

Summary of

# INNO +

## THE INNOVATIVE DENMARK

A basis for inspiration and prioritisation of strategic investments in innovation



#### PUBLISHED BY

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E-mail: [distribution@rosendahls.dk](mailto:distribution@rosendahls.dk)  
Website: [www.schulzboghandel.dk](http://www.schulzboghandel.dk)

The publication can also be downloaded  
from the website of The Danish Ministry of  
Science, Innovation and Higher Education:  
<http://www.fivu.dk/en/innoplus>

Layout: Formidabel  
Print: Stouge - No Limit Solution  
1st print run: 1500  
Printed: October 2013

ISBN (printed) 978-87-92776-80-8  
ISBN (Internet): 978-87-92776-84-6



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# FOREWORD

Increased competition, economic downturn, resource scarcity and climate change are examples of changes in global society that has an impact on Danish society.

The changes present Denmark with new challenges that can pose difficult dilemmas but also new opportunities that can lead to new solutions and new ways to make a living in Denmark and globally. In the intersection between challenges, dilemmas and opportunities, Denmark is to find the new ideas that we are to live off in the future and create the society we desire.

There is a need for a paradigm shift in the Danish innovation policy. The large investments in knowledge and education must be translated into concrete solutions and products to a greater extent than today, thereby creating growth and jobs in companies. In the future, the demand for solutions that meet concrete societal challenges must complement the current efforts and act as driving force of innovation. This requires new forms of cooperation and a more holistic approach.

Denmark qualifies by having strong research environments and strong competencies within innovation and design. We must adopt a global outlook and use our strongholds to ensure that the investments in knowledge and education are translated into new, innovative solutions capable of addressing the global challenges. The ambition therefore is to establish a new type of societal innovation partnerships that within a period of three-five years can deliver solid results, which enable the business sector to create growth and employment. The new societal partnerships must aim to accelerate innovation efforts in areas where Denmark has a solid knowledge base and a strong business sector.

Denmark cannot address all the challenges all at once. Therefore, we must identify and prioritise the societal challenges that we are able to meet and for which there is a global demand for new solutions – solutions that benefit both societal development and the national economy.

In the following pages, a summary of the INNO+ Catalogue is presented. The catalogue is designed as an inspiration and prioritisation framework for new, intelligent investments in innovation. INNO+ does not reflect the Danish Government's political priorities, but is instead the result of an extensive mapping process and close dialogue with several hundred stakeholders from trade organisations, employees' organisations, special interest organisations, research institutions, educational institutions, GTS institutes, innovation incubators, innovation networks and private foundations as well as municipal, regional and central government authorities.

Such broad-based and inclusive collaboration across professional sectors and interests gives a new and desirable input into how Denmark's future innovation efforts should be shaped.

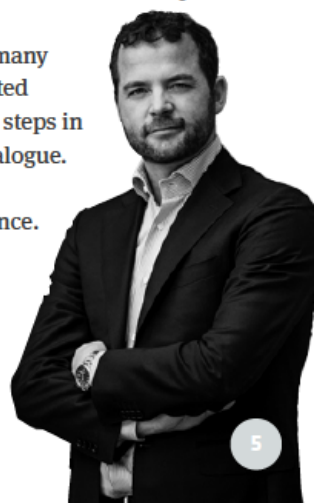
I wish to express my gratitude to the many committed people who have contributed energetically and constructively to all steps in the process of making the INNO+ Catalogue.

I wish you a pleasant reading experience.



*Morten Østergaard*

Minister for Science, Innovation  
and Higher Education







# INTRODUCTION

The INNO+ Catalogue describes a number of areas where Denmark has particular opportunities for creating solutions to Danish and global societal challenges within, for example, health, food, production, environment and efficient utilisation of natural resources. A focused research and innovation effort will enable Denmark to contribute to solving the major challenges of our time and also to create some of the jobs that Denmark are to live off in the future. This leaflet is a summary of the INNO+ Catalogue.

Concrete solutions to major societal challenges can seldom be created by single-standing, ingenious inventions. They typically need to be developed in a collaboration that cuts across sectors and disciplines, and there may also often be a need for changes in the system of regulation, in the market conditions or in other societal conditions before the innovation can reach a critical mass. This is of course complicated and requires the involvement of many societal actors. In return, however, there are prospects that these kinds of solutions can be used many other places in the world and can thus enable Denmark to achieve favourable conditions for generating export, growth and employment.

Denmark is a small country, and it is absolutely vital that the country take action in the areas where companies, and knowledge and education institutions are well-positioned to assert themselves on the global stage.

The INNO+ Catalogue contains six main thematic areas with 21 underlying focus areas, each of which has its own specific goal. The Danish Government's innovation

strategy, "Denmark – a nation of solutions", views the INNO+ Catalogue as a knowledge base that can be used to prioritise future societal innovation partnerships. In each of the INNO+ focus areas, it will thus be possible to establish a partnership in which public and private actors join forces to achieve the goals set out and to devise specific solutions. The objective of INNO+ is also to provide actors at all levels with a source of inspiration for the future-oriented innovation policy efforts in a broad sense.

The INNO+ Catalogue emerged from a political wish to devise a prioritisation framework for innovation policy that could facilitate the identification of specific and important societal needs, business perspectives and particular Danish strengths in order to target for significant innovation policy efforts.

A wide circle of representatives ranging from industrial and workers' organisations, higher education institutions, ministries, GTS institutes, innovation networks and research councils, etc. have contributed to identifying and selecting the focus areas summarised in this leaflet.

Additional information about INNO+ can be found at <http://www.fivu.dk/en/innoplus>





# 1. INNOVATIVE TRANSPORT, ENVIRONMENT AND URBAN DEVELOPMENT

Globally increased consumption and transport needs increase pressure on natural resources, environment, climate and people. This development creates a need for new economically and environmentally sustainable solutions within resource utilisation, transport systems, climate adaptation and urban development.

Denmark has good conditions to create solutions to the challenges and has a number of research and industrial strengths within a number of green technology areas. There is potential for developing internationally demanded solutions that can contribute to improved traffic flow in towns and cities, greener shipping as well as more climate-robust cities and increased recycling of waste.

Within the thematic area, *Innovative transport, environment and urban development*, the INNO+ process has identified four proposals for societal partnerships comprising companies, knowledge institutions and public authorities.

A partnership focusing on transition *From waste to resource – more efficient utilisation of household,*

*industrial and construction waste* must create new solutions for increased recycling of waste resources from residential housing, industry and the building sector.

A partnership on *Blue jobs via green solutions* must create new shipping transport solutions that enhance energy efficiency and reduce the impact of shipping vessels on the environment and climate.

A partnership on *An intelligent and green city with high mobility* must create solutions for a better and greener traffic flow system in cities – solutions that ensure high mobility and efficient supply chains as well as reduce air pollution, noise and the number of accidents.

A partnership on *Climate adaptation in cities – global solutions to climate-resilient and sustainable cities* must create integrated and cost-effective solutions to address climate change in cities and contribute to ensuring climate-resilient and sustainable urban development.

# 1.1 FROM WASTE TO RESOURCE – MORE EFFICIENT UTILISATION OF HOUSEHOLD, INDUSTRIAL AND CONSTRUCTION WASTE

Efficient utilisation of resources has a high position on the global agenda due to competition for non-renewable raw materials. At the same time, many countries have trouble coping with the increasing volume of waste. New technologies and optimised processes that can be developed in Denmark can provide an opportunity to recycle the resources more efficiently and to utilise waste as a resource rather than regarding it as a waste product. A well-developed and transparent Danish public system offers potential for collaboration with and between private sector actors and a good basis for developing new solutions that can be patented and exported.

The goal of a partnership is to create new, visible and tested solutions in two to three frontrunner municipalities within a period of five years that support the development of a more resource-efficient society. There must be focus on increasing the recycling of resources from three important waste resources. For household waste, the aim is to ensure a high level of quality and utilisation in the recycling of plastic (50 per cent), paper/cardboard (70 per cent), metal (70 per cent) and bio-waste (50 per cent). For industrial waste, 75 per cent must be recycled, and for building and construction waste the aim is to ensure that

over 90 per cent is recycled intelligently. At the same time, the PCB-polluted construction waste is to be handled in an environmentally and financially sound way.

The developed solutions are expected to reduce the quantity of waste. This will reduce treatment and landfill costs. It will also enable the quality of the recycling to be improved, creating greater value and better opportunities for selling the recycled materials. In addition a reduction in the consumption of natural resources will enable Denmark to become less dependent on the import of raw materials. Lastly, the developed solutions are expected to be able to benefit Danish companies by optimising their resource consumption and offering new opportunities for exporting innovative recycling solutions.



## 1.2 BLUE JOBS VIA GREEN SOLUTIONS

The high volume of international maritime trade entails that shipping transport impacts on the world's environment and climate. At international level, ever increasing requirements are being placed on the shipping industry to reduce its pollution and energy consumption.

Whilst this represents a challenge for the shipping sector, it also represents a business opportunity, particularly for Denmark. Despite the country's modest size, Denmark is a maritime heavyweight and in many contexts a frontrunner country within green solutions. The opportunities are to be found in utilising this leading edge to a competitive advantage. In other words, green solutions can create blue jobs.

