



DANISH  
TECHNOLOGICAL  
INSTITUTE

ANNUAL REPORT  
2009



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## PREFACE

### KNOWLEDGE IS GLOBAL

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All in all 2009 was a good year for the Danish Technological Institute despite the challenges caused by the economic downturn. Also in times such as these, the Institute manages to continue mastering many of the big challenges facing the Danish business sector and society. Moreover, we continue increasing the international activities undertaken by the Institute. We are selling more knowledge to foreign countries and establishing more international contacts to leading partners and customers in Europe and other parts of the world to attract new knowledge to Denmark.

Today, there are fewer barriers to corporate internationalisation than before. Companies choose to operate where they consider it most profitable. Outsourcing of labour-intensive tasks to low-pay countries has long been a reality, and now the global division of labour is changing shape in knowledge-intensive areas. Meeting this challenge requires great awareness of how to position oneself strategically in the global value chain, either as a facilitator of the full value chain or as a specialist in segments of the value chain.

Rapidly changing global conditions form part of the challenge, as does the manifestly higher frequency at which technology changes. Where shifts in technology once had time horizons of about 5-10 years, the

horizon is now 1-3 years. This means processes and production equipment must be renewed more quickly, and innovative developments must be based on a convergence of design, research knowledge and technology.

The Danish Technological Institute utilises all of its strength in technology and business technology to assist Danish businesses – big or small – with this ever-growing challenge. The Danish Technological Institute also continually strives to utilise and extend its international network for the purpose of acquiring knowledge about new technologies, processes and market trends, and we will continue to update, develop and transfer our knowledge about innovation, business development and productivity at all stages. In the annual report, we have outlined a large number of customer tasks and research and development projects in 2009, a testimony to our ways of approaching the opportunities that global changes also offer the Danish business sector.

This year, we will focus on the new Institute organisation consisting of seven divisions and two business areas, which will be representing the Danish Technological Institute in future. Each division and business area has been given a chapter in which to describe the challenges they face and the themes influencing their work in 2009.

The acquisition of the Danish Meat Research Institute (DMRI) in Roskilde opens new opportunities in the coming year. The Danish Technological Institute acquired a nationally and internationally leading competence centre within innovation, development and research in the meat industry, and the acquisition reinforces the Institute's position as Denmark's biggest supplier of technological services to the food industry and its suppliers. Moreover, we established the Life Science division in which we have gathered Institute competences in developing and analysing chemistry, microbiology and foods. The new division is described in more detail on page 30. Together with our investments in new facilities and our dedicated staff members, this paves the way for an interesting and rewarding 2010.

Enjoy our Annual Report.



Hans Kirk  
Chairman



Søren Stjernqvist  
President

## DANISH TECHNOLOGICAL INSTITUTE – KNOWLEDGE THAT WORKS



### KNOWLEDGE DEVELOPMENT

The Danish Technological Institute, working jointly with Danish and foreign research institutions and companies, develops new knowledge through research and development activities. Developing new knowledge and technologies is the cornerstone of the services the Institute provides.



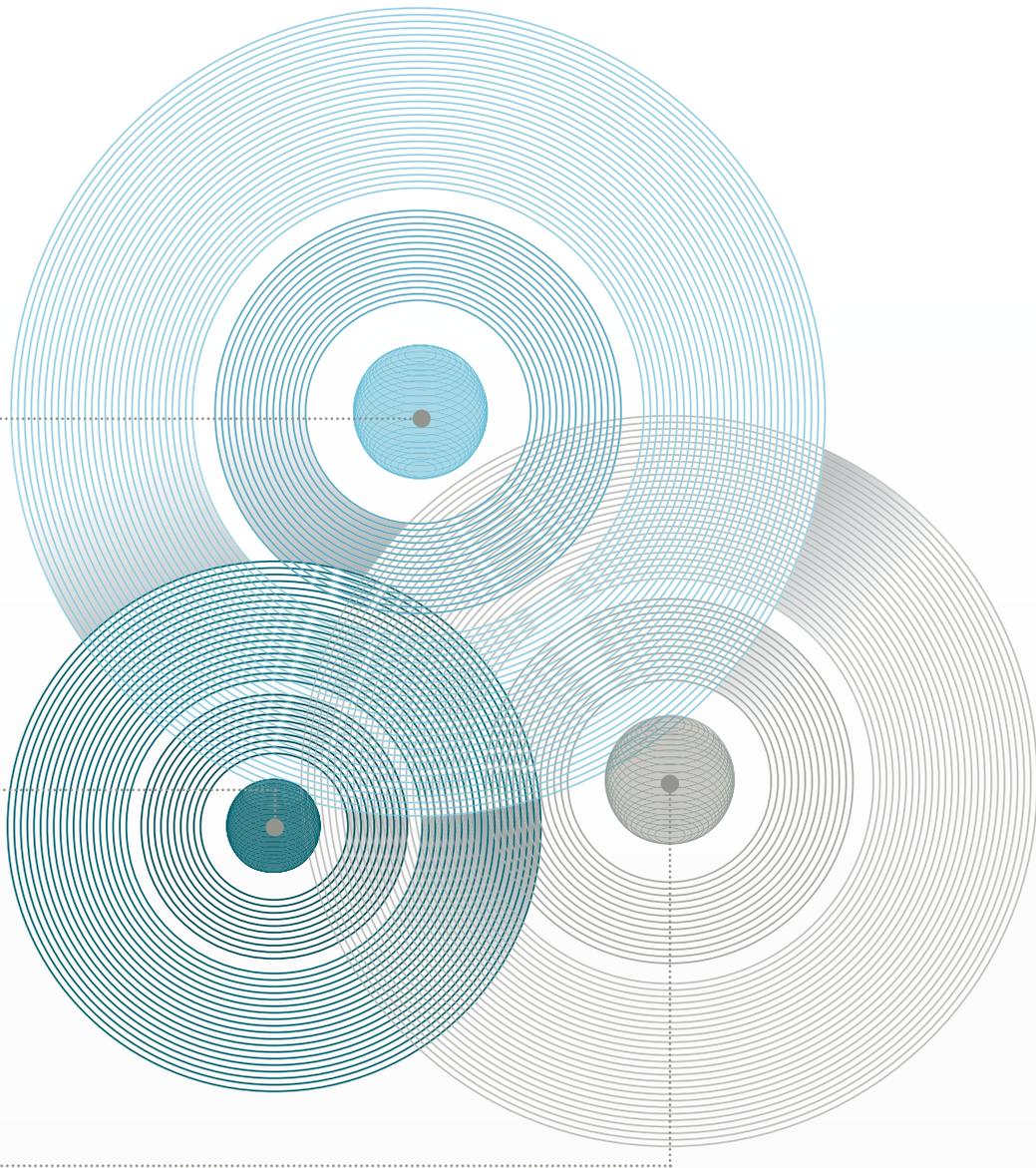
### KNOWLEDGE APPLICATION

New knowledge gives the Danish Technological Institute a basis for providing Danish companies with the assistance they need to meet the challenges of global competition. The Institute applies the newest technologies to develop technological services such as laboratory testing, sampling, calibration and certification.



### KNOWLEDGE TRANSFER

One of the Danish Technological Institute's key tasks is to facilitate efficient knowledge transfer. In its interaction with private companies, organisations and public customers, the Institute transfers knowledge through consultancy, training and networking activities. The Institute's activities cover all areas from courses, secretarial services, operational tasks to unique, custom-built advisory services.



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TRUE RENEWAL,  
REAL INNOVATION

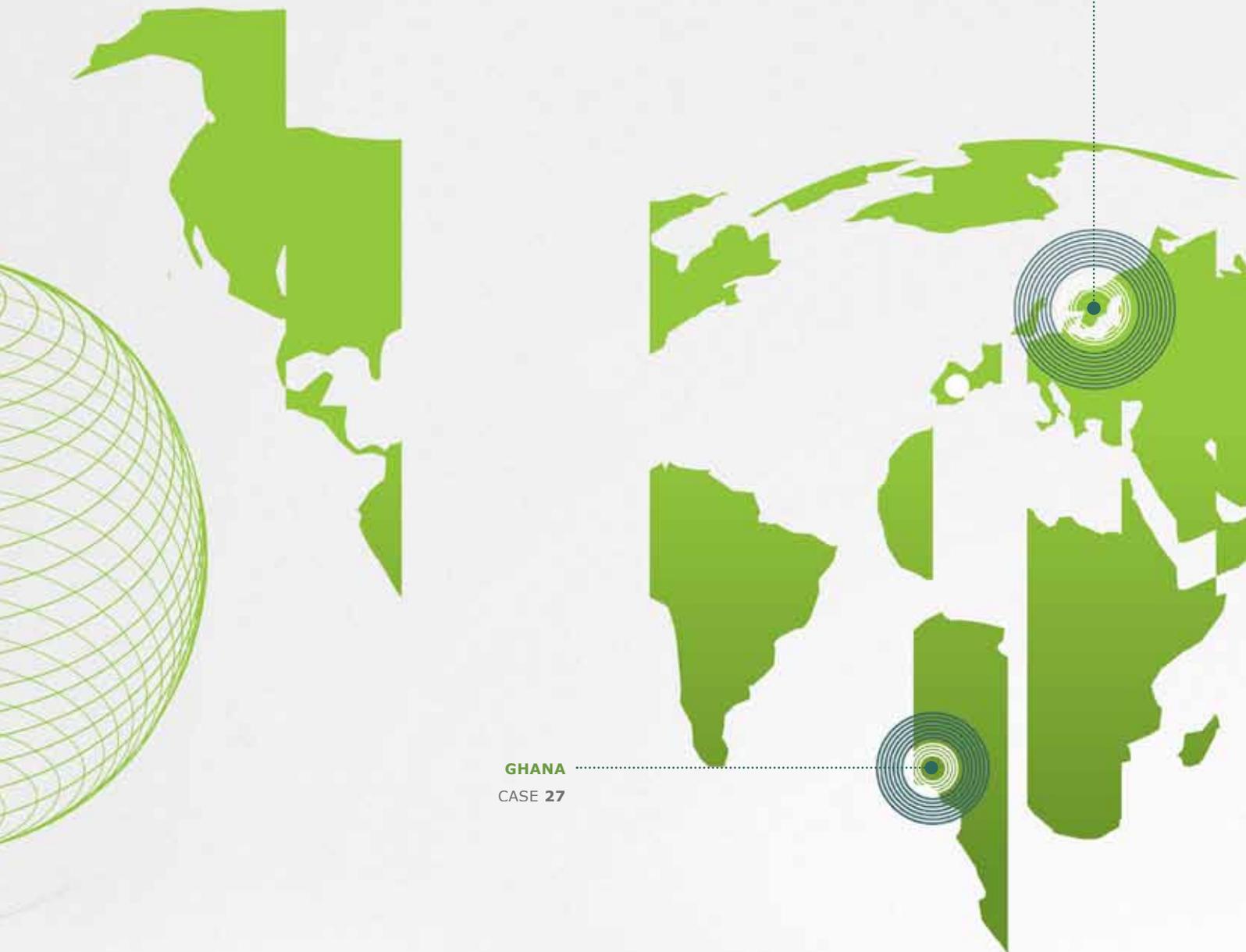
Technology must always serve humanity as something that contributes to job satisfaction and energy for individuals and for progress and growth in society. The Danish Technological Institute's founder Gunnar Gregersen held this attitude, a panoptic perspective that still characterises the Institute's work.

Implementing new technologies in existing and new products demanded by tomorrow's market and applying known technologies in new ways – that is true renewal and real innovation.



**SWEDEN**

CASE 1



**GHANA**

CASE 27

**CHINA**  
CASE 19



CASES

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The construction sector is of key strategic importance to both Danish and European economies. Europe is a major market for Danish construction products and expertise, and as Europe's largest industrial employer, the sector provides jobs for more than 7% of the total labour force. In 2007, more than EUR 1.3 billion was invested in constructions, which corresponds to 11% of Europe's GNP.

Historically, innovation and invention are foreign concepts for the building sector. But globally, the sector has a scale that gives progress, which on the face of it might seem insignificant, major social effects. For this reason, massive investments in sector development, innovation and conceptualisation are paramount.

#### **Development trends – challenges and opportunities**

Typically, the construction sector splits into an industrial segment, which produces building materials, components and equipment, and a building segment consisting of contractors, builders, architects and consulting engineers.

The industrial segment has globalised gradually, and today the vast majority of building material producers work internationally in global competition. By nature traditional and locally based, the building segment of the construction sector is being forced to enhance its professionalisation and internationalisation as a means of countering increasing competence requirements and transparency in

the market. Overall, this process will make the construction sector a more research-based and knowledge-intensive sector, that will, on par with the rest of the industrial sector, continually assimilate new knowledge and technological solutions and adapt them to globalised markets.

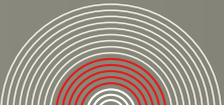
#### **Developments in technology and research**

The challenges and opportunities of the sector give rise to sweeping technology development spanning areas from the ongoing optimisation of existing technologies to giant technological leaps in which knowledge transferred from other sectors and international cooperation will generate actual paradigm shifts.



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## BUILDING TECHNOLOGY



Renewed focus is needed on developing next-generation, energy-efficient building materials, installation and components - and if the already high Danish standards are to be upgraded to new, tougher energy requirements, real technological leaps are needed. Attention is also being focused on combining new technologies to create the best living space overall - i.e. buildings with excellent architectural solutions and physical indoor conditions. After all, consumer expectations to life quality are constantly growing.

Focus also rests on innovating concepts and production methods, both when new buildings are being constructed and the old housing stock renovated. In this area, the

most promising technologies include greater use of digitalisation, which will pave the way for more efficient and faultless construction and for an actual industrialisation of the entire construction process and adjacent processes.

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SWEDEN

Case



## HIGH TECHNOLOGY FOR CONSTRUCTION



Breathtaking, unique architecture, low heating bills, excellent physical indoor conditions, simple maintenance and immense value in use — all included at no extra costs. These are features that coming house owners can look forward to as future development waves hit the construction sector. Development that is set to give the existing level of knowledge a new and exciting dimension.

The Danish Technological Institute is striving to make Denmark the centre of development for innovative building materials and intelligent building components. Such a position would open new markets to Danish producers, thus enabling them, with their unique, knowledge-based products, to gain a strong position in global competition.

### Facade textiles save maintenance

Facade maintenance and cleaning require a great deal of work and can be quite costly. But perhaps facades should simply be dressed in the optimum, tailored textiles that are water and dirt-repellent.

In 2009, the Danish Technological Institute cooperated with the Swedish knowledge centres, the KTH Royal Institute of Technology, the School of Architecture and the Built Environment, the Swedish Cement and Concrete Research Institute

and the Swedish School of Textiles at the University of Borås, on a research project aimed at reducing facade maintenance through use of textiles with functional capabilities. In addition to facades, the construction sector can also use textiles to reinforce buildings and to perform 3D concrete moulding in textile moulds.

### Robot production of unique buildings

With its high mouldability, concrete will play the lead role in future digitally produced architecture. As a partner of the extensive European research project, TailorCrete, the Danish Technological Institute is developing new industrial methods to produce concrete constructions in all-new forms. Other partners include Bekaert, Chalmers University of Technology, Czech Technical University, DesignToProduction, Dragados Offshore, El Caleyo Nuevas Tecnologias S.A, ETH Zürich, Gibotech A/S, Grace Construction Products, Paschal-Danmark A/S, Superpool, Unicon A/S and the University of Southern Denmark.

The project has a budget of EUR 8.7 million and has EU cofinancing. The project aims to ensure that - from design to production - supporting concrete structures can be industrially produced in appealing geometric shapes either at building sites or as precast elements.



Bridges, roads, rail facilities and tunnels cost billions to build and maintain. In future, society will pose even higher requirements to infrastructure. For this reason, it becomes interesting to develop solutions that render infrastructure facilities less costly to construct and easier to maintain while also prolonging their lifetimes.

The Danish Technological Institute focuses on new technologies to monitor the state of constructions like bridges, the purpose being to optimise maintenance. The development of concrete and concrete constructions with extremely long lifetimes further underpins these efforts, as do new and more productive construction methods. All efforts are aimed at protecting societal values while also bolstering Danish consulting engineers and contractors with new knowledge that can be used globally.

#### Sensors prevent moisture damage

The SensoByg project is a partnership between knowledge centres, installation owners and companies – for example moisture experts from Lund University in Sweden. The project builds on sensor technology, its aim being to develop cheap and reliable monitoring systems for bridges and buildings by means of built-in cordless sensors.

The project enables prevention of costly repairs on bridges and tunnels, etc., by means of cordless

sensors able to detect when moisture and hazardous substances that may damage concrete constructions begin to penetrate. Thus, sensors can minimise the need for repairs and also reduce traffic interruptions.

The technology will be used by the Danish Road Directorate and the client of the Fehmarnbelt fixed link.

#### Green concrete – an international success

The Danish Technological Institute has created an international success, the Green Concrete project, which develops, demonstrates and provides consultancy services on environment-friendly concrete constructions. The Institute has also developed and documented new green concretes such as self-compacting concrete, which benefits health and safety while also reducing CO<sub>2</sub> emissions. In the course of 2009, the project was expanded to include a structural survey of an existing green concrete construction, which documents that green concretes have durability comparable to conventional concretes.

In spring 2009, the Danish Technological Institute was invited to lecture on green concrete at the University of Tokyo in Japan. The lectures comprised examples of how much CO<sub>2</sub> one kilo of concrete emits from 'cradle to grave'. These were the first lectures in a string of international meetings set in the context of a Japanese research project.

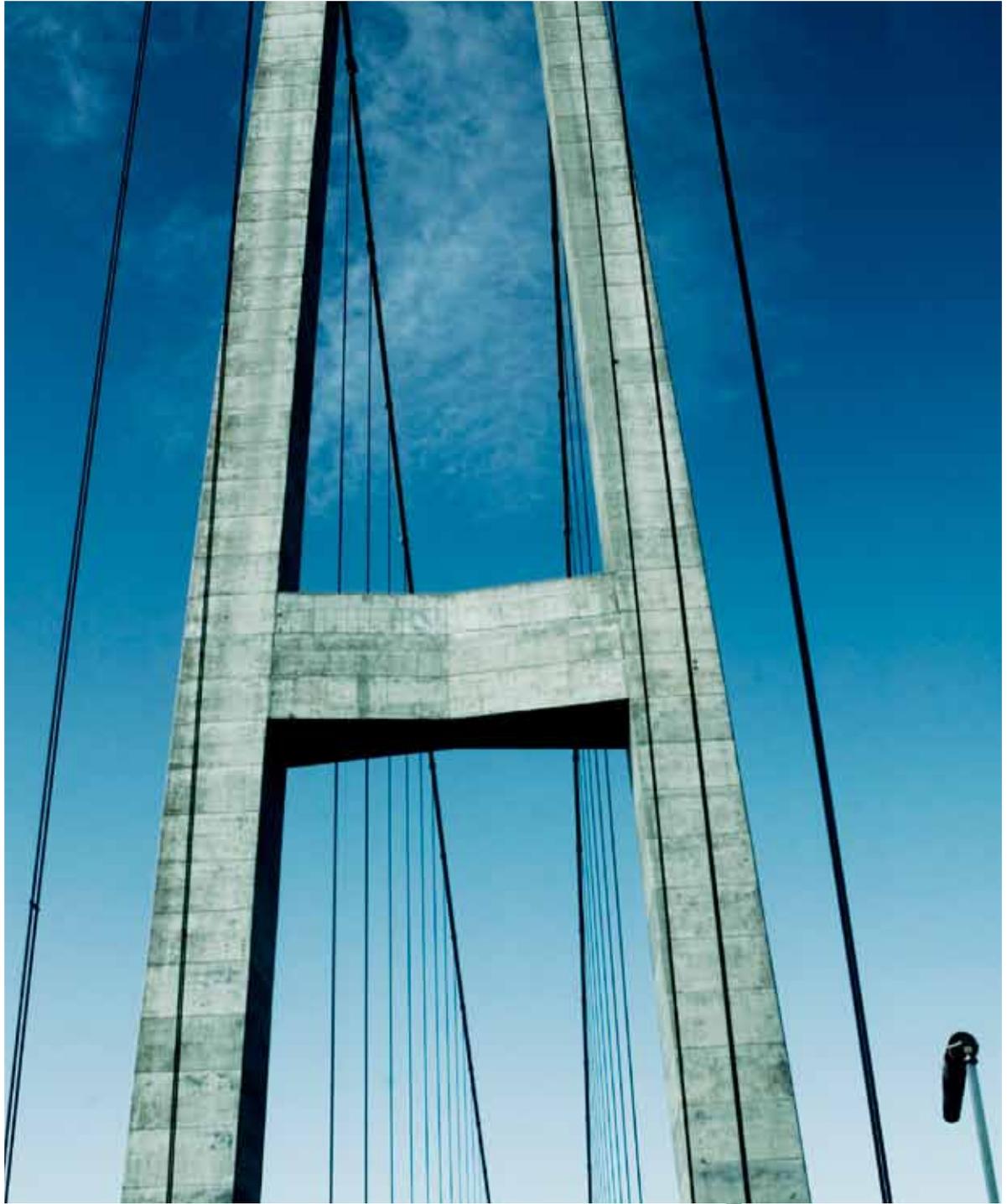


JAPAN

Case

2

SUSTAINABLE  
INFRASTRUCTURE – IN  
MORE THAN ONE SENSE



The construction sector is the largest industrial employer in Europe accounting for 7% of the total labour force; however, this sector is currently shrinking in Denmark. The Danish Construction Association, an industry and employer association, estimates that by 2011 the construction industry will employ 136,500 workers, salaried employees and masters. This is 44,000, or 25%, down from 2007.

**i**



ITALY

Case

# 3

## STANDARDISATION, TESTING AND CERTIFICATION

The value of standardisation is easily overlooked in day-to-day business, but well-defined technical requirements for all products from toys to concrete elements are invaluable. This is especially true, if companies become aware of the requirements as early as possible and have, perhaps, even been able to influence them.

The Danish Technological Institute participates in a number of selected areas in Danish and international standardisation work - not least on behalf of small companies. The aim is to gear Danish companies to future requirements in good time and to activate Danish knowledge internationally.

Similarly, the process gives the Danish Technological Institute time to establish relevant testing facilities and certification to the benefit of the Danish corporate sector. This is

particularly true for the construction sector, where standards, testing and certification interrelate closely with legislation.

### Clothing with high sun protection factor

As the only facility in Denmark, the Danish Technological Institute has been accredited to test and document how effectively textiles protect against ultraviolet solar radiation in accordance with the internationally recognised UV 801 standard. Such documentation will give major retail stores and producers of children's clothing and work clothing an extra sales argument for their marketing. And consumers can obtain important consumer information on clothing.

