

PV.

# Grow Your Ideas.

# What's an Idea?

Get the answer from an expert on creativity, Professor Gerard J. Puccio

## A New Wind Blowing in the Wind Energy Industry.

From innovative idea to IP strategy and viable business model

# Setting the Tone in Sound Design.

Conquering the market of wireless sound systems

# Foreword by Annette Siewert Lindgreen



### Welcome to the Inspiring and Innovative World of Intellectual Property.

Our world unfolds one of the most fragile yet powerful forces ever: **THE IDEA**. The magazine in your hands is bursting with exciting stories on creative ideas that have matured, or are in the process of maturing, into commercially interesting projects or products to solve a scientific challenge.

Plougmann Vingtoft has more than 50 years' experience in providing top professional consultancy services to people and companies behind innovative startups or multinationals to develop, protect and commercialize their ideas, inventions and brands by means of intellectual property rights.

We want to make a difference by strengthening knowledge, innovation and creativity. We take pride in the fact that we are committed to helping our clients benefit from the global IP system and strengthening their competitive position in the market. We live and practice this ideal in our daily work.

Our founders passed on their love of art, and we think of IP consulting as an art form: a creative process that transforms an idea into something which is beautiful, unique and worth protecting.

The stories in this magazine speak of our passion for ideas, innovation and new thinking which spans almost every industry you can think of.

It is our goal that you will indulge in this small selection of insights from the exciting world of intellectual property to share our passion for ideas, creativity and innovation.

Enjoy!

Annette Siewert Lindgreen CEO, Plougmann Vingtoft

# Need help to protect an idea?

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# What's an Idea?

Photo: Pixabay.com

Interview by Sarah Thurber

Professor Gerard J. Puccio is the author of "Creative Leadership" and director of the International Center for Studies in Creativity in Buffalo. New York. He also chairs the world's oldest program in Creative Studies. Those who earn their master's degree through his program graduate not with a Master of Arts, but with a Master of Science.



An idea is our imagination's way of responding to a gap. A gap might be created by a question that doesn't have an answer or a problem that doesn't have a solution. We bridge the gap by forming a new association or connection. That's an idea. People often confuse ideas with solutions. In my opinion, a solution is an idea that has already undergone the process of being evaluated, refined, and developed so you're very close to bringing it to the world. An idea, by contrast, is closer to the wellspring of imagination. In the overall process, it is closer to the initial insight – the 'aha' moment.

#### Where do they come from?

We find ideas by looking for them. While it's true that people occasionally stumble on a new idea. most ideas come in response to a need. It could be the need for a new product, business or opportunity. When our mind identifies that gap, our imagination starts working to create an association that will bridge it. The more we fuel our minds with rich stimuli such as new knowledge, ideas, concepts, theories, images and experience, the more effective we become at making associations that bridge gaps.

#### How do we become better at having ideas?

We can train our imagination. Exercising our imagination is just like developing any other ability. We may come into the world with some set point, but through sheer practice we can become more skillful at producing new ideas and concepts. There is a myth that developing our own creativity is impossible, so many people don't try. But there are a few effective strategies and methods that can really increase your output. Here I'm thinking of the creative problem solving process and the many divergent thinking tools that lay down specific rules, like learning to



suspend judgment and striving to come up with many potential options, rather than building a solution on the first idea. Again, feed your imagination with lots of stimuli both related to your iob domain or discipline as well as outside. Cross-fertilization of information is more likely to lead to a breakthrough because it injects a new train of thought.

Ideator

#### Who is best at having ideas?

I believe that everyone is creative. We just have different ways of expressing it. Some people seem to have a knack for asking the right questions. Some have the patience to perfect a plan. Some have the courage to take a creative leap. Others are hardwired to generate ideas. Now we've developed a psychometric measure called FourSight™: The Breakthrough Thinking Profile that identifies people's thinking preferences. One of the preferences is the 'Ideator'. As the name suggests, these are individuals whose minds are drawn to play continuously with new possibilities. They often stun others who do not have this thinking preference by the massive amount of new ideas they can produce. In fact, sometimes they can't seem to find the stop button. That's how natural the production of ideas is for an

# An idea is our imagination's way of responding to a gap.

#### Are there particular age groups, nationalities or cultural groups that are better at coming up with ideas?

You're likely to find people who are good at coming up with ideas in occupations that attract Ideators. I think of the 'creatives' in advertising, artists, designers, R&D, inventors, and consultants. Interestingly, through our recent research with FourSight<sup>™</sup>, we've learned that many top executives express a high preference for the Ideator thinking style. My sense is that senior leaders have this tendency because they are the big-picture thinkers, the visionaries, the individuals who forecast the future and explore the possibilities it holds.