The shipping industry faces four major, and to a large extent interrelated, challenges within the environmental and climate fields: firstly, to reduce the emissions of greenhouse gases – particularly CO<sub>2</sub> – out of regard for the climate; secondly and thirdly, to reduce the emissions of sulphur dioxide and nitrous oxide (SO<sub>2</sub> and NO<sub>x</sub>); and lastly, to reduce the level of underwater noise out of regard for marine life in the oceans and seas.

Some of the requirements are international, such as the minimum requirement that by 2025 newly constructed

ships are to use energy 30 per cent more efficiently per transported ton, whilst others are regional. These requirements will be gradually phased in during the coming years.

The goal of a partnership is to develop solutions that demonstrate the feasibility for future ships to realise a number of targets relating to climate and environmental impact by 2020. The CO<sub>2</sub> emission per transported unit is to be reduced by at least 30 per cent in relation to the 2008-level. The figure is a minimum target, as the ambition is to achieve a CO<sub>2</sub> reduction of up to 50 per cent. The SO<sub>2</sub> and NO<sub>x</sub> emission level is to be reduced by 80 per cent in relation to the current standard, and the noise produced by ship propellers is to be reduced by 3dB in relation to the current standard.

The bulk of the effort will be directed at the global market, and the solutions developed are expected to contribute to developing competitiveness, generating exports and creating jobs in the maritime sector, which besides the shipping operators also covers the maritime industry and sub-supplier firms. The developed solutions will also be able to contribute to strengthening Denmark's leading position within the climate and environmental field.



## 1.3 AN INTELLIGENT AND GREEN CITY WITH HIGH MOBILITY

A city with a good environment that makes it easy and quick to get around is a city companies want to move to and citizens want to live in. However, the majority of the world's cities experience problems with congestion, noise, CO<sub>2</sub> emissions and air pollution. Traffic jams and bottlenecks that bring traffic to a standstill or cause it to flow slowly result in wasted time for road users. This is expensive for society in terms of lost productivity.

According to the European Commission, Denmark loses DKK 11 billion – 0.7 per cent of GNP – each year due to traffic congestion. At the same time, reducing greenhouse gas emissions from traffic is a major challenge, and converting the transport sector to renewable energy is a slow-moving process. From a health-related perspective, it is also a challenge to reduce traffic-related noise pollution and air pollution, both of which are a source of illness, years of lost life and considerable health costs in many of the world's major cities.

The goal of a partnership is to demonstrate within a period of 3-5 years that it is possible in a Danish city to

reduce traffic congestion significantly and to develop new solutions that can contribute to reducing the CO<sub>2</sub> footprint. The partnership is also to demonstrate that it is possible to reduce the emission of nitrogen oxides and particle pollution to a level where the air quality meets the EU limit values. Lastly, it is to be demonstrated that traffic noise can be reduced by at least 7-9 dB in noise congested areas.

The solutions developed are expected to make traffic flow more efficient and environmentally friendly. It will benefit companies by making distribution easier, and it will entail less time wasted for citizens in traffic. In this way, the effort is to contribute to increasing productivity in society. At the same time, citizens are expected to have better health as a result of a better urban environment. Lastly, the effort is to contribute to creating the basis for exporting Danish solutions.



## 1.4 CLIMATE ADAPTATION IN CITIES – GLOBAL SOLUTIONS FOR CLIMATE-RESILIENT AND SUSTAINABLE CITIES

Climate change is one of the major global challenges and is expected to lead to more extreme weather situations. In Denmark, it will, on the one hand, manifest itself in more frequent and more violent outbreaks of heavy rainfall and cloudbursts, and on the other hand in longer and warmer periods with drought. Greater damage to buildings and amplified impacts of heat waves are expected. In addition, the population's health is put at risk by floods, in which sewers overflow and cause wastewater to become mixed with rainwater and surface water.

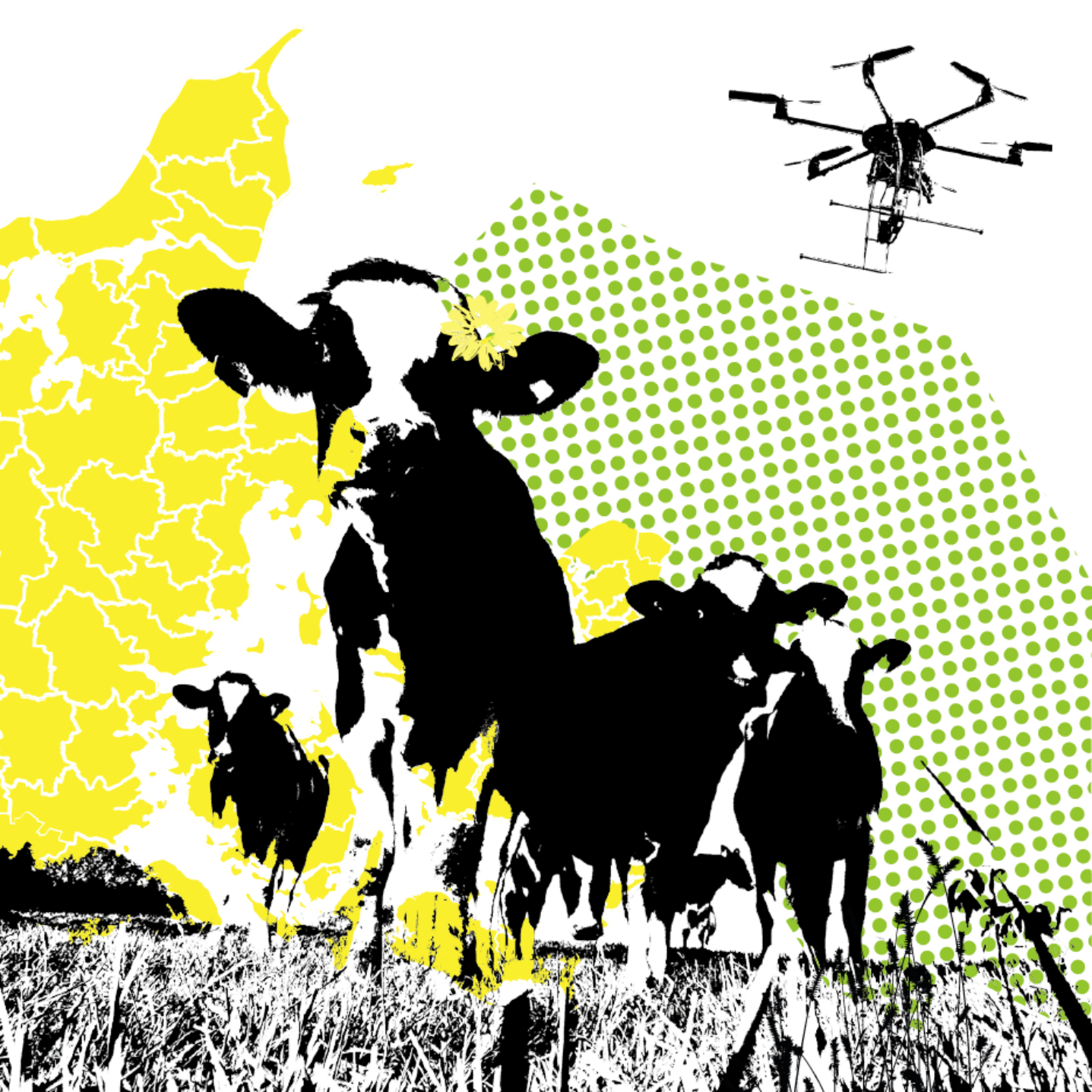
Denmark has decided to invest massively in climate adaptation, particularly in the cities. This provides the country with an opportunity to build up a number of competencies in the field. As many other countries face similar challenges, it is expected that they will also be on the look-out for innovative climate adaptation solutions.

The goal of a partnership is within a period of three to five years to develop climate-robust solutions in demonstration cities or major urban areas facing different challenges in relation to geography, topography, types of housing areas, etc.

There must be focus on planning and testing of new urban areas for robustness to floods through development of new planning and analysis methods. Focus must also be placed on optimising the use of the countryside outside the city for the purpose of keeping water out of the city. In addition, citizens must be given proper warning of extreme weather, so that unnecessary damage is reduced. Lastly, there must be focus on ensuring that existing urban areas use both fortified areas and green areas for controlled flooding, which together with new climate adaptation solutions will reduce damage by at least 30 per cent of today's level.

The solutions developed are to contribute to achieving substantial savings on climate adaptation spending in Denmark and to developing climate-resilient urban areas and green, attractive buildings and urban spaces that promote a better environment and enhance the quality of life of citizens. The cities that are selected for the partnership's demonstration projects are to generate the visibility of Danish competencies within climate adaptation and create the basis for increased exports of the solutions.







## 2. INNOVATIVE FOOD PRODUCTION AND BIO-ECONOMY

The combination of increased global resource scarcity and growing demand for food products, feed and bio-energy leads to a need for more effective and increased production of foods and other biological products. This puts pressure on global supply security and imposes heavy demands on resource efficiency with due consideration for sustainability, environment, animal welfare and public health. At the same time, society and citizens have increasing demands in relation to product quality, product differentiation, production methods as well as sustainability. These demands will change food production in the future and create an international competitive pressure on – and new opportunities for – Danish companies.