The test is based on an internationally recognised standard, UV-801, which is constantly being developed and tested in cooperation between the Danish Technological Institute, British BTTG High Performance Materials, Italian CENTRO TESSILE COTONIERO E ABBIGLIAMENTO S.p.A., Spanish AITEX Instituto Tecnológico Textil, Portuguese CITEVE Centro Tecnológico das Indústrias Têxtil e do Vestuário de Portugal, Austrian ÖTI – Institut für Ökologie, Technik und Innovation GmbH, Swiss Textile Testing Institute TESTEX and German Hohenstein Institute.

### European indoor climate label with Danish mark

Jointly with the German Federal Environment Agency, the French Scientific and Technical Centre

for Building, the British Cranfield University, the Finnish Society of Indoor Air Quality and Climate and the European Commission's Joint Research Centre in Italy, the Danish Technological Institute has started the work of defining a common indoor climate label, envisioned as a voluntary label scheme recognised throughout the EU. An indoor climate label recognised across borders will lower testing costs and underpin the international competitiveness of companies affiliated with the scheme - not least if they can immediately translate the Danish climate label into a European label.

The indoor climate label poses requirements to the product in its use phase and covers the product impact on indoor air quality. One aspect focuses on the content of chemical substances in the product, another on the substances discharged to the indoor air. An indoor-climate-labelled product has passed comprehensive testing and carries documentation for its discharge of chemical substance to the air. Ceiling products will also be tested to determine their discharge of fibres and particles.



## DANISH MEAT RESEARCH INSTITUTE

The Danish meat sector is of great importance to society – both as an export trade with a considerable GDP contribution and in terms of employment. Pork is one of Denmark's top export products, with a value of EUR 4 billion in 2008, equalling 50% of total Danish agricultural exports. Poultry exports amounted to about EUR 188 million in 2008, while beef and veal exports ran into EUR 282 million.

Sector employment totals about 90,000 full-time employees (2008), with some 35,000 in primary agriculture and some 21,500 at abattoirs and businesses manufacturing meat products. Finally, the sector generates derived employment for around 35,000 people in trades such as machinery and technology suppliers, supply and

service companies, wholesaling, financing and advisory services, etc.

### **Development trends – challenges and opportunities**

Denmark's history as a large exporter of agricultural products and food, including meat and meat products, goes far back. Competition from globalised markets makes maintaining competitive production in Denmark a major challenge. The abattoir trade is concerned because the number of pigs slaughtered in Denmark has stagnated, even fallen, in recent years, a trend attributable to rising exports of live pigs for slaughter in Germany.

To compensate for the relatively high cost level in Denmark, Danish businesses need to concentrate on

intelligent and efficient production as well as quality differentiation. In order to maintain stable and profitable food production, Denmark must automate processing and handling processes at the production stage as much as possible. Although the abattoir sector has made massive automation efforts in recent years, processes still urgently need further automation and streamlining. New technology in businesses has to be implemented in combination with the necessary competence development of supervisors and employees, and the way work is organised also requires adjustment.

Moreover, in terms of quality – in the broadest sense of the word – food must meet the new and revised requirements and expecta-



tions of the future market. Demands for eating quality, health and safety will continue growing as new, big sections of the population gain purchasing power. Food safety continuously meets challenges on new fronts. Food-borne virus infections thus attract great international attention in relation to both diagnostics and prevention. Moreover, the market calls for ethically justifiable treatment of production animals. In the market, the development of new differentiated products opens doors to different consumer segments, and the innovative food company will know how to create more added value. Global scarcity of fundamental resources and CO<sub>2</sub> problems engender a need to develop sustainable production processes.

#### **Developments in technology and research**

New technology and technological convergence create new or improved solutions in a number of areas. Particularly information and communication technology (ICT) combined with modern X-rays technologies and the latest initiatives in traceability offer great potential for developing innovative systems and solutions that can contribute to business profitability.

Considerable research competences in vision and grip technology are being accumulated and will be applied to developing ultra-flexible grip robot systems. By innovatively combining competences in user preferences, automation, robot technology, processing procedures and industrial implementation, the

Danish Technological Institute aims at finding solutions that will help solve the global challenges facing the food industry.

New processing procedures such as high pressure and new functional ingredients such as vegetable fibres as well as a greater understanding of protein functionality and bioactive components form the basis for establishing a knowledge platform for developing new processed foods. This platform must underpin innovative product development in businesses.



UKRAINE

Case

# 4

## SUSTAINABLE PRODUCTION PROCESSES



Global challenges in the context of the environment and resources call for adaption of production methods. Production must be sustainable, taking into account not only environment and resource aspects, but also ethics and, with respect to animal production, consideration for animal welfare and finances. The purpose is to attain a larger knowledge base for sustainable Danish food production, which remains competitive in the international market.

The target group comprises food producers and the process equipment industry as well as suppliers of raw materials and adjuvants for the food industry. Activities include efficiency improvement in production processes, energy recovery, cleaning optimisation in terms of energy consumption and adverse environmental impact as well as ethics and animal welfare in the treatment of animals to be slaughtered.

### Alternatives ensuring animal welfare

Along with 20 research institutions in Spain, France, England, Norway, Holland, Romania, the Ukraine, Austria, Italy, Germany and Switzerland, the Danish Technological Institute participates in the EU project ALCASDE, which aims to find alternatives to castration of boars.

For ethical reasons, the castration of boars should be avoided. However, meat from non-castrated boars may

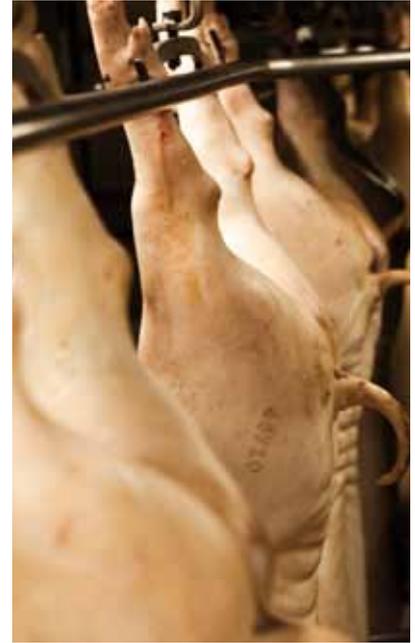
smell and taste differently. If boars are castrated, a method for sorting out the relevant carcasses must be found so consumers can be certain of the quality of the finished products in the refrigerated counter.

The objective of ALCASDE is to examine and analyse needs that can be used for developing a suitable and accepted method for sorting out boar carcasses at the abattoir. In 2009, the project parties ascertained what areas required further work on primary production, sorting methods, consumer analyses and finances.



According to the Danish Agriculture & Food Council, an industry association, Denmark had some 5,800 pig farms in 2008. The Danish pig population totals around 12 million, and pig production is currently concentrated in fewer and fewer but larger and specialised farms. The Danish pig population is highest in Jutland, accounting for more than 75% of the total pig population.

**i**



GERMANY

Case

5

## EFFICIENT AND HOLISTIC USE OF TECHNOLOGY IN THE MEAT INDUSTRY

For a number of years, the Danish Technological Institute has been endeavouring to give coherence to its strategic development, including development cooperation with small and medium-sized sub-suppliers and machine manufacturers.

To improve the efficiency of meat industry production systems, the Danish Technological Institute focuses on developing and applying new high-technology processes and process equipment as well as information and communication technology in production – especially in connection with fresh meat.

### High-pressure technology removes bacteria

Following several years of research and development in high-pressure technology, this effective way of removing unwanted bacteria from products and ensuring optimum durability is gaining a foothold in the meat industry in various countries.

In concert with the German Institute for Food Technologies (DIL), the Danish Technological Institute has expanded the scope of application of the technology by examining

how high pressure can be used to add value to meat products. The Danish Technological Institute has developed a method that allows the technology to be used as an alternative to heat treatment, which makes the meat juicier and more tender, thus improving eating quality.

### Production automation

The Danish Technological Institute regularly develops robots that can help automate abattoir production. In 2009, for example, the Institute developed a robot capable of cleaning the neck of the pig and cutting off its forefeet. The robot was developed in cooperation with SFK Systems A/S.

The robot removes the large glands on the pig cheeks and cuts off the forefeet between the shank bone and the forefoot. The robot performs the job with great precision, and calculations show that about EUR 0.13 can be saved per slaughtered body based on conditions in Denmark. The new robot is able to handle 600 carcasses an hour, thus performing the work of three employees. The robot is the first of its kind in the world and has aroused great interest in Denmark, Germany, Sweden and Finland.



THE NETHERLANDS

Case

## 6

SAFE AND DIFFERENTIATED  
MEAT PRODUCTS

The Danish Technological Institute develops easily accessible solutions that enable food companies to meet consumer and food service sector demands for differentiated products with maximum food safety. The fact that food-borne bacteria are the most frequent cause of gastro internal infections has spurred the Institute to focus on safety in this area.

By developing a tool box for food companies, the Danish Technological Institute has provided them with new manufacturing methods that take into account future demands for quality and safety. The tool box contains knowledge-based tools such as mathematical models, works of reference and process-oriented recommendations.

The primary target group of the Institute is small and medium-sized enterprises without their own quality and product development departments, but with ambitions to supply tomorrow's large segment in the food service sector.

#### New process technologies boost quality

Under the EU-financed NovelQ project, the Danish Technological Institute cooperates with 32 partners coordinated by Agrotechnology & Food Innovations B.V., which is part of Wageningen University & Research Centre in the Netherlands. The partners develop and test new process technologies that can improve the quality and durability of food.

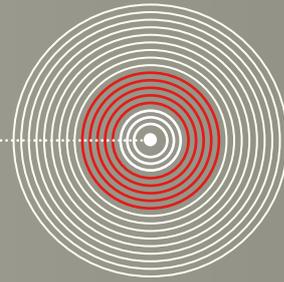
Specifically, the Institute has selected three technologies: Cold plasma, pulsating electric fields (PEF) and high pressure at extra high pressures combined with heat. The aim is to examine how the technologies impact on meat product quality and remove bacteria. Cold plasma is tested for its ability to remove bacteria from product surfaces, high pressure at extra high pressures combined with heat is to remove spores, and we test whether PEF can be used to accelerate curing processes in meat products. The technologies are examined in cooperation between European universities, which are working to develop the equipment and thus assess the industrial perspectives of the technologies.

#### Prediction of product durability

The Danish Technological Institute has developed various mathematical models that can be used for calculating the durability of fresh meat and calculating the growth of meat product bacteria. In 2009, the results were presented at the 55th international congress on meat research and technology at the Bella Center in Copenhagen, Denmark, which gathered more than 500 participants from 47 countries.

The calculation models allow abattoirs and meat-processing businesses easy and quick access to specific knowledge about production factors that may affect the durability and quality of products – merely by entering and possibly changing the values of the digitalised calculation models on the Internet.

## ENERGY AND CLIMATE



The energy and climate sector is one of the future key sectors in Denmark. The sector is experiencing massive progress with increased political attention, increased consumer focus and significant growth in exports. At EUR 8.6 billion, Danish export of energy technology reached a new height in 2008, soaring by 19% from 2007 to 2008, although the financial crisis affected growth in 2009. Climate sector progress is less pronounced, but the anticipated climate challenges may spur more growth in the sector.

Energy and Climate comprise all types of energy and energy technologies from energy production, storage and distribution for use in buildings, industry and transportation. The area also covers reductions of anthropogenic climate gasses and climate change solutions such as systems for local handling of rainwater

and improved drainage systems for large volumes of rain.

### **Development trends – challenges and opportunities**

The 2009 energy policy report envisions a Denmark that becomes independent of fossil energy sources. Gross energy consumption in 2020 must be reduced by 4% compared with 2006, and 20% of gross energy consumption in 2011 must come from renewable energy.

Internationally, Denmark has committed itself to ensuring that renewable energy will constitute 30% of net energy consumption and 10% of energy consumption in the transport sector by 2020. Together with the considerable structural changes in the energy sector, Denmark faces massive challenges when it comes to implementing energy savings

and integrating energy sources and systems.

Denmark already has a unique energy system with a large proportion of renewable energy, a nationwide natural gas grid, broadly distributed electricity and heat production and efficient energy consumption in the industrial, public and private sectors. However, renewable energy will be a central element in the energy system of the future, and fossil sources should be used only during peak periods and for backup. This requires major investments in infrastructure and new energy storage technologies, as production from renewable energy sources fluctuates considerably.

Businesses and consumers want to be energy and environment conscious but not at the expense of sta-



ble supplies or comfort. This places demands on the solutions developed and implemented, but also makes it possible for Denmark to be at the forefront in the energy area. Denmark's international commitment to reducing greenhouse gas emissions by 20% from 2008 to 2012 compared to 1990 under the Kyoto Protocol and reducing greenhouse gas emissions not subject to emission allowances by 20% by 2020 compared with 2005 also necessitates further focus on how to reduce climate impact. Finally, the need to develop climate adjustments will increase considerably, since climate changes in Denmark are generally acknowledged as unavoidable, particularly in the form of higher temperatures and heavy precipitation.

COP15 in Copenhagen was expected to boost this development further.

Although this was not the case, Denmark's and the EU's energy and climate policies seem likely to be maintained.

#### **Developments in technology and research**

As the amount of renewable energy in the Danish energy system increases, the electricity, heat, gas and transport areas will have to be integrated. New technologies must be researched and developed to solve the system imbalance. New products, systems and management models need to be developed to minimise conversion loss. Research into efficient methods to procure new biomass is also required.

In addition, sophisticated solutions to constructing energy-efficient buildings in future must be developed. Focus will be on second genera-

tion energy savings in industry and service. The transport sector will require components for electric and hybrid vehicles, including fuel cells and batteries. Strong climate gasses need to be phased out faster. Solutions for local handling and using large volumes of rainwater need to be developed, and climate issues in the construction industry must also be solved. Furthermore, energy and climate technology will have to be upgraded and supplementary training in the technology provided at all levels.



CHINA

Case

## 7

## ENERGY CONSUMPTION IN BUILDINGS – A GLOBAL CHALLENGE



The Danish Technological Institute wants to return Denmark to the forefront of the energy and climate sector, in which heating and ventilation of homes are the most energy and CO<sub>2</sub> intensive. Forty percent of Denmark's energy consumption stems from buildings, which offers a massive potential for savings but also means lot of barriers.

For this reason, the Danish Technological Institute opened a knowledge centre for energy savings in Høje-Taastrup in 2009. Workmen, contractors, technical advisors, energy consultants, suppliers and small companies in the construction industry can contact the knowledge centre to learn more about the practical possibilities of limiting energy consumption in buildings. A knowledge based on the most recent national and international research.

A consortium under the Danish Energy Agency consisting of the Danish Technological Institute, Danish Building Research Institute/Aalborg University, Viegand og Maagøe and KommunikationsKompagniet A/S are responsible for the establishment and day-to-day operations of the centre in cooperation with Danish Energy Association, Technical University of Denmark and Sebra A/S as permanent subcontractors.

### **EnergyFlexHouse**

With EnergyFlexHouse, erected on the Danish Technological Insti-

tute's premises in Høje-Taastrup, the Institute has created a new framework for companies to develop and test energy-saving technology for the construction industry. Two houses have been constructed as low-energy buildings using renewable energy, which covers the total energy consumption of each building. Annual energy consumption is thus 0 kWh.

As part of EnergyFlexHouse, the Institute teams up with innovative Danish companies and knowledge environments to develop and test energy-efficient technology and the control systems and user interfaces that get ordinary people to use the technology properly. The development and test centre consists of two similar houses – one for technology development and one that a number of test families will inhabit for short or long periods of time in the coming years. The first test family moved in during October 2009.

The business basis of EnergyFlexHouse must be ensured through international knowledge development and research and development work with companies and the related technological services. The effort is enhanced through international contacts anchored in innovation centres in Silicon Valley, Shanghai, Munich and universities in the countries where the various centres are located.



GREAT BRITAIN

Case



## ELECTRIC CARS – ENVIRONMENT- FRIENDLY TRANSPORTATION



For some time, the Danish Technological Institute has been focusing on electric cars. Technology studies and practical measuring assignments have boosted competences in battery testing and consultancy. As a result, testing, development, consultancy are now available, as well as courses and electrical safety in electric cars for auto repair shops.

Electric cars are an important feature of the Danish energy system. Electricity as fuel is much more energy efficient than petrol and diesel. Electrical transport reduces emissions, noise and the fossil fuel dependency of road transportation. Electric cars play an especially important role in increasing the share of wind turbine energy in the Danish electricity system while also considerably reducing CO<sub>2</sub> emissions.

The Danish Technological Institute is in charge of the 'Prøv1elbil' project, the first of its kind in Denmark. The project tests 13 cars of which eight electric cars are placed at the disposal of private families in the Horsens and Juelsminde areas of Jutland for three months at a time. The coming years are expected to bring considerable and increasing interest in electric and hybrid cars, which are exempt from vehicle registration tax until the end of 2012.

### Electric cars for COP15

The Danish Technological Institute succeeded in its ambition of showcasing electric cars during COP15. Car rebuilders in Italy and Great Britain were assessed, and a Citroën C1 remade into an electric car in Great Britain was selected. The electric cars were used at COP15 events and now form part of various tests.

As the Road Safety and Transport Agency's authorised test laboratory, the Danish Technological Institute was charged with testing and providing approval documentation for the Citroën C1 electric car under the Road Safety and Transport Agency's new requirements. The Citroën C1 electric car is the first electric car rebuilt from a conventional car to receive the approval of the Road Safety and Transport Agency. The Danish Technological Institute now offers a full 'approval package' to companies wanting to remodel a conventional car into an electric car.



PORTUGAL

Case

9

## RENEWABLE ENERGY



The combination of soaring energy prices and climate changes has intensified the focus on renewable energy technologies. Denmark has been working with these technologies for 30 years and has accumulated extensive competences in the field, both in terms of technology and the market. Thus, Denmark should continue to focus on developing this area, especially since Denmark could gain an advantage by targeting development efforts towards integrating and establishing cooperation between various RE-technologies and fossil energy sources.

### International trading in biomass

Under the pan-European project EUBIONET 3, which runs between 2008 and 2011, 18 countries are cooperating on increasing companies' opportunities to trade in biomass internationally. The participants include Dutch Utrecht University, Italian Università degli studi di Firenze, Portuguese Centro de Biomassa para a Energia, Slovenian Energy Restructuring Agency (ApE), Spanish Agencia Andaluza de la Energia and the British Imperial College of Science, Technology and Medicine.

The project aims to create a more efficient and transparent European market for trade in biomass. This is primarily a matter of creating transparency between price and

quality across borders and identifying what constitutes sustainable trade in biomass.

The project participants will prepare a proposal for a new European certificate by clarifying supply chains, describing international codes for both import and export of biomass and providing product declarations according to European standards. The certificate must document that the biomass is produced according to pan-European and sustainable criteria.

Trading in biomass for fuel is still relatively new, and there remain massive volumes of biomass to be traded. In addition to traditional biomass, the Danish Technological Institute considers finding new resources important, for which reason it has taken responsibility in the project group for uncovering alternative and unexploited biomass resources in the various participating countries.



USA

Case

10

## NATURAL REFRIGERANTS

Denmark is at the fore of green CO<sub>2</sub> cooling technology. Denmark was the first country in the world to introduce a ban on all synthetic gasses in cooling systems, effective from 1 January 2007. Danish supermarkets – especially small ones – have been quick to adopt the new technology – one reason being the tax levied on use of greenhouse gases for cooling in Denmark. Moreover, the new CO<sub>2</sub> technology helps lower operating costs for supermarkets compared with conventional HFC technology – e.g. because the use of CO<sub>2</sub> as a refrigerant results in reduced energy consumption.

### The Danish Technological Institute receives EU award

Together with Danfoss, Knudsen Køling and REMA1000, the Danish Technological Institute has received an EU award for a project to develop and demonstrate CO<sub>2</sub>-based cooling systems for supermarkets. The project has promoted the use of CO<sub>2</sub> as a natural refrigerant and ensures the supermarkets financial savings.

In the winning project, the Institute built a CO<sub>2</sub>-based system in the laboratory and intensively tested its cooling capacity, energy efficiency, safety and functionality over an extended period of time. The results were so good that Danish supermarkets now naturally choose to invest in decentral cooling systems based on this environment-friendly technology for keeping beverages and food cold in the shops.

The award is a recognition of the Danish Technological Institute's work and expertise in the cooling area – also on an international scale, in which the Institute attracts customers from countries like Sweden, Norway, Great Britain, Germany and Japan.

### CO<sub>2</sub> as refrigerant

In 2009, the Danish Technological Institute participated in the EU project NARECO<sub>2</sub> – NATural REfrigerant CO<sub>2</sub>. The project has prepared a handbook to help raise awareness of the considerable potential of using CO<sub>2</sub> as a refrigerant. The handbook is a tool for electricians, teachers and students. The handbook offers practical information about installing, dimensioning and maintaining cooling systems but also serves as a guide for people wanting to learn more about the potential of natural refrigerants.

NARECO<sub>2</sub> was completed at the Atmosphere 2009 conference in No-

vember. Other project participants included the Belgian Limburg Catholic University College, Norwegian SINTEF, Italian University of Padua, Swedish Royal Institute of Technology, German Bundesfachschule Kälte-Klima-Technik and Belgian shecco.

### Groundbreaking piping

With its 51,000 members, ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) is a leading player in the cooling area. ASHRAE initiates and supports research activities in cooling and includes the results in the international and highly respected 'ASHRAE Handbook'.

In CO<sub>2</sub>-friendly, industrial cooling systems using ammonia as a refrigerant, the piping usually runs along the roof, which puts special demands on piping design. Together with University of Wisconsin-Madison, ASHRAE chose the Danish Technological Institute to conduct a project on developing better piping for ammonia systems. The Institute was selected on the basis of its unique laboratory facilities and its innovative proposal for the test plan design. Being part of the ASHRAE development programme has given the Institute access to unique knowledge, which strengthens the Danish position in CO<sub>2</sub> reduction.



## BUSINESS DEVELOPMENT

Business Development focuses on the possibilities and uses of technology in private and public companies and operates in the zone between technology, organisation and employees/managers and end users. The basic idea is that man's ability to use technology innovatively produces competitive advantages and creates cohesion in a knowledge-based society.

### **Development trends – challenges and opportunities**

As a result of greater global specialisation and developments in information and communication technology, gaining a leading position in profitable and niche markets depends more and more greatly on the ability to take new knowledge and turn it into innovation. This engenders a need for

comparative insight into sector developments, market conditions and how political means are implemented in other countries.