#### Historically, has there been a good time for ideas?

Over the course of history, ideas seem to flourish where there is a cross-fertilization of different cultures and the free flow of ideas. The Renaissance is the classic example of a time in history when we saw a significant increase in new ideas. Today the Internet allows for cross-fertilization and imagination and the easy exchange of concepts. Look at the kind of collaboration we're seeing with people who have never met face-to-face writing books, composing music, developing technical innovations. Organizations are able to access new consumers and the broader world. Open innovation and crowd sourcing allow the larger population to submit ideas that may become the next innovation for the organization. Now is a very good time for ideas.

#### When do ideas happen?

It's a myth to believe that ideas come through stress or panic. Actually, research done by Teresa Amabile shows that harsh deadlines don't promote ideas. What they promote is a grasp at the low-hanging fruit the ideas you have already had. Generally, ideas happen when you have time to think. We're often struck with ideas when we're drifting off to sleep or driving to work or taking a shower.

#### Are there organizational conditions that help?

Yes. You can promote a culture of ideas by allowing 'idea time'. Google is the poster child for that. They encourage people to explore ideas, allocating a set percentage of people's time to 'think'. 3M has done the same thing in their R&D labs. Team leaders can provide their people with the latest knowledge in their field and encourage people to look outside their field. That's where most of the fresh thinking is going to occur. You also want to consider idea support. How are people treating

other people's ideas? If it's a highly critical environment, people will learn to keep their ideas to themselves. In a setting like that, imaginations can atrophy.

#### How should one receive an idea from others?

Counter-intuitively. The way most of us are taught to respond to a new idea is to find fault with it. That doesn't work so well for the idea. Remember, an idea is still a newborn. It's not a robust solution yet. So treat it gently. Specifically, we teach people to use the technique called 'Praise First'. You can remember it with the acronym POINT, which stands for Pluses, Opportunities, Issues and New Thinking. So when someone approaches you with a new idea, express what you like about it. Identify its good points and articulate the opportunities that might open up if the idea were to gain acceptance. Once you've established its merits, you can express any concerns you have about the idea. but worded as a question that invites new thinking. For example: How might we fund that? Or: In what ways might we convince the boss? When we did our research on training impact, the tool that was used most often was POINT. It gives leaders a structured way to honor the person who has an idea by acknowledging its attributes and offering constructive feedback that aims at developing and strengthening the idea. Fewer ideas get squashed in their infancy.

#### What do ideas do to us?

There's an emotional response when you have that 'aha' moment – a sense of relief and joy. Ideas make us more powerful because we resolve dilemmas, and that's a very life-giving experience. There's a deep sense of satisfaction in coming up with ideas that have value to us.

#### What physical environment works best?

It all depends on the person. People vary in terms of the physical surroundings. Me, when I need new thinking, I need music and physical movement. Other people find music distracting. People need to design their own space to create the physical environment that supports them best. Some people will like light, dark, warm or cold. Because there's no single recipe that works for everyone, it's important for people to take control of their own physical space and have it work for them. In organizations, it's important to be sure there's a physical location where people can collect, literally like the water cooler. People need to have ready access to each other because ideas often spring from those simple exchanges and conversations.



#### Do we need pauses for reflection or are we better off being immersed in information and constant stimuli?

We need time to pause and reflect. Take a walk. Go to a conference. Take a trip. Get away from an environment where vou're sprinting all the time. When we have time to step back and reflect, we literally give our minds the space to come up with new ideas. That's what I like about flying. No email. No interruptions. No fires to put out. I can think. It's absolutely crucial.

#### Do you have any personal favourite ideas?

The FourSight<sup>™</sup> theory and measure. The concept of creative leadership, i.e. the belief that leaders need to embody creative thinking to be successful in the 21st century. The idea that everyone can learn to be more creative and that creative thinking is an essential life skill.



We find ideas by looking for them. While it's true that people occasionally stumble on a new idea, most ideas come in response to a need.