Denmark is strongly positioned within production, processing and distribution of foods, feed and other bio-based products and has good opportunities for tapping the potentials of the bio-economy by creating new solutions that can meet the challenges and realise the potentials. Good opportunities are to be found in promoting an internationally competitive production and processing of foods, feed, bio-energy and biological materials, etc. whilst simultaneously promoting sustainability and providing consumers access to health, safe and tasty food of high quality.

Within the thematic area, *Innovative food production and bio-economy*, the INNO+ process has identified four proposals for societal partnerships comprising companies, knowledge institutions and public authorities.

A partnership on *Intelligent, sustainable and efficient plant production* must create test solutions that allow for plant production to be differentiated and optimised in relation to the production characteristics of the cultivated land areas. The partnership must facilitate a sustainable increase in overall plant production.

A partnership focusing on transition *From plant residue to high value* must innovate the way Denmark uses biomass and create solutions in relation to the production of sustainable, bio-based products and materials based on renewable resources.

A partnership on *Resource-efficient food production* must create solutions in relation to efficient and sustainable food production. The aim must be to produce more and higher quality food whilst minimising energy consumption and resource waste.

A partnership on *Denmark as a global supplier of nutritious and health-promoting foods* must develop ingredients and foods that can improve public health and for which there is a global demand.



## *Denmark at the forefront of precision farming*

# 2.1 INTELLIGENT, SUSTAINABLE AND EFFICIENT PLANT PRODUCTION

Within plant production, the future answer to the apparent contradiction between the wishes for increased production and lower environmental impact lies in precision agriculture.

Precision agriculture is based on the premise that soils are very diverse. The same applies to the drainage system, which have a bearing on the quantities of nutrients and pesticides being leaked to the aquatic environment.

Some soils are ideal for cultivating plants. Here, the soil retains the nutrients added to the field so effectively that in general they only disappear as the plants use them to grow. These constitute the robust soils. In other places, there is a risk of a substantial loss of nutrients and pesticides, with negative effects to the environment and the farm economy. These soils are called sensitive soils.

In other words, it is socio-economically and environmentally efficient to cultivate robust and sensitive soils differently. This can be done, for example, by cultivating the sensitive soils with crops that are hardy in relation to nutrients and more resistant to disease and pests.

Among fields there can be large differences in the soil. Even within the same field, it is possible to find both robust and sensitive soil. Therefore, up until now it has not been

realistic to vary the cultivation in a way that precisely matches the soil. In recent years, however, agricultural machines have been developed that are equipped with GPS control, enabling farmers to apply fertilisers and treatment pesticides with high precision.

The goal of a partnership is to establish a fully functional model landscape, in which solutions are implemented within a period of three to five years to demonstrate how plant production can be differentiated in relation to the production characteristics of the cultivated areas. The innovative solutions must in parallel be implemented in advisory services, IT, agricultural machines and environmental regulation, and knowledge must be gathered for use in the potential development of a new regulation paradigm based on differentiated cultivation.

The solutions developed are expected to help the farmer to achieve increased productivity and to reduce the impacts on the environment. The solutions are not only expected to benefit agricultural production and thus create growth and jobs, but also to benefit a number of support industries that will be able to obtain good opportunities for export.



*The refinery that uses plant residue and grass as raw materials*

## 2.2 FROM PLANT RESIDUE TO HIGH VALUE

A traditional petroleum oil refinery takes in crude oil and converts it into a large number of different products. These include, for example, diesel oil, petrol, solvents as well as a number of basic chemicals, which can be used as the basis for producing other chemicals and numerous types of plastic. However, the vision is for the bio-refinery of the future to be able to take biological raw materials and use them to manufacture a range of different products that can substitute the ones originating from the oil refinery.

In this way, it will be possible to achieve two objectives: firstly, to ensure that the particular raw material is utilised in the most appropriate way; and secondly, to minimise waste, as the different components and by-products in the raw material can often be utilised in the manufacturing of different products. In reality, a bio-refinery should be regarded as a technological platform capable of extracting the valuable components from the biomass, thus making them available for manufacturing products of high value.

The rising costs of raw materials and a wish to replace fossil-based products creates a need for sustainable, bio-based products based on renewable resources. At the same time, it is a great advantage that the biological raw materials can be far more climate-friendly compared to crude oil. This stems from the fact that plants absorb carbon from the atmosphere during their growth, and in so doing contribute to reducing

the greenhouse effect. In addition, production will be sustainable, as it will be based on plant residues and by-products which are otherwise often simply incinerated.

The goal of a partnership is within a period of five years to demonstrate that it is possible to develop bio-refineries that can utilise residue products from, for example, forestry, plant production as well as grasses. In this connection, value chains for at least two of the main components of the plant biomass must be developed. At the same time, it must be demonstrated that bio-based products and/or materials can be produced with a significantly higher value than earlier without adversely affecting food and feed production. Bio-refining must also be used to identify valuable application of a substantially greater part of the available residue biomass as well as of biomass from nature areas.

The efforts will potentially result in, among other things, new food ingredients developed from residue products and bio-based alternatives for materials made from fossil-based natural resources. Furthermore, it is envisaged that production of protein-rich feed from plant waste will replace a large part of the soybean meal which is imported today for use in cattle and pig feed. The solutions developed are expected to contribute to reducing climate change impact and provide fertile soil for growth in Danish companies and the primary sector, including in the peripheral areas of Denmark.



## *Sustainable manufacturing and handling of food products*

### **2.3** RESOURCE-EFFICIENT FOOD PRODUCTION

The food industry faces a number of challenges and opportunities. This stems partly from increased demand for food products and a global resource scarcity of raw materials as well as other resources essential in the processing operation, and partly from the fact that the global markets in the future will be characterised by increased international competition.

If the food industry is to preserve its competitiveness and at the same time reduce its impact on the surrounding community and its consumption of the scarce resources, there is a need to develop new, innovative solutions.

The key to maintaining a competitive food industry is to be found in the processing and development of new and resource-efficient production methods and technologies. At the same time, the food industry needs to minimise its waste and fully utilise the raw materials. Furthermore, the food industry needs to be able to reduce its consumption of energy, water and other resources significantly.

The goal of a partnership is within three to five years to develop solutions which demonstrate that it is possible to realise one or more of the following four targets: 25 per cent less energy consumption on cooling per exported food unit; 25 per cent less water consumption in the Danish food sector; 10 per cent better utilisation of raw materials during production and achievement of greater added value through improvements in processing, distribution and preparation of food products; and at least a doubling of the added value derived from by-products.

The solutions developed are expected to increase the utilisation of the biological raw materials and reduce the overall waste and consumption of energy and water. They will be able to contribute to maintain and strengthen Denmark's position among the world's leading manufacturers and exporters of food products and food-related technology whilst at the same time enhancing the sustainability of production.





## 2.4 DENMARK AS A GLOBAL SUPPLIER OF NUTRITIOUS AND HEALTH-PROMOTING FOOD PRODUCTS

In a world where increasingly more people are contracting lifestyle diseases and where the proportion of elderly people is growing, one of the challenges is to ensure the availability of nutritious and health-promoting food products. Among other things, there is a major and growing need for protein-rich food products for different population groups as well as for food products that can prevent for example diabetes, cardiovascular diseases and cancer. Coupled with a higher standard of living in the growth markets, this creates a rising demand for, among other things, high-quality proteins as well as health-promoting ingredients and food products. The global challenges create substantial business opportunities for Denmark's large and globally oriented ingredient and food industry.

The goal of a partnership is to develop new nutritious, safe and health-promoting food products, meal solutions and ingredients for a growing global market. Specific targets within a period of three to five years include demonstrating

competitive solutions that can increase the production of quality plant proteins by 60 per cent and developing products with reduced sugar, fat and salt content. The solutions must contribute to reducing the incidence of lifestyle diseases and to reducing national health service costs, partly through regulation-related incentives.

The solutions developed are expected to contribute to enabling Danish companies to capture a large share of the growing global market for health-promoting food products, including expanding the strong Danish position on the global market for enzymes, cultures and ingredients for food products. The solutions developed will also be able to make a positive contribution to public health, for example in the form of reducing the number of under-nourished elderly people.





# 3. INNOVATIVE HEALTH SOLUTIONS

The demographic development, our lifestyle, new treatment opportunities and rising patient demands are putting the health sector under pressure, and the sector in both Denmark and abroad faces substantial and rising costs combined with limited financial scope. This leads to a rising demand for new, innovative solutions within the health sphere.

Denmark is well-positioned to contribute to creating the required solutions. The country has a number of research and business-related strengths in the health sphere as well as a well-developed public health sector that demands innovative and effective solutions. There is potential for developing solutions that will be in demand on the global market and which also contribute to increased efficiency in the health sector as well as better health and quality of life.

Within the thematic area, *Innovative health solutions*, the INNO+ process has identified three proposals for societal partnerships comprising

companies, knowledge institutions and public authorities.