A key to success will be the ability to utilise in-house resources as well as external relations to spot and develop new knowledge and potentials and attain a position in the value chain precisely where new opportunities develop. In this respect, you need to know how to future-proof the labour force in a globalised world and how best to build competences systematically in the light of new conditions in the employment area.

A need exists to develop new models and analyses for understanding trends, erosion of industry barriers, possibilities of technological

convergence and the optimum development and use of companies' competences, networks and resources – to read the global challenges and apply the relevant innovation processes to find the most effective solutions. Business strategies based on an international platform are especially critical for the many small and medium-sized enterprises working as sub-suppliers.

### **Developments in technology and research**

The innovative use of existing and new technologies represents an enormous opportunity to create growth and welfare. Information and communication technology contributes half of Europe's productivity growth, and the continued use of technology in business



is essential to a dynamic and competitive society.

The innovative, efficiency-enhancing and user-oriented use of technology can offer solutions to Danish and global challenges such as climate change, the burgeoning pensions bill, company competitive power, new services and the need for more efficient work processes. To ensure continued growth and innovation, Denmark must acquire international knowledge and implement the resulting technology sustainably. The acquisition and use of new technology often make new demands as regards how to develop employees' and managers' competences and organise the company or the public sector. This calls for new perspectives and ideas when it comes to how best to

use technology – also with respect to users, their lives and work.

New technology also paves the way for new and improved forms of communication and cooperation – both among citizens themselves and in their interaction and communication with public authorities and companies. The Danish Technological Institute has, for example, helped identify best practice for developing and implementing digital government for the European Commission. Digital government is to help reduce the administrative burden on small and medium-sized enterprises and to facilitate citizens' communication with the public sector. The host of innovative measures was presented under the title everyday government.

Companies also use the new digital forms of communication to reach their target groups and customers in a broader fashion and thus involve them in developing products and service solutions. A team of consultants works across divisions to ensure that the many small and medium-sized enterprises are aware how e-business solutions can enhance the efficiency of business procedures and sales channels. Moreover, new technology plays a key role in terms of using core competences in dynamic value chains and networks, just as new technology offers new and often interactive possibilities in relation to competence development and learning as regards work practice.



BELGIUM

Case

# 11

## SERVICE INNOVATION



Service is a key business area. Firstly, the service sector is expanding rapidly, and, secondly, the manufacturing sector is becoming increasingly service intensive. But knowledge about service innovation is insufficient – not least in terms of the big differences between and conditions for service innovation in the various service industries.

This being the case, the Danish Technological Institute aims to stimulate interaction with international knowledge communities and create political initiatives that promote service innovation. The objective is to be able to translate international knowledge into innovation models and development measures that are practicable and have been adapted to small and medium-sized Danish enterprises as well as the public sector. The Danish Technological Institute also endeavours to strengthen service innovation through new business models and systematic methods for organisational and competence development as well as through tools for assessing and measuring their effects.

The Danish Technological Institute is part of an OECD working group tasked with acquiring more in-depth knowledge on how to further the process of ensuring that development measures lead to service innovation.

### IT sector competitiveness

In 2009, the Danish Technological Institute completed an analysis on behalf of the European Commission intended to determine the competitiveness of the European IT service sector. Among other things, the analysis focused on how differences in framework conditions can impact companies' competitiveness.

Data from the OECD and Eurostat shed light on development trends in a number of key areas such as private-

sector investments in research and development, the number of newly established companies and growth in these.

On balance, the analysis painted a varied picture of development trends and the strategies pursued by the companies in the sector. Moreover, the Danish Technological Institute prepared recommendations for possible initiatives that the European Commission, trade organisations and member states could take to boost the competitiveness of the European IT service sector.

### Training and education of tomorrow

The Danish Technological Institute analyses different forms of training and education on an ongoing basis. In 2009, for example, the Institute completed an analysis of the need for new educations in sports as an experience trade.

As a follow-up to the Danish Globalisation Council recommendations, a committee was appointed to future-proof vocational training and education. The committee decided that a body was needed to help identify development trends across existing industry structures. This was the third consecutive year that the Institute handled this task in which analyses based on statistics, forecast methods and job function analyses in pioneering companies shed light on development trends.



USA

Case

# 12

## NEW FORMS OF INNOVATION



Innovation is essential to development, growth and welfare – not least in Denmark where we are typically unable to compete on costs. The challenge facing companies therefore lies in creating added value through new positions in the value chain and development of services beyond the core product.

Often, different forms of innovation interact – e.g. user and employee-driven innovation, open innovation and complex innovation deliveries, including partnerships, strengthened public and private interaction as well

as of the development of welfare services.

Against this background, the Danish Technological Institute aims to acquire forms of innovation and processes from leading knowledge centres across the world and to adapt and develop this knowledge so that efficient innovation and development tools are available to small and medium-sized Danish enterprises. The Danish service sector has been growing in recent years, and companies in the manufacturing sector have become more service-intensive.

### User knowledge as a platform for innovation

In the AUTO (Active User TOpol-ogy) project, companies, educational establishments and research entities cooperate on models to ensure user involvement in innovation. The vision is to create a tool that can pave the way for a dialogue between companies, their active users and companies' specific innovation activities.

Thanks to their cooperation with the MIT Sloan School of Management and Harvard Business School, the Danish Technological Institute and the Copenhagen Business School have been able to obtain project design input from the foremost experts in lead user and user-driven innovation. The practical implementation of user-driven innovation was studied in the Netherlands, where the faculty of Industrial Design Engineering at the Delft University of

Technology and a host of other Dutch companies helped inspire the work.

The AUTO project is funded by the Danish programme for user-driven innovation.

### Clusters create growth

Cluster cooperation between companies that specialise in different areas creates growth. The Danish Technological Institute therefore provides assistance in establishing growth groups and clusters at regional, national and international levels – in this way helping to improve corporate development and competitiveness as well as helping companies to understand the importance of focusing on development, innovation and the acquisition of international knowledge.

The Danish Technological Institute helped establish a range of clusters, including the new cluster in medico innovation in Region Zealand and the Capital Region of Denmark. The greatest cluster development in 2009 was the merger of the CenSec (cluster focusing on the development of a strong defence and security industry) and the Danish space industry cluster. For instance, the cluster attended a workshop at the Danish Technological Institute, also attended by representatives from the National Aeronautics and Space Administration (NASA). Two of the participating companies subsequently signed bilateral agreements with NASA on technology transfer and knowledge acquisition for Denmark.



The Danish Technological Institute's activities in life science are aimed at the food and environmental industries and the health and welfare industries. With exports exceeding EUR 40 billion and more than 300,000 employees, Denmark holds a strong position in the area. An area that will remain vital for Danish business in the future. For a number of years, the Danish Technological Institute has been working with life science in various contexts. In 2009, the Institute intensified its focus, gathering the various expert competences in a new life science division. The Institute spearheads top-level research and development projects, advisory services and laboratory analyses in food, environmental technology, health and welfare technology.

#### **Development trends – challenges and opportunities**

Denmark can play a central role in providing technology to solve global shortage of basic resources like water and biomass for food and energy purposes. Market possibilities exist for new sustainable technologies, particularly as regards the sustainable use of bio-resources when high-value products are extracted and when water is handled and cleaned.

The busy and sceptical consumer of tomorrow engenders an acute need for innovation and rethinking in the food industry. Greater attention will be focused on food safety and the sustainability of production processes. At the same time, a growing number of people

will eat their meals outside the home. These trends create a need for large-scale development of new products based on quality raw materials that can be prepared locally. Moreover, the population is ageing and the incidence of life-style induced diseases rising sharply, both trends which create demand for new and specialised food products in segments such as older people, children and overweight people.

As in the rest of Europe, pressure on the Danish health sector is mounting. Consequently, new technologies need to be developed to ensure people a better life through disease prevention, self-help assistance and better treatment. Accordingly, obvious growth areas for Denmark include developing



## LIFE SCIENCE

new welfare and health technology and eliminating barriers to efficient implementation of technologies.

### **Developments in technology and research**

Technology development opens up for new diagnostic methods, pharmaceutical development and disease treatment. Developments in biotechnology have made the development of protein-based pharmaceuticals more targeted and allowed the beneficial effects of food in respect of e.g. hereditary diseases to be documented. At the same time, molecular-biological methods have increased understanding of the microorganisms that cause infections. In the long run, this may prevent global diseases like treatment-resistant tuberculosis.

New technology in chemistry and biotechnology has boosted knowledge about chemical and biological transformation processes and resulted in new green technology. Green chemistry and biotechnology form the foundation of future environment-efficient cleaning technologies and underpin the sustainable use of bio-resources when high-value products are extracted from residual products and waste.



KOREA

Case

# 13

## GREEN GROWTH – CLEANER PRODUCTS AND PROCESSES



Sustainable growth in a society focusing on climate and the environment requires new technology. Denmark has made great strides in the environmental area and has a great potential for extending this strong position by developing new, green technologies that suit Danish companies.

As a result, the Danish Technological Institute is cooperating with both Danish and foreign universities, institutes and companies to acquire the knowledge base that will enable it to develop new environmental technologies and green services for Danish companies to market globally.

This might include sophisticated oxidation processes for water treatment, new encapsulation technologies for reducing environmental and health-hazardous substances or a process for extracting high-value products from waste, residual products or biomass.

### Greener and more durable wood protection

Drawing inspiration from the most recent international research in medical 'drug-delivery', the Danish Technological Institute worked together with Dyrup and VELUX on developing a method to control how the active compounds of wood protection are released.

Based on micro-encapsulation, the method optimises the use of the fungicides used to reduce the environmental load and increase the life of the wood.

### Higher biogas yield

As partner in the Danish Centre for Verification of Climate and Environmental Technologies (DANETV), the Danish Technological Institute verifies environmental technologies. Experiments done in 2009 have shown that

the companies Green Farm Energy A/S and Xergi A/S can produce more biogas with shorter retention time in the reactor when the fertiliser has been pre-treated through pressure boiling and the addition of base before entering the biogas plant.

Since this type of documentation is recognised in the USA and Canada, the new verifications are expected to give Danish companies an edge in the rapidly growing market for environmental technology.

### Optimised control of manure separation

In the project 'Chemical manure separation, optimised control concept' the Danish Technological Institute and AL-2 Agro A/S, among others, have identified the properties of mink and pig manure for the purpose of integrating the automatic regulation of polymer and iron dosing based on physical and chemical characterisations. This optimises the use of chemicals, thus creating a better end product.

Pig and mink farmers are keenly interested in separating raw manure and controlling the distribution of nutrients such as phosphor and nitrogen. The amount of such nutrients in manure is often the factor that limits the number of livestock per farm area. Manure separation plants have been established in Moldova, the USA, Finland, Canada, Korea and Denmark.



Smaller companies can be innovative and technologically advanced. This is true for e.g. small Danish biotech companies in the health sector, which often focus on diagnosis, regenerative therapy, individualised treatment or 'drug delivery'.

The Danish Technological Institute cooperates with the Danish health sector, foreign universities and companies in the medico and life science sector to give small Danish companies access to the latest knowledge in their own fields and, not least, adjacent fields. The Institute also focuses on transferring knowledge and technologies from related areas such as food and environmental technology.

**A step forward for stem cells**

Stem cells for treating a number of diseases have the potential to become the greatest leap ever experienced by the health sector. To strengthen this field in Denmark, the Danish Technology Institute is cooperating on stem cell research with the University of Regensburg, Germany.

This field has engendered cooperation between the Danish Technological Institute and the medico company ORIGIO A/S. The objective is to create a basis for innovative growth media that allow stem cells to be grown and differentiated with a higher degree of certainty and control – a development that

will help pave the way for new and efficient types of treatment.

**Chemistry for two-year-olds**

In 2009, the Danish Technological Institute helped map and analyse the content of chemical substances in various products that two-year-olds come into contact with in course of a day.

The Institute performed the task on behalf of the Danish Environmental Protection Agency as part of the '65,000 reasons for better chemistry' campaign. The information campaign uses this slogan because in any given year there are 65,000 two-year-olds in Denmark, each of which gives good cause to improve the chemistry in our everyday lives. Interest in mapping and understanding the chemical substances to which small children are daily exposed is keen since many of the substances used in everyday products are suspected of causing hormonal disturbances and allergy.

The Danish Technological Institute has developed a special competency in mapping and analysing chemical substances and did work for, among others, the Norwegian Climate and Pollution Agency.



GERMANY

Case

14

HEALTH TECHNOLOGY WITH MASSIVE POTENTIAL



As its core service to the oil industry, the Danish Technological Institute maps and monitors microbiological growth in oil industry water systems. Against this backdrop, the Danish Technological Institute has created a comprehensive tool box that includes chemical analyses, DNA-based mapping of bacteria growth, monitoring of systems, problem-solving and courses. These tools developed in the past years make the Institute the global leader in the commercial market for molecular-biological analyses in the oil industry.

Institute is helping Mærskolie og Gas AS test a new Danish ceramic membrane technology developed by CoMeTas. The studies must clarify whether the technology facilitates the operator in treating water from the underground and thus in making it reusable.

#### Investigation of acidification

In 2009, the Danish Technological Institute mapped sulphide-formation in the South Arne Field in the Danish part of the North Sea for the operator HESS Danmark ApS.

The international oil industry needs technological service to fight against sulphide-creating bacteria, which lower the oil price and increase corrosion in the costly plants and systems. The Danish Technological Institute has successfully held international conferences giving the oil industry insight into the competences and offers the Institute has in this area – while also enabling the Institute to accumulate knowledge about industry needs.

Routine monitoring revealed no signs of bacteria growth, but a mapping using DNA-based methods revealed mild acidification of the oil reservoir despite extremely high temperatures and sophisticated water treatment. Since then, a coherent control strategy has been introduced and the Danish Technological Institute is charged with monitoring the system in future.

The Danish Technological Institute is a leader in the use of DNA-based methods in the oil industry and sells services to a number of Danish and Norwegian customers.

#### Membranes reduce oil discharge in the future

In modern oil production, large amounts of seawater are pumped into the underground to extract the oil from the reservoir. Once the water resurfaces, it needs to be treated and preferably reused.

A project was started in 2009 in which the Danish Technological



NORWAY

Case

# 15

TOTAL SOLUTION FOR  
THE OIL INDUSTRY



GREENLAND

Case

# 16

## FOOD TECHNOLOGY – HEALTHIER FOOD

The Danish food industry holds a strong position when it comes to the export of quality food and food ingredients. To develop this market position further, the Danish Technological Institute has launched a targeted research effort focused on developing and implementing new technologies, e.g. new types of consumer surveys, new analysis methods and sensors for characterising food to improve food quality and safety.

developing deep-fried convenience food products with reduced fat content.

Deep-fried products usually absorb large quantities of fat since fat replaces evaporated water during frying. The idea of the project is to use hydrocolloid coatings to create a barrier around the products. Under the project, the Danish Technological Institute has devised a model system for testing the barrier properties of a range of hydrocolloids.

Tests have shown that fat absorption can be reduced by more than 40 %. The project has brought food producers a big step closer to low-fat deep-fried products.



### Study of probiotic herbal beverages

Biosa Danmark, together with the Danish Technological Institute, has conducted a number of studies and analyses on some of their beverages with herbs and probiotic micro-organisms.



A new herbal beverage has been tested by a panel of consumers in respect of their taste preferences and will now be marketed. Existing products have been analysed for specific activity not only in relation to the amount of probiotic bacteria but also in respect of active natural substances from plant material. The analyses have documented expectations concerning the effect of the products.

### Less fat in deep-fried products

The Danish Technological Institute is working with Danish Danisco, KMC, Flensted A/S, Daloon A/S and Greenland Royal Greenland A/S on



Materials and Production is a cross-functional area that supports several sectors and addresses key social challenges. The area covers new materials, processes and efficient types of production, but also keeps a clear focus on contributing to develop and maintain knowledge-based, high-technology production, to develop the next generation of high-value products and to contribute groundbreaking innovation throughout the value chain from idea to product.

#### **Development trends – challenges and opportunities**

Our societal challenges are evident: maintaining competitiveness in high-technology production and

developing sustainable materials and processes able to underpin societal demand for optimum utilisation of resources. These challenges require that new production systems, better integrated solution concepts and new composite materials be developed and, not least, that the potential inherent in the brand-new enabling technologies, such as nanotechnology, be fully exploited.

Denmark shares these challenges with the entire European manufacturing industry in a time of turbulent financial conditions. In March 2009, the EU launched its European Economic Recovery Plan, one initiative being 'Factories of the

Future'. The initiative is to support small and large companies in taking advantage of new knowledge-based technologies, with a view to renewing their technology base and increasing their competitiveness.

Denmark's abilities to meet these challenges are estimated to be excellent. Denmark has a strong position in material development. It has a well-educated labour force, is known for its world-class entrepreneurship, and its industry is already in the midst of shifting to a higher degree of knowledge-based and automated production. In close cooperation with national and international knowledge insti-



## MATERIALS AND PRODUCTION

tutions, the Danish Technological Institute has, in recent years, built up competences and equipment infrastructure that will naturally enable it to respond proactively to challenges.

### **Developments in technology and research**

Recent years have yielded major advances in material research in the field of synthesising new materials and improving existing ones, advances achieved by combining various material types. Research is focused on optimising material capabilities through a fundamental understanding of the atomic and molecular building blocks. The research also combines conventional

material technology with nanotechnology, a combination that creates a latent potential for developing all-new product generations.

‘Surface engineering’ represents an area in material research with steeply increasing importance, not least because of the substantial commercial potential foreseen for the area. Surface engineering centres on altering surface properties through physical texturing and/or chemical modification of the surface. The idea is to add new functional properties to a given product, e.g. to make it corrosion-resistant, hard-wearing, dirt-repellent or to add vibrant colours.

‘Bionics’ is another new, exciting area directly inspired by nature. Bionics deals with mimicking nature’s product development and developing synthesis technologies to produce surfaces with properties that imitate nature’s own products. Both areas are key development platforms in material development.

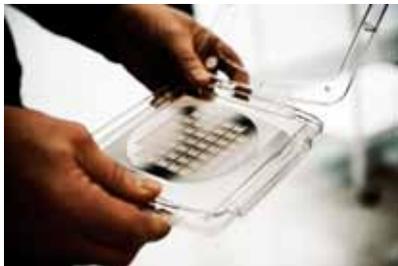


USA

Case

# 17

## NANOTECHNOLOGY IS GROWTH TECHNOLOGY



International reports indicate that nanotechnology is a growth technology with vast commercial potentials, and it is also a cross-sectoral technology. Nanotechnology paves the way for a paradigm shift towards an increasing degree of knowledge-based, high-tech production of high-value products. Cordless sensors, micro fuel cells, polymer-based printed electronics and components for hearing aids and head phones are examples of products being developed.

### Improved safety with nano-sensors

The Danish Technological Institute is involved in an international partnership with the University of Texas, the Carinthian Tech Research in Austria, the University of Southern Denmark, Technical University of Denmark/DTU Danchip, universities in Austria, France, Germany and Russia and the Danish companies NIL Technology ApS and Polyteknik AS. The partnership aims to develop nanoprocesses for cordless sensor production, SAW sensors (Surface Acoustic Wave sensors).

SAW sensors are tiny sensors used to measure various conditions without cabling or batteries and able to communicate measurement results via a mobile phone or similar media. Cordless SAWHOT sensors are being developed for, e.g., the airplane industry where sensors are used to measure temperatures in airplane engines. SAWHOT sensors can

measure temperatures up to 1,000 °C. The sensors used in the airplane industry today require cables, and the aim is to develop cordless sensors that can be attached as stickers that transmit measurement results to a receiver.

The long-term objective is to mass produce SAW sensors that have innumerable applications at advantageous prices.

### Durable, climate-friendly materials

In 2009, the Danish Technological Institute entered into an EU-financed research partnership with University of Hamburg in Germany and Centre de Mise en Forme des Matériaux (CEMEF) in France. The partnership works with theoretical models for calculating composite material properties at nano level.

The aim is to reduce airplane and vehicle CO<sub>2</sub> emissions by developing sustainable composite materials that reduce the weight of transportation means and thus their fuel consumption. To achieve the desired properties for nano-composite materials, nano particles must work together with polymers. This function is achieved by modifying particles in a way that makes nano particles and polymer material highly compatible. The compatibility distributes nano particles evenly in the polymer and gives composite materials the required toughness.



SPAIN

Case

# 18

## DESIGN AND FUNCTIONALITY – MATERIALS 2.0

Societies in general and industrial companies in particular continually demand materials with new properties. The interdisciplinary application of nanotechnology, biotechnology, chemistry, physics and applied material science have yielded detailed understanding of how micro and nano-structures of materials impact their macroscopic properties, thus opening up for new material breakthroughs. New materials will pave the way for revolutionary, new products and replace existing technologies.

### Developing intelligent surface functionalities

The Danish Technological Institute cooperates in a Eurostars consortium with Danish Polyteknik A/S, TETRA - Gesellschaft für Sensorik, Robotik und Automation mbH in Germany, Spanish Brugarolas S.A. and Falex Tribology in Belgium. The project focuses on performing groundbreaking research and development in equipment and deposit processes for production of low-friction coatings to be used in vacuum conditions. Such conditions arise in connection with space travel and airplane traffic and in advanced process instruments. The new coating type, Diamond Like Carbon (DLC), is a coating that needs an exceptionally low friction to work optimally in vacuums.

The Eurostars project consortium arises out of the EUREKA network. The Danish Technological Institute

is Denmark's representative in the European EUREKA umbrella ENIWEP (European Network for Industrial Wear Prevention), its aim being to establish common research and innovation projects between companies, universities and other knowledge institutions across EU borders.

