifying organisation KRAV are preparing a climate label that builds on good practices more than the calculation of effects. This fits well in the general way of thinking behind organic regulations, and it is far-sighted in relation to meeting the challenge from the conventional food sector. It is to be expected that there will be more initiatives in the future on establishing such labelling schemes, which would be able to attract some of the consumers who otherwise buy organic products. It is therefore recommended that the Danish organic farmers also start developing awareness about the climate impacts from the individual farm and from organic products, and preparing an action plan in order to establish a response to climate labelling in the conventional sector; perhaps by agreeing to make development plans on the reduction of energy consumption and climate impacts on all organic farms.

Cost efficient regulation with organic agriculture

The positive effects of organic management on nature and environment benefit society as a whole and not only the customers who pay a premium price. Economists therefore characterize these effects as "positive externalities". Where negative externalities can be warded off through politically determined prohibitions and taxes, positive externalities can be promoted through politically determined directions and subsidies. The positive effects on nature and environment are thus used as an argument for public support to organic management. However, the cost efficiency of support to organic agriculture is not clear. The reason is that the organic way of production seeks to meet many considerations to nature and environment at the same time. On the one hand, it is possible to measure the contributions from organic farms to very specific environmental objectives, such as the reduction of nitrogen leaching. On the other hand, there are currently no methods available to perform a total calculation, say, in monetary value, of the contributions that the organic farms make to the broad range of considerations for nature and environment, which this form of production intends to take. It is therefore not possible to make an overall assessment of the positive externalities and relate them to the marginal costs of the public support to organic agriculture. Hence, there presently exists no overall measure of the cost effectiveness of supporting organic agriculture as a measure for environmental improvement.

Nonetheless, it has been stated repeatedly in Denmark as well as internationally that there are considerable regulation advantages, in form of lower transaction costs for regulation, connected to the use of organic production as an environmental policy measure in the open country. First of all, it is possible for society, through just one regulation, to achieve several benefits to nature and environment, including more nature and a reduction of pesticide consumption and nutrient losses. Secondly, the requirements are formulated - or they are intended to be formulated - in a way that directly corresponds to the way farms are managed. In this way it is possible to balance several considerations in order to optimize the overall effect on nature,

environment and farm economy. In order to be fully able to make an overall assessment of the positive and negative externalities of organic agriculture, and to be able to realize the regulatory gains connected to the promotion of this form of production, there is an obvious need to supplement the existing partial assessments of the cost efficiency of different forms of regulation of the relation between agriculture and environment. They may be supplemented with more integrated assessments of the overall contributions from different forms of production to politically prioritized considerations for nature and environment and other things. This could presumably contribute to a more cost efficient and simple regulation of the impacts on environment and nature from agriculture. Moreover, a farm oriented regulation, such as this, could also contribute to reducing the risk of suboptimization, where regulations counteract each other or create one-sided efforts on those aspects that receive support, at the cost of those aspects that don't. Due to the organic management standards, organic agriculture seems particularly well suited to develop an integrated, farm oriented form of regulation. But in the long run, experiences done in this area can also be disseminated to other forms of production.

Rural development

The Danish rural development programme implements the EU Rural Development Regulation (EC 1698/2005) in Denmark. The overall mission of the regulation is to promote sustainable development in rural areas in a complementary manner to the market policy. The overall purpose is expressed in three specific objectives:

- improving the competitiveness of agriculture by supporting restructuring, development and innovation
- improving the environment and the countryside by supporting land management
- improving the quality of life in rural areas and encouraging diversification of economic activity

Organic agriculture has good prospects for contributing to the objectives of the Danish rural development programme. Not only do the organic farms on average have better economic return, they also have better possibilities of combining efforts for nature and environment and diversification of the economic activity on the farm with an added value on the market. The knowledge synthesis shows that there is a positive development on the market for organic products that can very much enhance and realize this potential, and there is considerable interest from some farmers to start local processing, driven by the wish to maintain the characteristics and qualities of the produce during processing. This incentive is seen both in small and large scale operations; lately, the production has been converted on several large estates where processing operations have been established in connection with the conversion of the primary production. Chapter 2 on the organic consumers show that more than a third of all consumers prefer a small niche product to a well known brand, and this goes for more than half of "The fully convinced", who buy almost half of the organic products. Furthermore, there is a large demand for a wider range of products from the broad group of consumers who go for organics and quality products.