A partnership on *Denmark as the preferred country for early clinical testing of new medicines* must develop clinical trial centres that contribute to the development of new medicines and create strong professional environments at hospitals, and in so doing can further enhance the quality of treatment.

A partnership on *Patient self-management of chronic disease* must create new, integrated and cost-effective telemedicine solutions that increase self-management among patients, enhance quality of treatment and contribute to reducing the number of bed days and outpatient treatment visits.

A partnership on *The efficient and safe hospital* must create the basis for a more efficient operation of hospitals and improved patient safety through targeted work on developing, among other things, tracking technology.



## *Early studies of new medicines as a source of better medical treatment*

### **3.1** DENMARK AS THE PREFERRED COUNTRY FOR EARLY CLINICAL TESTING OF NEW MEDICINES

Clinical trials is the professional term for studies in which trial subjects are given new promising medicinal products. Any new medicine must be tested in well-defined trials under closely controlled conditions before being approved by the public authorities and offered to large groups of patients as standard treatment.

There are great advantages to be gained by hosting clinical trials. The trials are conducted in a partnership between the companies' research and development activities and the public health service conducting the research. At this intersection, there are good conditions for developing innovative and effective treatments. This benefits the country's patients and also presents new business opportunities for the companies involved.

In the past, Denmark has been successful in attracting clinical trials. In recent years, however, other countries around the world have overtaken Denmark in regard to the largest clinical trials, where the medicinal product is administered to thousands of patients. Denmark cannot compete here because our costs are too high. Nevertheless, there are potentials to be found in making it more attractive to conduct the early-stage clinical trials in Denmark. These are trials in which a small number of healthy trial subject or patients are given the product, something that requires new innovative testing solutions.

The goal of a partnership is within a period of five years to make Denmark the preferred country for conducting early-

stage clinical trials on new medicines within a number of disease areas. The partnership must establish three to five pilot centres for experimental treatment and clinical proof of concept studies of a quality that can attract 10-20 studies of new medicines in the centres.

The pilot centres are to be used to develop a concept for experimental treatment centres that can offer Danish and international pharmaceutical companies the opportunity to have state-of-the-art proof of concept studies conducted in Denmark. The pilot centres are to be established, for example, within the fields of cancer, Parkinson's, dermatology, allergy and diabetes, where Denmark has strong clinical research environments and Danish pharmaceutical companies.

The centre solutions developed are expected to be able to strengthen professional development at hospitals through excellent research environments, boosting quality of treatment and health service efficiency. At the same time, the solutions will underpin the very strong Danish business cluster in the field. Lastly, Denmark will be able to share in the creation of jobs and economic activity directly associated with the clinical trials, which would otherwise be conducted abroad. The perspective is illustrated by the fact that the global market for clinical research and development totalled approx. DKK 500 billion in 2012.

## 3.2

### PATIENT SELF-MANAGEMENT OF CHRONIC DISEASE

Diabetes and a number of cardiovascular diseases as well as mental disorders are examples of conditions that a person can suffer from throughout life. In Denmark alone, there are around 1.8 million people who live with a chronic disease. The treatment of chronic diseases represents a major financial burden on society. It accounts for 70-80 per cent of total health spending. At the same time, chronic disease makes life troublesome for the patient concerned and is often associated with loss of control over their own situation because they need to attend regular check-ups and treatments. New solutions need to be found that can both help the patients to self-manage their disease and reduce the financial burden on society.

One of the answers to the challenge is cost-effective telemedicine solutions, in which the patient personally performs a number of the examinations at home that would normally take place in the hospital or a doctor's surgery and reports the results electronically. The feeling of actively contributing to the treatment process helps improve the patient's health and quality of life. At the same time, doctors obtain a better overview of the patient's treatment process compared to previously because they are able to monitor the patient constantly rather than perhaps only once every six months.

The trend of an increasing number of chronic patients is not confined to Denmark. The same trend can be seen worldwide. Consequently, there is a huge potential in developing innovative telemedicine solutions in both a Danish and a global context. The goal of a partnership is within a period of three to five

years to develop telemedicine solutions which document that they can contribute significantly to reducing the number of days spent in hospital and outpatient treatment visits. The solutions must also document that they promote greater self-management among chronically ill patients and increase satisfaction with, and quality of, treatment processes. This is to improve the patients' quality of life and create more effective treatment procedures for the health service as a whole.

New, integrated and cost-effective solutions aimed at helping groups of chronic sufferers and patients with long-term diseases not already subject to telemedicine solutions in Denmark are to be developed and tested. This can also involve solutions that can contribute to strengthening integration between the telemedicine efforts across diagnoses. The solutions can focus on treatment, rehabilitation and prevention of further illness.

The solutions developed are expected to empower chronic patients to become more self-managing and in general to contribute to improving health and quality of life. At the same time, the solutions are also expected to facilitate a cost-effective public healthcare expenditure and enhance the individual person's ability to work. In Denmark, more than one in three municipalities is expected to increase investments in welfare technology by 30-50 per cent within the next three years. Similarly, global demand for welfare technology is expected to rise, accompanied by a growth and employment potential. The development of new solutions can also strengthen Denmark's role as a test country for advanced products within the field of welfare technology.



*In control of people, medicines and equipment at hospitals*

## 3.3 THE EFFICIENT AND SAFE HOSPITAL

Logistics is one of the absolute key challenges facing modern health service. In hospitals, millions of packages with pharmaceutical products are moved around each day. This also applies to beds and equipment as well as patients and staff. Errors may have fatal consequences, for example if a drug is administered to the wrong person, or the results of an important analysis go astray.

Logistics has also great financial importance, as a significant proportion of the hospital's running costs are related to logistics and tracking. Disruption of these functions leads to costs that could have been avoided. Each time it is necessary to recall medicines or items of equipment, it costs money. The same is true when staff or patients are instructed to go to the wrong place. Similarly, unnecessary costs are incurred when a hospital ward has to maintain a large local stock of certain medicines or instruments in order to be sure of having them available at a time of real pressure.

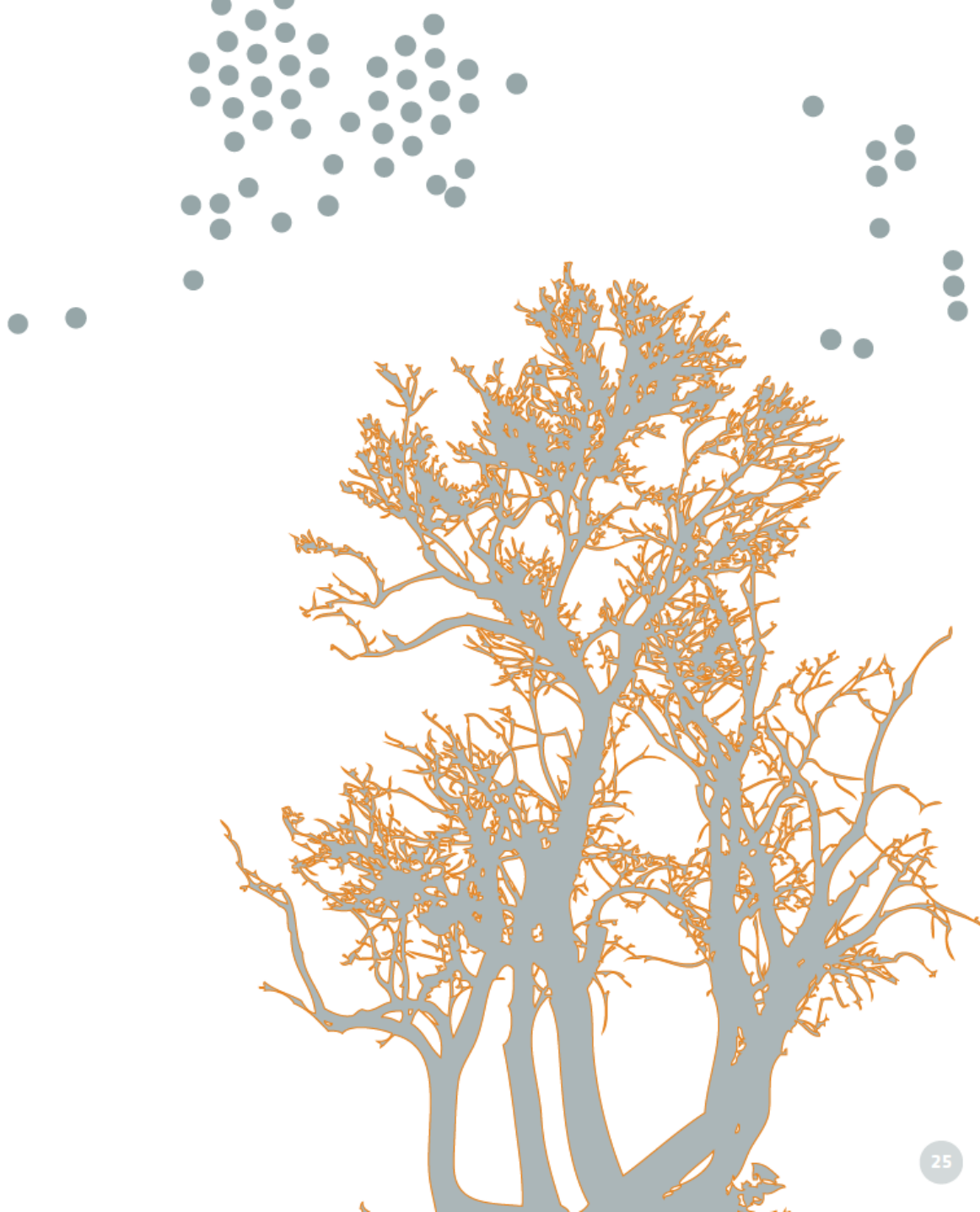
Better tracking of products and equipment leads to better stock management. It also facilitates a better overview of how many resources are used to perform the various tasks. This information can be used, for example, to prevent waste. It can also be used to reduce errors and thus adverse events, partly because the tracking technology can ensure that important information about contents, handling and shelf-life is always available.