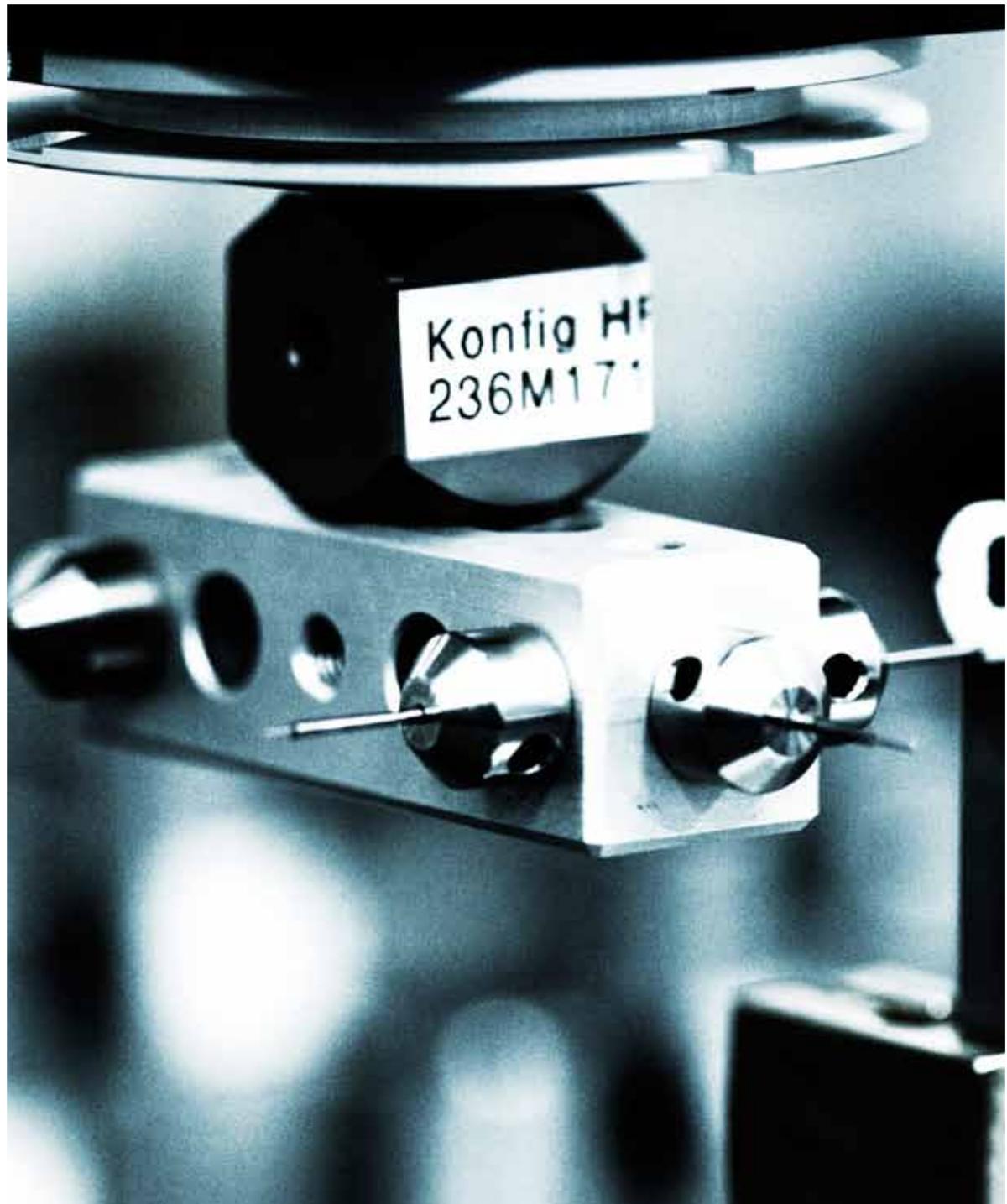
### Bioethanol in future diesel engines

In 2009, the Danish Technological Institute joined Haldor Topsøe A/S to establish a project aimed at transforming bioethanol into diethyl ether for use in diesel engines. Diethyl ether can be combusted in a diesel engine in the same way as diesel oil.

If diesel oil is replaced with diethyl ether from bioethanol, the costly dehydration process of the bioethanol production becomes superfluous, as diesel engines can run on aqueous bioethanol. The use of bioethanol as ether in a diesel cycle also ensures better fuel energy utilisation compared to petrol engines.

The project also has major environmental advantages, as diethyl ether combustion is a very clean process, producing almost no particles during combustion, unlike diesel oil.

Sweden, Brazil and parts of the USA are obvious markets for the technology, as these countries have already established an ethanol infrastructure. The Danish Energy Agency supports the project.



According to industry association Medicoindustrien more than 200 companies were classed as pharmaceutical companies in 2008; however, in all about 1,000 companies in Denmark were working in the industry to a greater or lesser extent. The 20 biggest companies account for 75% of the total turnover and more than 90% of the domestic production is exported.

**i**



CHINA

Case

# 19

## THE MEDICAL AND MEDICO-TECHNICAL SECTOR – ENERGY AND BIOMATERIALS



Currently, a great deal of research goes into determining how biomaterials can be used in various areas and how biodegradable materials can be used in new contexts. The Danish Technological Institute is exploring the possibilities of producing biopolymers from alternative sources. Research focuses on how by-products like whey can be transformed into biopolymers to be used in biodegradable packaging. In addition to their use in biodegradable packaging, biopolymers can also be used to regenerate body tissue.

Materials used for medical equipment must meet high requirements. Authorities also pose special requirements to producers and equipment before granting authorisation to market medico-technical products.

The Danish Technological Institute supplies the latest knowledge on the chemical, toxic and biological properties of materials to producers in connection with product development or authorisation of medico-technical products. Further, the Institute can contribute measurement-technical competences that can ensure the quality of the often tiny components used in the medical and medico-technical sector.

### Regeneration of bone tissue

One focus area of regenerative medicine is research into osteoporosis. Having several years' experience in the area, the Institute is at the vanguard of development and has positioned itself at the centre of European research. The Danish Technological Institute is involved in a partnership with the European Space Agency, a partnership that researches into bone tissue regeneration.

Osteoporosis means porous bones and is a bone disease that severely reduces both strength and volume of bone tissue. The disease is particularly evident in astronauts that remain in space for long periods of time. Once the body is

removed from the Earth's gravity, bone mass breaks down, and the body directs its energy to other areas. Osteoporosis is considered a systemic disease, in which outside influences make otherwise healthy people ill.

### Danish Technological Institute accompanies Novo Nordisk to China

In 2009, the Danish Technological Institute worked together with Novo Nordisk to quality-assure the new NovoPen® 4 by setting up measuring programmes for the pen components. NovoPen® 4 is the next generation of the Novo Nordisk NovoPen® 3, the world's most popular insulin pen. More than two million diabetics use the pen every day for their insulin injections.

Novo Nordisk has established a 20,000-square-metre facility in China, one feature being a new mounting facility for insulin pens. The Danish Technological Institute is tasked with training the Chinese staff to use 3D coordinate measuring equipment and to read working drawings. The actual training and programme compilation take place at Novo Nordisk' own 3D coordinate measuring equipment mounted at the Danish Technological Institute. The training also comprises CT scans to ensure optimum probe strategy for components.



## PRODUCTIVITY AND LOGISTICS

The manufacturing industry plays a key role in the Danish economy. Manufacturing accounts for more than half of Denmark's export of goods, for which reason Danish society needs activities in this area to be maintained. Globalisation poses a challenge to Danish companies, but also presents a range of opportunities if the industry is at the cutting edge of development.

Maintaining competitive production in Denmark is essential to society. The level of costs is generally lower in other countries. This increases the necessity of manufacturing Danish goods and products in an efficient and intelligent manner. Danish production systems must have a high degree of productivity,

flexibility and quality and a minimum health and safety burden and climate impact. This also applies to the trade and service sectors. Moreover, the ability to bridge the gap to the manufacturing industry can play a decisive role for the future development of this industry.

### **Development trends – challenges and opportunities**

Danish companies have realised that productivity is directly linked to competitiveness and thus of strategic importance. Price competition is no longer a local or national matter. Efforts are now concentrated on developing new methods that enhance company and staff competences – not on increasing the pace. Figures from

the Confederation of Danish Industry reveal that companies have recorded relatively moderate productivity growth in the most recent financial year, and that gives rise to concern.

Significant and continual efforts to research new productivity systems and methods, new manufacturing technology and intelligent goods transport will enable Denmark to meet the requirements for future production systems on an ongoing basis. Areas such as organisation, management, risk assessment, logistics and their integration into production systems are among the wide range of options to be put into use.



The long-term growth in the logistics and goods transport trade as well as increased mobility is a fundamental sign of health for economic growth. The main challenge for many years to come will be to ensure supply chains that operate more sustainably and make energy consumption, the environment, traffic flow and safety central values.

#### **Developments in technology and research**

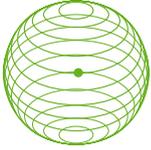
Eighty-five per cent of all industrial handling is manual, and the Danish business structure is characterised by many small companies and small series. This being the case, Danish research in robot technology and automation focuses on flexible robot cells that allow the

same robot to handle a variety of work processes. The Danish research community spans a wide field of research specialties, and the challenge is to have all these technologies work in coordinated interaction.

Only minimal research in management tools for handling strategic risks has been conducted, the consequence being that Danish companies are very poorly equipped to respond to unforeseen situations. Hence, new knowledge in this area would allow companies to respond more rapidly and expediently in future.

In the context of logistics, research concentrates on technology and

business developments. Integration, intelligence in supply chains, safety and mobility are research themes for optimising and streamlining solutions and systems and for finding answers to how society can perform the task with a minimum of resources and without heavy restrictions that impede growth. Intelligence is another key research theme that supports integration, safety, efficiency improvement in and optimisation of production and supply chains in a way that enables full automation and the use of information and communication technology at all stages.

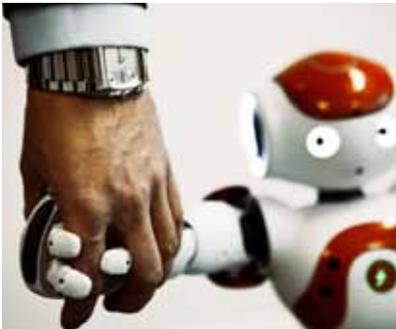


SWITZERLAND

Case

# 20

## PRODUCTIVE ROBOTS



Basic knowledge about robot technology develops in R&D projects that are often completed in cooperation with leading foreign knowledge centres and companies with competences that can be adapted to Danish conditions.

The Danish Technological Institute focuses on robot solutions for the manufacturing industry, health and welfare, green robots and intelligent buildings. The goal is solutions and principles useful in realising robot technology potentials across industries and sectors – a platform for the widespread Danish use of robots to lift productivity and quality.

### Flexible robotic hand to take over strenuous tasks

The cooperation with German SCHUNK forms part of the Danish Technological Institute's endeavours to develop a unique robotic hand which should be almost as flexible as a real human hand.

The robotic hand has been named the Hybrid Gripper, because it can be used for many unvarying tasks causing physical deterioration – thus strengthening Danish companies' competitive edge against countries with lower payroll costs. Consequently, the Hybrid Gripper would have to have the proper hygiene to obtain approval for food handling.

The activities are taking place in a project involving many different areas of development. For instance, new mechanical systems, units and management technologies need to be developed. The project receives support from the Danish National Advanced Technology Foundation.

### Cleaning robots to keep PV cells in top shape

PV cells need to be clean to make optimum use of sunrays and generate the maximum carbon-neutral power possible. In 2009, project cooperation took off between project originator Marco Reichel of Manu Systems AG, the Danish Technological Institute, the Regensburg University of Applied Sciences of Germany and Swiss Bern University of Applied Sciences on cleaning robots to keep future large-scale PV cell plants free from dust and dirt. The robot not only improves cleaning efficiency but also benefits the environment; it uses very little water to clean.



In Denmark alone, 2008 saw investments worth approx. EUR 134 million in complete robot-based production facilities. This should include investments in the production facilities operating without robots. The numbers show that 507 industrial robots were installed in automatic production facilities in Denmark in 2008 against 489 the year before.

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USA

Case

# 21

## SUSTAINABLE LOGISTICS – A DANISH SPECIALITY



Denmark has a declared objective to be a global leader when it comes to logistics and transport. For this reason, the Danish Technological Institute works together with a range of international knowledge centres on sustainable transport and logistics concepts that are economically and environmentally optimum.

To strengthen sustainability, distribution must occur in a more coherent, optimised and efficient manner across transport and supply chains than is currently the case. It is a question of integration, supply chain intelligence, safety and mobility.

The Danish Technological Institute aims at developing such solutions and answering how society can perform the task with a minimum of resources and without heavy restrictions that impede growth.

### Extended RFID test centre

The Danish Technological Institute has an international, research based RFID (Radio Frequency Identification) centre that can ensure and document the readability of RFID-labelled units. This means products and packaging provided with a small radio chip that serves as a “wireless barcode” and identifies the product. On the basis of its cooperation with institutions like the University of Arkansas, the Danish Technological Institute has extended the test centre to comprise the testing and demonstration of solutions that benefit consumers in supermarkets and shops.

This means that consumers can scan the wireless barcode with their mobile phone or PDA to find information about the individual product, cash in any coupons and buy groceries by scanning them on their mobile phones. This allows a brand-new type of marketing that enters special bargains as information in the barcode. Moreover, people with allergies can scan all articles for allergens.

### I-GTS - Intelligent Goods Transport Systems

The innovation consortium I-GTS focuses on exploiting the technology

available in lorries, road systems, GPS and company systems to develop intelligent freight transport systems and optimise service and transport. The innovation consortium I-GTS consists of various transport companies; Comlog A/S, the Danish Transport Federation, Scania Danmark A/S, City of Copenhagen, Danish Technical University/DTU Transport and the Danish Technological Institute.

An analysis made in 2009 shows that the optimisation of service and transport could be far better. For instance, the existing IT systems of most companies are unable to plan and organise transport, meaning that planning is done manually in 72% of the companies. The analysis is the foundation for developing new IT and CT solutions that can integrate mobile devices, public aerial networks, GPS sensors, traffic signals, vehicle computers, etc. and thereby increase efficiency and lower the environmental loads involved in carrying goods.

The project is inspired by experience gained at a visit to Hong Kong Science & Technology Parks. Hong Kong is currently one of the world’s largest trade and finance centres, from which much of Chinese exports to the USA and Europe are controlled. This gives them special expertise in logistics.



A large number of Danish health care professionals will retire in just a few years. The health care system faces a monumental challenge and is already under pressure from Danes' natural desire for even better care and quick access to the newest and best types of diagnostics and treatment. This demographic development also implies that the number of persons requiring care will grow.

Welfare technology is therefore an important area for the Danish Technological Institute, which is cooperating with both Danish and foreign universities and strong international industry partners. The aim is to establish competences and knowledge to assist Danish companies in developing innovative welfare technology to relieve care staff and reinforce the health care system – an initiative that also holds considerable and global market potential.

#### Meet our welfare robots

In June 2009, the Danish Technological Institute opened the first Innovatorium for Robot and Welfare Technology in Odense. The goal is to give Danish companies and institutions a taste of the newest robot technology. Frequent guests include public institutions interested in welfare technology. The guests primarily come to meet Japanese Paro, French Nao and German Robotino.

Baby seal Paro is a welfare robot that can see, hear and feel – and reacts

to touch and speech. Paro is already in use in various nursing centres because it has a positive impact on the physical and mental health of humans. Nao can dance and is an entertainment robot that can amuse and socialise with people. Robotino possesses the basic skills to analyse how people walk, so it can read where someone is heading and whether the person is looking for information.

#### Eating robot increases quality of life

Together with the Odense Municipality, the Danish Technological Institute is conducting specific experiments with the Japanese robot MySpoon, which helps physically disable persons to eat without assistance from care staff. The robot allows users to participate in meals without assistance and generally to eat whenever they want. A function that can help maintain the users' dignity and thus improve their quality of life.

Other exciting examples of welfare technology are robot baths and robot toilets which may also relieve care staff and improve the users' quality of life. The welfare technologies are acquired with the help of Japanese partners, e.g. the National Institute of Advanced Industrial Science and Technology, Nippon Welfare Instrument Corporation, CYPERDYNE Inc. and the University of Tsukuba.

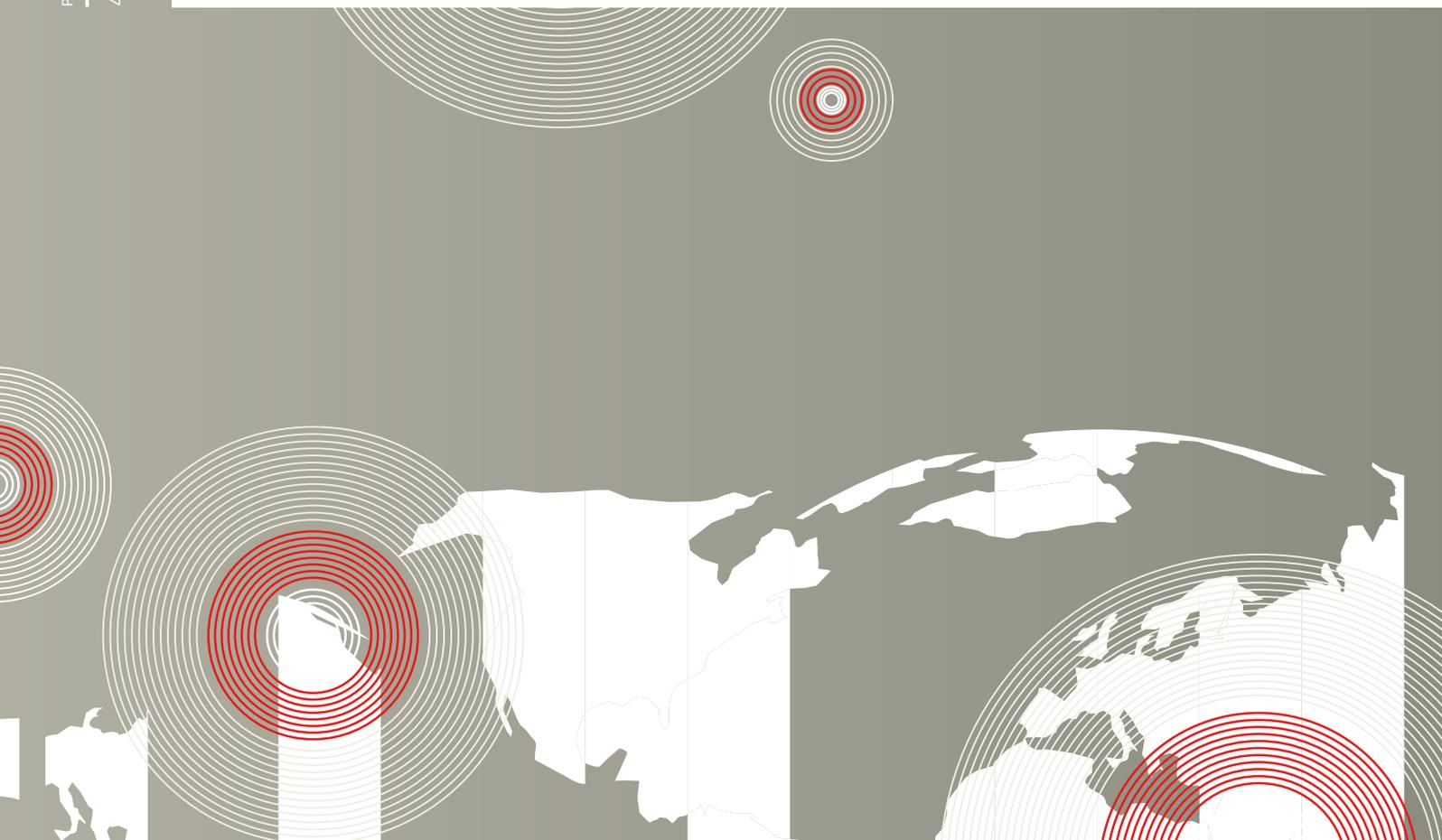


JAPAN

Case

22

CARE AND QUALITY OF LIFE THROUGH WELFARE TECHNOLOGY



As the global economy grows increasingly knowledge intensive, education and training are seen as the key to success. A 2007 report to the European Commission places Denmark among the OECD countries spending most public funds on education and training, i.e. 7.4%. This fact is seen as one reason why international reports rank Denmark among the most competitive countries.

#### **Development trends – challenges and opportunities**

Globalisation generates a more open and accessible world, offering new possibilities for greater welfare and creation of better jobs. But cou-

pled with accelerated technological development, globalisation makes a well-educated and flexible labour force a must for Denmark's competitiveness, growth and welfare. Access to education and training, competence development and lifelong learning are crucial contributions in the process of boosting Danish companies' development and improving individuals' competences.

#### **Developments in technology and research**

Technological development is accelerating at an ever-increasing pace. Previously, technology shifts were said to occur in 5-10-year cycles. Today, the lifetimes of some

technologies are less than two years - various mobile technologies, for instance. New technologies come into use even before the existing ones have become obsolete. The faster pace means that suppliers of training must be at the forefront of development in step with employees' need for upgrading - not only when new technologies are put into operation but also before technology development has completed, so that training must be based on beta versions.

With technological development comes greater complexity, a fact that calls for specialised knowledge and for which training is a key factor.



Generally, the economic situation determines the conditions setting the predominant trends in training and lifelong learning. Therefore, demand for training services is highly cyclical. In times of economic expansion characterised by development and growth, companies' main challenges lie in attracting qualified labour while retaining and developing key employees. In such times companies characteristically invest many resources in various training activities aimed at supporting the companies' growth potentials.

In periods of recession, other factors come into play. Companies often adapt to changed market conditions

by shifting their focus to minimising costs, competitiveness deteriorates and unemployment figures grow. This development changes the interdependency between companies and employees. Companies come under external pressure, and the survivors are companies that master the balance between trimming their staffs and seizing new development and innovation opportunities. In this context, training and competence development may support business development and become crucial for future success.

Employees are highly focused on remaining attractive both at their current workplaces and to other

companies, in other words on their employability. Coupled with personal development, knowledge and training are key factors - i.e. being updated on new knowledge and technology, able to embrace development and willing to change.

According to the annual 'Education at a Glance report 2009' from the OECD, Denmark – with the exception of Iceland – is the OECD country spending the most public funds on education compared to GDP. In Denmark, public funding of the education sector accounts for 6.7% of GDP. Iceland spends an amount corresponding to 7.2% of GDP on education, while Denmark comes in ahead of Sweden (6.2%), Finland (5.7%) and Norway (5.4%).

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SWEDEN

Case

23

TOMORROW'S  
MANAGEMENT

The Danish Technological Institute disseminates international knowledge to the Danish corporate sector in a variety of ways. One way consists of articles written specifically for the Danish Technological Institute by influential international dignitaries, all seen as leading experts in their fields. The articles are disseminated through the Danish Technological Institute's e-newsletter "LederUpdate", a magazine for managers by managers aimed at providing a panoramic view of management.

In 2009, LederUpdate offered inspiration from Jonas Ridderstråle, professor at the Stockholm School of Economics and co-writer of the bestsellers 'Funky Business' and 'Karaoke Capitalism' and 'Funky Business Forever', and from Paul Evans, professor of organisational behaviour, human resources and organisational development at INSEAD.