Studies in a DARCOF II project showed that half of the organic full time farms had other sources of income on the farm, such as direct sale, processing, farm shop and tourist related activities. Among the part time farmers, 60% indicated that they had "other farm related activities" apart from farming itself, whereby they contributed to maintaining the economic activity, while they also contribute to rural development through settlement and social life in the country. There are thus pluri-activities on the organic farms, which draw on other resources and, conversely, help create resources and "goods" for the regional economy through a wide range of life and production strategies. Likewise, a British investigation documents a substantial potential for organic agriculture with regard to increased value added and contributions to rural development; a potential which however depends strongly on the linkage with local development processes.

The desire to create an alternative in form of organic food chains has been an important driving force for the appearance of an undergrowth of new, small processing companies in the 1980s, 1990s and later. A number of new dairies were set up, and in spite of a difficult start, the initiators held on to their idea about creating an alternative to the big cooperatives. The development of several of these companies, private and cooperative, has been described well in a number of Ph.D. studies, partly financed by DARCOF II projects, and in a couple of EU projects. The studies showed that the motivation for conversion is largely bound up with the opportunity to create a new, smaller dairy, which they are more in control of, and where the quality of the produce matters to the products of the company.

In the same decades, the established food companies and cooperatives have closed up many local divisions in favour of centralized processing near the main arterial roads. However, organics is not alone on the market for locally made specialities, and even though the organic companies are probably over-represented among the locally anchored food initiatives, the documentation is lacking for their economic and social significance to local communities in the rural areas, including the Danish islands.

Even though there are many things that suggest that organic agriculture has a potential, there is a lack of quantitative knowledge on the actual role that organic agriculture has in rural development today, and what role it may have in the long run, both in terms of employment and the opportunities for adding added value to the production in connection with the farm. There is also a lack of investigations on whether organic farms with on-farm processing and smaller organic food companies are actually over-represented in the rural areas. A comparative analysis of seven European countries concludes that the role of organic agriculture in rural development depends strongly on how the organic food networks relate to the local community and that there is a need for new institutional practises and research which focuses on these questions.

Possible solutions and knowledge needs

There is a large potential in integrated protection of nature and environment combined with bioenergy production in comprehensive conversions to organic production of clusters of farms and areas in geographically connected areas, including relevant water catchments and areas with special nature values.

It can be concluded that in an intensively farmed landscape like the Danish, there will be a positive effect on biodiversity from organic production as a horizontal policy measure to promote nature in general. It should be considered how this can be utilised in public and private initiatives and in connection with the development of new methods for landscape management.

The positive effects on nature values that have been shown are predominantly systemic (intrinsic) effects of the organic form of production, given that there are no rules on the use of diversity or specific considerations for nature, which is why there are large differences between organic farms. Therefore, it should be considered whether organic farms can be motivated to make proper nature plans for the properties and whether the methods and contents of such plans can be further developed in the light of new knowledge.

There is a need to develop systems for organic management of wet meadows where cutting and removal of biomass in order to reduce the discharge of phosphorus is combined with production of bioenergy, and to include such solutions in coming environmental and nature measures.

There is a need to develop organic forms of cultivation with even better nutrient management, which can be strategically applied in geographical areas with a large need for reduction in phosphorus and nitrogen leaching and thereby as an alternative to regular fallow or afforestation.

It is a definite opportunity to develop clear directions for organic management in terms of reducing the dependency on fossil energy and climate impacts in general, for instance by way of a sector agreement on establishing a scheme with climate plans and documentation of actions to reduce climate impacts.