Improved logistics is therefore one of the answers to the health service's overall challenge, namely to deliver an increasing number of services of high quality with limited financial resources.

The goal of a partnership is within a period of three to five years to identify, develop and demonstrate solutions within logistics and tracking that can be rolled out to hospitals and regions and contribute significantly to achieving efficiency gains in the operation of hospitals and, where possible, to reduce the rates of adverse events and mortality in hospitals. Focus must be placed on examining effects, such as the reduction in the amount of time clinical staff spend in connection with handling products, and on reducing the time spent waiting for access to products, apparatus and equipment. There can also be focus on products and reduction of stocks, waste and errors associated with handling medicines as well as an increase in the number of product groups, equipment, implants, etc. that are subjected to IT-supported registration and tracking.

Besides contributing to improving the quality and operating efficiency of hospitals, the solutions developed are to provide a platform for export activities for Danish companies, which are thereby able to gain early access to the growing global market for innovative operating efficiency solutions targeted at the health sector.









# 4. INNOVATIVE PRODUCTION

For several years, Denmark has been challenged by weak productivity performance and loss of competitiveness. As a consequence, the country has experienced outsourcing of manufacturing and job losses in the manufacturing industry during the last decade. The manufacturing industry is constantly searching for solutions that can boost productivity, maintain and increase resource-efficient production, as well as improve the quality of products.

Denmark has the research and industrial strengths to create solutions within innovative production. Many Danish companies invest in research, development and equipment that increase resource-efficiency and improve productivity performance. In 2010, the manufacturing industry accounted for more than half of the total expenditure on research and development in the business community, and public-private partnerships on research are common.

Within the thematic area, *Innovative production*, the INNO+ process has identified five proposals for societal partnerships comprising companies, knowledge institutions and public authorities.

A partnership on *Water-efficient industrial production* must create competitive solutions that can increase water efficiency in industrial production, including in-

creased use of secondary quality water, and contribute to tackling increasing pressure on water resources.

A partnership on *Pharmaceutical and biotechnological production – better, cheaper and safer processes and products* must develop new technological production methods that can maintain and enhance Denmark's stronghold as a country for pharmaceutical and biotechnological production.

A partnership on *The intelligent factory* must create solutions that digitalise physical production and contribute to ensuring that a competitive Danish manufacturing industry can produce in a sustainable and efficient way.

A partnership on *Advanced materials as a basis for growth and solution of societal challenges* must create advanced material solutions that can accelerate the use of new materials in the business sector and contribute to addressing and solving societal challenges within, for example, health, food, environment and energy.

A partnership on *Made in Denmark – sustainable fashion and textile production* must create design and production solutions that contribute to a competitive and environmentally friendly Danish-based fashion and textile production.



## *Industry economises on water consumption*

# 4.1

## WATER-EFFICIENT INDUSTRIAL PRODUCTION

There are many good reasons for industry to economise on water consumption. Firstly, the cost of water is rising, and in some companies water is a major item in the budget. Secondly, responsible water management is a key aspect of operating a sustainable company. Thirdly, the available quantities of high-quality water are severely limited in many countries. This means that companies which are interested in exporting their technology or in establishing production operations elsewhere in the world would be wise to keep their consumption of water in the processes as low as possible.

The problem is expected to become ever more pressing. According to a UN estimate, half of the world's population will be affected by water shortage by 2050. The pressure on global water resources increases the demand for technology that can reduce water consumption. In total, the global market for water technology therefore is estimated to constitute approx. USD 3,000 billion, and it is growing by 6-8 per cent annually.

The goal of a partnership is within a period of three to five years to develop and demonstrate solutions that enable at least 15 per cent of industrial water consumption to be based on recycled water of adequate quality

as well as reduce industrial consumption of ground-water by at least 20 per cent through water savings, water recycling, and water exchange through industrial symbiosis.

The solutions developed are to contribute to enabling a number of Danish production companies to save on their water bill and in so doing become more competitive, whilst at the same time increasing sustainability. This applies in particular to the food and pharmaceutical sectors. The solutions will also be able to contribute to giving Danish companies a leading edge when European competitors have to conform to the same environmental standards. Lastly, the solutions developed are to contribute to increasing exports of Danish water technology.



*Medicine factories of the future will never sleep*

## 4.2

### PHARMACEUTICAL AND BIOTECHNOLOGICAL PRODUCTION – BETTER, CHEAPER AND SAFER PROCESSES AND PRODUCTS

The pharmaceutical industry throughout the world face a radical transformation of their production. Today, virtually all pharmaceutical drugs are manufactured in batch production, in which one portion of the product is manufactured at a time and thereafter preparation is made for the next production run. There are huge potentials to be tapped in the future by switching to continuous production, in which a small quantity of raw materials is entered continuously at one end of the “system”, after which a constant flow of products emerges at the other end.

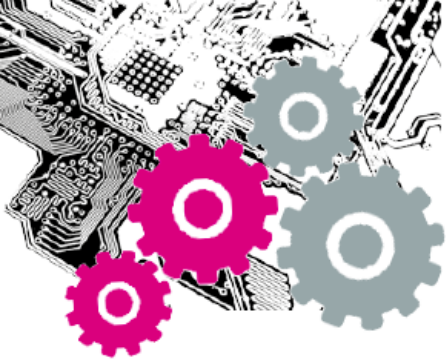
When the production runs continuously, more flexible production facilities can be used to manufacture the quantity required. This leads to lower production costs. The opportunities for monitoring pressure, temperature, composition and other complex and critical parameters also become significantly enhanced, and the consumption of materials and energy becomes far less – benefiting both economy and environment.

The transition to continuous production is a challenge for the Danish pharmaceutical and biotech industry. This production technology requires closer and constant monitoring of the manufacturing process and the technology requires development of a wide range of analysis and controls tech-

nologies. However, it also offers an opportunity. By being among the first to convert to full-scale continuous production, Danish companies can gain a number of advantages. Firstly, the enhanced process controls can further improve the quality. Secondly, continuous production allows for greater flexibility and efficiency, keeping costs down.

The goal of a partnership is within a period of three to five years to ensure that at least one production facility based on continuous flow technology is developed and commissioned. Knowhow and experience can subsequently be used widely by the pharmaceutical and biotech industry. The goal is also to demonstrate how continuous production can make Denmark one of the five most competitive countries in which to manufacture pharmaceutical and biotech products.

The solutions developed are expected to be able to increase productivity and minimise faulty production. The solutions are also expected to be able to optimise the production process, raise product quality, utilise energy better and reduce costs. Similarly, the solutions are expected to be able to contribute to enabling both the expansion of production in Denmark and the movement of production operations back to Denmark. The development of continuous production will also be transferable to other business sectors.



*The digital factory can reconfigure quickly*

## 4.3 THE INTELLIGENT FACTORY

In the early years of industrialisation, companies sought to manufacture a very large number of the same products in order to achieve as low a unit cost as possible. In the future, customers will increasingly have individual demands in relation to the products, which requires a completely different approach to organising production.

This means that many small companies, particularly subcontractors, will need to demonstrate flexibility when meeting the changing demands of consumers and large business customers for new and customised components. Production for many customer groups with very diverse needs is a challenge, as it requires a considerably agile production system with the capacity for late product configuration, rapid introduction of new products as well as downscaling and upscaling of production. Therefore, the Danish manufacturing industry must be robust and agile in its ability to create and reshape ideas, knowledge and technologies for products and services that can be sold for a high value.

However, there are many Danish companies that have not yet embraced the new production methods. Small companies in particular face a number of challenges. Today, less than half of these companies have fully integrated information and com-

munication technology (ICT) in their business and production operations. In addition, recruiting employees with the required qualifications is also a challenge often faced by these companies.

The goal of a partnership is for Danish industrial enterprises within five years and within selected areas to develop globally competitive industrial manufacturing on a large scale and for a greater number of small and medium-sized enterprises to gain access to the latest digitalised production technologies and production systems, in which staff at all levels contribute to the ongoing development of intelligent and specialised production.

The solutions developed are expected to contribute to enhancing the ability of small and medium-sized companies to deliver flexible production of high quality and in small series. This will have a positive impact on the export. Similarly, there is potential to increase the number of product and process innovative companies in Denmark. The efforts are to contribute to improving competitiveness and increasing employment.