#### **Crisis? What crisis?**

Under the heading "Crisis? What crisis?", Jonas Ridderstråle described how in today's deregulated and internationalised corporate world we experiment in more areas and at more locations than ever before – geographically, in financial services, through IT solutions, in the biotech industry, etc. Experiments are risky. Some may and will fail. But that does not mean that we should cease trying - not

moving is the surest way of falling behind.

This is why Jonas Ridderstråle asks whether in a period of change, managers can merely function as managers or whether they should take responsibility for leading change processes? The answer is evident. The only way to gain affluence requires the leader to focus attention, energy and efforts on becoming a trailblazer.

#### **From busy to targeted management**

The pivotal aspect of Paul Evans' contribution to LederUpdate was "Return-on-time-invested". His point is that managers need to consider how they spend their time during a typical work week in the light of what is important versus not important and what is urgent versus not urgent.

Paul Evans urges managers to step back and compare how they spend their time to how they should spend their time. Just consider an average difference of 15% in an average work week of 60 hours. That would leave a manager the option of improving his/her return-on-time-invested by 9 hours – and changing from a busy manager to a dedicated manager.



USA

Case

# 24

## INTERNATIONAL INSPIRATION IN TIMES OF CRISIS



The Danish Technological Institute regularly organises exclusive seminars with internationally renowned experts able to introduce participants to the latest knowledge in key areas.

### Volatility as a management condition

“The New Age of Innovation” was the title of a seminar with one of the most influential experts in strategy – the distinguished C.K. Prahalad, professor at University of Michigan. Professor Prahalad set the stage by focusing on the elements deciding the agenda: Volatility as the management condition of our time as witnessed by volatility in financial markets, in raw materials and in consumer behaviour, coupled with a heightened focus on climate, fear of terrorism, pandemics and government influence.

To be a manager navigating in a sea of unpredictability requires revolutionary thinking and a reformulation of business goals. The current focus is on holding on to available funds, reducing the impact of fluctuations and alleviating portfolio risks. Companies need to be in the market, adaptable and close to their customers at the lowest possible costs. And the risk should be minimised by ‘co-creating’ with other companies via global networks of supply, logistics and communication.

### Growth in turbulent markets

“Face the challenges of 2009 and lead the way to top profitable sales” – this was the message from one of the world’s marketing masters, Malcolm McDonald, professor at Cranfield University School of Management.

Professor McDonald advises major international companies such as IBM, Shell, Tetra Pak, Xerox and Tesco in areas like key account management, strategic marketing, marketing planning, market segmentation, international marketing and marketing accountability. At the seminar, the participants gained an understanding of how major international companies develop long-term, profitable customer relations and ensure their own growth in turbulent and changeable markets in economic recession, thus increasing company profits.

Professor McDonald provoked the participants by questioning their existing customer strategies, and started them thinking whether their individual customer activities were strategically durable – were they concentrating on the right customers? Who are really the key customers? Do they spend too much energy on winning new customers?



An aspect of learning consists of hands-on experience instead of merely hearing about it. Hands-on experience is ensured via the Danish Technological Institute MasterClasses, in which participants can take on the latest technologies.

**Future .Net**

IT expert, Michele Bustamante, chief architect of IDesign Inc. and vice president of Microsoft, gave a MasterClass in which the participants were taken on an intensive guided tour in the .Net universe – from development of the latest versions to upcoming releases and on to the next step. Participants gained an understanding of the intentions and goals forming the basis of future versions. This presentation enables companies to make qualified decisions when selecting technologies today that will make implementation of new technologies more flexible tomorrow.

Dino Esposito, IT expert in architecture, gave an intensive five-day MasterClass in which participants achieved an in-depth understanding of .Net design and were given the blueprint for creating optimum designs and implementing layered applications. Dino Esposito shared his experience of working with major multinational companies. The class focused on topics like appropriate development principles, best practices and pitfalls.

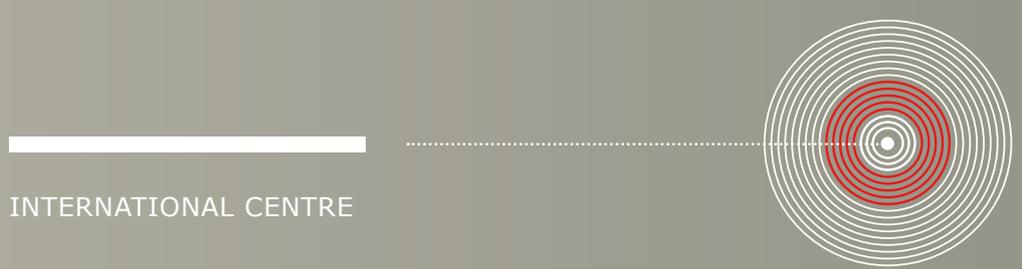


CANADA

Case

25

MASTERCLASSES WITH LEADING IT EXPERTS



## INTERNATIONAL CENTRE

The Danish Technological Institute has a wide range of divisions and centres that acquire international knowledge and implement it in Danish society. The International Centre does the reverse, acting as a coordinating commercial entity to ensure that knowledge gathered and created at the Danish Technological Institute is channelled to the international market. The Centre's primary task is to extract resources and knowledge across the organisation, thus allowing the Danish Technological Institute to take part in inter-disciplinary tasks in the international market for consultancy services.

The International Centre ensures that the Danish Technological Institute has a place as partner in both neighbouring EU countries

and key third-world countries. Over the past 10 years, the Institute has been implementing projects in more than 25 countries with a mix of in-house consultants and external experts from both Danish and international partners. Work involved with almost all large contracts is undertaken in consortiums or partnerships with key Danish and European consulting businesses and institutions in the semi-public sector. Through these partnerships, we provide the Danish consulting industry and others in the international market with services and technical platforms that only an approved technological service institute can supply.

The tasks performed by the International Centre are practically all donor-funded projects submitted

for international tender. The EU is the primary donor and runs large-scale development programmes in numerous neighbouring and third-world countries. Danida is another important partner in the programmes on environmental improvement in industry and industrial development.

### **The international future**

The Danish Technological Institute often offers assistance to Danish companies' production overseas. In this context, the International Centre provides knowledge about conditions in the individual countries and considerable experience in addressing international contracts, partnerships and working conditions.

The donor-funded activities undertaken by the Danish Technological



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Institute are an important element in its international strategy. First, the Institute has achieved a significant status in many countries such as India, Egypt and South Africa, which might become important trading partners for Denmark in future. Second, through its work with local industry and authorities, the Danish Technological Institute has accumulated valuable knowledge about the trends forming in the major third-world countries.

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Developing and implementing national quality programmes – also known as MSTQ – entails matters such as accreditation, metrology, standardisation, market surveillance and consumer protection. The EU in particular is interested in helping its neighbouring countries develop their own systems for checking and approving goods, the aim being to increase cross-border trading. The Danish Technological Institute has played, or is playing, an active role in Turkey, Jordan, Syria, Egypt, Serbia, Montenegro and Russia in the so-called MSTQ area.

**National quality plan in Montenegro**

In 2009, the Danish Technological Institute, in close cooperation with the Danish Accreditation and Metrology Fund, the Danish Standards and Danish Fundamental Metrology Ltd., prepared a plan for further work on the national quality plan in Montenegro. The plan follows up and expands the work for which the International Centre was responsible in 2005-2007, when Montenegro was a member of the Serbian union.



MONTENEGRO

Case

26

DEVELOPING NATIONAL  
QUALITY PROGRAMMES

Following Montenegro's secession from the union, a need arose to build up national capacity in terms of knowledge about European legislation, technical regulations and product safety. In addition, a need arose to establish own institutions such as an accreditation body and a metrology laboratory. This being the case, the task involved training and education, organisational development and proposals for national policies on quality.



GHANA

Case

27

## FOOD SAFETY IN THIRD-WORLD COUNTRIES



The need for international advisory services related to foods has soared in recent years. Both Danida and the EU have programmes supporting developments towards better foods – from the point of view of production as well as consumers.

The Danish Technological Institute commands a strong position in both the Danish and international markets, and we expect this field to develop in the course of the coming years. For instance, the Danish Technological Institute has joined forces with the Egyptian government in a multi-year cooperation programme regarding the Egypt Food Technology Centre in Cairo. Furthermore, the Danish Technological Institute has completed a large-scale project on food development and certification in India and some smaller projects in Uganda and Tanzania.

### Help for the fishing industry in Ghana

The Danish Technological Institute is participating in a large-scale EU framework contract targeted at 60 countries in Africa, the West Indies and the Pacific region. The project is managed from Brussels in Belgium and concerns a vast number of missions to the fishing industry in the various countries. The objective is to strengthen food safety in the countries' fish produce production for export purposes.

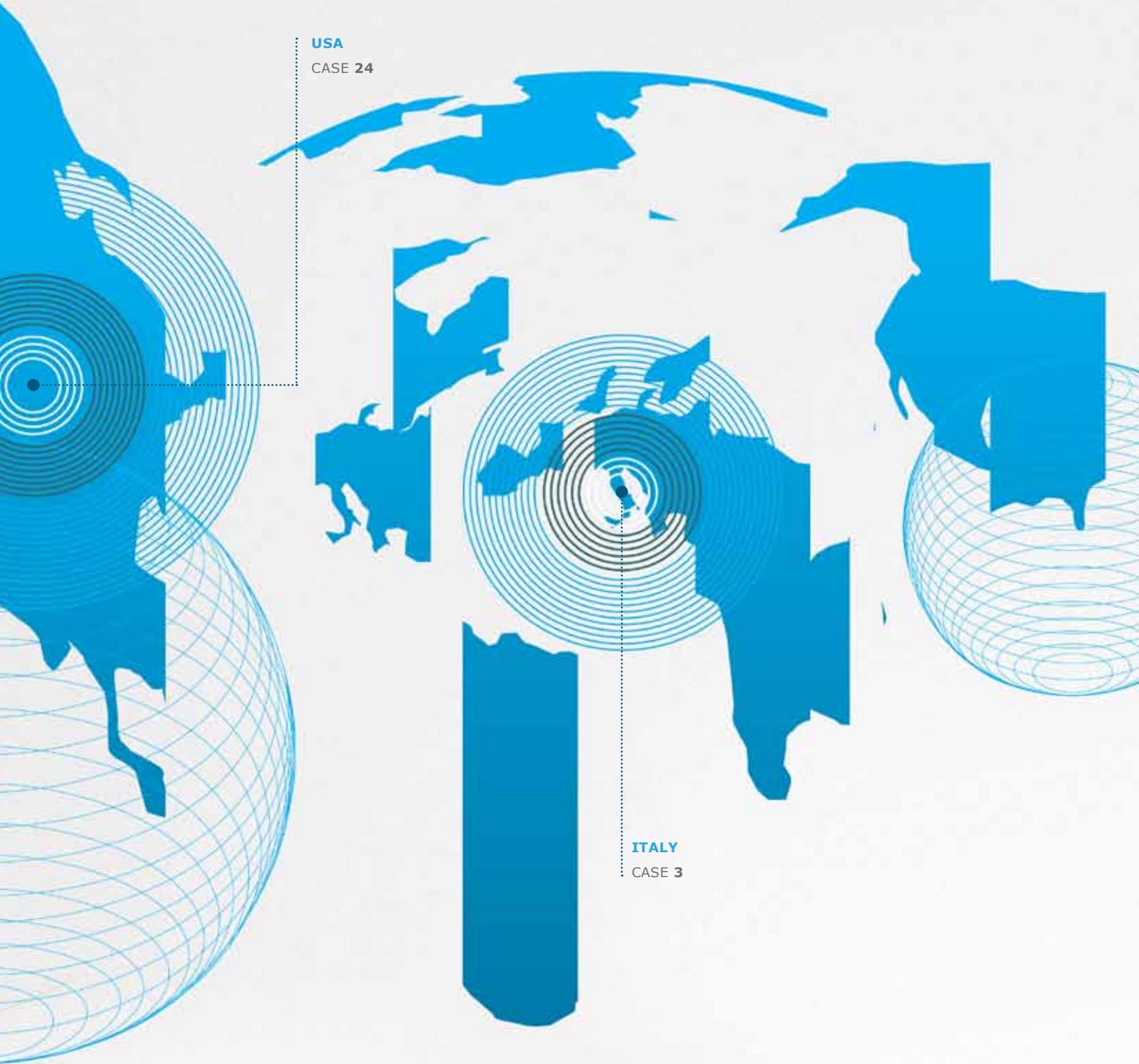
To date, the Danish Technological Institute has, for instance, described future support projects aimed at food production in Ghana and a range of new food safety and Hazard Analysis and Critical Control Point (HACCP) projects have been designed. HACCP is a systematic approach to quality management. The work included an analysis of the need to train exporting food producers in EU hygiene rules, the HACCP system, own controls and manuals. Moreover, the Danish Technological Institute contributed a needs analysis relating to investments and adaptations in the fishing industry.

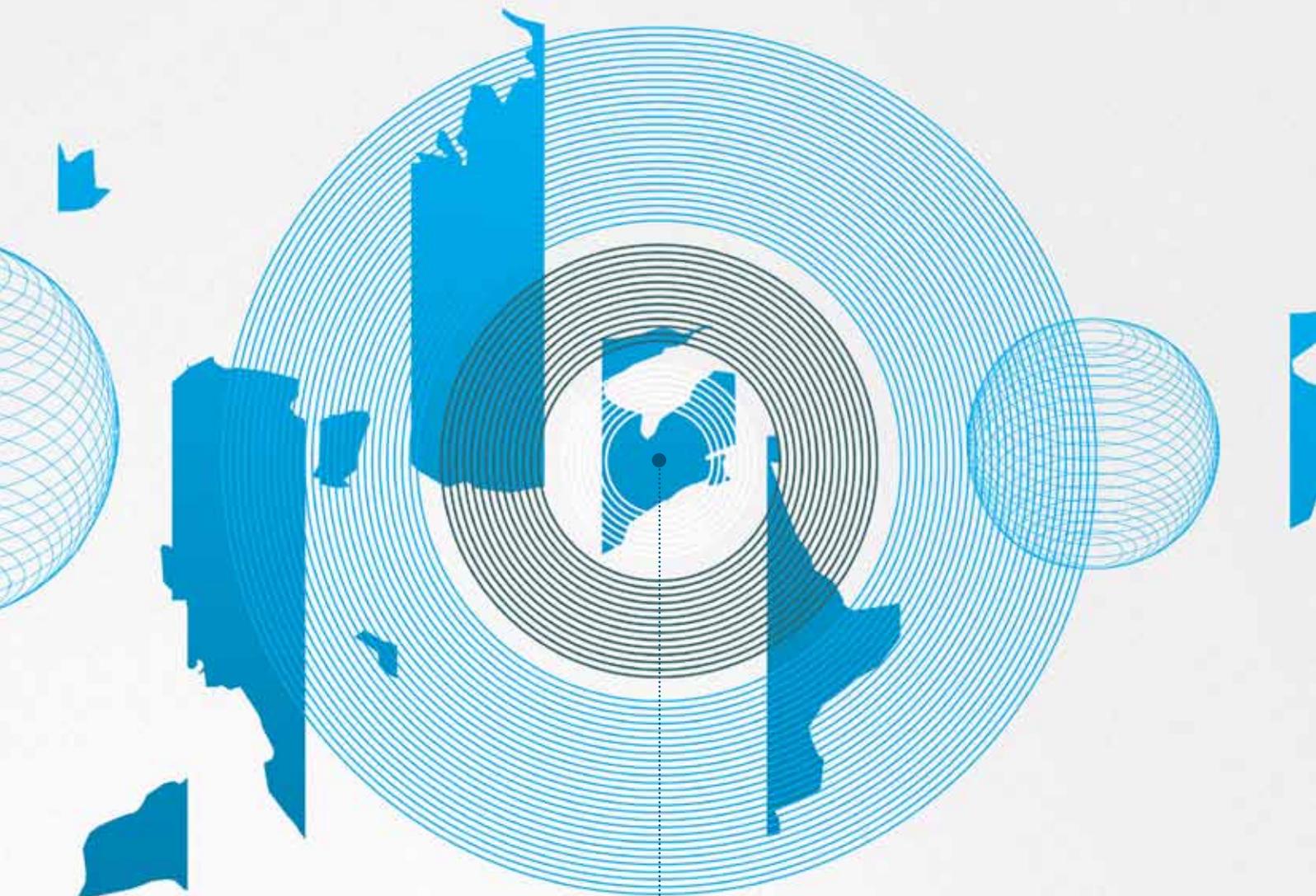
**USA**

CASE 24

**ITALY**

CASE 3





REVIEW 2009

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## REVIEW 2009

All in all 2009 was a good year for the Danish Technological Institute despite the challenges caused by the economic downturn. Our strategic focus on research and development activities continued to make a positive contribution as revenue from these activities rose to 32.2% of total revenue in 2009. In 2008, Institute R&D revenue accounted for 26.3% of total revenue.

The year 2009 was characterised by two large-scale acquisitions and organisational changes.

In January 2009, the Danish Technological Institute took over 27 key staff members as well as the accelerator, magnet and power supply activities from Danfysik A/S in Jyllinge. Thereby, the Institute secured a number of high-tech jobs in Denmark. Danfysik A/S holds unique key competences in high-energy nuclear physics and development of modified surfaces for industry. Expectations are that Danfysik A/S – thanks to renewed focus on its original core business – will produce fair results. Long term, Danfysik A/S and the Institute are also expected to produce trailblazing results on the basis of commercialisation of research and development results – especially in high-technology materials.

Institute divisions and centres were reorganised with effect from February 2009, the reason being a wish to strengthen cooperation across the organisation allowing obvious synergies to pave the way for quickly realisable gains to the benefit of the Danish business sector.

A new division by the name of Life

Science was created. The division puts specialist core competences into play to offer Danish customers and international partners even better possibilities of generating growth in the area.

In October, the Danish Technological Institute took over the Danish Meat Research Institute (DMRI) from the Danish Bacon & Meat Council. DMRI is now organised as a division of the Danish Technological Institute.

In this way, the Danish Technological Institute acquired a nationally and internationally leading competence centre within the areas of meat industry innovation, development and research. The objective of the new division is to create an even stronger research, consultancy and innovation institute which addresses all of the food industry. This will ensure a broader technical and commercial basis for developing and utilising the competences that have been developed over a number of years.

With the takeover, the Danish Technological Institute expands its position as Denmark's biggest supplier of technological services to the food industry and its suppliers in analysis, consultancy and research and development.

The strategy for the period 2007-2009 served two overall objectives: growth and internationalisation. Both objectives underpin the government globalisation strategy and the strategy intention of fostering the competitiveness of the Danish business sector. Throughout the strategy period, the Danish Technological Institute boosted interaction with small and medium-

sized enterprises, and the Institute contributed even further than before to improving the framework for companies for research, development and innovation in a global context.

Also, the Danish Technological Institute spent time in 2009 looking ahead and laying down the strategy for the period 2010-2012 – a strategy concentrating on innovation, competence development and international cooperation.

Furthermore, Institute investments in laboratories and equipment were stepped up. Investments included the purchase of a Thermos LTQ Orbitrap Velos mass spectrometer, the establishment of a motor laboratory and a nanotechnology experiment station. Investments in building projects, laboratories and equipment more than doubled on 2008. Total investments in 2009 amounted to EUR 9.7 million, including the acquisition of DMRI's buildings in Roskilde and of Danfysik A/S.

### Financial review

The Danish Technological Institute recorded profit of EUR 2.2 million for 2009 (2008: EUR 3.0 million), which was below budget. Total consolidated revenue was EUR 113.0 million, a rise of 9.7% compared to 2008.

The Danish Technological Institute's revenue is generated through commercial activities and research and development activities, including performance contract activities.

Commercial revenue was EUR 76.7 million, which was EUR 0.8 million up on 2008, corresponding to a rise of 0.9%.



"Look ahead, ahead! Take the coming time to discover how it paves the ways to development, and then place yourselves there where you discern the need for the Institute's help. Expect not to reach new land from worn, cobbled roads. The road often runs down unknown paths and shortcuts."

**Gunnar Gregersen, Founder of the Danish Technological Institute  
President, 1906-1950**

## CONSOLIDATED REVENUE AND NET PROFIT, IN THE PERIOD 2006-2009



Research and development revenue as well as performance contract revenue accounted for EUR 36.3 million, or 32.2% of total revenue, corresponding to a rise of 5.9 percentage points compared to 2008.

In 2009, the Institute's self-financed development activities ran into EUR 6.6 million, up EUR 1.1 million compared to the year-earlier period. We are of the opinion that the knowledge development resulting from the research and development activities is of considerable importance to the Danish business sector. The new knowledge means that the Institute also in future will be able to provide technological services of the highest quality.

Equity rose by EUR 2.3 million and stood at EUR 45.8 million at 31 December 2009. The balance sheet total went up by EUR 14.7 million to EUR 90.0 million. Cash flow from operating activities amounted to EUR 8.4 million compared to EUR 5.1 million in 2008.

Cash flow from investing activities totalled EUR 9.7 million.

Financial resources remain strong and worked out at EUR 16.0 million at end-2009.

### Post-balance sheet events

No material events have occurred after the balance sheet date that will affect the financial statements.

### Subsidiaries

The year 2009 was not so good a year for the two subsidiaries in Sweden. Technological Institute AB Sweden ended up recording a loss of EUR 0.4 million. However, measures were initiated in 2009 to adjust the cost structure to the new market conditions prevailing during the crisis currently experienced by the Swedish training and education market.

Swedcert AB broke even in 2009 compared to recording profit of EUR 0.04 million in 2008.

Dancert A/S was established in 2008 to enhance Institute certification activities. Dancert A/S recorded fair operations in 2009, posting profit of EUR 0.1 million.

The Polish subsidiary, FIRMA 2000 Sp. z.o.o., recorded a loss of EUR 0.1 million in 2009. However, the order book for 2010 causes us to be optimistic about 2010.

Danfysik A/S, the new Danish subsidiary, generated revenue of EUR 5.7 million and profit of EUR 0.0 million in 2009. To Danfysik A/S, 2009 was a year of restructuring. Efforts were made to restore relations with former customers, and the efforts bore fruit.

Technological Innovation A/S experienced major upheaval in 2008 as its licence as an approved innovation environment was not renewed. Consequently, the company changed its status from an approved innovation environment to a dormant company.



The main asset of the company is a 50% interest in Syddansk Teknologisk Innovation A/S and a number of small shareholdings and loans to entrepreneurial businesses. The staff were transferred to Syddansk Teknologisk Innovation A/S during the year. This also applies to the ownership interests previously under management by Technological Innovation A/S on behalf of the Ministry of Science, Technology and Innovation.