Previous analyses of the economic efficiency of support for organic agriculture/environmentally friendly cultivation have had difficulties in dealing with the diversity of positive effects on nature and environment from such a form of cultivation. There is a need to develop methods for describing and quantifying the special advantages and disadvantages of the comprehensive effort that is connected to the promotion of organic and other wholeness oriented forms of production. Such analyses could benefit agriculture and political development in general, because it could form a basis for developing new and more comprehensive measuring instruments which could then form a basis for the development of more comprehensive agricultural regulations for nature and environment.

There is a need for more quantitative knowledge on the past effects of organic production, product development and processing on the activities in rural areas. There is also a need to further clarify the potential for future support for rural development through activities related to the organic food system, including the use of micro processing techniques, and which barriers there are to such a development.

3 Recommendations for future efforts

Since 1987 there has been a dynamic interplay between the Ministry of Food and the organic sector, with many specific efforts on information, advice, professional development and research, that has resulted in a well developed sector. This is also an essential platform for future efforts. In the present situation, the market based growth can be secured and further integrated through a range of substantial, long term strategic efforts, which involve concurrent and coordinated contributions across the organic value chains.

In section 2, a range of possible efforts and solutions to important barriers and challenges were described, and knowledge needs were pointed out within each area. The present section emphasizes the efforts and knowledge needs that are most important to the future growth, development and integrity of the organic sector.

Effort 1: More new products on the shelves

A continued and strengthened effort to ensure innovation and diversity in processing and sale

The knowledge synthesis shows that the market is ripe for more organic products. Consumers attach more importance to the values behind the products and this fits well with organics. The organic consumers are trendsetters and give a good reception to the increased range of organic products in recent years. The effort therefore focuses on continuing and strengthening this positive development in the market.

Effort 2: Increased production of organic produce

A targeted, long term effort to increase conversion and develop new forms of organic operations

Even though the market is growing, only few farmers convert to organics. This means that the production is not large enough to meet the demand – and there are only few signs that this will improve in the future. The effort focuses on creating a basis for increased conversion by way of lowering the risk of conversion

and fostering a vision of organics as the modern agriculture of tomorrow, and on overcoming the specific professional and structural barriers in the primary production that the knowledge synthesis has pointed out.

Effort 3: Consumer confidence and credibility

Open communication with the consumers and a dynamic development of farming and processing based on the organic principles

The knowledge synthesis has shown that consumer confidence is crucial to the development of the organic market. It is a dynamic process to sustain confidence in the organic production system. The effort involves continued improvements of the production and processing methods in accordance with the organic principles; documentation of the effects with regard to consumer expectations, societal goals and the options for a sustainable trade; and an open and participatory communication with consumers.

Effort 4: Synergy between organics and society

Create synergy between the organic production and the societal objectives

The organic methods of cultivation can contribute to the promotion of nature and biodiversity and the reduction of nutrient pollution and emission of greenhouse gases. Larger, coherent areas with organic production will contribute to the biological diversity, especially in selected areas where there are special needs of protection. Furthermore, it is possible to combine the protection of environment and nature with the development of specialities like “meadow calves” and sheep's milk cheese. Many organic farmers are willing to open their farms to visitors so that nature experiences can be combined with farming encounters.

Effort 5: Research in strategically important areas

Strengthened research and knowledge building that can advance the development of organic food production and food systems and the sector's contributions to the societal development through a market based growth of organics

A range of strategically important challenges to the organic sector can only be solved with help from a continued research in both primary production and processing. Among other things, there is a need for development of organically adapted breeds and varieties; farming systems that maintain and use ecological functions more and thus combine diversity with resource efficiency; minimal and careful processing methods and improved product quality; as well as more knowledge of how the positive externalities of organic cultivation can be augmented and how this can promote consumer confidence in the long run.