## 4.4 ADVANCED MATERIALS AS A BASIS FOR GROWTH AND SOLUTION TO SOCIETAL CHALLENGES

Economic growth and solution of a number of modern society's challenges is very much based on constant utilisation of technological advances in relation to materials. For example, it is estimated that 65-70 per cent of future growth within energy and biotechnology by 2020 will arise from the development of advanced materials.

The development of new materials is very much reliant on new analytical tools. In this respect, a number of scientific breakthroughs in recent years have paved the way for studying both hard physical materials and soft biological materials in a far more detailed way than earlier. The companies that make effective use of new material solutions will be better positioned to compete in the global marketplace. Denmark is well equipped to develop and use new material solutions, but there are a number of challenges in this field.

The development of new materials and innovative applications is heavily dependent on research, often with contributions from a wide range of research fields and technologies. This means that few companies are able to undertake this development task on their own. Therefore, development and application of new materials often requires close and strategic collaboration between university environments, research

institutes and companies. The individual company also faces barriers in relation to, for example, securing approval for new material solutions and acquiring sufficient knowledge about the materials' potential. Similarly, companies may lack the expertise to conduct targeted studies.

The goal of a partnership is within five years to halve the time from the new discovery of a material's technological potential to launching commercial production within specific industry-relevant areas. This goal is to be achieved through development of one or more industry portals, which are to function as a universal entry point for companies facing specific challenges in relation to advanced material solutions.

The industry portals will be able to provide the individual company access to a number of instruments at major international facilities as well as provide access to smaller state-of-the-art instruments available in Denmark, for example in university environments or at GTS institutes. Small and medium-sized enterprises in particular will be able to benefit from the efforts. The USA and the UK have had good experience with industry portals, which have had great appeal for companies and promoted their innovation. The portals can thus contribute to growth and job creation through new or better material solutions.



### 4.5 MADE IN DENMARK - SUSTAINABLE FASHION AND TEXTILE PRODUCTION

Global fashion and textile production is extremely damaging to the environment and uses considerable resources. At the same time, the sector is disrupted by underpayment and poor working conditions.

Changing the situation in a sustainable direction is a major challenge because production predominantly takes place in countries where it is difficult for Danish companies to expect compliance with environmental and ethical standards.

However, a development has taken place within robot technology and automation that can make it attractive for countries like Denmark to re-establish domestic production of textiles. With cheaper and more flexible robots, small companies will also have an opportunity to automate a greater part of their production process, which will reduce the impact of payroll costs on overall expenditure.

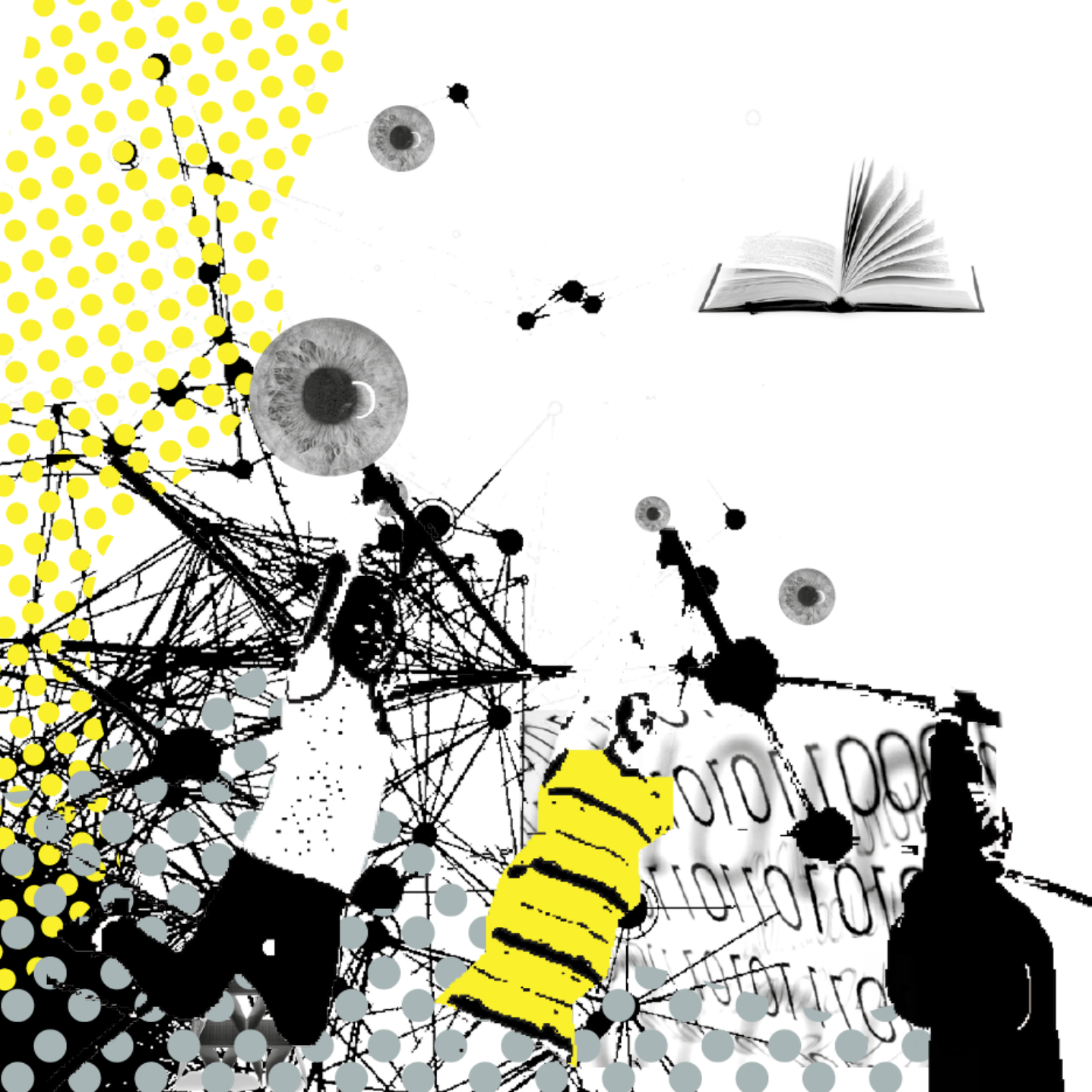
At the same time, designers will gain better access to the production process and thus obtain a better opportunity

to develop new design solutions in collaboration with the manufacturers. Already during the design phase, the product can be integrated in a cradle-to-cradle perspective, so that the product's total impact on the environment can be minimised.

The goal of a partnership is within a period of three to five years to develop specific, competitive solutions within fashion and textile production that reduce environmental impact and resource consumption, for example in the form of an integrated test production facility. Focus is also to be placed on increasing the recycling of materials.

The solutions developed are expected to be able to give the Danish fashion and textile industry greater control over production, including the ethical and environmental aspects. At the same time, it will be possible to brand Danish fashion and textile as sustainable. Lastly, it is expected that the new solutions can be exported and transferred to Danish production abroad.







# 5. INNOVATIVE DIGITAL SOLUTIONS

Information and communication technology (ICT) is gaining increasing societal importance and is an integral part of virtually all areas of society. There is great potential for creating value through development and integration of ICT-based solutions in companies' products. Similarly, there are a number of societal challenges within, for example, health, energy and education that can be addressed more effectively using digitalised solutions.

Denmark is well positioned to tap the potential in the digital field and to develop the solutions of the future. This applies to both the research and business communities. In relative terms, Danish companies invest a great deal in research and development within the ICT field. This research and development is not driven only by ICT companies, but also involves a wider range of companies that utilise the opportunities of embedded IT systems to differentiate their products and services from their competitors.

Within the thematic area, *Innovative digital solutions*, the INNO+ process has identified two proposals for societal partnerships comprising companies, knowledge institutions and public authorities.

A partnership on *A SMART Society based on utilisation of "Big Data"* must create digital solutions that enable a number of societal challenges and opportunities to be tackled in a far more qualified and effective way by gathering and utilising the enormous quantities of data that are created in step with the increasing digitalisation of society.

A partnership on *Digital learning – competencies for the 21st century labour market* must create new competitive digital learning aids and methods that contribute to boosting the population's level of competence through innovative teaching and competence development.



## 5.1

### A SMART SOCIETY BASED ON THE UTILISATION OF “BIG DATA”

Meters that register household water consumption are just one of many examples of how large amounts of data are collected in society. In technical jargon, this is called “Big Data”. The primary purpose of water meters is naturally to give the individual customer the correct reading of consumption, but as with many other forms of “Big Data”, the information can also be used for other purposes. Typically, the utilities company is able to plan its production during the day better when it knows its customers’ consumption patterns. This can facilitate better supply security and enable the company to lower its costs.

The opportunities to utilise “Big Data” are ever increasing. IT systems are embedded in ever more contexts, and at the same time the opportunities for Internet connection are growing. In the example of the water meter, it means that in the future the meter will be able to deliver continuous information to the utilities company.