In 2009, Syddansk Teknologisk Innovation A/S developed according to plan and, like the other innovation environments, succeeded in obtaining increased funding for the next three years.

#### Special risks

The Danish Technological Institute's prime operating risk is linked to the management of ongoing research and development projects and longer-term commercial projects. The risk has been paid due consideration in the financial statements. The Institute's solvency and financial resources render the Institute sensitive only to a limited extent to changes in the level of interest rates. No material currency risk or material risks relating to individual customers or partners exist.

#### Outlook for 2010

The budget of the Danish Technological Institute for 2010 very much reflects the acquisitions of DMRI and Danfysik A/S. The new activities are set to contribute revenue of just under EUR 27 million in 2010, thus raising total Institute revenue to more than EUR 134 million and giving the Institute a staff corresponding to 997 man-years.

Own production from research and development is expected to be significantly bigger in 2010 than in 2009. We have budgeted for an own production of about EUR 46 million, compared to realised own production of EUR 33 million in 2009. Just over EUR 8 million of the expected rise is attributable to the acquisition of DMRI.

The goal for 2010 is to maintain the commercial revenue despite the special challenges arising due to the economic downturn.

The situations of FIRMA 2000 Sp. zo.o. and Danfysik A/S developed positively at the end of the period under review. At this point, FIRMA 2000 Sp. zo.o. already has an order book corresponding to the budget for 2010, and Danfysik A/S has an order book amounting to 50% of the revenue budgeted for. As regards Technologi-

cal Institute AB, we expect the market for courses to have bottomed out. As mentioned, costs were trimmed, and we forecast a modest profit for 2010.

For the group as a whole, profits are set to rise compared to 2009.

#### Customers

Customers buying the Institute's commercial services are Danish business customers, organisations, public customers and international customers. In 2009, the Institute provided solutions to a total of 14,778 customers, 11,039 of whom were Danish customers. 81% of the Danish business customers come from the service sector, while 19% come from manufacturing industry. In this context, too, the Institute works closely with small and medium-sized enterprises in particular. Enterprises with fewer than 50 employees accounted for 58% of the customers.

The Institute had 932 public customers in 2009. Public customers and organisations procure services such as consultancy and training in the same way as private companies. In addition, the Institute serves public customers via various operator projects.

#### International activities

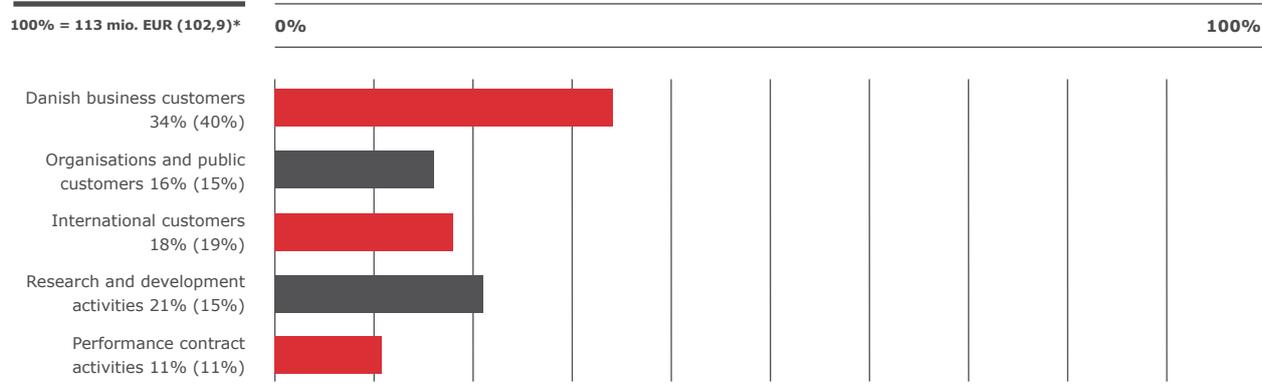
The Institute had 3,739 international

## FINANCIAL HIGHLIGHTS

EUR million	2009	2008	2007	2006	2005
<b>Key financial figures</b>					
Revenue	113.0	102.9	100.7	97.6	95.9
<b>Net profit for the year</b>	<b>2.2</b>	<b>3.0</b>	<b>3.2</b>	<b>1.8</b>	<b>3.6</b>
<b>Balance sheet total</b>					
<b>Equity</b>	<b>45.8</b>	<b>43.5</b>	<b>41.0</b>	<b>37.7</b>	<b>35.9</b>
Cash flow from operating activities	8.4	5.1	8.4	1.0	7.8
Cash flow from investing activities	9.7	5.4	4.4	3.7	4.1
Of which for investment in property, plant and equipment	5.0	4.8	4.1	3.3	4.1
<b>Total cash flows</b>	<b>-1.3</b>	<b>-0.3</b>	<b>4.0</b>	<b>-2.7</b>	<b>3.8</b>
<b>Financial ratios (%)</b>					
Operating profit margin	1.9	2.9	3.2	1.8	3.7
Equity interest (solvency)	50.8	57.9	57.8	53.8	49.9
Self-financed development	5.9	5.3	4.5	3.9	4.4
<b>Average number of full-time employees</b>	<b>904</b>	<b>854</b>	<b>795</b>	<b>831</b>	<b>835</b>

Definitions and terms appear from the accounting policies.

## BREAKDOWN OF REVENUE



\*The figures in parentheses refer to 2008.



customers, including subsidiary customers in Sweden and Poland. Overall, the Institute's international revenue stands at EUR 22 million.

### **Project evaluation**

To the Danish Technological Institute, the work of transforming new knowledge into daily practice in companies constitutes a central element in its non-profit activities, and it is important to learn how satisfied the customers are with the projects undertaken by the Institute. So in recent years, customers have been asked to evaluate the Institute's work in the light of a number of parameters such as quality and time of delivery, and 97.4% of customers said in 2009 that they were satisfied or very satisfied. A new initiative in 2009 was the introduction of similar evaluation of all research and development projects for which the Institute was responsible.

### **New innovation consortia**

The Danish Technological Institute strengthened its position within research and development again in 2009. During the period under review, the Institute assumed the role of project manager of eight innovation consortia granted by the Ministry of Science, Technology and Innovation. These are: "Prostheses: Reduction of infections and pain", "Energy materials – development of materials and components for future environment-friendly technologies", "IdeAL Surfaces", "Sustainable concrete structures with steel fibres", "Risk management in extended enterprises", "Multicaps", "Renewable energy technology" and "Nanovation". Moreover, the Institute joined the "NaKIm", "CIA-CT" and "Nanomorph" projects as partners.

### **Performance contract activities**

In late 2009, the Danish Technological Institute concluded the negotia-

tions for the performance contract for 2010-2012 with the Ministry of Science, Technology and Innovation. These activities are set to be of great importance to the future competitiveness of the Danish business sector in a large number of technologies.

### **EU projects**

The Institute is an active participant in the EU's Seventh Framework Programme. In 2009, the Institute submitted 15 project applications, of which five new projects were committed. This means that the Danish Technological Institute hit rate was 33% in 2009, which was above the average EU hit rate of 16% in 2009.

### **New facilities**

The Danish Technological Institute intends to be a pioneer on behalf of companies as regards technology and innovation. This being the case, the Institute continued its massive investment in facilities in 2009, making the Institute a leader in a range of technological fields. The investments ensure that the Institute – also in future – is well prepared to meet company needs for world-class laboratories and other facilities.

The establishment of a new motor laboratory takes the Danish Technological Institute to the forefront among European laboratories with motor fuel testing and emissions measuring as their line of business. The new motor laboratory is under construction and will be inaugurated in the spring of 2010. The laboratory contains a state-of-the-art motor test bench with equipment for determining the fuel consumption and measuring the pollution of a motor. The Institute can now perform measurements in compliance with the strictest European and American standards in the field.

The Danish Technological Institute expanded its protein analysis facilities with one of the most advanced instruments existing for that purpose – a Thermos LTQ Orbitrap Velos mass spectrometer. The instrument is based on highly advanced physical principles and is able to characterise proteins and their roles in, for instance, diseases and their treatments. The Danish Technological Institute has over a number of years accumulated substantial competences in protein chemistry and protein-chemical analyses, also known as mass spectrometry-based proteomics. Introduced in the spring of 2009, the instrument is preferred by leading researchers in the field and thus takes the Danish Technological Institute to the same level as the best in the world. First, the equipment is to be used in projects focusing on developing new and better pharmaceuticals – but is intended for broadly-based use in the food industry and health sector in the long term.

The Institute also invested in a Functional Coating Laboratory, which was put into use in April 2009. In the laboratory, it is possible to give a liquid functional coating to metals, glass and polymeric blanks using a spray gun, a paint roller or a brush, and the liquid reagents then harden into glass-ceramic surfaces. By means of this technology, the Institute helps companies develop surfaces possessing various unique properties such as non-stick, anti-ice, anti-graffiti, corrosion-resistant or scratch-proof properties.

Prompted by growing market demand for flexibility and shorter times of delivery and a sharp rise in activities related to function and materials testing, the Danish Technological Institute set up a metal shop for production of test tools and processing of customer blanks prior to mechanical testing.



The shop opened in February and has been fully operational since October 2009. At present, the shop is operated by two full-time staff members and serves the entire Institute with respect to design and production of metal components and tools involving complicated geometry.

The Danish Technological Institute is one of the first in Denmark to have invested in 3D MetroTomografi®, and the test equipment was ready for use in August 2009. Metrotomography is the result of combining the technologies of 3D measuring and CT scanning. It is now possible to perform geometric measuring of details that are difficult to access or are hidden – by applying a non-destructive method. A single scan gathers information about geometry and volume as well as measurements and tolerances.

Thanks to the Danish Technological Institute, the Danish business sector gained access to unique world-class production facilities on 26 June 2009 when a new nanotechnology experiment station opened at the Technical University of Denmark (DTU) in Lyngby, north of Copenhagen. The investment in the experiment station totals EUR 13 million, and the station was established on the basis of strategic cooperation between the Danish Technological Institute and DTU Danchip to utilise the facilities.



The experiment station will be staffed by five consultants from the Danish Technological Institute, who will be advising companies on the countless uses of nanotechnology.

In June 2009, the Danish Technological Institute opened Denmark's first Innovatorium for Robot and Welfare Technology in Odense. The purpose is to offer Danish businesses and institutions an innovative meeting place for researchers, experts from approved technological service institutes (GTS experts) and high technology companies interested in industrial robots and welfare technology where they can test and learn about new technologies and are inspired to use them. Further information about the Innovatorium is available in case no. 22.

We entered into a cooperation agreement in 2009 under which ANDRITZ FEED & BIOFUEL erects a new grinding and pelleting plant with a capacity of 1.5 tons an hour, and under which the Danish Technological Institute will be charged with operating the plant. The new unit will give a clear indication of the grinding and pelleting properties of new, unknown biomasses and provide information about many process parameters via data logging. In this way, the unit is also suitable for research and development activities. Moreover, the capacity of the unit will pave the way for wage production of

large quantities of biomass.

Finally, the Institute completed the research and development laboratory known as EnergyFlexHouse – a unique platform for innovation and development of tomorrow's energy-efficient technology for new and existing buildings. The first test family moved into the new energy-friendly house in October 2009. Further information about EnergyFlexHouse is available in case no. 7.

### **Consultancy services and training**

Consultancy services for private and public companies account for 27% of total Institute revenue. Consultancy services are rendered on the basis of the knowledge developed from research and development activities and through long-term cooperation with a large share of the business sector. Hence, these tasks comprise all the Institute's technical fields and represent the width and diversity of its work.

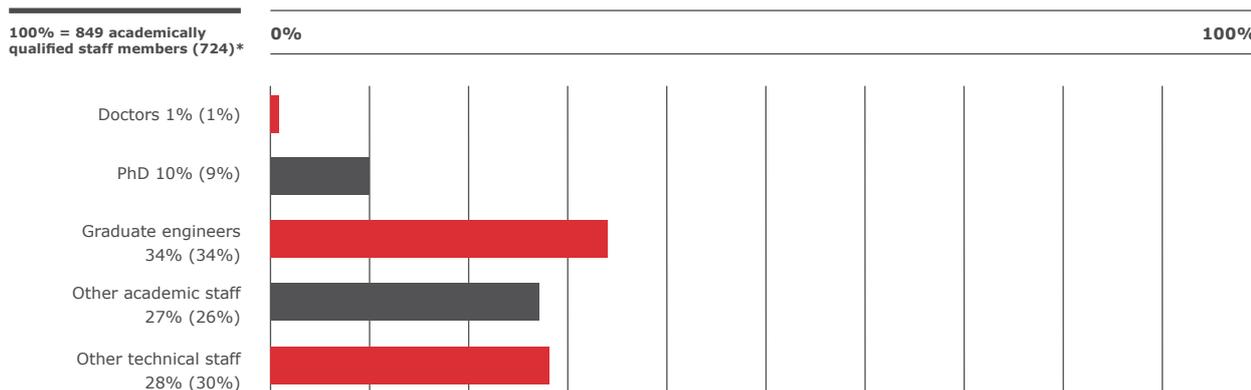
Training accounts for 18.4% of total consolidated revenue. In 2009, a total of 31,210 people attended Institute courses, seminars and conferences. The Institute witnessed an increase in the number of course participants, but revenue did not show a corresponding rise as course participants primarily register for cheaper courses than before.

## BREAKDOWN OF INSTITUTE COMMERCIAL REVENUE



\*The figures in parentheses refer to 2008.

## ACADEMICALLY QUALIFIED STAFF



\*The figures in parentheses refer to 2008.

### Operator projects

The Institute has been managing the Public Service Scheme for Inventors on behalf of the Ministry of Science, Technology and Innovation for many years. In 2009, the Institute won the project for the period until 2012. Furthermore, the scheme was introduced in a new format in 2009 in which focus was much more on seeing the most promising inventions all the way through. The scheme is therefore no longer measured by the number of inquiries, but, for instance, by the number of commercialisation processes and licence agreements we see in the end.

### Organisation and employees

The Danish Technological Institute took over 120 employees from DMRI in 2009, taking the total number of employees to 920 at end-year.

The Danish Technological Institute is aware that staff qualifications need to match an international market. This is reflected in HR development, for instance, as the Institute in 2009 registered 10% of managers for international supplementary training. In addition, the Institute completed a management and business-oriented talent development programme for 30 staff members, many of the modules being taught by select internationally recognised teachers.

The strategic goals for HR and organisational development for the period 2010-2012 comprise continued enhancement of technical and personal development for the individual employee, and the Institute will continue to aim at ensuring international focus on HR development.

### Corporate social responsibility

The Danish Technological Institute has described what it understands by corporate social responsibility and the policies and guidelines this entails. Management has decided to publish its statutory report on corporate social responsibility on its website at [www.dti.dk/csr](http://www.dti.dk/csr).

BELGIUM

CASE 11





JAPAN  
CASE 22

EXTRACT OF THE  
**FINANCIAL STATEMENTS**

The complete financial statements can  
be ordered from the Danish Technological  
Institute.

## INCOME STATEMENT

EUR million	Note	2009	2008	2007
Commercial activities		76.7	75.9	77.9
R&D activities		24.0	15.4	11.9
Performance contracts		12.3	11.6	10.9
<b>Revenue</b>		<b>113.0</b>	<b>102.9</b>	<b>100.7</b>
Project costs, excluding salaries		21.4	21.7	23.4
Other external expenses		21.0	20.2	17.3
Staff costs	1	64.7	55.9	53.2
Depreciation, amortisation and impairment losses	2	3.5	2.7	3.9
<b>Total costs and expenses</b>		<b>110.6</b>	<b>100.5</b>	<b>97.8</b>
<b>OPERATING PROFIT</b>		<b>2.4</b>	<b>2.4</b>	<b>2.9</b>
Income from associates after tax		(0.3)	0.0	0.0
Financial income		0.8	1.1	0.9
Financial expenses		0.6	0.6	0.4
<b>Financial income and expenses, net</b>		<b>(0.1)</b>	<b>0.5</b>	<b>0.5</b>
<b>PROFIT BEFORE TAX</b>		<b>2.3</b>	<b>2.9</b>	<b>3.4</b>
Tax on profit for the year	3	0.1	0.0	0.2
<b>NET PROFIT FOR THE YEAR BEFORE MINORITY INTERESTS</b>		<b>2.2</b>	<b>2.9</b>	<b>3.2</b>
Profit of subsidiaries attributable to minority interests		0.0	0.1	0.0
<b>NET PROFIT FOR THE YEAR</b>		<b>2.2</b>	<b>3.0</b>	<b>3.2</b>

A proposal has been made to transfer net profit to equity.

### GROUP SEGMENT INFORMATION, EUR MILLION

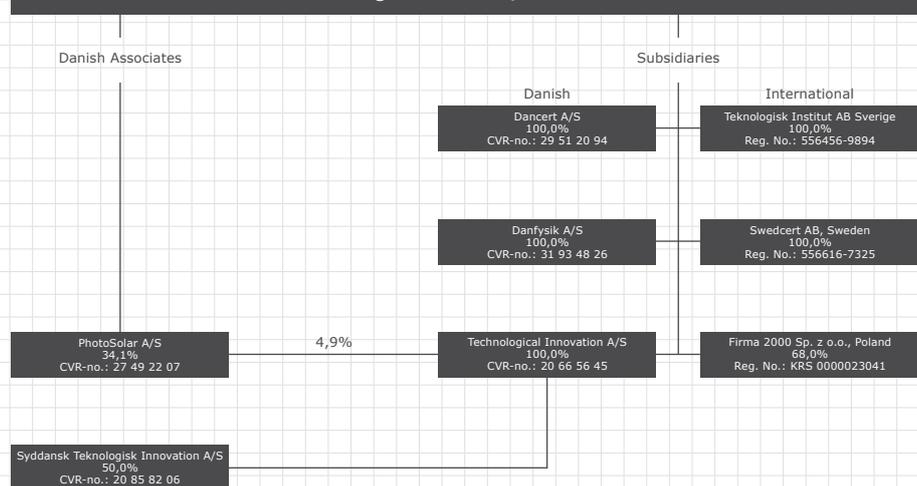
Revenue	Commercial activities			R&D activities			Performance contracts (R&D)			Total revenue		
	2009	2008	2007	2009	2008	2007	2009	2008	2007	2009	2008	2007
Building Technology	12.5	12.9	12.3	1.9	1.3	1.1	1.7	1.9	1.9	16.1	16.1	15.3
Energy and Climate	10.3	10.0	9.7	5.9	4.5	3.4	3.0	2.8	2.0	19.2	17.3	15.1
Business Development	7.3	7.1	7.2	1.2	0.8	0.6	1.8	1.2	1.1	10.3	9.1	8.9
Materials and Production	7.9	7.6	6.5	5.4	4.0	3.3	2.3	2.3	2.4	15.6	13.9	12.2
Productivity and Logistics	6.6	7.0	7.0	2.9	1.5	0.7	1.5	1.1	1.2	11.0	9.6	8.9
International Centre	1.1	3.6	6.9	0.0	0.0	0.0	0.0	0.0	0.0	1.1	3.6	6.9
Danish Meat Research Institute	1.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0
Training	9.4	11.0	11.5	0.0	0.0	0.0	0.0	0.0	0.0	9.4	11.0	11.5
Life Science	5.6	6.7	6.4	4.0	3.3	2.8	2.0	2.3	2.3	11.6	12.3	11.5
<b>Total, Institute</b>	<b>61.7</b>	<b>65.9</b>	<b>67.5</b>	<b>24.0</b>	<b>15.4</b>	<b>11.9</b>	<b>12.3</b>	<b>11.6</b>	<b>10.9</b>	<b>98.0</b>	<b>92.9</b>	<b>90.3</b>
Subsidiaries*	15.0	10.0	10.4	0.0	0.0	0.0	0.0	0.0	0.0	15.0	10.0	10.4
<b>TOTAL, GROUP</b>	<b>76.7</b>	<b>75.9</b>	<b>77.9</b>	<b>24.0</b>	<b>15.4</b>	<b>11.9</b>	<b>12.3</b>	<b>11.6</b>	<b>10.9</b>	<b>113.0</b>	<b>102.9</b>	<b>100.7</b>

\* Primarily training activities at Technological Institute AB in Sweden, production of particle accelerator equipment at Danfysik A/S, certification activities at Swedcert AB and Dancert A/S and consulting and training activities at FIRMA 2000 Sp. z o.o.

