DANISH
TECHNOLOGICAL
INSTITUTE

IT'S ALL ABOUT INNOVATION

Annual Report 2014

Contents

The Danish Technological Institute is an independent and non-profit institution approved as a technological service institute by the Danish Ministry of Higher Education and Science.

Her Majesty the Queen of Denmark is patroness of the Danish Technological Institute.

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Read more at www.dti.dk

Technology and knowledge are the key drivers in society

Denmark needs to retain jobs and create new ones. Both to ensure economic growth and to maintain a society in which we have the economic scope to ensure the welfare of the citizens.

Every time you open a newspaper or tune into the news, you are reminded of the fact that the question 'how to achieve this' is subject to constant debate. But certainly also when you are engaged in research and innovation.

Indeed, growth and job creation are the two main topics when you look at the major national and international research and innovation programmes. The evaluation criteria for obtaining funding for research and development increasingly involve taking technologies to a level where they can create an impact on the companies' bottom line. And not least on the bottom line of society.

It is only right to place technology and knowledge in front of this movement, since it is by applying new technology and knowledge that we can give Denmark the edge that enables us to compete in the global market.

The Danish Technological Institute is a key driver for innovation and technology application in the Danish business sector. We engage in close cooperation with the business sector: In 2014 alone, we cooperated with 13,501 customers.

Today, the Danish Technological Institute constitutes a unique platform for the technological development of our business sector. We deliver technological services to almost all industries in Denmark. We are a key player when it comes to applying research and knowledge.

We provide consultancy services and cooperate with companies on research and development activities.

In other words, we have the technological expertise and the facilities required to support Danish and international companies when it comes to applying new technology and knowledge. And to ensure high innovative capacity.

Our response to how to create and retain jobs is that we must invest massively in technology and knowledge as a driving force for society and business growth. Specifically, focus must be directed at action areas such as resource optimisation, material and product properties as well as a more efficient and quality-assured production.

This is true regardless of whether we talk about energy, construction, health, food service or manufacturing industries. Or whether we talk about production of raw materials, processing procedures, end product or associated services.

In 'Annual Report 2014', we offer specific examples of how we, in collaboration with businesses, have applied technology and knowledge to create solutions that create value for the business sector and for society.

Clas Nylandsted Andersen
Chairman

Søren Stjernqvist
President

Danish Technological Institute

We cooperate with small and large companies alike on everything from research and development to actual implementation of knowledge and technology.

We make sure that our customers have access to the technologies and the knowledge that give them the optimum background for meeting their customers – we believe that this is for the benefit of Danish society.

INSPIRATION

We are ambitious on behalf of Denmark.

We look ahead and pave the way for technology development.

We inspire our partners to seek new avenues and embrace technological opportunities.

INSIGHT

We have unique insight into society's needs.

We know the challenges of our partners.

We create solutions by applying our multi-disciplinary competencies and high-technology facilities.

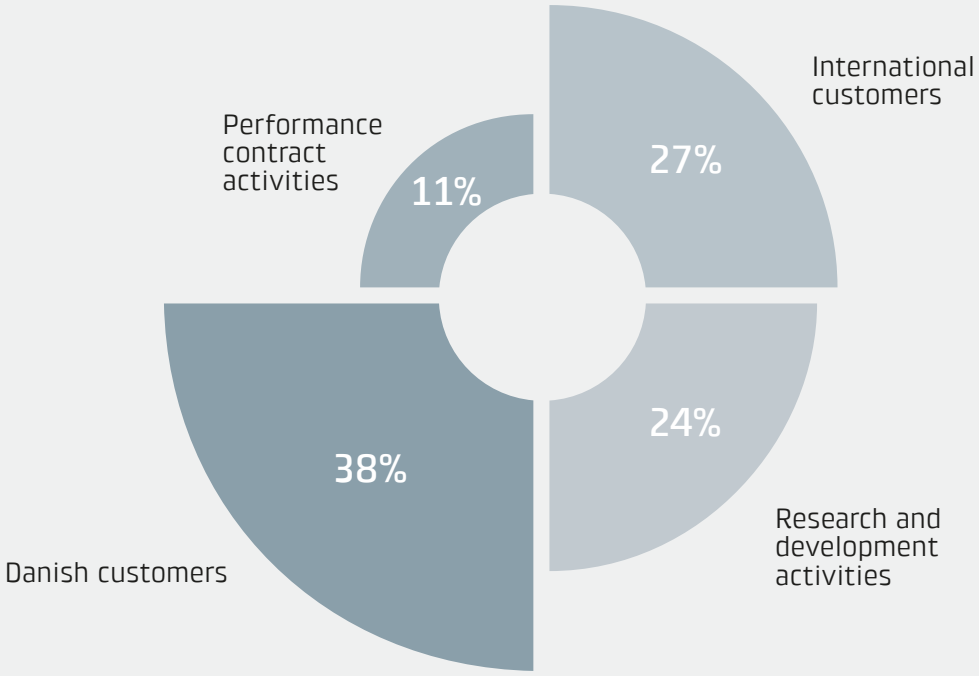
IMPACT

We are ambitious on behalf of our partners.

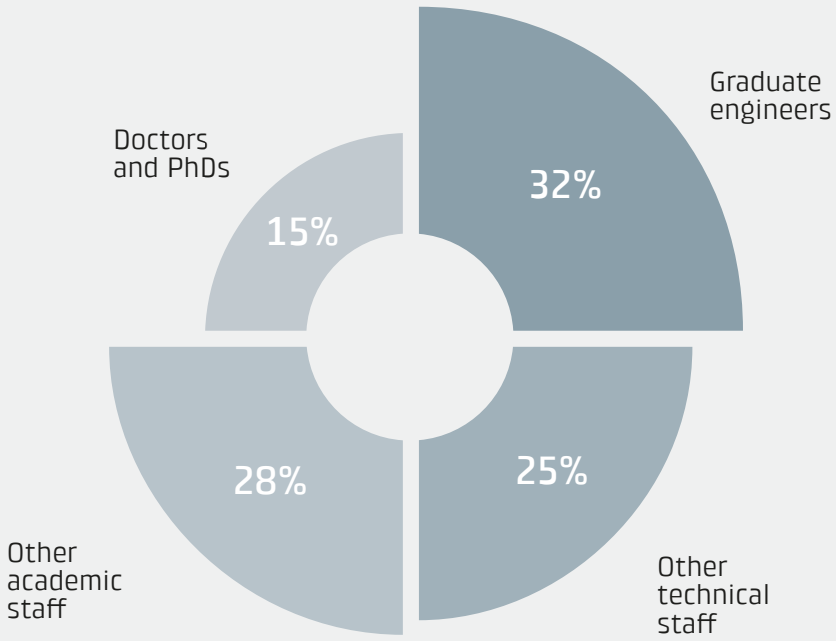
We deliver technological solutions that work.

We ensure that our partners use technology and knowledge that have visible and measurable effects.

Breakdown of revenue



Academically qualified staff



Technological progress

Technological progress is often created where innovation flourishes across diverse technology and knowledge areas. It therefore counts as one of DTI's greatest strengths that we work across a wide range of different specialist fields.

Overall, DTI constitutes a multidisciplinary competency platform which ensures that we and our business partners have access to world-class facilities – both for development, test and pilot production.

The annual report offers insight into our work to develop, transfer and disseminate knowledge and technology in cooperation with both Danish and international business partners.

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Production in Denmark – a strong driver for growth and wealth

Recognising that production is a strong driver for growth and wealth, this area has been given a more prominent global position in the past years. In a number of countries such as the US, Germany, Sweden, South Korea, Brazil, India and China, we see a strong increase in investments in research, innovation and training that target production technology and manufacturing processes.

This global development makes it even more important that we in Denmark maintain our focus on research and development of production technologies and on implementing the technologies in Danish companies. The competitiveness of our production companies relies heavily on this.

In the Production division, we support companies in applying technology and knowledge, partly to improve resource consumption and enhance productivity in the production line and partly to increase product quality and to improve product properties.

We know that automation can help increase both productivity and product quality. We therefore advise companies on how to minimise expenses for non-value creating processes by optimising flow and processes and on how to implement technological solutions that support the companies' production flow.

Moreover, we create the foundation for resource-efficient production by focusing on new green production processes for making advanced functional nanomaterials. These nanomaterials are utterly essential if you want to be part of the continuing development of e.g. batteries, solar cells, fuel cells and exhaust systems for diesel vehicles.

The ability to create documentation and ensure traceability places Danish companies in a good position when it comes to joining international supplier chains. The most recent research combined with many years of experience and knowledge about metrology, setting of objectives and tolerances form a sound basis for cost efficient and reliable production.

Today, production is not just about physical products, but to a high degree also about services. Collection and application of Big Data is predicted to have a significant impact on the development of service-based products. Based on an innovative healthcare sector and a strong biotech and ICT cluster, Denmark has an excellent background for developing and exporting products and services based on Big Data, which has the ability to streamline service production in e.g. welfare services.

Whether it is production of physical products or services, the clear aim of the division is to ensure that Denmark will continue to have a strong and technology-based production, which will remain a driving force for our growth and wealth.

Anne-Lise Høg Lejre
Vice President


SICK
Sensor Intelligence.

PRODUCTION

Impact 2014 >

HERBERT, THE FULLY AUTOMATIC FACTORY WORKER HAS COMPUTER VISION

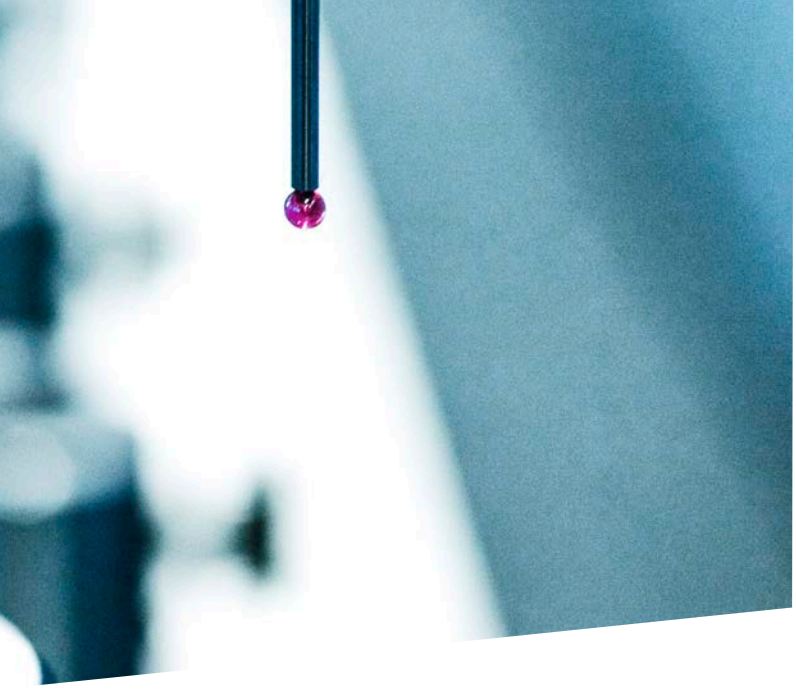
The company Ammeraal Beltech in Vejle has just invested in Herbert: a robot that works around the clock to assemble chains for the company's process and conveyor belts. Herbert, which has been developed by a local manufacturer, is a highly efficient assembly line worker, which makes absolutely no errors thanks to its computer-based vision developed and delivered by DTI. Herbert's 'computer vision' consists of cameras, light and special software that check all the products passing Herbert's field of vision. When the computer vision detects a defective product, the product is immediately removed mechanically from the conveyor belt. Computer vision is therefore the perfect shortcut to guarantee customers 100% quality. Indeed, Ammeraal Beltech expects to be able to double its sales of chains in the coming year.