# **A New Wind** Blowing in the Wind Energy Industry. Wind power & commercialisation

Just north of Bergen, Norway, a bunch of wind enthusiasts are on a path to revolutionise the wind energy industry with something as seemingly simple as kites. Norwegian start-up Kitemill is planning to launch their first commercial kite power station in 2017.

Most children have felt the strong tug and pull of the wind when flying kites. Kite surfers use the same principle of wind traction to tow their surf boards. This inspired the idea that became the foundation of Kitemill-

Subject

## Why not use the kite principle to harness the traction force of the wind to create power?

Thomas Hårklau and Olav Aleksander Bu originally intended to use the kite principle to circumnavigate the world in record time. However, with the onset of the worldwide financial crisis sponsors were hard to come by and the project was abandoned.

But the two friends could not let go of the idea that there was

an untapped potential in kite power. In 2008, they brought on board professional hang glider and investor Jon Gjerde, and Kitemill was formed.

#### How Kitemill's Kite Power Works

Kitemill's vision was originally inspired by kitesurfing as were their kites in the shape of light fabric membranes on pliable frames. However, Hårklau and his crew soon realized that the extreme force and traction of the wind at high altitudes would wear out the pliable kites in a matter of weeks. Instead, they developed a rigid kite shaped like a small airplane. (See fig. 1)

The design of the "kiteplane" is much like that of an airplane with flaps that can be released when the kite reaches the right altitude. The kite is fastened to a long wire attached to a generator at a power station on the ground. Small propellers bring the kite to the right altitude, the flaps are released to catch the wind and spin the kite in a long spiral with the help of the steering propellers, reeling out the wire with the traction force to create power.



The spiral pattern creates much more power than if the kite flew in a straight line – a principle that is also used in the rotation of traditional windmills.

When the kite reaches the end of its tether, it is reeled back in to the winch drum to be levitated once more. The entire return phase consumes less than 2 % of the power generated and requires less than 20 % of the total cycle time.

Kitemill are planning to launch their first commercial kite power station hub in Lista, Norway in 2017. One kite generates approximately 35 kW which is enough to power 5 households. Kitemill expect to be able to enlarge the kites over time to create more energy from each kite, but for now, their goal is to generate more operational hours than any other kite power supplier.



#### **Coasting in the Slipstream of Wind Power**

While Airborne Wind Energy Systems (AWES), to give kite power its proper name, is still a budding technology, using wind as a sustainable source of energy is by no means a new idea. Large windmills can be seen on many a windswept hill, and offshore wind farms are dotted along the coasts of many countries.

The first power-producing windmills in Denmark were built in the 1970's, often set up by small, private investor groups.

The first windmills had a power production capability very like that of Kitemill's first power station.

It took the windmill industry more than 30 years to develop into the billion-dollar industry it is today, with hard and costly lessons along the way. The wind power industry paved the way for wind energy in general, and the AWES industry can coast in their slipstream, learn from their mistakes and try to repeat their successes.

## From the beginning, the founders of Kitemill were very conscious of the importance of protecting their new technology to attract investors.

AWES has the potential to grow as an industry at a much faster pace because of this and because it relies on a patchwork of new technologies and technologies that already exist: The first known kites were invented in China more than 2000 years ago, and the principle has been used by countless children and kite surfers alike.

In their kite design, Kitemill are utilising tried and tested technologies from airplanes in the kite's aerodynamic shape and the flap functionality; from drones in the steering propellers; and from windmills in the spiralling flying pattern which creates more energy than a straight line.

The wire and winch are off-the-shelf technologies used in other industries as is the generator.

This patchwork of new and existing technologies lowers development and production costs considerably, speeds up the growth process for the industry and improves the prospects of return on investment for investors.

#### **Benefits of AWES Compared to Wind Power**

#### Lower production costs

The production of kites only uses 1/10 of the materials needed for windmills. Several of the components are off-the-shelf units, and logistics are easier as the components are relatively small and make for easy transportation.

#### Less windy locations •

Windmills only utilise a small percentage of the wind energy and need to be placed at very windy sites to be cost-effective. Kitemill's kites can reach altitudes of up to 1500 meters, harnessing the stronger, more steady force of jet streams in the atmosphere which can be found in almost any location worldwide.

#### More full load hours per year Ð

When Kitemill's kites reach their full potential, they are estimated to produce an average of 4200 full load hours per year. In comparison, windmills produced 2453 full load hours on average in 2012<sup>1</sup>.