### REVENUE - GEOGRAPHICALLY

Group	2009	2008	2007
Denmark	90.7	82.7	78.2
International	22.3	20.2	22.5
<b>TOTAL</b>	<b>113.0</b>	<b>102.9</b>	<b>100.7</b>

### Danish Technological Institute / CVR-no.: 56 97 61 16



## BALANCE SHEET

ASSETS, EUR million	Note	2009	2008	2007
Goodwill		0.3	0.1	0.1
Development projects		0.0	0.0	0.0
Patents		0.6	0.0	0.0
<b>Total intangible assets</b>	<b>4</b>	<b>0.9</b>	<b>0.1</b>	<b>0.1</b>
Land and buildings		37.6	32.5	32.5
Fixtures and operating equipment		9.7	8.3	6.0
<b>Total property, plant and equipment</b>	<b>5</b>	<b>47.3</b>	<b>40.8</b>	<b>38.5</b>
Investments in associates	6	1.1	0.5	0.1
Receivables from associates		0.2	0.0	0.0
Other investments	6	0.5	1.0	1.2
<b>Total investments</b>		<b>1.8</b>	<b>1.5</b>	<b>1.3</b>
<b>TOTAL NON-CURRENT ASSETS</b>		<b>50.0</b>	<b>42.4</b>	<b>39.9</b>
Inventories	7	1.0	0.0	0.0
<b>Total inventories</b>		<b>1.0</b>	<b>0.0</b>	<b>0.0</b>
Trade receivables		14.6	13.5	11.3
Contract work in progress	8	8.0	1.5	1.2
Deferred tax asset	3	0.2	0.1	0.1
Other receivables		0.2	0.4	0.6
Prepayments		0.2	0.3	0.3
<b>Total receivables</b>		<b>23.2</b>	<b>15.8</b>	<b>13.5</b>
<b>Cash</b>	<b>9</b>	<b>15.8</b>	<b>17.1</b>	<b>17.3</b>
<b>TOTAL CURRENT ASSETS</b>		<b>40.0</b>	<b>32.9</b>	<b>30.8</b>
<b>TOTAL ASSETS</b>		<b>90.0</b>	<b>75.3</b>	<b>70.7</b>
<b>EQUITY AND LIABILITIES, EUR million</b>	<b>Note</b>	<b>2009</b>	<b>2008</b>	<b>2007</b>
<b>TOTAL EQUITY</b>	<b>10 + 16</b>	<b>45.8</b>	<b>43.5</b>	<b>41.0</b>
<b>Minority interests</b>		<b>0.1</b>	<b>0.1</b>	<b>0.1</b>
Deferred tax	3	0.2	0.0	0.0
Guarantees		0.1	0.0	0.0
<b>TOTAL PROVISIONS</b>		<b>0.3</b>	<b>0.0</b>	<b>0.0</b>
Mortgage debt		6.3	6.3	6.3
<b>Total long-term liabilities other than provisions</b>	<b>11</b>	<b>6.3</b>	<b>6.3</b>	<b>6.3</b>
Trade payables		5.0	4.5	2.3
Contract work in progress	8	10.0	4.6	5.7
Corporation tax payable		0.2	0.0	0.0
Other payables	12	22.3	15.5	14.4
Deferred income		0.0	0.8	0.9
<b>Total current liabilities other than provisions</b>		<b>37.5</b>	<b>25.4</b>	<b>23.3</b>
<b>TOTAL LIABILITIES OTHER THAN PROVISIONS</b>		<b>43.8</b>	<b>31.7</b>	<b>29.6</b>
<b>TOTAL EQUITY AND LIABILITIES</b>		<b>90.0</b>	<b>75.3</b>	<b>70.7</b>

Auditors' remuneration, note 13, Charges, guarantee commitments and rental and lease commitments, note 14  
Contingent liabilities, etc., note 15, Derivative financial instruments, note 16, Related parties, note 17

## CASH FLOW STATEMENT

EUR million	2009	2008	2007
Operating profit	2.4	2.4	2.9
Adjustment for non-cash items	4.3	0.1	0.3
Depreciation, amortisation and impairment losses	3.5	2.7	3.9
<b>Cash flow from operating activities before change in working capital</b>	<b>10.2</b>	<b>5.2</b>	<b>7.1</b>
Change in work in progress and prepayments	(0.6)	(2.3)	(2.7)
Change in inventories	0.6	0.0	0.0
Change in trade payables and other short-term debt	(0.8)	3.7	0.2
Change in receivables	(1.0)	(2.0)	3.3
<b>Cash flow from operating activities before items under financial income and expenses, net</b>	<b>8.4</b>	<b>4.6</b>	<b>7.9</b>
Financial deposits and withdrawals, net	0.1	0.5	0.5
Corporation tax paid	(0.1)	0.0	0.0
<b>CASH FLOW FROM OPERATING ACTIVITIES</b>	<b>8.4</b>	<b>5.1</b>	<b>8.4</b>
Investment in intangible activities	0.0	0.0	0.0
Investment in company acquisitions and disposals	(4.3)	0.0	0.0
Investment in property, plant and equipment	(5.0)	(4.8)	(4.1)
Investment in fixed asset investments	(0.4)	(0.6)	(0.3)
<b>CASH FLOW FROM INVESTING ACTIVITIES</b>	<b>(9.7)</b>	<b>(5.4)</b>	<b>(4.4)</b>
<b>CASH FLOW FOR THE YEAR</b>	<b>(1.3)</b>	<b>(0.3)</b>	<b>4.0</b>
Cash and cash equivalents, 1 January	17.1	17.4	13.3
<b>CASH AND CASH EQUIVALENTS, 31 DECEMBER</b>	<b>15.8</b>	<b>17.1</b>	<b>17.3</b>

The cash flow statement cannot be deducted from the other components in the consolidated financial statements.  
Figures without parentheses = increase in liquidity  
Figures in parentheses = (reduction in liquidity)

## NOTES

1.	Note	EUR million	2009	2008	2007
	<b>Staff costs</b>				
	Wages and salaries, etc.		63.2	54.5	51.8
	Pension contributions and other social expenses		1.5	1.4	1.4
	<b>TOTAL STAFF COSTS</b>		<b>64.7</b>	<b>55.9</b>	<b>53.2</b>
	Fees to Executive Board and Board of Trustees amounting to EUR 0.4 million (2008: EUR 0.4 million)				
	The number of Group employees averaged 904 against 854 in 2008.				
2.	<b>Depreciation, amortisation and impairment losses</b>				
	Depreciation and amortisation		3.5	2.7	2.7
	Impairment losses - loans		0.0	0.0	1.2
	Loss/gain on sale (negative amount = gain)		0.0	0.0	0.0
	<b>TOTAL DEPRECIATION, AMORTISATION AND IMPAIRMENT LOSSES</b>		<b>3.5</b>	<b>2.7</b>	<b>3.9</b>
3.	<b>Tax</b>				
	<b>Tax on profit for the year</b>				
	Current tax		0.2	0.0	0.2
	Adjustment of deferred tax		(0.1)	0.0	0.0
	<b>TOTAL TAX ON PROFIT FOR THE YEAR</b>		<b>0.1</b>	<b>0.0</b>	<b>0.2</b>
	<b>Deferred tax asset</b>				
	Deferred tax asset, 1 January		0.2	0.1	0.1
	Adjustment during the year		0.0	0.0	0.0
	<b>DEFERRED TAX ASSET, 31 DECEMBER</b>		<b>0.2</b>	<b>0.1</b>	<b>0.1</b>
	<i>The deferred tax asset can be specified as follows:</i>				
	Investments		0.0	0.0	0.0
	Tax loss		0.2	0.1	0.3
	Valuation reserve		0.0	0.0	(0.2)
	<b>Deferred tax asset, 31 December</b>		<b>0.2</b>	<b>0.1</b>	<b>0.1</b>
	<b>Deferred tax</b>				
	Deferred tax, 1 January		0.0	0.0	0.0
	Acquisition of subsidiary		0.2	0.0	0.0
	Adjustment during the year		0.0	0.0	0.0
	<b>DEFERRED TAX, 31 DECEMBER</b>		<b>0.2</b>	<b>0.0</b>	<b>0.0</b>
	<i>Deferred tax can be specified as follows:</i>				
	Intangible assets		0.0	0.0	0.0
	Property, plant and equipment		0.0	0.0	0.0
	Current assets		0.2	0.0	0.0
	<b>Deferred tax, 31 December</b>		<b>0.2</b>	<b>0.0</b>	<b>0.0</b>
4.	<b>Intangible assets</b>				
	<b>Goodwill</b>				
	Cost, 1 January		1.9	1.7	1.7
	Additions		0.0	0.2	0.0
	Additions relating to acquisitions		0.2	0.0	0.0
	Disposals		0.0	0.0	0.0
	<b>COST, 31 DECEMBER</b>		<b>2.1</b>	<b>1.9</b>	<b>1.7</b>
	Amortisation, 1 January		1.8	1.6	1.0
	Amortisation		0.0	0.2	0.6
	Amortisation relating to disposals during the year		0.0	0.0	0.0
	<b>Amortisation, 31 December</b>		<b>1.8</b>	<b>1.8</b>	<b>1.6</b>
	<b>CARRYING AMOUNT, 31 DECEMBER</b>		<b>0.3</b>	<b>0.1</b>	<b>0.1</b>
	<b>Development projects</b>				
	Cost, 1 January		0.0	0.0	0.0
	Additions		0.0	0.0	0.0
	Disposals		0.0	0.0	0.0
	<b>COST, 31 DECEMBER</b>		<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
	Amortisation, 1 January		0.0	0.0	0.0
	Amortisation		0.0	0.0	0.0
	Amortisation relating to disposals during the year		0.0	0.0	0.0
	<b>Amortisation, 31 December</b>		<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
	<b>CARRYING AMOUNT, 31 DECEMBER</b>		<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
	<b>Patents</b>				
	Cost, 1 January		0.0	0.0	0.0
	Additions		0.6	0.0	0.0
	Disposals		0.0	0.0	0.0
	<b>COST, 31 DECEMBER</b>		<b>0.6</b>	<b>0.0</b>	<b>0.0</b>
	Amortisation, 1 January		0.0	0.0	0.0
	Amortisation		0.0	0.0	0.0
	Amortisation relating to disposals during the year		0.0	0.0	0.0
	<b>Amortisation, 31 December</b>		<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
	<b>CARRYING AMOUNT, 31 DECEMBER</b>		<b>0.6</b>	<b>0.0</b>	<b>0.0</b>
	<b>TOTAL CARRYING AMOUNT OF INTANGIBLE ASSETS, 31 DECEMBER</b>		<b>0.9</b>	<b>0.1</b>	<b>0.1</b>

## NOTES

5.	Note	EUR million	2009	2008	2007
	<b>Property, plant and equipment</b>				
	<b>Land and buildings</b>				
	Cost, 1 January		50.5	50.0	49.7
	Additions		1.7	0.5	0.3
	Additions relating to acquisitions		4.1	0.0	0.0
	Disposals		0.0	0.0	0.0
	<b>COST, 31 DECEMBER</b>		<b>56.3</b>	<b>50.5</b>	<b>50.0</b>
	Depreciation and impairment losses, 1 January		18.0	17.5	17.0
	Additions		0.0	0.0	0.0
	Depreciation		0.7	0.5	0.5
	Depreciation relating to disposals during the year		0.0	0.0	0.0
	<b>Depreciation and impairment losses, 31 December</b>		<b>18.7</b>	<b>18.0</b>	<b>17.5</b>
	<b>CARRYING AMOUNT, 31 DECEMBER</b>		<b>37.6</b>	<b>32.5</b>	<b>32.5</b>
	<b>Public cash value, 31 December</b>		<b>108.7</b>	<b>93.8</b>	<b>93.7</b>
	<b>Fixtures and operating equipment</b>				
	Cost, 1 January		29.3	25.3	21.5
	Translation adjustment		0.0	(0.1)	0.0
	Additions		3.3	4.5	3.8
	Additions relating to acquisitions		0.7	0.0	0.0
	Project-financed		(0.1)	(0.1)	0.0
	Additions, own development projects		0.1	0.0	0.0
	Additions		(1.8)	(0.3)	0.0
	<b>COST, 31 DECEMBER</b>		<b>31.5</b>	<b>29.3</b>	<b>25.3</b>
	Depreciation and impairment losses, 1 January		21.0	19.3	16.5
	Translation adjustment		0.0	(0.1)	0.0
	Additions relating to acquisitions		0.0	0.0	0.0
	Depreciation		2.5	2.1	1.6
	Impairment losses		0.0	0.0	1.2
	Depreciation and impairment losses relating to disposals during the year		(1.7)	(0.3)	0.0
	<b>Depreciation and impairment losses, 31 December</b>		<b>21.8</b>	<b>21.0</b>	<b>19.3</b>
	<b>CARRYING AMOUNT, 31 DECEMBER</b>		<b>9.7</b>	<b>8.3</b>	<b>6.0</b>
	Of which value of assets leased under finance leases		0.0	0.0	0.0
6.	<b>Investments</b>				
	Investment in and value adjustment of securities and fixed asset investments can be specified as follows:				
	<b>Associates</b>				
	Balance, 1 January		0.5	0.1	0.1
	Additions during the year		1.1	0.4	0.0
	Disposals during the year		0.0	0.0	0.0
	<b>Balance, 31 December</b>		<b>1.6</b>	<b>0.5</b>	<b>0.1</b>
	Value adjustment, 1 January		0.0	0.0	0.0
	Translation adjustment, 1 January		(0.2)	0.0	0.0
	Share of profit or loss after tax for the year		(0.3)	0.0	0.0
	Value adjustment relating to disposals		0.0	0.0	0.0
	Impairment losses		0.0	0.0	0.0
	<b>Value adjustment, 31 December</b>		<b>(0.5)</b>	<b>0.0</b>	<b>0.0</b>
	<b>CARRYING AMOUNT, 31 DECEMBER</b>		<b>1.1</b>	<b>0.5</b>	<b>0.1</b>
	<b>Other investments</b>				
	Balance, 1 January		1.0	1.0	0.8
	Additions during the year		0.1	0.0	0.4
	Disposals during the year		(0.2)	0.0	(0.2)
	<b>Balance, 31 December</b>		<b>0.9</b>	<b>1.0</b>	<b>1.0</b>
	Value adjustment, 1 January		(0.3)	0.2	0.1
	Translation adjustment, 1 January		0.1	0.0	0.0
	Share of profit or loss after tax for the year		(0.2)	0.0	0.0
	Impairment losses		0.0	(0.2)	0.1
	<b>Value adjustment, 31 December</b>		<b>(0.4)</b>	<b>0.0</b>	<b>0.2</b>
	<b>CARRYING AMOUNT, 31 DECEMBER</b>		<b>0.5</b>	<b>1.0</b>	<b>1.2</b>
7.	<b>Inventories</b>				
	Raw materials and consumables		1.5	0.0	0.0
	Work in progress		0.2	0.0	0.0
	Manufactured goods and goods for resale		0.0	0.0	0.0
	Prepayment, inventories		(0.7)	0.0	0.0
	<b>INVENTORIES, 31 DECEMBER</b>		<b>1.0</b>	<b>0.0</b>	<b>0.0</b>
	Of which the carrying amount of inventories recognised at net realisation value is		0.2	0.0	0.0

## NOTES

8.	Note	EUR million	2009	2008	2007
	<b>Contract work in progress</b>				
	Contract work in progress		48.8	39.4	37.4
	Invoicing on account and prepayments		(50.8)	(42.5)	(41.9)
	<b>WORK IN PROGRESS, NET</b>		<b>(2.0)</b>	<b>(3.1)</b>	<b>(4.5)</b>
	recognised as follows:				
	Contract work in progress		8.0	1.5	1.2
	Contract work in progress (liabilities)		(10.0)	(4.6)	(5.7)
	<b>WORK IN PROGRESS, NET</b>		<b>(2.0)</b>	<b>(3.1)</b>	<b>(4.5)</b>
	Work in progress is determined at selling price				
9.	<b>Cash</b>				
	Free funds		11.6	17.1	17.3
	Tied-up funds		4.2	0.0	0.0
	<b>TOTAL CASH</b>		<b>15.8</b>	<b>17.1</b>	<b>17.3</b>
	Tied-up funds comprise custody account deposits and EU prepayments				
10.	<b>Equity</b>				
	Equity, 1 January		43.5	41.0	37.7
	Translation adjustment of financial instruments		0.1	(0.3)	0.0
	Translation adjustment of subsidiary		0.1	(0.2)	0.1
	Net profit for the year		2.1	3.0	3.2
	<b>EQUITY, 31 DECEMBER</b>		<b>45.8</b>	<b>43.5</b>	<b>41.0</b>
11.	<b>Long-term liabilities other than provisions</b>				
	<i>Due in five years or more</i>				
	Mortgage debt		6.3	6.3	6.3
	<b>TOTAL LONG-TERM LIABILITIES OTHER THAN PROVISIONS</b>		<b>6.3</b>	<b>6.3</b>	<b>6.3</b>
12.	<b>Other payables</b>				
	Holiday pay obligation		9.9	7.4	6.8
	Other liabilities		5.9	4.6	4.5
	Tax payable		2.1	0.0	0.0
	VAT payable		0.8	0.6	0.7
	Other items payable		3.4	2.7	2.2
	Miscellaneous deposits		0.2	0.2	0.2
	<b>TOTAL OTHER PAYABLES</b>		<b>22.3</b>	<b>15.5</b>	<b>14.4</b>
13.	<b>Auditors' remuneration</b>				
	<b>Total remuneration</b>		<b>0.2</b>	<b>0.2</b>	<b>0.1</b>
	Of which services relating to statement work amount to		0.1	0.1	0.1
14.	<b>Charges</b>				
	As security for bank debt (mortgages registered to the mortgagor and indemnification letter on Institute properties), nom.		0,0	0,0	0,0
	<b>Guarantee commitments</b>				
	As security for on account payments received (primarily EU projects)		5,4	1,8	3,6
	<b>Rental and lease commitments</b>				
	<b>Rental commitments</b>				
	Commitment, next five years		0,7	1,4	1,7
	Commitment, coming year		0,7	0,8	0,8
	<b>Operating leases</b>				
	Commitment, next five years		0,1	0,2	0,8
	Commitment, coming year		0,1	0,1	0,3
	<b>Finance leases</b>				
	Commitment, next five years (incl. interest)		0,0	0,0	0,0
	Commitment, coming year		0,0	0,0	0,0
15.	<b>Contingent liabilities, etc.</b>				
	The Group is party to a few disputes, the outcome of which is not expected to influence the financial position.				
	The Group participates in projects that under certain circumstances may lead to a commitment to repay the grants received.				
	The Group has issued a statement on financial support to subsidiaries for the purpose of ensuring ongoing business for the next 12 months.				

## NOTES

16.

### Note

#### Derivative financial instruments

As part of its hedging of individual foreign currency contracts, the Group uses forward exchange contracts. The signed contracts can be specified as follows:

EUR million	Period	Contract value			Profit and/or loss recognised in equity		
		2009	2008	2007	2009	2008	2007
<b>GROUP TOTAL</b>	<b>0-6 MONTHS</b>	<b>5.3</b>	<b>0.7</b>	<b>1.8</b>	<b>(0.1)</b>	<b>0.2</b>	<b>-</b>

Forward exchange contracts have been signed for CAD, CHF, GBP, JPY, SEK and USD.

17.

#### Related parties

The Group's related parties, with material influence, comprise members of the Board of Trustees and Executive Board as well as subsidiaries and associates. The Group has no transactions with related parties apart from usual trade with subsidiaries and associates. Transactions are on an arm's length basis.

# ACCOUNTING POLICIES

## GENERAL

The Annual Report of the Danish Technological Institute for 2009 is presented in conformity with the provisions of the Danish Financial Statements Act governing class C companies (large) and the adjustments resulting from the Danish Technological Institute being an independent institution and an approved technological service institute.

The accounting policies applied are consistent with those applied last year.

### Recognition and measurement in general

Assets are recognised in the balance sheet when it is probable that future economic benefits will flow to the company and the value of the asset can be reliably measured.

Liabilities are recognised in the balance sheet when it is probable that future economic benefits will flow from the company and the value of the liability can be reliably measured.

At the time of initial recognition, assets and liabilities are measured at cost. Subsequent to initial recognition, assets and liabilities are measured as described for each individual accounting item below.

For recognition and measurement purposes, due consideration is given to gains, losses and risks arising before the Annual Report is prepared and proving and disproving matters arising on or before the balance sheet date.

Income is recognised in the income statement as earned, including value adjustments of financial assets and liabilities measured at fair value or amortised cost. Moreover, expenses incurred to generate earnings for the year are recognised, including depreciation, amortisation, impairment losses and provisions as well as reversals resulting from changed accounting estimates of amounts that used to be recognised in the income statement.

## CONSOLIDATED FINANCIAL STATEMENTS

The consolidated financial statements comprise the Parent Company, the Danish Technological Institute, and subsidiaries in which the Danish Technological Institute directly or indirectly holds more than 50% of the voting rights or, in any other way, exercises control. Undertakings in which the Group holds between 20% and 50% of the voting rights and exercises a significant, yet no controlling, interest are considered associated undertakings, see group chart.

Intercompany income and expenses, shareholdings, balances and dividends as well as realised and unrealised gains and losses on transactions between consolidated companies are eliminated on consolidation.

Investments in subsidiaries are eliminated at the proportionate share of the subsidiaries' fair value of net assets and liabilities at the date of acquisition.

Newly acquired or newly established companies are recognised in the consolidated financial statements from the date of acquisition or establishment. Divested or liquidated companies are recognised in the consolidated income statement up to the date of divestment or liquidation. Comparative figures are not restated for newly acquired, divested or liquidated companies.

In the event of company acquisitions, the acquisition accounting method is used, according to which the identifiable assets and liabilities of the newly acquired companies are measured at fair value at the date of acquisition. Provisions are recognised to cover the cost of decided and published plans to restructure the acquired company in connection with the acquisition. Deferred tax is recognised of the reassessments made.

Positive differences (goodwill) between the cost and fair value of acquired identifiable assets and liabilities are recognised as intangible assets and amortised systematically in the income statement on the basis of the estimated useful life of the asset not exceeding twenty years.

Negative differences (negative goodwill), reflecting an expected unfavourable development of the companies in question, are recognised in the balance sheet on an accruals basis and recognised in the income statement in parallel with the realisation of the unfavourable development.

An amount of negative goodwill not related to an expected unfavourable development is recognised in the balance sheet, equalling the fair value of non-monetary assets, which is subsequently recognised in the income statement over the average life of such non-monetary assets.

Goodwill and negative goodwill from acquired companies are adjustable until the end of the year following the acquisition.

Any profit or loss on the divestment of subsidiaries and associates is determined as the difference between the selling or liquidation price and the net asset value at the date of divestment, including unamortised goodwill, as well as the expected cost of divestment or liquidation.

### Minority interests

The items of subsidiaries are fully recognised in the consolidated financial statements. Minority interests' proportionate share of the profits or losses and equity of subsidiaries are determined on an annual basis and recognised as separate items in the income statement and balance sheet.

### Foreign currency translation

At the time of initial recognition, transactions in foreign currencies are translated using the exchange rates prevailing at the date of transaction. Exchange differences arising between the exchange rates prevailing at the date of transaction and the date of payment are recognised in the income statement as items under financial income and expenses, net.

Receivables, payables and other monetary items in foreign currencies are translated using the exchange rates prevailing at the balance sheet date. The difference between the exchange rate prevailing at the balance sheet date and the exchange rate prevailing at the date when the amount receivable or payable originated or was recognised in the latest annual report is recognised in the income statement under financial income and expenses.

Translation adjustments of intercompany balances with independent foreign subsidiaries that are considered a part of the total investment in the subsidiary are recognised directly in equity. Exchange gains and losses on loans and derivative financial instruments used for hedging foreign subsidiaries are also recognised directly in equity.

The income statement of foreign subsidiaries is translated using an average exchange rate, and balance sheet items are translated using the exchange rates prevailing at the balance sheet date. Exchange differences arising from the translation of the equity of foreign subsidiaries at the beginning of the year at the exchange rates prevailing at the balance sheet date and from the translation of the income statements based on average exchange rates at the exchange rates prevailing at the balance sheet date are recognised directly in equity.

### Derivative financial instruments

Derivative financial instruments are initially recognised in the balance sheet at cost and subsequently measured at fair value. Positive and negative fair values of derivative financial instruments are included in other receivables and other payables, respectively.

Changes in the fair value of derivative financial instruments classified as and qualifying for recognition as an instrument used for hedging the fair value of a recognised asset or liability are recognised in the income statement together with changes in the fair value of the hedged asset or liability.