COSTLY USE OF PLATINUM MUST BE REDUCED BY 25% IN DIESEL ENGINES

The future catalytic converters in diesel engines must be cheaper without compromising the environment. That is the goal of a new three-year research collaboration that started between DTI, Dinex A/S, Aarhus University and DTU Physics in October. The four partners share the task of developing catalytic converters for lorries capable of reducing the use of platinum by 25% without compromising any future requirements for reduction of exhaust gas. The reduction of the use of platinum will generate considerable savings in the production of catalytic converters. The costly metal has a kilo price of DKK 280,000. Dinex A/S alone uses 500 kg annually for its production of exhaust systems.

The universities are in charge of the basic research in new, alternative material compositions, while DTI is charged with bringing the research results to production level.

“ To ensure that Denmark is at the leading edge of useful welfare technology, DTI also provides strategic advice as well as competence development in the implementation of welfare technologies which, in particular, may benefit local elderly care.



CT SCANNING OF THE INTERIOR AND EXTERIOR OF PRODUCTS

The company Vaavud is making plastic-based wind meters for smartphones. They contacted DTI when they needed to develop a new meter capable of combining the x-ray technology of the CT scanner with 3D visualisation. This method allows analyses of the internal and external structures of products without having to take them apart so that any errors can be corrected immediately. For Vaavud, this meant that they were able to launch their new meters much sooner.

ROBOT COLLEAGUE WITH 3D VISION

DTI has collaborated with robot supplier Bila in developing a robot with 3D vision, which is able to look into boxes and differentiate between the individual objects. Even in connection with complicated packaging, the robot can use its force and torque sensors to twist and rotate the objects so that they become lose and can be taken out of the box.

DUAL-ARMED ROBOT EXCELS IN THE PRINTING INDUSTRY

In collaboration with DTI, Yaskawa Nordic AB has developed a dual-armed robot for handling paper at a Danish printing works. In most cases, the tasks of the industrial robot are limited to handling non-flexible products. The printing works, however, needed a robot which was able to handle flexible objects that bend when they are lifted.

The solution developed was the first of its kind. The potential of the dual-armed robot is fully utilised, and it is precisely the use of two arms that makes it possible to automate an otherwise manual process. Since the summer 2014, the solution has been applied in a pilot production at the printing works. When sheets of paper leave the printing machine, the robot collects them in 'bumps', bends them slightly to air them and then lays them down on a shaker table which moves the paper further on in the process.

BIODATA, BIG DATA AND OPTIMUM HEALTH DECISIONS

By applying physiological data from biosensors, health authorities can achieve massive human and financial savings in connection with chronic diseases and rehabilitation. In future, DTI will therefore join new research and development projects in biodata and big data and, together with users and companies, create technological solutions that ensure better health for more people.

As an example, DTI will focus on the development of sensors for measuring fluid in the body. Its focus will partly be on dehydration, partly on acute, early detection of fluid retention, because this is an area holding potential to help some of the many patients who suffer from chronic heart problems.

> DTI is expanding with a new robot innovation facility, so that this area now has over 2,000 square metres. The facility is to ensure the optimum setting for product development of both welfare technology and more industrial robot technology, all the way from concept to pilot production.

Efficient resource utilisation – with consideration for the environment

In the Life Science division, we work to solve two of the greatest challenges in the world: shortage of resources and the general health of people and the environment.

The global shortage of resources shows in many different ways. The lack of raw materials and the ensuing increase in prices create a massive focus on re-use of materials and resources previously considered to be waste. It requires considerable knowledge about the chemical composition of products and materials to identify the resources that can be reused. At the same time, this knowledge can be used to help Danish companies design their products so that, in future, it will be easier to reuse the materials.

Shortage of resources also applies to the extraction of oil. For many years to come, the world will remain dependent on oil, both as a fuel and as a raw material for the production of plastic and other products. Life Science focuses on new technologies for Enhanced Oil Recovery, i.e. environment-friendly ways of extracting oil from existing oil fields. At the same time, we apply the latest biotechnological methods to predict biocorrosion – one of the major challenges facing the oil industry. On the one hand, we are involved in optimising corrosion control in oil pipelines and, on the other hand, to reduce the use of the harmful chemicals currently used for corrosion control.

Animal feed and human food are resources for which demand is also increasing globally. In particular protein is increasingly becoming in short supply. Life Science is therefore working on converting by-products and waste from animal feed and food production into new animal feeds and new foods. There is a massive potential in creating new value chains via green production processes that are also capable of minimising resource waste. For instance, insects can be used to convert virtually useless by-products into feed as well as food.

The health area is extremely important to our society. We constantly require better methods for diagnosing and more efficient treatment of diseases. Therefore, Life Science also wants to contribute to the cluster of strong Danish companies in the biotech, medico and pharmaceutical sectors, in order to continue the development of new and better drugs and diagnostic tools. And we want to limit the use of harmful chemicals in our environment and products. We therefore support Danish production companies with chemical engineering tools so that they can phase out substances in their products that are harmful to the environment as well as to our health.

Bo Frølund
Vice President

LIFE SCIENCE

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NEW PARTNERSHIP IN ENVIRONMENT-FRIENDLY CHEMISTRY

Problematic chemicals which can cause cancer or disrupt hormones must be removed from our products. It will benefit our health considerably and it will help create Danish jobs.

DTI is in charge of a new partnership called 'Kemi i Kredsløb' (Circle of Chemicals), which, with the support of the Danish Environmental Protection Agency, has four years in which to advise companies on how they, in a practical manner, can find good alternatives to the problematic chemicals they are using today. DTI's contribution to the partnership is our strong chemical engineering skills in product and material chemistry, formulation and chemical analysis. The other key partners are DHI, English consultancy firm Risk & Policy Analysts, Swedish institute SP and the universities of Aarhus and Copenhagen.

INSECTS IN ANIMAL FEED AND FOOD OF THE FUTURE

The vast volumes of vegetable waste from food production must be used to feed insects which can be eaten by both humans and animals.

DTI is investigating the possibilities of establishing an insect production that uses insects to convert food scraps into animal protein. The insect production holds great potential since insects have a highly nutritious biomass capable of converting vegetable waste from food production into valuable proteins. DTI is researching whether an insect farm can be used to convert residues from bread and cake production into animal protein, which in turn can be used as feed for pets, fish and poultry. Based on the forecasts of the UN Food and Agricultural Organisation, FAO, who claim that the demand for animal protein will increase by 70% toward 2050, DTI predicts that insect production will strike a central cord in addressing a massive demand for feed internationally.

> "An increasing part of the world population demands its share of the high-quality foods and healthy lifestyle of the western world. We want to help meet this demand.

OIL INDUSTRY RECEIVES HELP THROUGH MULTIDISCIPLINARY COOPERATION

The consumption of oil in the world will not change substantially over the next several years; however, production from existing oil fields will drop and findings of new large oil fields will become rarer. Therefore, oil companies focus on cost-effective oil extraction from their marginal and old oil fields.

DTI has accepted this challenge, and engineers, chemists and microbiologists are on the case. The goal is to enable the oil to be released easier, which can be induced by chemically based methods or by stimulating the microbiology in the reservoir. We conduct advanced microbiological mapping of the reservoirs and then simulate the actual reservoir conditions. The data obtained is used to model the reservoirs and measure the expected effect. At the same time, it will provide the oil companies with information about the actual reservoir conditions – e.g. by applying tracers to map water flows between oil wells. The new collaboration targets both the onshore and offshore industry.

NEW DRUG FOR THE TREATMENT OF A RARE BUT SERIOUS DISORDER

Through its participation in a major EU project, DTI has helped develop a new drug for the treatment of the rare and extremely serious genetic disorder alpha-Mannosidosis. This disorder affects one in 500,000. It causes the body to produce a defective enzyme which cannot break down cellular glycoproteins (a special type of sugar) so that instead they build up in the cells of the body. Alpha-Mannosidosis has very serious neurological and physiological consequences, including progressive mental retardation, speech impairment, increased risk of infection, fluid retention in the brain and skeletal changes – all of which lead to the premature death of most patients. The newly developed drug contains the enzyme the patient is missing. Treatment is carried out using the Enzyme Replacement Therapy method, which introduces the drug in the patient's blood in replacement of the defective enzyme. The clinical trials of the drug effect have shown very promising results. DTI has been in charge of analysing the sugar levels in the patients' cells. The results of this analysis are used to assess how effective the treatment has been.

ENVIRONMENT-EFFICIENT HOSPITAL SEWAGE TREATMENT

The hospitals in Denmark must deliver environmental solutions to reduce the discharge of drugs in waste water since many drugs contain xenobiotic substances. Under the MERMISS project, DTI and several water suppliers are developing robust technology to treat waste water directly from the hospitals. The technology is based on Moving Bed Biofilm Reactor (MBBR) followed by chemical oxidation. The technology is so flexible that it can also be used for subsequent treatment at local treatment plants – something which is extremely relevant, because mapping has shown that as much as 95% of all drugs are taken in the home.

"We focus on improving the technology available to doctors so as to improve diagnosing and ensure more individual treatment.

Innovation as a growth engine

In the wake of the financial crisis, the trend has been that many – both in the private and public sectors – have moved their attention from the top to the bottom line of the accounts, mainly because their aim has been to create a healthy business with consistency in the figures.

Lean, productivity and cost adjustments are effective means to achieving bottom line results. However, it should be borne in mind that these tools mainly ensure survival in the short term. Unfortunately, it is often at the expense of innovation and new thinking, where the effect may be more uncertain and have longer prospects.

Studies show that those companies that have done particularly well during the crisis are those who have had more strings to their bow in terms of growth and innovation strategies. They have not only focused on performance optimisation but have also been aware of staff, market and product development.

Innovation is about translating new knowledge and new ideas into commercial value, i.e. creating profitable top line growth. It is important to think broadly when working to ensure innovation, since it is not just about physical products. It is also about customer relationships, business models, service and market awareness.

Innovation is also important in the public sector. Having a competent public sector is extremely important to the competitiveness of companies and our ability to attract international investments.

Therefore the primary purpose of the Business and Society division is to support both private companies and the public sector in order to increase their innovative capacity.

We believe that it requires a skilled staff to create innovation, just as it requires knowledge and analyses and inclusion of both customers and users. Innovation emerges when you are able to create environments that work systematically to identify ideas and new opportunities and to transform these into solid and comprehensive business cases. We are, therefore, working with a wide range of diverse activities ranging from courses and supplementary training and consultancy for both private companies and public organisations, to general analyses, mapping and technological foresight based on Danish and international data and experience.

Even though it is still too early to say that the crisis has released its grip and is now replaced by a stable upturn, it is still the right time to look up from the bottom line and focus on what makes things happen: we need to create innovation and change so that we can get the growth engine of Danish business started again for real.

Jane Wickmann
Vice President


TOOLS
#FABLABTI

BUSINESS AND SOCIETY

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SOCIAL INNOVATION NETWORK

DTI has started the third season of the Municipality Network on Social Innovation. The mission of the network is to prepare managers and employees in local authorities and regions for collaboration with companies, associations, volunteers, social-economic businesses and citizens in order to create new and better welfare solutions.

Members of the network face a number of shared social challenges. The success of the network therefore builds on the inspiration and knowledge the members give each other about ways in which the non-public players can become an active part of the solutions of shared challenges. As local authorities and regions from all around Denmark have sent representatives, the network has grown quite large, so that now, more than half of Denmark's local authorities are part of the network.