#### Less visible in the landscape Ð

To some, windmills are an eye-sore. Kites, on the other hand, are barely visible when they reach their spiralling altitude.

#### Safer in hurricane-prone areas Ð

Windmills cannot be placed in locations with a risk of hurricanes as the force of the wind might damage the propellers. Kites, however, can be reeled in guickly if the wind is too strong.

#### Drawbacks of AWES Compared to Wind Power

#### Dependent on investors willing to take risks 8

Airborne Wind Energy Systems is still a budding industry relying heavily on investors willing to take risks.

#### Wider safety zones 0

AWES hubs need a wider safety zone than windmills so the kites do not get tangled or endanger low-flying aircraft. In other words, they require more space per kite.

#### Unclear subsidy scheme

Sustainable energy is a heavily subsidised industry, but AWES has yet to be officially defined and standardised as a sustainable energy technology. It is currently a work in progress.

<sup>1</sup>Average world GWEC 2014





Ironically, this is also the biggest challenge for Kitemill from an IPR perspective.

#### Patenting a Patchwork Technology

From the beginning, the founders of Kitemill were very conscious of the importance of protecting their new technology to attract investors and be seen as competitive in a heavily subsidised industry. However, the patchwork nature of the technology made it impossible to patent Kitemill's airborne wind energy technology as a whole.

Instead, with the help of Plougmann Vingtoft and its techtrans and commercialisation team tto, Kitemill formed a long-term patenting strategy focusing on patenting smaller technological developments in an on-going process. Our experts continue to collaborate closely with Kitemill's developers to safeguard Kitemill's technology and help them become well-versed in the jungle of sustainable technology patenting.

This sound, well-argued strategy has enabled Kitemill to attract several investors who might otherwise be wary of investing in a new technology where the patent protection will never be entirely perfect.

tto's profound knowledge of the wind power industry and vast experience in maturing and bringing sustainable energy technologies to market also helped shape Kitemill's launch and investment strategy to the point where Kitemill are now ready to launch their first commercial power station hub in 2017.

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#### The Potential of AWES

Kitemill are not the only ones developing kites to harness the power of the high-altitude winds. Competitors worldwide are working on various kinds of airborne wind energy systems, and while they are all racing to be the first to market a commercial version of their product, the widespread interest and competition in the field of this budding technology is largely a benefit to the players in the field rather than a drawback.

The competitors within the EU would do well to take a leaf out of the windmill industry's book and work together to develop certifications and standardisation rules for the industry. They can use the same test sites and learn from each other, and the first competitor's success will eventually pave the way for the other players in the field.

Despite the many benefits of AWES, the technology is not likely to replace wind power as the main wind energy technology anytime soon - if ever - but it is on its way to becoming a viable supplement in the sustainable energy grid and may even be used in conjunction with wind farms as kites harness the wind energy at much higher altitudes.

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A small houseboat in Copenhagen is home to a remarkable, progressive food laboratory. Founded by the food experts behind famous restaurant Noma, head chef René Redzepi and gastronomic entrepreneur Claus Meyer, Nordic Food Lab has been the breeding ground for several important food discoveries. Among these is the discovery that Scandinavian søl seaweed contains umami.

# Noma's Arc.



It is a motley crew of chefs, chemists and anthropologists that goes by the name of Nordic Food Lab. This group of professionals is dedicated to researching Nordic cuisine, new flavours and alternative raw ingredients, all in the name of tasty food.

One of the lab's great discoveries was when their research uncovered large concentrations of the basic taste umami in søl seaweed, found in abundance in Scandinavian waters. Umami is a naturally occurring flavour in many foods such as meat, mature cheese and tomatoes – and seaweed, as it transpires.

While the Japanese have extracted umami from konbu seaweed for many decades, this was the first time umami was found in Scandinavian seaweed. Nordic Food Lab followed up the discovery with experiments on how to incorporate the seaweed's unique flavour into Nordic dishes.

Nordic Food Lab's research into Scandinavian seaweed's umami content has been cited in the scientific article 'Seaweeds for Umami Flavour in the New Nordic Cuisine' in the magazine 'Flavour'.

#### Ice Cream Made of Seaweed

"It has a full-bodied, satisfying taste; a deep flavour that makes me feel full."