3.1 More new products on the shelves

A continued and strengthened effort to ensure innovation and diversity in processing and sale

- *Help to the next generation of organic processing companies*
In order to develop a broad and varied range of companies, it is important to support them with advice in different areas, such as product development, marketing and packaging design, so they can live up to market expectations. The smaller companies, such as micro-processing food producers and farmers who want to finish their produce on-farm, are particularly in need of this kind of help supplemented with technology development adapted to small scale productions and adaptation of the requirements for authorisation in compliance with the food legislation.
- *Create increased product development and innovation in companies*
Both small and large companies need to create inspirational networks, share new knowledge and work

together on innovation of the technological aspects of organic processing. They must also be motivated to work together and along the whole organic value chain from farm to fork, and to integrate the practical experience, the knowledge created in development projects supported through innovation schemes, rural development schemes, agricultural funds etc., and the research effort.

- *Continue the strategic cooperation with retail trade that creates new opportunities in the market; inclusion of alternative sales channels*
- *Promote organic exports*
Exports are a potential growth area. It is important to build on the positive opportunity that Denmark is the Land of the Year on BioFach 2009. This will secure the possibilities for a future balanced growth in the processing sector and establish Denmark as a leading country in organic food.
- *Starting a multi-pronged effort in relation to public meals*
New concepts must be developed where diets, nutrition, health and quality are integrated in an organic dietary change, so that new, healthier and competitive options can be offered to large and public kitchens. This should be supplemented with the development of organic catering products and product service systems, and efforts that ensure knowledge dissemination and institutional anchorage in the area.
- *Strengthening organics in the "food trade educations" that are targeted toward the processing and food service sectors*
- *Create better conditions for financing organic companies*
The effort can with advantage be extended outside the processing sector and include new types of farms, which incorporate the finishing of the products and new forms of collaboration as parts of their business strategy, and new forms of intergenerational succession.

3.2 Increased production of organic produce

A targeted, long term effort to increase conversion and develop new forms of organic operations

- *Create and realize visionary examples of modern organic agriculture*
Develop and promote examples of modern organic companies with a basis in primary production, which can function as strong images of the future. They can be based on new forms of ownership and financing; new cooperations between farms, such as integrating different operations with separate managers, organic efficiency improvement and eco-functional intensification; advanced technology, such as weed robots; and increased value adding through diversity, processing of quality produce and synergy with societal goals for nature, environment and rural development.
- *Contribute to schemes that reduce the risk of converting to organics, and make it more transparent*
Reduce and distribute the economic, social and strategic risk of conversion through schemes that are established by the sector in cooperation with private and public partners. This can be done for instance through long term supply contracts and actual vertical integration between groups of primary producers and marketing and processing companies; through intensified networking, professional advice and targeted initiatives on conversion; through an effort for organics in vocational agricultural education; and by making the administration of support schemes more flexible in relation to conversion.
- *Establish a better framework for market adaptations of inefficient land distributions in agriculture*
Improve the opportunities for conversion and development of organic agriculture through efficient

distribution of farm acreage. This can involve advice, legislation and new incentives to land consolidation, which enable participation in the environmental schemes of rural district programmes including conversion to organic production.

- *Further development of organic crop production based on organic strategies*
Development of an organic crop production based to a greater extent on organic strategies, and not dependent on input from conventional operations. This includes development of mobile green manures for high value crops; further development of biogas plants for transformation of green manure and grass from extensive areas; optimisation of rotations with strategic use of catch crops, green manure crops and pulses; targeted breeding of varieties for organic agriculture; and identification and utilisation of alternative sources of recycled nutrients. A special effort is needed on organic fruit and berry production. Since organics is a small target group, there is a need to promote international cooperation and company involvement in technology development and breeding.
- *Promote innovative livestock production systems that combine animal welfare, product quality and environmental consideration*
A special effort is needed to support growth in the organic free-range productions of meat and eggs, which are essentially different from conventional productions, and to support the further development of systems that combine high animal welfare with low environmental impact. One option is to develop new strategies for gastronomic quality through the use of alternative breeds and food items.