In a “Smart Society”, “Big Data” will be used to a far greater extent. This can offer great benefits in terms of better utilisation of scarce resources such as water and energy, better traffic flow, public health improvements as well as a more efficient public administration. Within the

business sector, “Big Data” can be used for everything from financial services to optimization of production.

The goal of a partnership is within a period of three to five years to develop 15-25 new IT solutions based on efficient data utilisation. At least ten of these must be subsequently able to document productivity improvements in municipalities, regions, central government authorities or private companies. A digital infrastructure must also be built up with tools that can provide a comprehensive and common digital framework for the collection and use of data as well as an associated marketplace. The ambition is for 1,000 companies within five years of the creation of the infrastructure to use the infrastructure to develop new, relevant products and services for both the public and private sectors. At the same time, the goal is for Denmark to become a leading test and development country in relation to services based on “Big Data”.

The solutions developed are expected to lead to improved data utilisation of benefit to large sections of society. The market for Danish ICT companies that develop tools and products to handle large amounts of data can be strengthened. In addition, the Danish business sector can increase productivity and achieve more targeted product and process innovation.



*Denmark as a frontrunner country within digital learning*

## 5.2

### DIGITAL LEARNING – COMPETENCIES FOR THE 21ST CENTURY LABOUR MARKET

A high level of competence is a precondition for Denmark's ability to compete successfully in the global marketplace. Here, interactive, digital teaching methods are a strong aid to providing education and training to the population.

With a targeted effort in this area, Denmark can strengthen the labour force's competencies and at the same time provide Danish providers of digital learning the opportunity to assert themselves on the global market. The global market for digital learning aids is rapidly growing, and ever more countries are on the look-out for methods for educating and training independent, problem-solving employees, students and pupils.

Denmark holds a strong position in the pedagogical field and is internationally recognised for placing emphasis on participation, commitment and independence in teaching. In addition, Denmark is a frontrunner when it comes to incorporating IT in teaching. Whilst considerable investments are already being made in this area, the initiatives are dispersed and many of the initiatives do not fully exploit the opportunities offered by the digital media. There is a need to gather the initiatives and actors in the field in a targeted and coordinated

effort that can ensure a well-functioning ecosystem for digital learning aids that reflect the latest technological developments.

The goal of a partnership is for Denmark within five years to become a key player in relation to developing, using and selling digital learning aids and learning contexts. In connection with devising solutions, focus must be placed on a number of aspects, such as individualisation and integration of the learning aids, improvement in learners performance, and generation of increased revenue on the domestic market and the export markets for digital learning systems. In addition, the use of digital learning aids must be increased at educational institutions, at workplaces and in in-service training.

The solutions developed will be able to contribute to gearing the population to compete in the global marketplace. In addition, Denmark is expected to be able to tap a growing market potential for digital learning aids that could lead to increased export of technologies and digital solutions that are integrated with pedagogical practices, didactic design and organisation of education and training practice.





# 6. INNOVATIVE ENERGY SOLUTIONS

Scarce resources and challenges to environment and climate have triggered an ambitious green transition within the energy field, not just in Denmark but in a number of countries. In a Danish context, there is focus on reducing energy consumption, using more renewable energy sources and using energy in a cost-effective and intelligent way. It creates a need for new green energy solutions for a Danish but also an international market.

Denmark has strong research and industrial capabilities for creating new green energy solutions for the global market. There is potential to be found in developing competitive energy solutions that can address the challenges associated with the green transition and at the same time contribute to developing Denmark as a showroom for the sustainable and cost-effective energy solutions of the future.

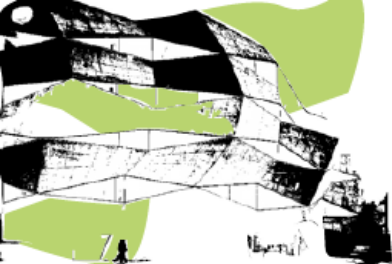
Within the thematic area, *Innovative energy solutions*, the INNO+ process has identified three proposals for societal partnerships comprising companies, knowledge institutions and public authorities. The partnerships are to supplement the efforts that underpin the

existing research, development and demonstration programmes in the energy field and incorporate analyses, etc. from the Danish Energy Agreement.

A partnership on an *Innovatorium for building renovation of world-class standard* must develop and demonstrate solutions for renovating buildings using less energy and fewer resources.

A partnership on *Industrialisation of wind power on an XXXL scale* must develop new solutions for offshore wind power that can tackle the challenges associated with very large wind turbines, and thus contribute to cost reduction and green transition.

A partnership on *Integrated energy solutions – managing energy in the city intelligently and efficiently* must create new solutions within integrated energy systems (electricity, gas, heating and cooling) that contribute to improved energy efficiency, greater integration and use of renewable energy, as well as better energy storage and management of energy consumption.



## *Old buildings with low energy consumption*

# 6.1 INNOVATORIUM FOR BUILDING RENOVATION OF WORLD CLASS STANDARD

Buildings account for 40 per cent of Denmark's total energy consumption and a large part of greenhouse gas emissions. At the same time, the construction industry faces challenges in using solutions that reduce energy consumption. In particular, the process of retrofitting existing buildings with modern energy saving features has been slow. However, Denmark is not alone in facing these challenges, and there are therefore good opportunities for exporting innovative solutions within building renovation.

In the past, the Danish construction industry has devoted only moderate funds to research and development. To reverse this trend, private and public sector parties must join forces to find common solutions. In this respect, public authorities play an important role. Firstly, the public authorities can impose requirements to the energy consumption of buildings and to the products used. Secondly, the public authorities can utilise their role as public contracting authority to set out functional requirements and thereby contribute to promoting the demand for energy sound solutions.

The goal of the partnership is for the construction industry within three to five years to demonstrate sustainable and cost-effective renovation solutions in a small number of full-scale demonstration projects.

These solutions must reduce total energy consumption in existing buildings by 50 per cent after the renovation work, reduce resource consumption throughout the renovation process by 30 per cent with regard to the consumption of materials, energy, etc., and create a productivity increase in the renovation work of 20 per cent.

The solutions developed must contribute to ensuring that Denmark can achieve the goals of reducing its energy consumption and greenhouse gas emissions faster than would otherwise be the case. In addition, the solutions developed are expected to be able to contribute to both higher productivity in the construction industry and growth in the export of energy efficient solutions.



*Wind turbines have grown in size*

## 6.2 INDUSTRIALISATION OF OFFSHORE WIND POWER ON AN XXXL SCALE

The bigger the wind turbine, the cheaper the electricity it can deliver. Therefore there has long been a development in the industry where offshore wind turbines have been made bigger. In this way, it has proved possible to substantially improve the competitiveness of wind power in relation to the other energy technologies.

At the same time, the consideration for climate and the wish to reduce dependence on nuclear power and fossil fuels has led a large number of countries to develop plans to increase the proportion of renewable energy. For example, the EU has set a goal that 20 per cent of Member States' total energy consumption is to come from renewable energy by 2020. Achieving the target will require, among other things, a ten-fold increase in the current capacity of offshore wind power, which is estimated to require investments totalling DKK 1,000 billion.

The Danish wind turbine industry has an international lead position and thus good opportunities to share in the orders for offshore wind power. However, this requires the industry to stay ahead technologically. In this regard, one of the most important parameters is the ability to continue building larger wind turbines and thus reduce the price of the electricity delivered.

However, this is easier said than done. The time has gone when producers could take last season's wind turbine and make the

many different components a few per cent bigger. Development of offshore wind turbines on the scale of XXXL is an increasingly complex task that involves subcontractors, production, research, erection, etc.

The goal of a partnership is to develop new technological solutions for wind power on a large scale that can contribute to making wind power competitive against newly installed coal power plants by 2020. It entails that the costs incurred in connection with offshore wind power in comparable conditions and locations are to be reduced by 50 per cent by 2020, measured by price per megawatt hour. The reduction is to be achieved in relation to the 2010 level. In addition, the partnership can set out sub-targets for, for example, wind power plants, wind turbines, materials, components, foundations, electrical infrastructure, operation, maintenance and logistics.

The solutions developed are expected to have importance for growth and employment in the sector. The wind turbine industry employed 28,000 in 2012, and it is expected that the number of jobs can be increased significantly in the years up to 2020, when wind power in the EU is to be significantly expanded. This also constitutes a potential in relation to creating growth in other Danish industrial sectors, for example among suppliers of materials and transport. Lastly, the solutions developed could also contribute to a more cost-effective transition to a green economy in both Denmark and other countries.

### **6.3** INTEGRATED ENERGY SOLUTIONS – MANAGING ENERGY IN THE CITY INTELLIGENTLY AND EFFICIENTLY

One of the advantages of the traditional energy system, in which a few large power plants were responsible for much of the supply of electricity and district heating, is that it is easy to regulate. In a system with a high proportion of renewable energy, the forces of nature play a role. For example, there are fluctuations in the production of wind, solar and wave energy. Consequently, it requires a far more advanced management of the overall system to ensure that there is always a constant balance between production and consumption. The challenge will be further amplified by the fact that the future will bring many small producers of energy, i.e. owners of small wind turbines, heat pumps, fuel cells and solar heating installations. The energy will be usable in several different contexts. Electricity, for example, could be used for heating and transport made accessible through IT-based solutions. The fact that the energy system will continue to include a number of fossil energy sources, such as oil, coal and gas, will also pose a challenge over a period of several years.