This is how Lars Williams, former chef and head of research at Nordic Food Lab, describes the taste of umami, also known as the fifth basic taste. We were invited to the food laboratory, where they served up a mouthwatering portion of lilac-coloured, creamy ice cream made from an extract of søl seaweed. At first glance, it looks exactly like three scoops of raspberry ice cream on the plate, but the taste is quite unique. The ice cream, which in addition to seaweed concentrate is seasoned with beetroot, initially tastes very sweet. However, the taste soon takes on a flowery, full-bodied quality.

In many ways, the surprising ice cream highlights the essential properties of umami, namely its ability to accentuate and bind together different flavours. The ice cream contains far less sugar and fewer calories than any of its supermarket rivals. Nevertheless, the sweet taste is unmistakably strong because umami helps to enhance the sweetness before it develops in other directions.

#### The Fifth Basic Taste

Umami is the taste of processed proteins such as those found in air-dried ham or enjoyed in a good meat and vegetable stew.

The taste was first recorded in Japan in 1908 when the Japanese chemistry professor Kikunae Ikeda discovered that konbu seaweed with its high content of the amino acid glutamate had a wholly unique taste. Kikunae Ikeda named the taste umami, which means roughly 'the essence of tastiness'.

Long before Ikeda's discovery, umami was one of the cornerstones of Japanese cuisine. In particular, the classic Japanese soup stock dashi made from konbu seaweed and used in a host of Japanese dishes such as miso soup is considered the very essence of umami.

In Western cuisine, however, umami is a relatively new phenomenon, which has only been recognised in recent years.

#### Food and Science

Inspired by Japanese dashi, Nordic Food Lab decided to take a closer look at the glutamate content in a range of Nordic seaweeds. The studies were carried out with the help of Ole G. Mouritsen, professor of biophysics at the University of Southern Denmark and a member of Nordic Food Lab's board of directors. Ole G. Mouritsen has also written books on seaweed and umami.

Aboard Nordic Food Lab's houseboat, the team extracted umami from three different types of seaweed: brown alga sugar seaweed and the two red algae søl and gracilaria seaweed.

The extracts were then sent to Ole G. Mouritsen's laboratory at the University of Southern Denmark, where the glutamate content was measured and compared with the glutamate content in Japanese konbu seaweed.

#### Get in touch with our food technology experts at foodtechnology@pv.eu

Lars Williams – Nordic Food Lab Nordic Food Lab is a kitchen-cumlaboratory established in 2010. The aim of the food laboratory is to explore Nordic food. Photo: Mads Armgaard

> The results showed surprisingly high quantities of the umami-producing amino acid in one of the seaweeds. The red alga søl contained 140 milligrams of glutamate per 100 grams, almost equaling the umami extract from the very finest Japanese konbu seaweed, which contains 145 milligrams of glutamate per 100 grams.

"We were very surprised by the levels of umami in the søl seaweed. I remember that Ole called me and asked me to run the tests again because the results were so sensational," says Lars Williams.

#### **Huge Commercial Potential**

Both Lars Williams and Ole G. Mouritsen see a huge commercial potential in the new Nordic flavour source. Both emphasise, however, that they are not businessmen, but work to inspire others.

In fact, Ole G. Mouritsen says there is nothing to prevent manufacturers from producing easily accessible Nordic umami products that ordinary consumers can use to spice up their evening meal.

"I can easily imagine a stock cube made of søl, for example. That would be quite easy to produce. All it needs is for the first person to invest in the idea."

Nordic Food Lab is an autonomous, non-profit organisation that receives funding from private and public foundations and companies.





# Using Ozone in the Fight to Purify Water.

Subject Water purification

A far more efficient system for water purification is needed if we are to avoid irreparable damage to our marine environment. Bombarding effluent with ozone, the earth's natural sunscreen, can solve the problem.

Contraceptive pills, antidepressants and hundreds of other medicine remnants are floating in rivers and streams the world over. The medicine we ingest is expelled by the body and ends up in the world's effluent. We still do not know exactly how this cocktail affects us, but we are beginning to see the negative impact this pollution is having on fish and other marine life. Some species have lost the ability to reproduce, while others have begun to change gender.

For years, the Swedish company Primozone worked on developing and refining an eco-friendly method to transform bacteria and medicine-infected effluent into clean drinking water. In brief, an ozone generator bombards the effluent with the unstable molecule ozone, better known as the earth's UV filter. Primozone finally succeeded in developing an industrial purification system that uses 70% less energy than previous generators.