SKILLS DEVELOPMENT OF TOMS GROUP MANAGERS

A new management strategy at Toms Group became the starting signal for a tailored training programme at DTI. The goal was to prepare management staff to implement the new strategy in the organisation through openness, matching of expectations and good communication. During the training programme, work involved conversion of management theories into practical tools which could immediately be implemented and used actively in the daily work. The participants were also given personal coaching both to support what they had learned and as a practical help for the implementation.

The process ended with an examination and a certification. Subsequently, DTI has solved several tasks for Toms Group, since they have chosen to send more management teams on similar training programme.

> " The path to success in Danish businesses is built by knowledge, innovation and skilled staff. DTI will help ensure this success.

LOCAL AUTHORITIES AND CITIZENS DRIVE COMPANY INNOVATION

Innovation consultants from DTI turned local authorities and citizens into the driving force behind the development of the competitiveness of companies. This took place under the Challenge Water project, the originator of which was the Fresh Water Centre in the Central Danish Region.

The objective of the project was to encourage the local authorities to demand new innovative solutions and make companies better at developing products and services – with special focus on the issues and potentials offered by the increased water volumes in nature. The situation calls on utilities, businesses and citizens to work together. Focus was addressed to three water management projects. This included one on Samsø dealing with ways in which companies together can handle – and potentially exploit – the water volumes on the North Island. Another project in Aarhus created a large LDR-solution (local drainage of rainwater), and in Silkeborg, work involved the handling of rain water in a new residential area. The project has led to a number of new solutions to the climate challenges.

ELDERLY CARE IS IMPROVED THROUGH TRAINING IN INNOVATION

The quality of elderly care in Denmark is severely challenged by growing demands for rationalisation, new therapies and not least demographic development. This calls for the development of new technological solutions and requires that more people are motivated to work voluntarily in elderly care.

This challenge was accepted by a group of students when the OK Foundation and the OK Clubs in Denmark asked them to optimise the services for the elderly in the future. The young people came from business academy Cphbusiness and the Consultancy Service for Private Inventors' school service at DTI.

The process was kick-started with an innovation and learning process that focused on finding out what it takes to motivate young people to engage in voluntary work in nursing homes and healthcare centres – and then couple this with the application of technology.

The initiative serves as the kickoff of a new way of finding solutions to welfare issues.

DTI ADVISES THE EUROPEAN PARLIAMENT ON FRAMEWORK CONDITIONS FOR THE INDUSTRY

The financial crisis has made economists and politicians think differently about industrial development policy. The crisis has increased the focus on the impact of industry and the fact that there is a much closer connection between production and advanced service and knowledge production than previously thought. Not least due to the increased digitalisation of production.

Today, the industry only employs 15% of the European labour force, but the European Commission has set as a goal that this number must reach 20% as early as 2020. Therefore, DTI and our German partner WIK were asked to prepare a briefing for the European Parliament about the complex dynamics that apply to the work of strengthening the competitiveness of the industry in the future.

The report focuses on a number of the key factors that impact industry competitiveness, and it looks at the options available to the EU institutions if they want to influence the framework conditions for industry competitiveness and growth.

The construction industry must be green, sustainable and innovative

We stay inside buildings for 20 hours of the day, and of the last four hours, we spend quite a lot of time transporting ourselves on roads, across bridges, in trains and in tunnels. The buildings we live in, are educated in and work in, are key factors to our being fit and healthy and able to learn, work and function optimally.

In addition to the social and health implications of our buildings, the construction industry has a significant impact on the economy and the achievement of a more sustainable society. This is particularly reflected in the Government's construction policy strategy, which sets various goals for e.g. sustainability in construction.

Broken down into numbers, the construction industry accounts for 40% of energy consumption in Denmark. This must be reduced by 35%. At the same time, the construction industry accounts for 40-50% of resource consumption and 35% of all waste, which must be either minimised or reused, respectively. In future, we must therefore focus on renovation and reuse and, consequently, sustainable building materials.

Moreover, in the coming years, approx. DKK 200 billion must be invested in infrastructure such as the Fehmarn Belt Fixed Link, light railways and the metro city ring.

Such expectations and requirements weigh heavily on a construction industry that is carried by traditions and has - due to its very organisation - quite a low capacity for innovative thinking.

One of the goals of the Building and Construction division is to enable the construction industry to meet the high demands and expectations and to increase competitiveness. It will take more innovative capacity in the industry as well as the development of new technologies. We can assist with product development, problem solving, new processes and construction methods, and we take the initiative for innovation projects and group the industry in various strategic partnerships. Furthermore, we support all of this by developing and maintaining laboratories and equipment.

Our goal is to be the preferred supplier of specialist services for the construction industry so that we can contribute to ensuring the provision of:

- technology for building structures such as bridges, tunnels and roads that ensures better durability, less maintenance, higher productivity and better working environment and which alleviates the effects of climate change and reduces environmental impacts.

- technology, construction processes and organisation of sustainable renovation that not only reduce energy consumption but also create a healthy indoor climate, eliminate environmentally harmful substances and increase the value of the building so that it makes sense to invest in its renovation.

- documentation and development of sustainable buildings and building materials, including new bio-based materials and reuse and upcycling of residual products.

Mette Glavind
Vice President

BUILDING AND CONSTRUCTION

< Insight 2014

Photo: Stamers kontor

BUILDING AND CONSTRUCTION

Impact 2014 >

THE EU RECOGNISES DANISH SCHEME FOR ENVIRONMENTAL PRODUCT DECLARATIONS

Danish construction product manufacturers can now obtain an environmental declaration for the properties of their products in a Danish context and, at the same time, be certain that the quality and content are recognised in the EU.

DTI launched EPD Denmark in 2013, and for a company like ISOKLINKER ApS, which produces insulation systems with brick for facade renovation of houses, it was natural to become the holder of the first Danish-produced EPD, since the company's products enjoy great success in Europe. The new EDP ensures that the same documentation is valid in several export countries.

ASPHALT ROADS NEED PROTECTION AGAINST NOISE AND WATER

Noise and water are major challenges in connection with asphalt roads. DTI has therefore launched the Klimavejen (Climate road) project to solve both problems at once. More than 723,000 homes across Denmark are affected by noise that exceeds the recommended limit of 58 dB, above which level there may be consequences hazardous to your health.

There is already noise-reducing asphalt on the market, but it is not good enough. The objective of Klimavejen is, therefore, to extend the life and improve the quality of this asphalt. The project must also develop the technology behind the permeable properties of drainage asphalts to make them better suited to keep the sewers free of the large water masses from the increasingly frequent cloudbursts. The project is a collaboration between DTI, the Danish Asphalt Pavement Association, Greater Copenhagen Utility, NCC A/S, Rødovre Local Authority and the Danish Road Directorate.

> “ Brick and mortar have been stable elements in Danish construction for 800 years. They are here to stay and are, therefore, subject to continuous improvement to be able to adapt to current requirements for energy, comfort and aesthetics.

Photo: Metroselskabet/Ulrik Jantzen, Das Buro

THE CLASSIC BRICK HOUSE STAYS WARM USING NEW RENOVATION METHOD

450,000 brick houses were built in the 1960s and 70s and most of them are unable to keep the heat inside due to poor insulation. Many of the owners have chosen to plaster their facades as a means of post-insulation. However, now, an EUDP project with DTI as project manager has come up with a new way to post-insulate houses without letting go of the classic Danish brick facade.

More specifically, the method involves removing the outer walls so that optimised insulating material can be placed on the inner wall before a new and slimmer outer wall is built up of brick. The method was demonstrated when the project partners – DTI and a number of local contractors – renovated a brick house on Thyholm in Limfjorden.

The method has great future potential as it manages to upgrade the classic brick houses to a higher energy class. DTI predicts that the solution may be relevant for a third of the 450,000 brick houses from the 60s and 70s.

WINDOWS OF THE FUTURE TO REDUCE HEAT LOSS BY 75%

DTI is heading the EU-financed project cooperation Winsmart, the aim of which is to develop a new type of windows capable of reducing the heat loss from buildings by 75% while being 50% lighter than conventional windows. DTI has developed the design concept behind the frame of these energy-neutral windows. The background for the project is that, today, up to 60% of a building's heat loss comes from the windows, so massive energy savings can be achieved by optimising their energy properties. The project focuses on the window frame, since this is the weakest part of the window when it comes to heat loss. The next step for DTI is to optimise the interaction between the load-bearing elements of the frame and its insulating properties. Finally, a prototype must be prepared for 2015.

The energy windows must not only reduce heat loss in a building, they must also be able to divert any overheating caused by the sun. Therefore, the partners in Germany and Switzerland are working to develop a window that, by means of solar shading technology, is able to alter its colour so as to regulate the light influx when the rays of the sun fall directly on the window.

SOUND MANAGEMENT OF CONSTRUCTION WASTE FROM A FIRE SITE

The clean-up after a burnt down Sports Hall in Odsherred offered a number of environmental challenges. The Sports Hall was built in the late sixties, and the remains contained both asbestos from the ceilings and building waste containing the environmental toxin PCB. DTI helped Odsherred Local Authority to identify the waste offered them advise on how to handle the waste properly, dispose of it safely - and at the right price. At the same time, following the environmental recovery, DTI consultants were able to identify the concrete and steel, which could be reused, thus saving money.

> “ The construction industry accounts for 40% of the energy consumption in Denmark, 40-50% the consumption of resources and 35% of all waste in Denmark. In future, we must therefore focus on renovation, and reuse as well as sustainable building materials.

Consumption of resources must be reduced for productivity to increase

It is in many ways imperative that Denmark becomes a low-emission society with a low consumption of resources. Fortunately, the politicians have specified a number of goals and objectives that the energy industry must meet. However, their achievement requires new solutions, new products as well as a rethinking of our entire energy system. At the same time, this allows Danish companies to create new products and new jobs within an energy sector where Denmark already stands strong internationally and has great growth potential.

An essential condition for a future society of low emission and a low consumption of resources is the development of new products that are both more energy efficient and less resource consuming than those available today. To develop the products and to document their improved efficiency, sophisticated, up-to-date laboratories are required that are able to test the products. This is where the Energy and Climate division plays a key role, since we have the largest and most modern energy laboratories in Denmark.

To fulfil the vision for the future, it is also paramount that we find a new way of thinking our energy system. The Energy and Climate division is a central player in the development of a new energy system with competencies in Smart Energy, biomass, district heating, heat pumps, batteries, user behaviour and energyflex houses, industrial processes and transportation.

We are therefore in a good position to play a major role in the work required to convert our energy system.

One key area where savings need to be found and new ways need to be established is the energy consumption in the industry. We have skills to improve energy efficiency and produce renewable energy, and these skills are to constitute the basis for a new energy saving system that will help the industry to maintain their competitive edge.

Biomass will become a limited resource in the future. It is therefore important to develop new processes and components for a better and more efficient use of our biomass resources, even for purposes other than energy production. This is an area where the division is working at a high international level within torrefaction, biorefinery and production of second and third generation biofuels.

Our climate is already marked by the impact that high-emission energy production and consumption have on the environment. This has caused several unusual natural events to occur, such as heavy rain and exceptionally strong cloudbursts. The division has massive skills in for example both local drainage of rainwater and design of drainage systems capable of handling even very large volumes of rainwater. However, we keep looking forward and cooperate with innovative companies to develop new products that can meet these challenges.