The challenge of an integrated energy system is not something that only Denmark faces. Many other countries in the future will face similar challenges and therefore constitute a potential market for the sale of innovative solutions.

The goal of a partnership is within a period of three to five years to demonstrate and test new energy solutions and to combine already existing solutions in new ways. The solutions are to be tested in a large Danish city, municipality or urban area. Depending on the location's geographical conditions, this will involve launching a number of test and demonstration projects that can integrate more wind energy in the existing electricity and heating supply in order to reach the targets set out in the Danish Energy Agreement of approx. 35 per cent renewable energy and just under 50 per cent electricity production from wind energy in Danish electricity consumption by 2020. It will also involve integrating existing plants and systems for natural gas, district heating and cooling so that they interact with the power grid in a cost-effective way and demonstrating increased use of energy storage.

The solutions developed are expected to contribute to growth and export of energy components and energy systems. In this way, Denmark can strengthen its position as a contributor to the efforts to address the global challenges in the energy field.



# THE INNO+ PROCESS

## THE INNO+ PROCESS CONTAINED FOUR PHASES:

### 1. Mapping of potential focus areas for strategic investments in innovation

In December 2012, the Danish Ministry of Science, Innovation and Higher Education invited a number of stakeholders (trade and industry organisations, ministries, councils and foundations, higher education institutions, etc.) to come up with proposals for INNO+ focus areas with the societal challenges described in RESEARCH2020 – a basis for prioritizing strategic investments in research – as a starting point. All contributions can be found on the ministry's website, <http://www.fivu.dk/en/innoplus>

### 2. Stakeholder dialogue on selection of the proposed focus areas

Based on the INNO+ focus areas proposed – in which almost 500 proposals were submitted by a wide range of stakeholders – five workshops were held in spring 2013 at different places around the country, in which the stakeholders were invited to provide input regarding which proposals should be prioritised.

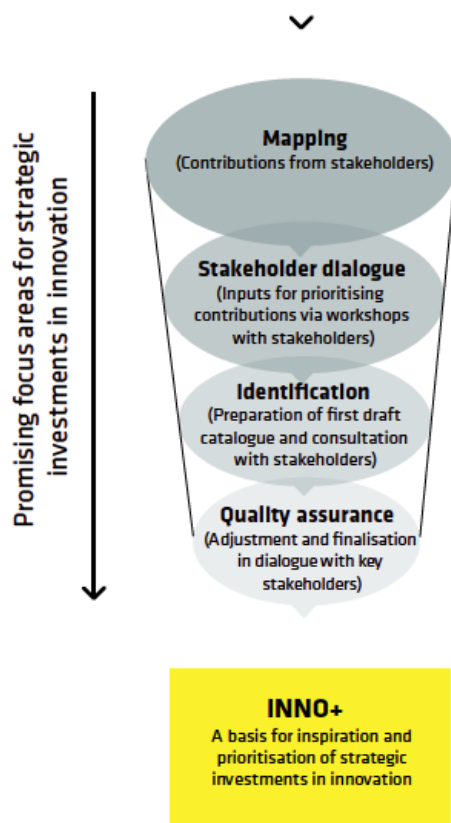
### 3. Identification of thematic areas and focus areas

On the basis of the proposals submitted, the workshops held and the criteria set out at the start of the INNO+ process regarding the formulation of focus areas, the Ministry of Science, Innovation and Higher Education prepared a first draft of the INNO+ Catalogue. RESEARCH2020, Horizon 2020 and the recommendations made by the the Danish government's growth teams were also used in the selection process. The catalogue was subsequently submitted for consultation to the stakeholders in May 2013 and a number of dialogue meetings were held.

### 4. Finalisation of the INNO+ Catalogue

Based on the consultation responses and the dialogue, and in continued collaboration with key stakeholders, the INNO+ Catalogue was adjusted and finalised during summer 2013.

Societal challenges, need for innovation, research and regulation, etc., strengths and capabilities, and potentials



# CONTRIBUTORS

## ORGANISATIONS

AC – The Danish Confederation of Professional Associations  
Danish Agriculture & Food Council  
Danish Association of Architectural Firms  
Danish Dairy Research Foundation  
Danish Engineers' Association  
Danish Fishermen's Association  
Danish Lighting Center  
Danish Maritime  
Danish Patients  
Danish Regions  
Danish Shipowners' Association  
Danish Venture Capital & Private Equity Association  
DANSK BIOTEK  
FOIN  
FTF – Confederation of Professionals in Denmark  
LO – The Danish Confederation of Trade Unions  
Local Government Denmark  
Regional Business Development Centres  
The Confederation of Danish Industry  
The Danish Academy of Technical Sciences  
The Danish Association of Managers and Executives  
The Danish Association of the Pharmaceutical Industry  
The Danish Bankers Association  
The Danish Cancer Society  
The Danish Chamber of Commerce  
The Danish Construction Association  
The Danish Energy Association  
The Danish Federation of Small and Medium-Sized Enterprises  
The Danish Metalworkers' Union  
The Danish Society of Engineers  
The Danish Wind Industry Association

## MINISTRIES

The Ministry of Business and Growth  
The Ministry of Children and Education  
The Ministry of Climate, Energy and Building  
The Ministry of Culture  
The Ministry of Defence  
The Ministry of Employment  
The Ministry of Food, Agriculture and Fisheries  
The Ministry of Health  
The Ministry of Housing, Urban and Rural Affairs  
The Ministry of Social Affairs and Integration  
The Ministry of the Environment  
The Ministry of Transport

## HIGHER EDUCATIONAL INSTITUTIONS AND SECTOR RESEARCH INSTITUTIONS

Aalborg University  
Aarhus School of Architecture  
Aarhus University  
Business Academy Aarhus  
Copenhagen Business Academy  
Copenhagen Business School  
Copenhagen School of Design and Technology  
Copenhagen University College of Engineering  
Danish Business and Technical Colleges  
Danish School of Media and Journalism  
IT University of Copenhagen  
Kolding School of Design  
Lillebaelt Academy of Professional Higher Education  
Metropolitan University College  
National Research Centre for the Working

## Environment

Roskilde University  
Statens Serum Institut (SSI)  
Technical University of Denmark  
The Association of Rectors at Danish Maritime Schools  
The Royal Danish Academy of Fine Arts  
Schools of Architecture, Design and Conservation  
University College Lillebaelt  
University College of Northern Denmark  
University College South Denmark  
University College UCC  
University College Zealand  
University Colleges Denmark  
University of Copenhagen  
University of Southern Denmark  
VIA University College

## COUNCILS, FOUNDATIONS, ETC.

Energy Technology Development and Demonstration Program  
Green Development and Demonstration Programme  
Danish Dairy Research Foundation  
Orphan Disease Council  
The Danish Council for Strategic Research  
The Danish Council for Technology and Innovation  
The Lundbeck Foundation

## GTS-INSTITUTES, INNOVATION NETWORKS, ETC.

Access2Innovation  
Advanced Technology Group  
AgroTech  
Alexandra Institute  
AluCluster  
Bloneer A/S

## Biopeople

BioRefining Alliance  
Copenhagen Cleantech Cluster  
Danish National Metrology Institute  
Danish Sound Innovation Network  
Danish Technological Institute  
DELTA  
DHI  
FoodNetwork  
FORCE Technology  
Infinit  
InnoBYG  
Innonet Lifestyle – Interior & Clothing  
Innovation Network for Biomass  
Innovation Network for Environmental Technologies  
Innovation Network RoboCluster  
InSPIRe  
iPower  
Lean Energy Cluster  
Medicon Valley Alliance  
No Age  
Offshoreenergy.dk  
Partnership UNIK  
Patient@home  
PlastNet  
Service Cluster Denmark  
The Danish Institute of Fire and Security Technology  
The Danish Lighting Innovation Network  
The Renewable Energy Innovation Network  
Water in Urban Areas

## INNO+ TASK FORCE

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## INNO+ THE INNOVATIVE DENMARK

This summary of the INNO+ Catalogue identifies promising focus areas for strategic investments in innovation. The focus areas target fields where Denmark has particular industrial and research strengths and capabilities that can contribute not only to finding solutions that address important Danish and global societal challenges, but also to creating growth and employment in Denmark. The INNO+ Catalogue contains six main thematic areas, subdivided into a total of 21 focus areas.

Finding solutions to the major societal challenges most often requires cooperation between many actors across sectors and disciplines. Each focus area in the catalogue can thus provide a framework for societal partnerships on innovation comprising companies, knowledge institutions and public authorities.

The INNO+ Catalogue emerged from a political wish to improve the basis for prioritising resources for targeted innovation efforts.

The INNO+ Catalogue is the result of an extensive process through which a wide range of stakeholders from industry and interest organisations, knowledge institutions, ministries and research councils, etc. have been involved in identifying the essential and most promising areas for strategic investments in innovation in Denmark.

Read more at <http://www.fivu.dk/en/innoplus>



Ministry of Science, Innovation  
and Higher Education