3.3 Consumer confidence and credibility

Open communication with the consumers and a dynamic development of farming and processing based on the organic principles

- *Create new forms of dialogue with the consumer*
New forums must be created where the consumer can be involved in the development of the organic food systems, and the experience based communication must be further developed, with open farms, harvest markets and open industries. Furthermore, improve internet communication and launch new initiatives like involving consumers directly in the process of developing the individual farm or the individual food outlet (canteens, sports arenas, etc.).
- *Development of a comprehensive strategy for labelling, dynamic development of practices and inclusion of new value based areas*
Ensure that organic food continues to be a distinct alternative. The confidence in the Danish organic “Ø” logo and the coming EU logo must be maintained through a collective, strategic effort by the sector and the public authorities that includes prevention of fraud in the European and international control systems; identification of new value based focus areas; development of additional tools that ensure sufficient dynamics in the requirements to Danish production practices; and, to match, an enhanced communication with consumers. This must be supported with a reinforced development effort in primary production on value related areas such as animal welfare, biodiversity and soil fertility.

3.4 Synergy between organics and society

Create synergy between the organic production and the societal objectives

- *Create synergy with societal goals*

It is possible to increase the synergy between the goals for business, environment and nature, in that the signals that society conveys through support schemes, can underpin the farmer's risk assessment and thereby promote conversion. In addition, organic agriculture should further develop principles for, and self-regulation of, how the management systems contribute to nature protection and reduced climate impact and energy consumption, possibly by means of nature and climate plans on all farms.

- *Promote spatial concentrations of organic agriculture to the benefit of biological diversity and the protection of particularly sensitive nature areas*

Organic management can contribute to the promotion of nature and biodiversity, the reduction of nutrient pollution of the aquatic environment and the reduction of greenhouse gas emissions, if the conversion is promoted in appropriate areas. Measures that are targeted at facilitating spatial concentrations of organic operations, could contribute to the maintenance and improvement of biological diversity in areas with special needs of protection (Natura 2000 and the like). Better methods are needed to assess the societal benefits and costs of integrated means of environmental protection, where several considerations are promoted at the same time, such as organic agriculture.

- *Protection of the aquatic environment*

Organic agriculture can contribute to a reduction of the pesticide and nutrient load on the aquatic environment in several ways, including reduced nitrogen leaching from dairy farming and reduced phosphorus losses to streams and lakes. There is a need to further develop organic operations targeted toward specific requirements in water catchments, for instance in form of "Organic Plus".

- *Promote organic biogas plants to produce green energy and recycle nutrients*

Nature restoration and removal of surplus nutrients from highly prioritized permanent grass areas can be combined with an improvement of the nutrient supply in organic crop rotations through organic management of these areas coupled with cutting for the production of biogas. There is a need to solve a range of spatial and regulatory challenges to support the establishment of organic bioenergy plants.

3.5 Research in strategically important areas

Strengthened research and knowledge building that can advance the development of organic food production and food systems and the sector's contributions to the societal development through a market based growth of organics

A range of strategically important challenges for the organic sector can only be solved with the help from research in both primary production and processing in continuation of the current Danish and transnational research programmes. There is a need for research and knowledge building within all parts of the organic food systems and with contributions from many different research disciplines. The research often has to be cross-disciplinary in order to deal with the connections between, for instance, crop and livestock enterprises, primary production and processing, and production, environment, animal welfare and consumer confidence, which are essential to the organic food systems. Many aspects of research and development targeted toward organic food systems will be applicable in sustainable biological production in a broader sense. Below are listed a range of important research needs that have been identified in the

knowledge synthesis, but the list is not to be taken as a complete and adequate list of future research efforts.

In *primary production* there is a need for additional research and development in generating increased productivity while other sustainability considerations are continuously improved:

- organic intensification, including improved maintenance and use of ecological support functions such as predators and soil organisms, increased and more deliberate use of diversity in and outside the fields and multifunctionality on the farm level
- organically adapted breeds and varieties and organic breeding systems
- free-range animal husbandry in combination with ICT and automation and improved environmental protection
- increased use of ICT and robot technologies in crop production to reduce soil compaction and labour use
- methods for economically competitive production of fruit and berries
- improved nutrient flows, including the combination with production of bioenergy and maintenance of semi-natural grasslands and nature areas
- new forms of operations and businesses that integrate specialised productions, considered in a cross-disciplinary perspective that integrates economics, management and law with biology, agronomy and animal husbandry
- knowledge of current driving forces, opportunities and barriers of conversion to organic production (attitudes, networks, visions, farm structure, risk assessment, financing, etc.)