David Tveit
Vice President

ENERGY AND CLIMATE

Impact 2014 >

MAPPING OF THE BIOREFINERY POTENTIAL IN AFRICAN RAW MATERIALS

How much bioethanol can be extracted from the cassava plant, and what is the potential of rice husks and old bananas? These are some of the questions that have been answered via a careful mapping of raw materials in Ghana, Morocco, South Africa, Kenya and Egypt – through the EU-financed project Biowaste4SP. This project aims to use African waste for biorefinery. The potential for this is massive in Africa, where countless tonnes of raw materials each year lie unused and rot on landfills. The project has also included African research students from the five focus countries to teach them to convert the different raw materials into biogas, fertilizer, ethanol, lactic acid, protein and amino acids so that, eventually, they can help implement the biorefinery methods in their own countries.

NEW HEAT PUMP LABORATORY EXPANDS RAPIDLY

In November 2013, DTI opened one of the most modern heat pump test centres in the world. Since then, things have been moving fast. So fast, in fact, that it has been decided to expand the laboratory after just one year. The success comes from the fact that the laboratory, already in its first year, achieved some of the highest certifications and approvals, which quickly expanded its customer base.

The demand for testing of heat pumps in the European market has also exploded. This is in part due to the introduction of harmonisation of energy labelling requirements and in part because several EU countries have national subsidy schemes that encourage consumers to switch from fossil heating sources to heat pumps.

The current laboratory can test all types of heat pumps and it also offers noise tests, which is of key importance as a competitive parameter for the producers.

“ New energy requirements call for new solutions and new products. However, it also allows Danish companies to develop new products and create new jobs within an energy sector where Denmark is already strong internationally.

DOES THE CLIMATE AFFECT ELECTRIC CARS?

The Danish Technological Institute has tested how the climate affects the performance of electric cars. While new electric cars are usually tested in warm laboratories without frost and head winds, DTI set out to test five different electric cars at an airfield in Karup in February.

The purpose of this study was to gain insight into whether the cold winter weather and the variations in terrain and driving style affected the capacity of the car batteries. It did. The results showed that their capacity was reduced in the cold Scandinavian climate. However, the reduction was not big enough to make the owners of the cars doubt their potential. Indeed, the study showed that many of the large fluctuations can be avoided if the owner knows how to treat his car.

The electric car study is a part of the EU project Green eMotion. It was carried out by use of the world's first mobile electric car laboratory, the custom-made 'batmobile', which is equipped with measuring devices and charging stations to make it possible to perform the tests anywhere.

WATER TEST CENTRE IS THE LINK BETWEEN COMPANIES WITH WATER KNOWLEDGE

The Danish National Water Test Centre is the link between water technology companies and the laboratories and test providers that can help the companies with the necessary knowledge and equipment.

This was the link the company AmTech was looking for when they needed testing of their product 'Kalkknuseren' (the 'Lime crusher'). The lime crusher produces sound waves that can reduce the lime content in water. Although the small family company already had scientific evidence for the effect of its lime crusher on the water, it was not enough to convince the large water supply companies. However, with the help of the water test centre, AmTech received support from the Danish Nature Agency to have the effect of the lime crusher documented on a large waterworks in full function and for an extended period of time.

DTI and COWI operate Denmark's National Water Test Centre as a partnership, but they also cooperate with the universities in both Aarhus, Aalborg and Copenhagen as well as a network of companies, including water supply companies.

POWER GRID OF THE FUTURE FOLLOWS WIND AND WEATHER

The challenge posed by wind energy is that the power supply fluctuates a lot, meaning that it requires a high level of flexibility to exploit it. It may therefore sound like a monumental task to move the operation of the millions of refrigerators, washing machines and other electrical appliances in Denmark to such a fluctuating source of energy. Nevertheless, this is the ambition of the iPower project, which is a collaboration between researchers and industrial partners, for which DTI is partly responsible.

On stormy days when the wind turbines generate energy, the power grid of the future must be able to utilise this energy and immediately supply the many appliances with the required power. Any increase in the wind must serve as a wake-up call for the appliances – and when the wind abates, they must 'go to sleep' again. However, the switch must take place unnoticed and must not interfere with the use of neither refrigerator nor washing machine. iPower is therefore in the process of developing intelligent control of the power grid, i.e. a Smart Grid, which can effectively absorb the fluctuating energy production for the benefit of both the industrial and private sectors. The benefits of the iPower cooperation are to be documented in a number of projects involving e.g. cooling systems, air conditioning and heat pumps.

Technology and knowledge makes food production more profitable

Few countries are able to prepare sustainable food products as efficiently and safely and to such a high quality standard as Denmark. This is also reflected in the export of goods, which in 2013 accounted for 25% of Denmark's total exports.

However, it is no matter of course that Denmark performs so well in the food area. The trade crisis with Russia clearly shows how hard exports are hit when individual markets are taken out of the equation. Yet, the greatest challenge for the whole food sector is to be found in a different place altogether: the production of raw materials. In particular the production of pigs is dropping at a terrifying speed. If we do not manage to stabilise the production of raw materials with lasting solutions, the food sector will come under severe pressure.

There are no easy solutions, but competitiveness in all production stages must be optimised. The DMRI (Danish Meat Research Institute) division is working hard to reduce costs in the production and processing stages while creating a basis for new products capable of generating greater value for the companies. This is a field where new technology and new knowledge are key requirements and our focus lies within four areas:

Optimum raw material utilisation: It is deeply rooted in Danish food companies that waste equals loss of value. Therefore, all production flows are constantly optimised, and in future, this will become a decisive competitive factor for the companies' ability to earn money.

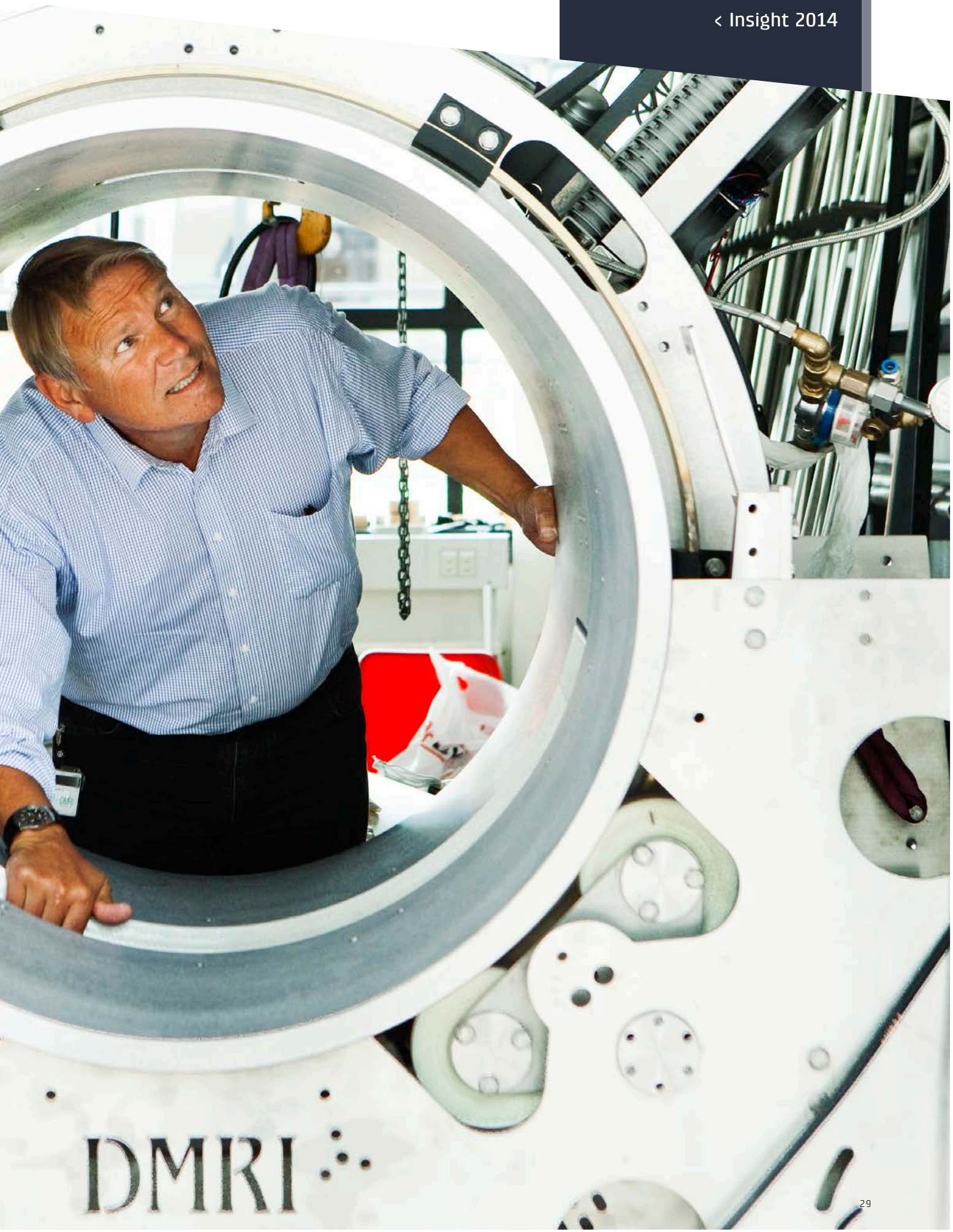
Higher production efficiency: As labour costs and the degree of automation increase abroad, Danish companies will have to create new standards for automation. DMRI ensures that Denmark continues to be at the forefront in this area and thus also reaps the benefits first.

Greater environmental efficiency: We must not only lower CO2 emissions from production animals, we must also reduce the food industry's consumption of energy and water. The savings potential is massive, but it requires new thinking and above all innovative solutions to realise it.

Healthier meat products: Fresh meat is a healthy and nutritional dietary component in any balanced diet, whereas processed meat products are often criticised for not being nutritious enough. Brand new product concepts and process technologies are required to redefine processed meat products as healthy and nutritious.

Generally, Danish companies have a strong position in the international competitive field of the future. If we succeed in addressing the current challenges and bringing the right technologies from 'desk to meat cutting room', the Danish meat industry in particular will have a solid basis which is unrivalled in the global competition.

Lars Hinrichsen
Vice President


DMRI

DMRI

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CUSTOM-MADE COOLING TUNNEL ENSURES HIGH-QUALITY PORK

This year, Denmark's second largest slaughterhouse, Tican, started using a new cooling tunnel for cooling down pigs. The tunnel is designed by DMRI and enables the slaughterhouse to cool up to 920 pig carcasses to an average temperature of six degrees within just 110 minutes. And in this area, time is the key. Where slow cooling typically means that the meat shrinks, fast cooling ensures least possible shrinkage as a result of the cooling. Moreover, the meat achieves a perfectly balanced water-binding capacity, so that the leaking of fluid is reduced to a minimum when the meat is cut.

After its stay in the cooling tunnel, which freezes the pig carcasses on the outside, they are transported to an equalisation chill room, which has also been designed by DMRI.

VISION-BASED TECHNOLOGY MONITORS CHICKENS

DMRI is spearheading an ambitious project which is working on developing aids for veterinary inspections in Danish chicken slaughterhouses.

Today, the slaughter process is carried out at a high pace with 12-14,000 chickens being slaughtered per hour. However, since food safety must remain high, legislation requires each and every chicken carcass that passes through the slaughterhouse must be subjected to veterinary inspection. The project partners are therefore working on developing a vision technology that uses cameras to photograph and analyse the individual carcasses from all angles as they pass, so as to help the veterinary inspection ensure that only healthy chickens reach the consumers. Apart from DMRI there are five other project participants: the slaughterhouses HKscan Denmark and Danpo, the two technology companies Linco Food Systems and IHFood and the meat control department under the Danish Veterinary and Food Administration.