Changes in the fair value of derivative financial instruments classified as and qualifying for recognition as an instrument used for hedging future assets and liabilities are recognised in other receivables or other payables and in equity. If the future transaction results in the recognition of assets or liabilities, amounts previously recognised in equity are transferred to the cost of the asset or liability. If the future transaction results in income or costs, amounts recognised in equity are transferred to the income statement for the period during which the hedged item affects the income statement.

In regard to derivative financial instruments not qualifying for hedge accounting treatment, changes in fair value are recognised in the income statement when they occur.

## INCOME STATEMENT

### Revenue

The method of revenue recognition is the completed contract method according to which income is recognised in the income statement as invoiced.

The revenue of the Danish Technological Institute falls into three categories: Commercial activities, research and development activities and performance contract activities. Commercial activities include projects undertaken on behalf of private and public customers with the customer being the owner of the rights to the results of the project. Research and development activities are undertaken on behalf of Danish and foreign licensors. The results of these projects will become publicly available through the licensors. Performance contract activities comprise a number of projects undertaken on behalf of the Danish Council for Technology and Innovation, the general objective being to allow small and medium-sized enterprises to benefit from new knowledge and new technologies in a smooth and efficient manner.

Major and longer-term contract work in progress is recognised under the percentage of completion method, meaning that the profit on any services sold is recognised in the income statement as the work is performed.

### Project costs

Project costs comprise costs incurred during the year, excluding salaries, which are directly attributable to the individual projects.

### Research and development

Research and development costs and agreed development costs of completing project agreements entered into, completed without remuneration, are recognised in the income statement under project costs and staff costs, depending on their nature.

### Other external expenses

Other external expenses comprise expenses of distribution, sale, advertising, administration, premises, bad debts, operating leases, etc.

### Income from investments in subsidiaries and associates

The proportionate share of profit/loss after tax of the individual subsidiaries is recognised in the income statement of the Parent Company after full elimination of intercompany gains/losses.

The proportionate share of the profit/loss after tax of associates is recognised in the income statement of both the Parent Company and the Group after elimination of the proportionate share of intercompany gains/losses.

### Financial income and expenses

Financial income and expenses comprise interest, exchange gains and losses on securities, liabilities and transactions in foreign currencies as well as reimbursements under the on-account tax scheme, etc.

### Tax on profit for the year

Being an approved technological service institute, the Danish Technological Institute is exempt from liability to pay tax.

Danish subsidiaries liable to pay tax are subject to the Danish rules on compulsory joint taxation. Subsidiaries are included in the joint taxation scheme as from the time when they are included in the consolidated financial statements until the time when they are no longer consolidated.

Current Danish corporation tax is allocated through payment of tax contributions between the jointly taxed companies in proportion to their taxable incomes. In this connection, companies suffering a tax loss receive tax contributions from companies having been able to use these losses to reduce their own tax profits.

Tax for the year, which comprises current tax and changes in deferred tax, is recognised in the income statement with the part attributable to profit for the year and directly in equity with the part attributable to equity items.

## BALANCE SHEET

### Intangible assets

#### Goodwill

Goodwill is amortised over the estimated useful life, which is determined on the basis of management's experience within the individual business areas. Goodwill is amortised on a straight-line basis over a period of five years. The carrying amount of goodwill is continuously assessed and written down to recoverable amount in the income statement provided that the carrying amount exceeds the expected future net income from the company or activity to which the goodwill relates.

#### Development costs

Development costs comprise costs, wages and salaries and amortisation that are directly and indirectly attributable to the Institute's development projects.

Development projects that are clearly defined and identifiable, and where the capacity utilisation rate, sufficient resources and a potential future market or development prospects for the company can be established, and where the intention is to produce, market or use the project, are recognised as intangible fixed assets if the cost can be determined reliably and there is adequate certainty that future earnings will cover selling costs and administrative expenses, etc., as well as development costs. Other development costs are recognised in the income statement as incurred.

Development costs recognised in the balance sheet are measured at cost less accumulated amortisation and impairment losses.

On completion of development work, development costs are amortised on a straight-line basis over the estimated useful life of the asset. The amortisation period is normally five years.

#### Patents and licences

Patents and licences are measured at cost less accumulated amortisation. Patents are amortised on a straight-line basis over the remaining patent period, and licences are amortised over the contract period, not exceeding five years. Any profit or loss on the disposal of patents and licences is determined as the difference between selling costs and the carrying amount at the date of disposal. Profit or loss is recognised in the income statement under depreciation, amortisation and impairment losses.

#### Property, plant and equipment

Land and buildings, plant and machinery as well as other fixtures and fittings, tools and equipment are measured at cost less accumulated depreciation and impairment losses. Land is not depreciated.

Cost comprises the acquisition cost and costs directly attributable to the acquisition up to the date when the asset is available for use.

Property, plant and equipment are depreciated on a straight-line basis over their estimated useful lives as follows:

Buildings	50 years
Machinery, equipment, etc.	5 years
Computer equipment	3 years

Property, plant and equipment are written down to the lower of recoverable amount or carrying amount. Impairment tests are conducted annually in respect of each individual asset or group of assets. Depreciation is recognised in the income statement under depreciation, amortisation and impairment losses.

Any profit or loss on the disposal of property, plant and equipment is determined as the difference between the selling price less selling costs and the carrying amount at the date of disposal. Profit or loss is recognised in the income statement under depreciation, amortisation and impairment losses.

#### Leases

Leases for non-current assets in respect of which the Institute has all significant risks and benefits related to ownership (finance leases) are measured at the time of initial recognition in the balance sheet at the lower of fair value and net present value of future lease payments. For the calculation

of net present value, the internal rate of interest specified in a particular lease, or the Institute's alternative lending rate, is used as a discount rate. Assets under finance leases are subsequently treated like the Institute's other non-current assets.

Any capitalised remaining lease commitment is recognised in the balance sheet as a liability, and the interest portion of the lease payment is recognised in the income statement over the term of the lease.

All other leases are operating leases. Payments under operating and other leases are recognised in the income statement over the term of the lease. The Institute's total liability under operating leases is recorded under contingent liabilities, etc.

#### Investments in subsidiaries and associates

Investments in subsidiaries and associates are measured according to the equity method.

Investments in subsidiaries and associates are measured at the proportionate share of the equity value of the subsidiaries and associates, determined according to the Institute's accounting policies plus or less any unrealised intercompany profits or losses and plus or less the remaining value of positive or negative goodwill.

Investments in subsidiaries and associates with a negative equity value are measured at EUR 0.00 and any receivable from these associates is written down to the extent the receivable is deemed irrevocable. To the extent that the Parent Company has a legal or constructive obligation to cover a negative balance, which exceeds the receivable, the remainder is recognised under provisions.

Net revaluation of investments in subsidiaries and associates is taken to the reserve for net revaluation according to the equity method under equity to the extent that the carrying amount exceeds cost.

#### Impairment of assets

The carrying amount of both intangible assets and property, plant and equipment is tested on an annual basis for indications of impairment in addition to what is expressed through amortisation and depreciation.

In case of indication of impairment, an impairment test is carried out for each individual asset and group of assets, respectively. Assets are written down to the lower of recoverable amount or carrying amount. The highest value of net selling price and value in use is used as recoverable amount. The value in use is determined as the net present value of expected net income from the use of the asset or group of assets.

#### Inventories

Inventories are measured at cost in accordance with the FIFO method. Where net realisable value is lower than cost, inventories are written down to this lower value.

Goods for resale and raw materials and consumables are measured at cost, comprising cost with the addition of delivery costs.

The net realisable value of inventories is calculated as selling price less completion costs and costs involved in executing the sale and is determined with due regard to marketability, obsolescence and movements in expected selling price.

#### Receivables

Receivables are measured at amortised cost. Following individual assessment, receivables are written down for uncollectibles.

#### Contract work in progress

Contract work in progress regarding major and longer-term projects is measured at the selling price of the work performed. The selling price is measured on the basis of the degree of completion at the balance sheet date and total expected income from the individual contract for work in progress.

If the selling price of a contract cannot be determined reliably, it is measured at the lower of costs incurred or net realisable value.

The individual contract for work in progress is recognised in the balance sheet under receivables or payables. Net assets are made up of the sum of construction contracts where the selling price of the work performed exceeds invoicing on account.

#### Prepayments

Prepayments comprise costs incurred relating to subsequent financial years.

#### Corporation tax and deferred tax

Current tax payable and receivable is recognised in the balance sheet as tax computed on taxable income for the year, adjusted for tax on taxable incomes for prior years and for taxes paid on account.

Deferred taxes are measured according to the balance sheet liability method on all temporary differences between the carrying amount and tax base of assets and liabilities.

Deferred tax assets, including the tax base of tax loss carryforwards, are recognised in the balance sheet at their estimated realisable value.

#### Provisions

Provisions comprise expected expenses for completing development projects. Provisions are recognised when the Institute has a legal or constructive obligation as a result of past events and the discharge of such obligation is likely to involve an outflow of the Institute's financial resources.

#### Liabilities other than provisions

Payables to mortgage credit institutions and banks are recognised at the date of borrowing at the proceeds received net of transaction costs paid.

In subsequent periods, financial liabilities are measured at amortised cost, corresponding to the capitalised value using the effective interest rate. Accordingly, the difference between the proceeds and the nominal value is recognised in the income statement over the term of the loan.

Other payables are measured at net realisable value.

#### Deferred income

Deferred income comprises received payments relating to income in subsequent years.

## CASH FLOW STATEMENT

The cash flow statement shows the Institute's cash flows for the year distributed on operating, investing and financing activities, changes in cash and cash equivalents for the year as well as the Group's cash and cash equivalents at the beginning and end of the financial year.

The cash flow effect of business acquisitions and divestments is shown separately under cash flows from investing activities. Cash flows from acquired companies are recognised in the cash flow statement from the date of acquisition, and cash flows from divested companies are recognised up to the date of divestment.

#### Cash flow from operating activities

Cash flows from operating activities are determined as the Institute's share of profit adjusted for non-cash operating items, changes in working capital and corporation tax paid.

#### Cash flow from investing activities

Cash flows from investing activities comprise payments in connection with the acquisition and sale of companies and activities and the acquisition and sale of intangible assets, property, plant and equipment and investments.

#### Cash flow from financing activities

Cash flows from financing activities comprise changes in the size or composition of the Institute's capital and related costs as well as borrowing transactions and repayment of interest-bearing debt.

#### Cash and cash equivalents

Cash and cash equivalents comprise cash as well as short-term securities with a term of less than three months that are readily convertible into cash and subject to insignificant risks of changes in value.

#### Segment information

Revenue information is provided about primary Group segments. The segment information is based on the Group's accounting policies, risks and internal financial management. The primary segments comprise the Group's various activities (divisions and subsidiaries).

## STATEMENT BY THE BOARD OF TRUSTEES AND EXECUTIVE BOARD

The Board of Trustees and the Executive Board have today considered and approved the Annual Report of the Danish Technological Institute for 2009.

The Annual Report is presented in conformity with the Danish Financial Statements Act and the adjustments resulting from the Danish Technological Institute being an independ-

ent institution and an approved technological service institute.

In our opinion, the consolidated financial statements and the Institute's financial statements give a true and fair view of the Group's and the Institute's assets, liabilities and financial position at 31 December 2009 as well as the results of the Group's and the Institute's operations and the Group's cash flows for

the financial year ended 31 December 2009.

We also believe that the management's review provides a fair and accurate report on developments in the operations and finances, net profit for the year of the Group and the Institute and of the financial position of the Group and the Institute.

Taastrup, 12 February 2010

### **Executive Board**

Søren Stjernqvist  
President

### **Board of Trustees**

Hans Kirk, Chairman

Clas Nylandsted Andersen, Deputy Chairman

Jan Helbo

Niels-Erik Lundvig

Gunde Odgaard

Jens Nørgaard Oddershede

Jørgen Elikofer

Lars Aagaard

Carsten Christiansen

## INDEPENDENT AUDITORS' REPORT

### To the Danish Technological Institute and users of financial statements

We have audited the consolidated financial statements and the Parent Company's financial statements of the Danish Technological Institute for the financial year ended 31 December 2009 on pages 70-77. The consolidated financial statements and the Parent Company's financial statements of the Danish Technological Institute comprise the accounting policies, income statement, balance sheet, cash flow statement and notes. The consolidated financial statements and the Parent Company's financial statements are prepared in compliance with the Danish Financial Statements Act.

In connection with our audit, we have read the management's review, prepared in compliance with the Danish Financial Statements Act, and issued a statement in this regard.

### Responsibility of management for the Annual Report

Management is responsible for preparing and presenting consolidated financial statements and Parent Company financial statements which give a true and fair view in conformity with the provisions of the Danish Financial Statements Act. This responsibility includes establishing, implementing and maintaining internal controls of relevance to the preparation and presentation of consolidated financial statements and Parent Company's financial statements which give a true and fair view and are free of material misstatement, regardless of whether such misstatement is the result of fraud or error, and choosing and applying appropriate accounting policies and making accounting estimates which are reasonable under the circumstances.

### Responsibility of the auditors and basis of opinion

Our responsibility is to express an opinion on the consolidated financial statements and the Parent Company's financial statements based on our audit. We conducted our audit in accordance with Danish auditing standards and generally accepted auditing practices; cf. the audit instructions of Guidelines for Approved Technological Service in Denmark 2005. These standards require that we comply with ethical standards and plan and perform our audit to obtain reasonable assurance that the consolidated financial statements and the Parent Company's financial statements are free of material misstatement.

An audit comprises procedures to obtain audit evidence of the amounts and disclosures stated in the consolidated financial statements and the Parent Company's financial statements. The procedures chosen depend on the auditors' assessment, including an assessment of the risk of material misstatement in the consolidated financial statements and the Parent Company's financial statements, regardless of whether such misstatement is the result of fraud or error. In the risk assessment, the auditors consider internal controls of relevance to the Institute's preparation and presentation of consolidated financial statements and Parent Company's financial statements which give a true and fair view for the purpose of establishing audit procedures that are appropriate under the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Institute's internal controls. An audit also includes assessing whether the accounting policies applied by management are appropriate, assessing whether the accounting estimates made by management are reasonable and assessing the overall presentation of the consolidated financial statements and

the Parent Company's financial statements.

In our opinion, the audit evidence obtained provides a reasonable and suitable basis for our opinion.

Our audit has not resulted in any qualification.

### Opinion

In our opinion, the consolidated financial statements and the Parent Company's financial statements give a true and fair view of the Group's and the Danish Technological Institute's assets, liabilities and financial position at 31 December 2009 and of the results of the Group's and the Danish Technological Institute's operations and cash flows for the financial year ended 31 December 2009 in conformity with the Danish Financial Statements Act.

### Statement on the management's review

Pursuant to the Danish Financial Statements Act, we have read the management's review. We have not performed any other procedures in addition to the audit of the consolidated financial statements and the Parent Company's financial statements. On this basis, it is our opinion that the information given in the management's review is consistent with the consolidated financial statements and the Parent Company's financial statements.

Copenhagen, 12 February 2010

KPMG  
Statsautoriseret Revisionspartnerselskab

Finn L. Meyer  
State-authorized Public Accountant

Carsten Strunk  
State-authorized Public Accountant

## BOARD OF REPRESENTATIVES OF THE DANISH TECHNOLOGICAL INSTITUTE

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Hans Kirk (Chairman)

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Nielsen & Nielsen Holding A/S  
Elected by the Board of Representatives

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Appointed by the Danish Chamber of Commerce

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Appointed by the Danish Association of Managers and Executives

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Appointed by the Danish Federation of Small and Medium-Sized Enterprises

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KJ Industries A/S  
Appointed by the Confederation of Danish Industry

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Confederation of Danish Industry  
Appointed by the Confederation of Danish Employers

Bsc (Eng.)

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Appointed by the Economic Council of the Labour Movement and the Danish Confederation of Trade Unions

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Dep. of Food and Research  
Appointed by the Danish Agriculture & Food Council

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The Capital Region of Denmark  
Appointed by Danish Regions

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Appointed by the Ministry of Science, Technology and Innovation

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Ejde Nielsens Værktøjsfabrik A/S  
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Danish Construction Association  
Appointed by the Confederation of Danish Employers

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University of Southern Denmark  
Appointed by the Danish Academy of Technical Sciences

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Federation of Building, Construction and Wood-Workers' Unions  
Appointed by the Economic Council of the Labour Movement and the Danish Confederation of Trade Unions

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Municipality of Lejre  
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Taasinge Træ A/S  
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Managing Director

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Danish Academy of Technical Sciences  
Appointed by the Danish Academy of Technical Sciences

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Danish Confederation of Trade Unions  
Appointed by the Economic Council of the Labour Movement and the Danish Confederation of Trade Unions

Branch Chairman

Simon Tøggern  
Union of Commercial and Clerical Employees in Denmark, IT, Media & Industry  
Metropolitan Branch  
Appointed by the Economic Council of the Labour Movement and the Danish Confederation of Trade Unions

Chairman

Jørgen Vorsholt  
Confederation of Danish Employers  
Appointed by the Confederation of Danish Employers

### Employee representatives

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Laboratory Technician  
Eva Bak Jacobsen  
Laboratory for Microbiology

Electrician  
Niels Peter Lindeblad  
Building Services

Consultant  
Benny Neister  
Plastics Technology

## BOARD OF TRUSTEES

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Clas Nylandsted Andersen  
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Nielsen & Nielsen Holding A/S

Consultant  
Jørgen Elikofer

Managing Director  
Niels-Erik Lundvig  
Q-Transportmateriel A/S

Vice-Chancellor  
Jens Nørgaard Oddershede  
University of Southern Denmark

Head of Secretariat  
Gunde Odgaard  
Federation of Building, Construction  
and Wood-workers' Unions

Deputy Director  
Lars Aagaard  
Danish Energy Association

Sales Consultant  
Carsten Christiansen  
Employee Representative

Senior Consultant  
Jan Helbo  
Employee Representative

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Lars Drejer

Director  
Bo Frølund

Director  
Lars Germann

Director  
Lars Hinrichsen

Director  
Bjørn Lykke Jensen

Director  
Sanne Juul Nielsen

Group CFO  
Jørgen Kunter Pedersen

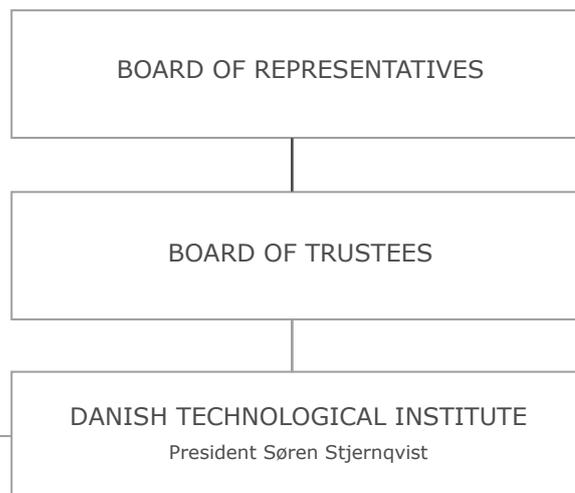
Company Secretary  
Andras Splidt

Director  
Leif Kirk Thøgersen

Director  
David Tveit

Director  
Jane Wickmann

# ORGANISATION



## BUILDING TECHNOLOGY

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**Building Processes**  
Centre Manager  
Henriette Hall-Andersen

**Indoor Climate and Humidity**  
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Centre Manager  
Ole Bisted

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Jørgen Baadsgaard-Jensen

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Centre Manager  
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Kaj L. Bryder

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Claus Schön Poulsen

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Centre Manager  
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Centre Manager  
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**Technology Partnership**  
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Henrik Givskov Larson

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Bo Frølund

**DTI Oil & Gas**  
Acting Centre Manager  
Bo Frølund

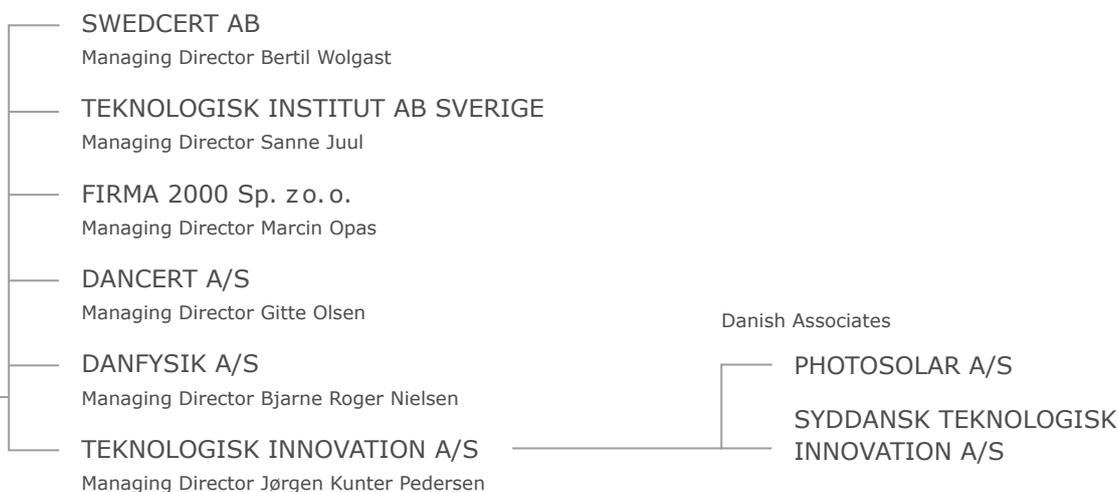
**Fisheries and Environmental Technology**  
Centre Manager  
Lars Jøker

**Food Technology**  
Centre Manager  
Anne Maria Hansen

**Chemistry and Microbiology**  
Centre Manager  
Mikael Poulsen

**Laboratory for Microbiology**  
Acting Centre Manager  
Paul Lyck Hansen

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Centre Manager  
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**Tribology**  
Centre Manager  
Lars Pleth Nielsen

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Lars Germann

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Centre Manager  
Kristian Eldam

**Packaging and Transport**  
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Jens-Chr. Sørensen

**Production**  
Centre Manager  
Merete Nørby

**Robot Technology**  
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Claus Risager

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Sanne Juul

**IT Training**  
  
**Conferences**

**Management**

**INTERNATIONAL CENTRE**

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Lars Drejer

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Head of Secretariat, Lawyer  
Andras Splidt

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Manager, Group CFO  
Jørgen Kunter Pedersen

**Personnel and Development**  
Personnel Manager  
Annemarie Søgaard

**IT Services**  
IT Manager  
Peter Hjortshøj

**Building Services**  
Service Manager, Lawyer  
Andras Splidt



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The cooperation between the Danish Technological Institute and the business sector rests on confidentiality and professional secrecy. The companies mentioned have all authorised publication.

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