Specific research and development in *food processing* targeted to industry needs, including:

- process innovation based on organic values and principles, including methods to reduce the need of additives and methods of careful processing of the produce
- techniques and methods of micro processing that can assist the growing group of small processing companies including on-farm processing
- product quality and food safety seen in connection with primary production, processing and distribution, including the meaning of the special organic principles
- knowledge of different forms of ownership in the organic niche strategy cluster that can ensure an optimum of integrity as well as economy, seen in both a Danish and an international perspective

On the *market and consumer* side there is a need to investigate new and participatory forms of consumer communication that can ensure confidence and development of the sector, including:

- development of methods to involve consumers and other interested parties in the development of new management systems and productions seen in connection with the organic values, principles and goals
- development of methods to document climate actions and contributions to nature quality
- the connection between labelling and other forms of communication and maintaining consumer confidence to the organic food chains
- development of concepts for catering and large kitchens that enables the sector to contribute to societal demands on food services

- knowledge on how the three archetypical actor strategies, mainstream, alternative conservative and alternative innovative can contribute to the development and branding of organics in a positive dynamics instead of appearing as competitors that damage each other and organics

There is a distinct potential in developing the *societal benefits* of organic agriculture:

- improved organic systems adapted to specific environmental requirements in specified geographical areas such as compliance with requirements for the water framework directive
- methods for promoting integrated protection of nature and environment and production of bioenergy in selected areas with special management needs
- knowledge of the potential for carbon sequestration in organic agriculture in connection with the build-up of soil fertility and soil organic matter
- the effect of the organic sector on rural development and anchorage in local communities, including how local processing can contribute to employment and economic activity
- methods for an overall assessment of benefits and costs of the externalities of organic agriculture as an element in a more wholeness oriented and simple regulation of agriculture's impacts on nature, environment, etc.

Furthermore, there is a need to focus on the development of the Danish organic sector in an *international perspective*:

- knowledge export of organic know-how, its methods and contents and its synergy effects
- methods for how to increase communication and put common values into practice in global food chains and how to communicate this to the consumer

4 List of background chapters

The background chapters will be published in November 2008 in the full knowledge synthesis report, and they are available online at <http://ecowiki.org/OekologiskUdvikling/Hvidbog>.

1. *Den økologiske markedsudvikling [The development of the organic market]*, Kirsten Lund Jensen (Danish Agriculture)
2. *Hvorfor køber forbrugere økologi? [Why do consumers buy organic?]*, K. O'Doherty Jensen and T.B. Lund (Department of Human Nutrition, University of Copenhagen), L.M. Andersen, V.T. Christensen og S. Krarup (Danish Institute of Governmental Research, AKF), T. Christensen og S. Denver (Institute of Food and Resource Economics, LIFE, University of Copenhagen), H. Bossen og H. Hindborg (Organic Denmark), T. Roland (The Danish Consumer Council), G. Øllgaard G (Explora A/S)
3. *Potentialet for omlægning til økologisk jordbrug i Danmark [The potential for conversion to organic agriculture in Denmark]*, Tommy Dalgaard, Chris Kjeldsen, Inge T. Kristensen og Ib Silkeborg Kristensen (Department of Agroecology and Environment , Aarhus University)
4. *Muligheder og barrierer i den økologiske husdyrproduktion [Opportunities and barriers in the organic livestock production]*, John E. Hermansen (Department of Agroecology and Environment, Aarhus University), Jan Tind Sørensen (Department of Animal Health, Welfare and Nutrition, Aarhus University), Troels Kristensen (Department of Agroecology and Environment, Aarhus University), Marianne Hammershøj (Department of Food Science,