> " 2014 was the year when DMRI moved into its new domicile of 6,600 square metres filled with new research facilities, thus consolidating DMRIs position as Denmark's leading food centre.

MARKEDLY INCREASED SHELF LIFE

It can be a challenge to be a Danish pork producer with global ambitions. When the transport time to the new high-price markets is as much as e.g. 42 days to China. DMRI has set out to solve this challenge with a new shelf life concept for food packing plants. The new concept gives fresh products a shelf life of up to 50 days – and it is all natural. Pork has a much greater shelf life potential than what is currently realised; hygiene and the production process just need to be optimised. DMRI's new concept offers companies a systematic review of processes and hygiene and helps them implement specific solutions so that they get the most out of their product potential.

IT ENSURES INTERNAL TRACEABILITY AND OPTIMUM SLAUGHTERING PROCESSES

When consumers choose from the huge selection of meat products in the supermarket's cold counters, each package has its own sender, since the EU requires full traceability. This means that each package of meat can be traced from the cold counter back to the farmer.

With the delivery of a comprehensive IT system, DMRI has helped ensure the internal traceability at Danish Crown's newly opened cattle slaughterhouse in Holsted, which is the largest of its kind in Northern Europe. The system is called Manufacturing Execution System and is applied throughout the slaughter process – from reception and recording of the living cows, via slaughtering and cutting to the individual meat products are sent out to the customers. The system ensures a fully controlled slaughter process and an unbroken line of information, since all procedures and orders are passed down to the computers that control the individual conveyors and machines.

FREE WEB SERVICE IN THE FIGHT AGAINST LISTERIA OUTBREAKS

This summer's outbreak of listeria in Denmark, which resulted in many headlines in the media about disease outbreaks and deaths, made hundreds of meat producers start using the free Web service www.dmripredict.dk. Here, the producers can find answers to how, within minutes, they can secure their products against various bacteria such as listeria.

The Web service shows how bacteria grow in relation to the composition of the individual meat product. When the producer enters the temperature conditions together with the product's specific content of preservatives, the service creates a growth chart that illustrates where the bacteria grow. In this way, the producers do not have to add more preservatives than absolutely necessary – and at the same time, they can control the shelf life of their product.

> DMRI activates research-based knowledge by translating it into practical consultancy, which is extremely beneficial to the companies in the food industry.

The revolution of materials must be invisible and take place on the surface

When international experts talk about new materials as 'Key Enablers' of industry development and growth, it rarely has something to do with brand new material compositions such as composites or alloys. Most often it is about using known technologies and materials in a new context to exploit properties that have not previously been available.

DTI has brought the development of functional coatings to an internationally recognised level. And with the current intensity of research and innovation, these functional coatings are no longer reserved for space technology and high-end sports cars. In fact, today's costs have reached a level where more and more everyday products can exploit the possibilities. Often, you will not be able to see the difference with the naked eye, but you will experience it as a highly value-creating function or property of a product.

DTI's large skills base in the material area has made it easy to create differentiated, advanced and, above all, competitive solutions for the production industry so that it can offer the market unique products that are ready for the global competition. DTI's technological approach is versatile and advanced, spanning from thin-film coating and ion implantation to glass-ceramic coatings and hyper-advanced packaging film. We are very well prepared to equip almost any surface with practically any property.

More specifically, we have developed functional coatings capable of reducing the cost of cleaning and maintenance by 80% in many areas of the production industry. For the convenience food market, we have created functional coatings allowing fresh and well-prepared food directly from the freezer. We have also designed functional and aesthetic surfaces for consumer products to provide them with a significantly higher market value.

The same technologies can be used for major global challenges such as the environment, climate and sustainable energy production. Both hydrogen technology, fuel cells, catalytic processes and the production of synthetic gas depend on these surface functions to be operated profitably and to become a real alternative to the fossil fuel society.

In addition to the many apparent applications, it is an intelligent way to develop materials simply by focusing on the outer micrometres of a material and alter its properties here. This allows us to maintain already acquired knowledge about the strength and durability of the base materials. It can be said that we have turned it into our particular specialty to invent and add new features to existing and well-functioning basic designs.

Mikkel Agerbæk
Vice President

MATERIALS

Impact 2014 >

LOUDSPEAKERS OFFER SUPERIOR SOUND AND AESTHETICS WITH NEW COATING

It is now possible to tailor very specific material properties for high-end loudspeakers, thus giving loudspeaker companies even more options for transforming their creative ideas into design-optimised products. In collaboration with the north Jutlandic company Raidho Acoustics, DTI has demonstrated how vacuum-based evaporation processes can produce so unique properties that the company keeps being voted best in the world. The challenge has been to make a speaker diaphragm so stiff that its natural frequency is moved well beyond the audible range. At the same time, the diaphragm had to have a low density to ensure a rapid response time.

BOTTLES OF PAPER AND SAND

Paper company EcoXpac A/S and DTI have developed a bottle prototype made of fibres from recycled paper. The bottles can complement the market with an alternative to existing plastic bottles, and they can be fully reused as paper. This means that the bottles, if they end up in nature, dissolve naturally and enter the natural cycle without causing pollution.

The waterproof coating is based on beach sand or other sustainable materials and replaces the traditional plastic coating. EcoXpac A/S has also developed a pilot production system which can produce the bottles directly in connection with the filling system – adding an economic edge as it is expensive to transport empty packaging. The project is funded by the Danish Market Development Fund and is part of 'Production in Denmark', which has as its purpose to strengthen the competitiveness of Danish companies.

> At DTI we work with high-tech pilot production to allow our customers to test their technologies without having to make costly investments first.

Photo: Raidho Acoustics

DIRT-REPELLENT COATING BENEFITS THE DANISH OIL INDUSTRY

DTI has developed a unique coating which eases the work on North Sea drilling rigs. As the oil fields in the world are being reduced, the extraction process is gradually becoming more and more dirty and creates major challenges for the production equipment on the drilling rigs. The reason is that the oil that can be extracted is mixed with by-products from the subsoil such as lime and wax, and these by-products sticks to the equipment as stubborn deposits. It typically means that the equipment needs to be sailed ashore to be cleaned every six months. To help the problem DTI has developed a special coating for the plate heat exchangers that control the temperature of the raw oil. The coating consists of a glass ceramic hybrid coating that is dirt repellent and enables the plate heat exchanger to run for more than 1000 days without cleaning. DTI's next objective is to spread the use of the coating to more areas in the Danish oil industry.

THE RIGHT PACKAGING TURNS THE MICROWAVE INTO A GASTRONOMIC WONDER

The microwave has a tarnished reputation in good cooking. Too many have experienced that the food has been unevenly cooked, reducing the use of the microwaves to popping popcorn and heating leftovers. However, it does not have to be that way. With the proper packaging, the microwave has properties that can easily compete with those of a traditional oven. Over the past years, DTI has developed a number of different types of 'active packaging' which ensure that ready meals are prepared just right so that all parts of the food product are heated to perfection. The packaging is strategically lined with ultra-thin layers of perforated metal. The perforation follows special patterns to ensure that the product absorbs the microwaves in exactly the right amount and the right places. This way the consumers avoid the steaming and overheating which can ruin the eating experience completely. The newest packaging was launched at a fair in Frankfurt where it successfully demonstrated how microwaves can transform frozen pizza into a perfectly heated pizza with a crisp and crunchy crust.

SECOND GENERATION OF DENTAL SCREWS IMPROVES STABILITY

The latest generation of dental screws makes tooth implants sit more stable in the mouth, while maximising the biological properties. The new dental screw has been developed by DTI in collaboration with T Technology, and it increases stability significantly between the various implant elements. The coating on the new screw has a titanium binding layer, and the total coating system offers very low friction. The new screw is predicted to have considerable international potential.

"It takes guts for the industry to take the leap from conventional materials and production to concepts such as Manufacturing Materials, nanomaterials, graphene, etc. DTI is working to support this process and make it easier for the companies.

Accelerator technology makes us wiser and saves lives

When you say the word 'particle accelerator', many people think of something extremely complex and abstract that is difficult to relate to. Many can connect it with CERN, which uses highly advanced research facilities to research 'the building blocks of the universe'.

However, accelerator technology is much more than that: The technology is used to examine very small structures. And even though the principles behind may seem quite abstract, particle accelerators are highly relevant when it comes to making us healthy and ultimately saving our lives.

In recent years, several synchrotron particle accelerators have been built around the world. These systems are used as a very intense and accurate light source, almost like giant a microscope. The technology allows us to see molecules, DNA structures, chemical compounds and materials in nano-size and down to atomic level.

A highly intense light source with absolute precision is required to examine these tiny structures. You need a synchrotron accelerator where the speed of the electrons travelling the synchrotron ring comes close to the speed of light and the energy becomes extremely high.

In these systems, the quality of the light source is limited by the budget, since it is the economy which determines the size of the accelerator you can build – and thus, how much energy the electrons can generate. Danfysik has developed compact magnet types that eliminate this particular limitation.

Synchrotron light sources are used for research and industrial applications, and for developing enzymes, electrodes, catalysts and new medicine. And Danish companies and researchers are eager to get to use synchrotron radiation for the many research and product development activities facilitated by these systems. It is therefore important that more and better systems are put into use.

The health sector is also about to start using accelerator technology, namely for cancer treatment. Radiotherapy today uses strong radiation. The disadvantage of this type of therapy is that you cannot restrain the beams to the tumour only, the healthy tissue is affected as well and risk great damage. To avoid these side effects, the dose is limited, which unfortunately results in lengthy therapy.

An alternative to radiotherapy is particle therapy where you use ions instead of radiation. The ions can penetrate deeply into the body and target the tumour without affecting the surrounding tissue. This type of therapy is therefore more accurate and more gentle than radiotherapy. Treatment is carried out by the use of high-energy ions that require a large particle accelerator. For the past 10 years, Danfysik has been developing accelerator technology for particle therapy – and the first system is now being used for therapy.

Frank Ebskamp
President

DANFYSIK

Impact 2014 >

GREEN MAGNETS SAVE ENERGY AND PROTECT THE ENVIRONMENT

In collaboration with Aarhus University, Aalborg University and Danish companies, Danfysik has developed a new technology based on permanent magnets, which, in contrast to traditional electromagnets, do not need cooling water and only require very little power. Accordingly, they are significantly cheaper to operate and they have less impact on the climate. The technology is called Green Magnet technology.

The first Green Magnet was used in a synchrotron accelerator at Aarhus University. The next is used in an Accelerator Mass Spectrometer (AMS) at ETH in Zürich where it is used for highly sensitive C-14 dating. Several other AMS laboratories have ordered Green Magnets, and many customers have shown interest in the highly energy-efficient Green Magnet technology.