"The unique thing about our product is the generator's ability to regulate the amount of ozone. At three a.m. when people are sound asleep and not using water, the system ticks over. At seven a.m., when everyone's taking a shower, it can instantly switch to 100% efficiency," says Arash Golshenas, head of Research & Development at Primozone.

#### **Unstable Ozone**

Ozone is the strongest molecule we have for disinfecting water purifying plants. It is made up of three atoms of oxygen that are bound together. Two oxygen atoms, i.e. O<sub>2</sub>, produce oxygen. If you add a third oxygen atom, you get ozone, O<sub>2</sub>. The third oxygen atom does not stay attached to oxygen as a sort of third wheel, nor is it content to remain on the earth's surface. It therefore does everything it can to find a better partner, which renders the ozone molecule unstable. It flies about with the third oxygen molecule heading the group, searching for organic material with which to react.

"Ozone is so efficient at purifying water because it reacts immediately to organic matter. As soon as it has the opportunity to split, it does."

Any microorganism that can be disinfected, changed or removed in an oxidisation or oxygenation process will be affected by ozone.

"Ozone is such an effective disinfection agent that you don't have to add other hazardous chemicals that have to be removed later in the process."

Compared to chlorine, the most common chemical used for disinfecting water, ozone reacts 3,000 times faster and is 50% more potent at killing bacteria, and unlike chlorine, ozone water purification does not release any undesirable by-products.

#### Pure Air

"Most people are familiar with the aftertaste of chlorine in drinking water, particularly in Southern Europe. All the chlorine we use to cleanse effluent ends up in nature and we still don't know the full consequences of this," says Arash Golshenas.

Whereas chlorine remains in the water as a by-product of purification, ozone is transformed into pure air. Because the ozone molecule is so unstable and constantly trying to split off, it can neither be stored nor transported. It must, therefore, be produced on-site, as and when it is needed. This process takes place in a generator by exposing oxygen atoms to UV light, just as in the upper atmosphere when the sun's rays hit the stratosphere where we find the ozone layer. As soon as the three atoms bind together, they are pumped out into the effluent where they immediately search for organic material.

"When the unstable ozone molecule finally locates organic material with which to react, the third oxygen atom splits off, leaving pure air. Water purification with ozone doesn't release any hazardous by-products," explains Arash Golshenas.

The ozone breaks down the long chains of molecules into smaller building blocks. These blocks are often more biodegradable and less hazardous. The small molecules are a minor pollution issue because they are more easily reused in nature or removed in the filtering process.

"Precisely because water purification with ozone isn't a new technique, we know there aren't any unknown and undesirable side-effects," says Arash Golshenas.

Primozone was founded in 2000 by entrepreneur and electro-engineer Jan Borgström. He is the brains behind the technique using high ozone concentrations and the energyefficient construction.

The patented, eco-friendly technology behind Primozone's ozone generators sets the standard for new generations of generators.

"The high ozone concentration, the low energy consumption and the compact size are what set Primozone apart from other conventional ozone generators."

It was these very gualities that led Sustainable Business Hub to award Primozone the 'South Sweden Cleantech Award' in November 2012. Sustainable Business Hub is an organization that works to promote companies with a cutting-edge eco profile.

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Water purification with ozone is nothing new. In fact, the method has been used for more than a century.

Freeing robots from their cages creates both foreseeable and unforeseeable problems, as Grundfos discovered when they unleashed their new Little Helper onto the factory floor. But there is no substitute for experience when developing the flexible industrial robot of the future – a robot that in the long term may safeguard European jobs.

# **Robots on** the Loose.

Subject Mobile robotics

In the mid-90s, Grundfos was one of the first companies outside the car industry to use production robots on a large scale. Since then, they have been leaders in the field of industrial robots, and today the company owns more than 200 robots that paint, assemble, weld, cut, glue, empty boxes and move things about. But even robots have their limitations. They are heavy and inflexible, they need to be fenced in, and they require slow, professional programming every time they need to learn something new.

Grundfos therefore began to wonder whether it was possible to build more intelligent robots. What if a robot could run among people? What if you could teach a robot what to do easily and intuitively? And what if you could use a robot in a far more flexible wav?

In 2008, Grundfos began developing a new type of industrial robot that will gradually render production more flexible and efficient, and which at the end of the day might just help save jobs in European industry.

#### From Idea to Factory Floor

"The idea is to create a robot that doesn't need to be closed off but which can drive about the production floor, helping out where it is needed," says Johnny Overgaard, Head of the Development Department at Grundfos' Technology Centre and tasked with optimizing the company's production processes.