- Aarhus University), Frank Oudshoorn (Department of Agricultural Engineering, Aarhus University)
5. *Muligheder og barrierer i den økologiske planteproduktion [Opportunities and barriers in the organic crop production]*, Margrethe Askegaard (Department of Agroecology and Environment, Aarhus University), Kristian Thorup Kristensen og Hanne Lindhard Pedersen (Department of Horticulture, Aarhus University), Ib Sillebak Kristensen (Department of Agroecology and Environment, Aarhus University), Frank W. Oudshoorn (Department of Agricultural Engineering, Aarhus University), Michael Tersbøl (Organic Denmark)
 6. *Økonomi og økologisk jordbrugsproduktion [Economy and organic agricultural production]*, Jens Abildtrup (Institute of Food and Resource Economics, University of Copenhagen)
 7. *Landbrugernes opfattelse af økologisk jordbrug [The farmers' perception of organic agriculture]*, Egon Noe (Department of Agroecology and Environment, Aarhus University)
 8. *Den økologiske forarbejdningssektor i Danmark [The organic processing sector in Denmark]*, Paul Kledal (Institute of Food and Resource Economics, University of Copenhagen), Mette Meldgaard (consultant)
 9. *International handel [International trade]*, Kirsten Lund Jensen (Danish Agriculture), Klaus Bentzen (Organic Denmark)
 10. *Aktøranalyse - samspillet med detailhandelen [Actor analysis – the interplay with retail industry]*, Henrik Hindborg (Organic Denmark)
 11. *Økologi og catering [Organics and catering]*, Niels Heine Kristensen (Department of Management Engineering, Technical University of Denmark)
 12. *Økologireglerne nu og i fremtiden [The organic regulations now and in the future]*, Kim Boesen (Ministry of Food, Agriculture and Fisheries) og Lizzie M. Jespersen (International Centre for Research in Organic Food Systems)
 13. *Fødevarersikkerhed og sundhed i relation til økologiske fødevarer [Food safety and health in relation to organic food]*, Dorte Lau Baggesen, Susan Herrmann, Kit Granby, Pia Knuthsen, Torben Leth, Laurids Siig Christensen, Anne Wingstrand, Jens Kirk Andersen og Ilona Sørensen (The National Food Institute, Technical University of Denmark), Peter Sandøe og Jesper Lassen (Institute of Food and Resource Economics, University of Copenhagen)
 14. *Energi- og gødningproduktion ved hjælp af biogas [Energy and fertilizer production by way of biogas]*, Michael Tersbøl (Organic Denmark)
 15. *Natur i landbrugslandskabet – samfundets forventninger til det økologiske jordbrug [Nature in the agricultural landscape – societal expectations to organic agriculture]*, Vibeke Langer (Department of Agriculture and Ecology, University of Copenhagen) and Pia Frederiksen (Department of Policy Analysis, Aarhus University)
 16. *Energiforbrug og drivhusgasudledning i økologisk jordbrug [Energy consumption and greenhouse gas emission in organic agriculture]*, Niels Halberg (International Centre for Research in Organic Food Systems)
 17. *Arketypiske økologiske aktørstrategier [Archetypical organic actor strategies]*, Hugo F. Alrøe (International Centre for Research in Organic Food Systems)
 18. *Scenarier for udviklingen i markedet for økologiske fødevarer [Scenarios for the development of the organic food market]*, Stig Yding Sørensen and Tina Andersen (Danish Technological Institute), Frank Oudshoorn (Department of Agricultural Engineering, Aarhus University), Chris Kjeldsen (Department of Agroecology and Environment, Aarhus University), Mette Meldgaard (consultant) and Hugo F. Alrøe (International Centre for Research in Organic Food Systems)
 19. *Økologiens fremtider - aktørworkshop og scenariespil [Organic futures – actor workshop and scenario game]*, summed up by Hugo F. Alrøe (International Centre for Research in Organic Food Systems)