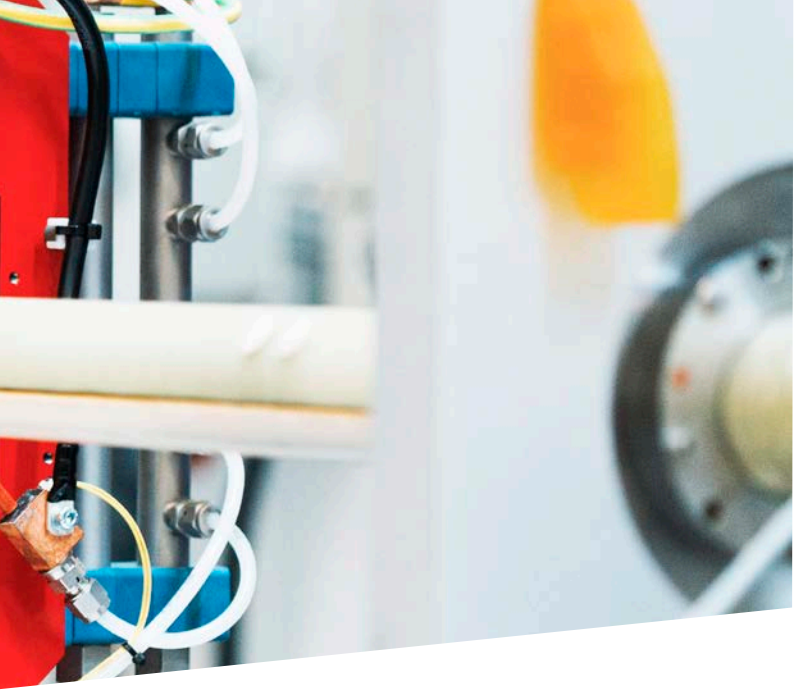
DANFYSIK HAS DEVELOPED SUPER-CONDUCTING MAGNETS FOR CERN

Particle accelerators use extremely precise magnetic fields that either deflect or focus particle beams. As a rule, electromagnets and ultra-stable devices are used to accelerate charged particles to high-speed. The heavier the particle and the higher the energy, the greater the magnetic field required.

However, even very large electromagnets cannot exceed a certain magnetic field strength. If you want even stronger magnetic fields, you must use superconducting magnets where the power is extremely intense when the temperature is extremely low.

Danfysik has developed a new, highly compact superconducting magnet for CERN. The magnet is cooled down to a few degrees above absolute zero, under which conditions its magnetic field becomes many times stronger than the maximum achievable magnetic field of electromagnets.

“ In 2014, Danfysik celebrated its 50 years' anniversary. The founder, Ejnar Jespersen, established the company in 1964 to with the sole objective of providing the research milieu with particle accelerator equipment.



DANFYSIK DELIVERS SUPER-COMPACT MAGNETS FOR THE DEVELOPMENT OF THE WORLD'S BRIGHTEST LIGHT SOURCE

With the delivery of a number of supercompact magnets to the MAX-lab at Lund University, Danfysik has established its position in the major league of accelerator physics. The physicists at MAX-lab are working to develop a synchrotron accelerator ring that can produce the brightest light source in the world, MAX IV.

Success requires that the accelerator is equipped with as many control magnets as possible, which previously meant that the machine would become colossal.

Danfysik has solved this problem by developing a completely new type of super-compact magnet, which in one steel unit can integrate up to 13 different magnet types. This allows the accelerator to generate the brightest light in the world in less space and at less cost. Danfysik predicts that magnets will have major international potential as there are many synchrotron accelerators throughout the world that will need upgrading in the coming years.

PARTICLE THERAPY SYSTEM FOR CANCER TREATMENT READY IN SHANGHAI

Cancer treatment in the Chinese health sector has taken a new and important step after Danfysik handed over a new particle therapy system for clinical use in a hospital in Shanghai.

Particle therapy treats cancer tumours with protons and carbon ions, and compared with radiotherapy, this treatment can reach deep-set tumours in the body without damaging the surrounding healthy tissue. This is particularly important when you treat cancer tumours close to sensitive organs such as the brain, eyes, spinal cord, etc.

The particle therapy facility marks the culmination of a 10-year collaboration with Siemens, in which Danfysik for the past three years has been responsible for installing and commissioning the giant facility at the hospital in Shanghai. The accelerator was installed at the end of 2014 and has operated steadily since.

During 2014, the clinical part of the facility was completed, and the first patient was treated in June – before the eyes of the hospital management and senior politicians in Shanghai. In the course of summer and autumn, more patients were treated; all with good results.

To complete the process, a considerable amount of documentation on the particle accelerator and the clinical treatment facilities were submitted for approval to the Chinese authorities, and the hospital was then ready to begin normal operation. It is expected that the new facility is able to treat more than 1,000 patients a year.

In April 2014, Danfysik won a major contract with the European consortium EuroGammaS for the delivery of all magnets for the most advanced and powerful gamma ray facility in the world, Europe Extreme Light Infrastructure for Nuclear Physics (ELI - NP) in Romania.

Aiming to become the best tech training provider in Sweden

At Teknologisk Institut, Sweden we have made it our area of specialisation to offer expert courses and programmes in our three core businesses – open and customised training, education and training conferences and Higher Vocational Education. The courses and programmes focus on basic technology or the management of technical undertakings, and we believe that their high level of expertise position us as one of the most thorough and competent providers of such courses and programmes in Sweden today.

With nearly 9500 people attending the courses, programmes and conferences we provided in 2014, we have clearly made a difference. Partly by enabling individual employees to enhance their skills and competences, partly by strengthening a number of companies through employee training and added knowhow.

We offer about 300 courses, programmes and conferences a year, and some of them more than once. Most courses are designed specifically to professionals, whereas the conferences are more focused on issues of a decidedly topical nature. Aside from the professional courses, we make sure to always have available courses and programmes in Higher Vocational Education (HVE).

In our view, it is up to the education and training companies in Sweden to supply the courses and programmes demanded by the market. Ensuring this requires a large degree of collaboration with the industry.

We are aware that in a time of intense competition in the market, companies are extremely sensitive to the cost of courses including lost working time. This is why the use of new technologies such as e –learning is a strong focus of ours.

In 2014, Teknologisk Institut, Sweden also focused on creating growth and improving business and business processes. A strategy to become Sweden's best tech training provider in 2020 was adopted, and a number of targets decided upon as productive means of generating growth.

The company increased sales from SEK 57.5 in 2013 to 64.8 million in 2014, with a result of 8.5 %. Educational conferences alone showed a growth of 33 %.

A number of initiatives were taken during 2014: Marketing campaigns were largely converted to digital media; the total portfolio was reviewed and action plans were made – allowing for investments and new trainers to be included.

At Teknologisk Institut, Sweden we are well prepared to accept the challenges of 2015, the known as well as the unknown, while we strive to achieve our ambition of becoming the leading training company in Sweden.

Peter Bergermark
Managing Director

TEKNOLOGISK INSTITUT, SWEDEN

< Insight 2014

Projects are everywhere

The global economy offers the Danish Technological Institute new opportunities to expand abroad on a financially sound basis, but it must respond quickly when opportunities arise. To better position itself, the Institute has teamed up with partners in Poland. Poland has the largest economy in Central Europe and is one of the fastest growing economies in the EU.

Yet, unemployment remains high in Poland, and the need for vocational training is more important than ever. The Polish people want to improve their lives and are ready to accept the new opportunities presented to them – the virtual workplace, for example.

Projects are everywhere
'Projects are everywhere' is a motto for DTI Polska. We strongly believe that approaching business development as a project will help us achieve our goals faster. We believe that a doctoral study can be completed within the standard time limit and within budget, and even with less effort if it is approached as a project. And the same goes for all other business goals. Therefore, when working with our clients we follow a predefined project management procedure. We teach project management to leaders of organisations, and we assist our clients in the implementation of projects.

Our services range from coaching project management and training individuals to interim project management for corporate clients. Our efforts to become market leaders in Poland were already recognised by the International Project Management Association, as, in 2013 and 2014, DTI Polska reached the finals of the Polish Project Excellence Award and received both a silver and a bronze medal.

Teaching technology and innovative knowledge
As a subsidiary of the Danish Technological Institute, we have access to the innovative technologies that business organisations demand. We see ourselves as an intermediate agent, who is to recognise the needs of the industry and supply solutions based on DTI's resources. The model proved itself succesful in the collaboration with the DMRI division who is an acknowledged supplier of advanced services to leading meat processors in Poland. The impressive results of this collaboration made Polish companies realise how important it is to be innovative in the production management if they are to improve the competitiveness of their companies without major capital investments.

Investments and financing
Poland is the largest beneficiary of EU cohesion funds and DTI Polska is one of the main candidates to acquire the funds for business activities and social projects. Since 2007, we have worked with numerous companies, organisations and consultants to implement programs and projects under the supervision of large international corporations like the World Bank, the European Bank for Reconstruction and Development, and The Polish Agency for Enterprise Development. We have gained invaluable experience from over 100 training and consulting projects in Poland and abroad, and we are pleased to share this experience with our partners.

Marcin Opas
Managing Director

Danish Technological Institute - Innovation for society

The Danish Technological Institute (DTI) is a key innovation partner for Danish companies. DTI has many core competences and a wide technological base, which each year benefit more than 10,000 companies. Our solutions are generally characterised by durability and innovation, and DTI continues to improve its international position and role.

DTI is a non-profit institution and an approved technological service provider. Our 1,055 employees represent a significant knowledge resource. More than 66% of our employees have an academic background, while 14% have a research training background.

DTI is a multi-layered entity, which, in addition to the parent company, is made up of the subsidiaries Danfysik A/S, Dancert A/S, Teknologisk Institut AB, Sweden, DTI Polska Sp. Z o.o. plus 50% of Syddansk Teknologisk Innovation A/S, which we share with the other shareholders, Syddanske Forskerparker A/S and University of Southern Denmark.

DTI's 2014 revenue totalled EUR 145.5 million, which is in line with 2013. Revenue increased in the areas of construction, food and life science, while a few of the subsidiaries saw a drop in revenue.

DTI came out of the year with a net profit of EUR 4.1 million, which is satisfactory.

It is absolutely essential that DTI maintains a healthy financial position so that we can continue to invest in new facilities and methods. These are often pre-competitive and help provide access for Danish companies to an open infrastructure, which can strengthen the companies own resources and thus help bring life to new products and ideas. In an economy where production is fragmented into global value chains, it is important that there is easy access to resources, which can complement the individual companies' own resources.

This obviously benefits small and medium-sized companies the most, but development environments in general can also benefit from the increased synergy opportunities.

Jørgen Kunter Pedersen
Group CFO

RESULTS AND RESOURCES

Consolidated revenue and net profit for the period 2010-2014

Financial highlights

EUR million	2014	2013	2012	2011	2010	2009
KEY FIGURES						
Net revenue	146	145	141	132	129	113
Operating profit	4	5	6	5	4	3
Financial income and expenses	-	-	-	-	-	-
Profit for the year	**4**	**4**	**6**	**5**	**4**	**3**
Balance sheet total	114	112	110	100	90	90
Equity	**74**	**70**	**65**	**59**	**55**	**51**
Cash flow from operating activities	3	8	14	12	-1	8
Cash flow for investment activities	-14	9	12	2	3	10
Of which for investment in property, plant and equipment	14	9	12	2	3	5
Cash flow for financing	-	-2	-4	-	-	-
Total cash flow	**-12**	**-3**	**-3**	**10**	**-4**	**-1**
FINANCIAL RATIOS						
Profit margin	3.1	3.2	4.2	4.0	3.1	3.1
Equity interest (solvency)	65.1	62.5	59.6	59.3	61.0	57.0
Liquidity ratio	123.5	139.4	145.0	175.0	160.0	104.2
Development financed by operations	8.6	10.1	9.0	7.6	5.9	5.9
Average number of full-time employees	**1,055**	**1,051**	**992**	**953**	**974**	**904**

Excerpts from DTI's financial statements can be read on and downloaded from DTI's website at www.dti.dk

COMMERCIAL REVENUE

Consolidated commercial revenue totalled EUR 95.4 million in 2014. For the parent company, commercial revenue increased by 1.4% to EUR 67.4 million.

The moderate increase in commercial revenue is naturally marked by the general economic trends: For instance, the number of medium-sized companies (50-199 employees) in Denmark has dropped by 15% since 2008. In spite of this negative trend in DTI's Danish market, we managed to increase our market share.

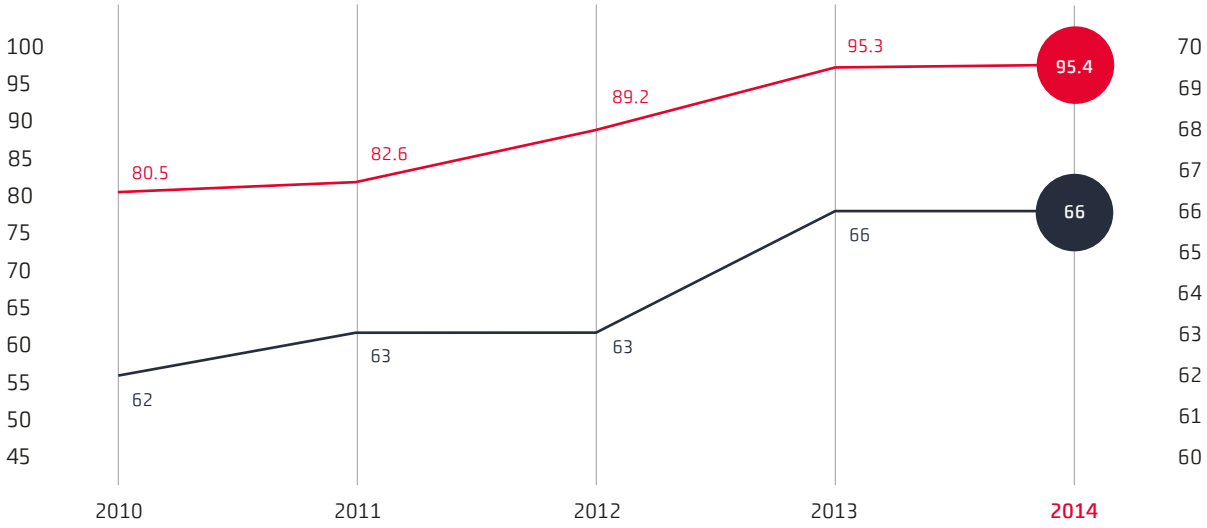
DTI's 2013-2015 strategic plan has as its objective that consolidated commercial revenue should total approx. EUR 98.9 million in 2014. This objective was almost achieved with a realised commercial revenue of EUR 95.4 million, corresponding to 96.5% of the strategy objective. The difference is mainly due to a slightly weak development in the revenue of Danfysik A/S and DTI Polska in Poland.

R&D REVENUE

R&D revenue increased by 0.9% to total EUR 50.1 million. This amount includes funds related to the performance contract which DTI has concluded with the Danish Ministry for Higher Education and Science. These funds total EUR 15.6 million, corresponding to 10.7% of DTI's total revenue.

Commercial revenue

Result, EUR million



Commercial revenue, Group Percent of consolidated revenue

A key success criterion for DTI is to include as many companies as possible in the development of new products and processes. One of the instruments involves participating in publicly funded projects e.g. via Innovation Fund Denmark. DTI typically assume the role of initiator, which, before project application, spends considerable resources on finding interested companies and on developing a project that can be accepted by the funding provider. Under the project itself, DTI develops services which both the participating companies and others may use in their future work. Accordingly, they can help create the required and desired development of Danish industry and the public sector. Dissemination of results is a considerable and important part of DTI's work.

The effect of this effort can be measured by looking at the size of DTI's revenue in R&D compared with that of the participating companies. The table below shows the development over the past five years. While DTI's R&D revenue increased from approx. EUR 56.5 million (including financing by operations) in 2010 to approx. EUR 62.6 million in 2014, the participating companies' R&D contribution has increased from approx. EUR 124.5 million in 2010 to approx. EUR 202.7 million in 2013, but dropped to approx. EUR 177.3 million in 2014. For each EUR DTI spent on R&D, the participating companies invested EUR 0.4 in 2010 and EUR 0.5 in 2014.

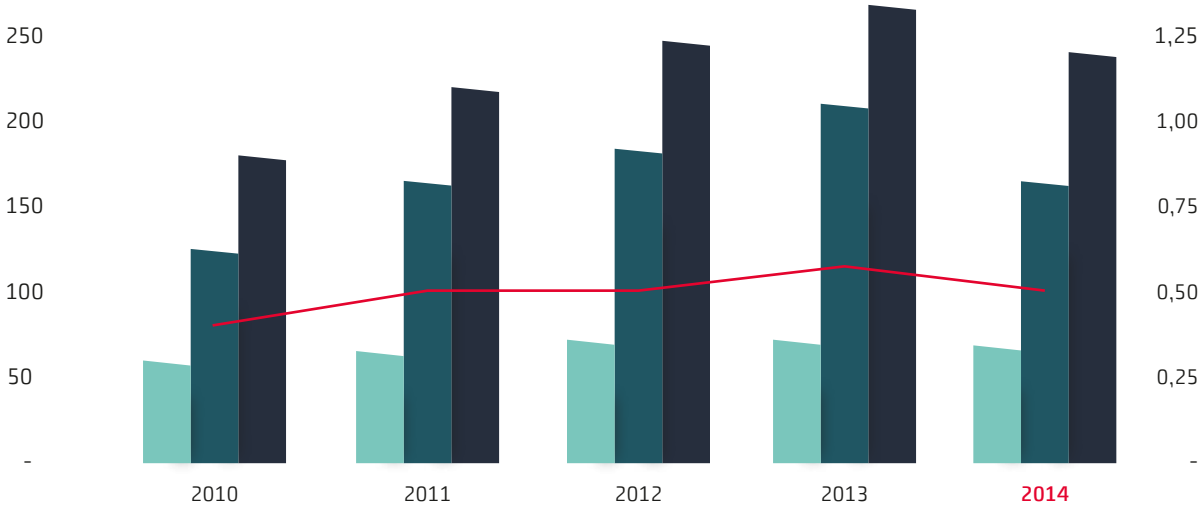
The decrease from 2013 to 2014 is due to a drop in funding from the Danish Innovation Consortium Scheme, the FP7 programme and to some extent the EUDP programme - all programmes, which require a high degree of company participation.

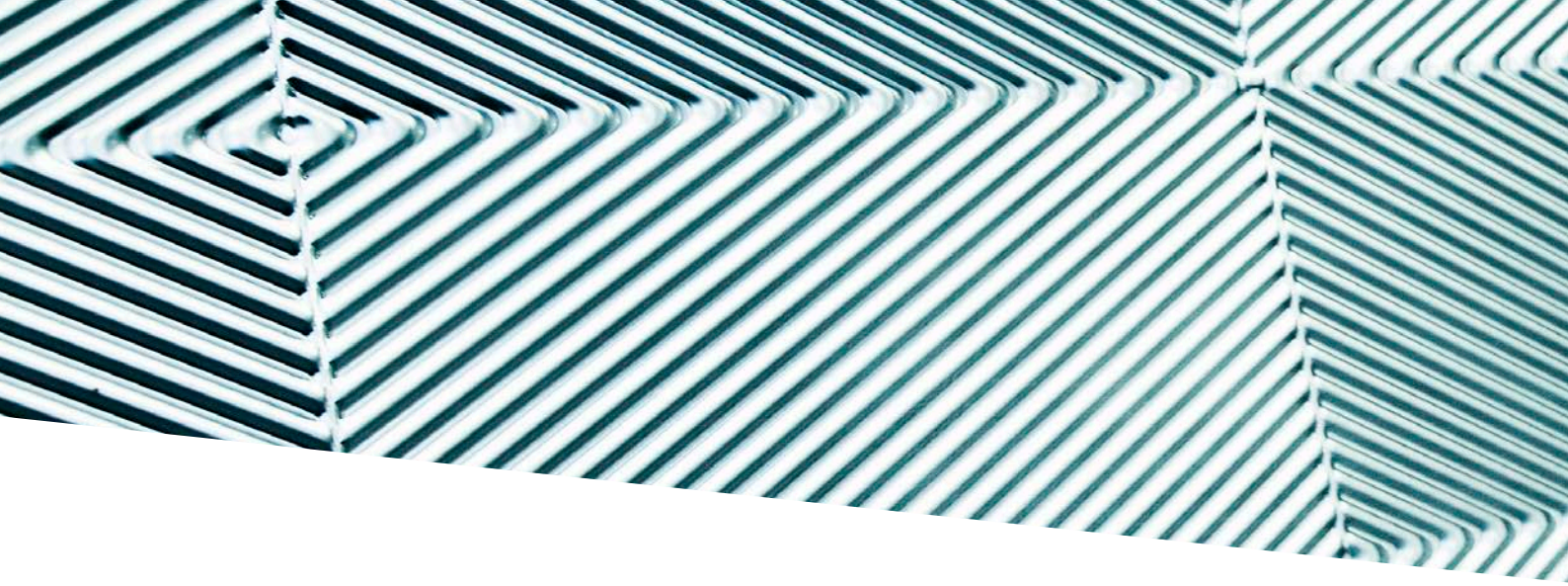
The perception that fewer R&D project funds are offered than before has led to both increased competition for funds and poorer funding. This is reflected by e.g. DTI's continued considerable own-financing of R&D projects, which, in 2014, accounted for EUR 12.6 million.

DTI's 2013-2015 strategic plan sets as an objective that R&D revenue in 2014 should be approx. EUR 54.7 million. The realised revenue came in at EUR 50.1 million, corresponding to 91.6% of the strategy objective.

R&D revenue and partner activity

Other amounts in EUR '000.





INTERNATIONAL REVENUE

The international revenue is composed of three subtotals, viz. export revenue from the parent company (including R&D revenue financed by e.g. the EU), the revenue of the two foreign subsidiaries as well as the revenue of Danfysik A/S. Out of the total consolidated revenue of EUR 145.5 million, the international revenue accounts for EUR 45.6 million, i.e. 31.4%. Trends in the past five years are illustrated in the table below. It is a part of DTI's strategy to grow internationally, both with regard to R&D revenue and commercial revenue.

Increasing international revenue is also an absolute success criterion, as it gives DTI optimum conditions for assisting Danish companies in a global market.

INVESTMENTS

In 2014, investments were made in buildings and property, plant and equipment for a total of EUR 14.2 million, which is a record figure.

For instance, DMRI built a new domicile, which was inaugurated on 23 September 2014 by Her Majesty the Queen.

In Aarhus, an agreement was made with Aarhus Local Authority to buy off the site area listed in a registered reversion clause, meaning that DTI now has obtained full right of disposal of the entire property.

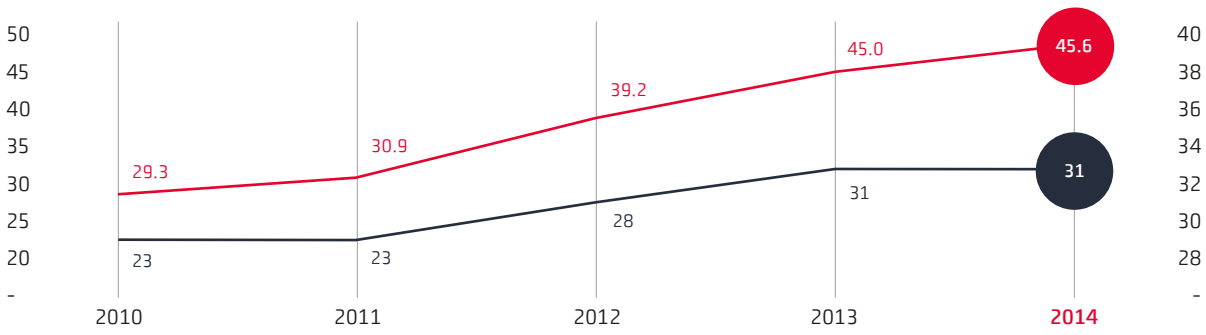
A considerable amount was also spent on modernising the central meeting facilities in Aarhus so that they now appear fully upgraded both environmentally and technically.

In Taastrup, the buildings housing the Building and Construction division underwent a total renovation of everything from air-conditioning to laboratory equipment.

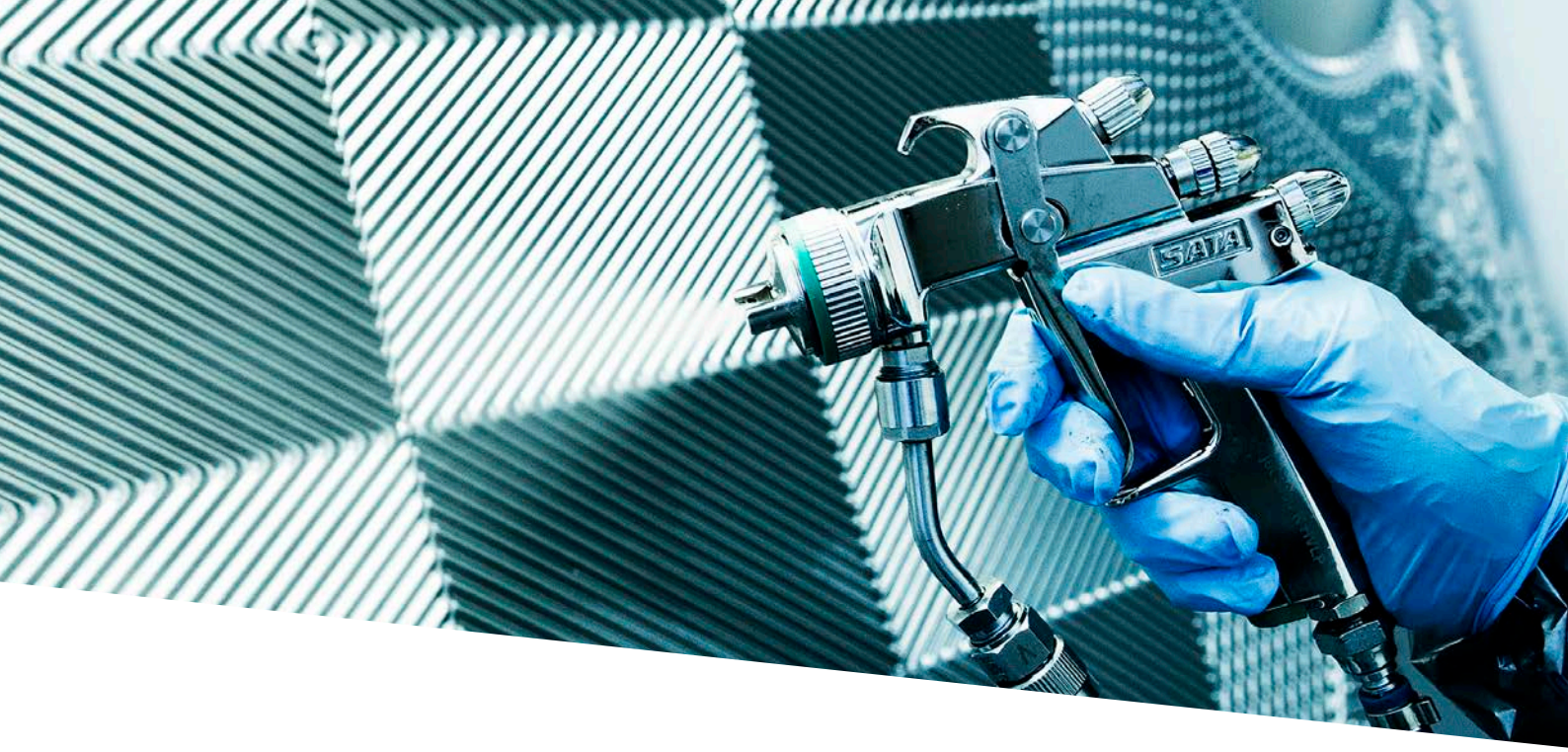
In addition, many millions were spent on general maintenance of DTI's many buildings, to ensure that DTI appears as a modern, inviting and constructive environment for our guests and employees.

International revenue

EUR million



International revenue Percent of consolidated revenue



Of all the development tasks solved by IT and Communications, the development of a new task management system had the highest priority. The benefits of the new task management system is that it provides an overview of all types of customer tasks, allows preparation of the basis agreements for tenders and facilitates invoicing of customers and viewing performance. The new task management system runs quickly and safely on a brand new infrastructure, and all employees have access to the system from both PCs and smartphones.

OUTLOOK FOR 2015

The external uncertainties combined with the development in 2014 resulted in the budget for 2015 primarily focusing on satisfactory productivity and secondarily on growth.

Total consolidated revenue is budgeted at EUR 148.2 million, while the other budget figures can be broken down as follows:

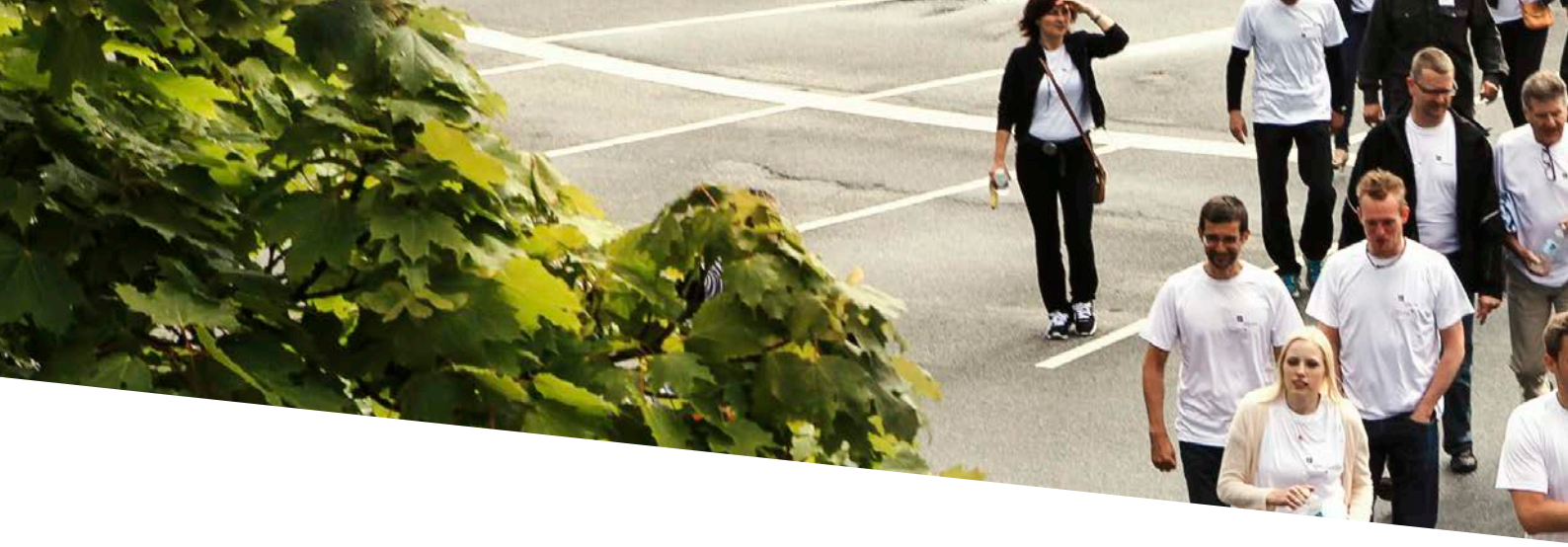
The parent company's commercial revenue is budgeted at EUR 69.8 million, which is an increase of 3.6% compared to 2014.

R&D revenue in 2015 is budgeted at EUR 52.1 million, compared to a realised revenue in 2014 of EUR 50.1 million.

The structural changes of the innovation system in Denmark with the establishment of the Innovation Fund Denmark and the launch of the EU's Horizon 2020 have reduced the number of order intake below what was expected. Accordingly, the budgeted R&D revenue should be seen as an expression of the fact that DTI will concentrate on fulfilling its purpose – only to expect to get its 'fair share' once the new schemes are launched in 2015.

The subsidiaries are expected to have a total revenue of EUR 26.2 million against EUR 28.0 million in 2014. The drop can be attributed to the Danfysik A/S' and DTI Polska Sp. Z o.o.'s conservative budgeting.

! DTI's overall objective for 2013-2015 is to increase commercial revenue by 16%, generate an increase in revenue in international activities of 25% and realise a total R&D growth of 10%.



DTI'S ORGANISATION IN CONSTANT DEVELOPMENT

In 2014, DTI conducted a satisfaction survey among DTI employees. The survey asked about their position on both external and internal factors, including the relationship with customers and management. At 91%, the response rate was high.

It is the 7th time such an employee survey is made at DTI, and the responses have generally become more and more positive for every time. On a scale from 1 to 8, where 8 is very good, most responses have an average of more than 6.2.

To the question on being a good manager, the average assessment across all management levels was above 6.3.

DTI'S SERVICES REGARDED HIGHLY BY CUSTOMERS AND EMPLOYEES

We have evaluated our services in relation to our customers since 2002. In these evaluations, we have asked a few selected questions about quality, commitment, professionalism and on-time delivery; but we have also asked if our customers would recommend others to use DTI.

In this year's survey, we asked our employees the same questions we asked our customers, and the responses of the two groups to the same questions were consistent.

Customers as well as employees evaluate DTI highly when it comes to professionalism and commitment, and it is extremely positive to see that many of our customers would recommend others to use us.

Evaluation of DTI services

EMPLOYER BRANDING

In 2014, we also consolidated our activities in employer branding on the social media and in including our employees in the work to attract new labour. For instance, we have had major campaigns in printed media, and we have extended our cooperation with e.g. universities.

We have also conducted a larger number of company visits in both Taastrup and Aarhus. The visits are meant to increase our visibility and show DTI as an attractive workplace.

In the recruitment area, we have entered into cooperation with LinkedIn to ensure optimum profiling of DTI job postings and to make sure that we reach as many relevant candidates as possible. An employer branding video has also been prepared and broadcasted in various media and in particular on the social media.

KNOWLEDGE SHARING ACROSS DTI

In June 2014, all DTI employees met for a multi-disciplinary day, which we called 'Døgnet14' ('The Day14').

The day involved not less than 108 presentations and everyone were invited to share experience and knowledge within all DTI core areas.

Besides the aim to create networks across the organisation, the day was meant to give our employees as broad and comprehensive knowledge of DTI's products and services as possible.

! DTI had 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/csr2014

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Amager Data ApS
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“ The photo shows small metal test samples, which have been polished and etched to create different degrees of surface roughness. Subsequently they have been coated with different hard coatings and ion-implanted to provide the surface with new and improved properties. This can often be particularly valuable for both products and production processes.

In this case, the samples are part of a research project focusing on enhancing product quality and productivity in the plastic injection moulding industry.

Our Annual Report 2014 offers more examples of how we develop new, ground-breaking technologies and translate knowledge into products and services of real value to society and our partners.