From the very outset, the aim of the project was to ensure that the robot could do three things: move things from one place to another, assemble things and perform its own quality control.

In 2008, Grundfos initiated a collaboration project with Aalborg University to develop the new robot, which was soon named *Little* 

Trent to the local data 

Helper. Two business PhDs were attached to the project and began developing the basic robot elements, which went on to become part of the European TAPAS project. This project included players such as the German company KUKA, one of the world's leading manufacturers of industrial robots, the Institute of Robotics and Mechatronics at the German Aerospace Center, Convergent Information Technologies GmbH in Austria, Autonomous Intelligent Systems Lab at Albert Ludwigs University of Freiburg and Aalborg University, who came together to drive the technological breakthrough in robot-based production.

In May 2011, the robot was ready for testing at Grundfos. Little Helper – which basically consisted of a robotic arm mounted on wheels - began performing the tasks for which it was created and succeeded in collecting and emptying boxes. But before long, it lost its sense of direction. It turned out that the small irregularities in the factory floor caused the wheels to skid, and this interfered with the robot's calculations.

"You can try to allow for this kind of thing at the drawing board. but you only really find out how things work when you try them out in practice," says Johnny Overgaard.

#### **Deadly Machines**

The developers are currently fitting Little Helper with a new, improved laser-based navigation system, but there are still problems to be solved before the robot can be let loose on the production floor. One of the main issues is safety.

"These robots are dangerous. They can kill you. They possess enormous strength that truly demands respect. When you suddenly remove a robot from its protective enclosure and let it loose on the production floor you have to be absolutely sure it won't hit anyone," explains Mathias Kielgast Garbus, robot engineer and project manager at Grundfos and attached to the TAPAS project.

The robot already has a driving platform fitted with laser scanners that make it stop before it hits anything or anyone, but the robotic arm is still not entirely safe.

#### **Another Challenge Is User-Friendliness**

"One of the goals is to be able to program this robot ten times faster than a traditional robot system, and when you consider that this mobile robot is an advanced high-tech system, that poses a major challenge," admits Mathias Kielgast Garbus.

Right now, attention is focused on developing a simpler navigation system so that factory workers can tell the robot what to do using a user-friendly touch screen. In time, the aim is to create a robot that can learn and receive instructions through simple, on-the-job training - in other words using speech and gestures.

#### Go or Kill

The TAPAS project stresses testing the new technologies in real factory environments, an essential feature for Grundfos. Had the project been research-based, Johnny Overgaard would probably have turned it down.

Overgaard.

As a leader on the robotics front. Grundfos has often encountered skepticism from other sectors of the industry.

Kielgast Garbus.

But for Grundfos it is important to adopt a far-sighted, ambitious approach – even with long-term projects like Little Helper that inevitably bring their share of problems and disappointment.

your competitors."

An early version of the Little Helper which is now on the loose at Grundfos.



"For us it's important that it isn't just a research project where we don't test things to see if they work. We need to know if it's go or kill. There's no point in investing in a lame duck," he says.

Grundfos has not only placed its production floor at the robot's disposal; the company is also actively involved in development.

"There are substantial benefits for a large company such as ours to develop processes using robots," says Johnny Overgaard. And when it comes to developing new robots, Grundfos offers crucial advantages over a purely research-based environment.

"We have a good understanding of what is needed and how to get a robot to perform a specific operation," explains Johnny

"Our expertise is such that our European robot project partners refer other companies with robot challenges to us. If there is a particular problem that they know we have experienced, they ask us to explain how we solved it," he says.

#### Just a Good Idea

"When we first began laser-welding extremely complex geometries, no one believed it was possible. Even the suppliers thought it was impossible and opted out," explains Mathias

"Sometimes you have to implement ambitious projects that might not be completely realizable because although not entirely successful, there are always elements that can be used later," says Johnny Overgaard.

"All it takes is a good idea. A good idea that enhances production can make all the difference in the world between you and

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# What's on the Menu for Fish?

The story of how BioMar has developed and refined fish feed to create a sustainable and healthy fish farming industry that meets the world's increasing demand.

Fish are increasingly being farmed because global demand for this healthy source of protein is rising steadily. Confining large numbers of any animal in a small space inevitably breeds certain diseases. This affects the wellbeing of the fish and ultimately the product that goes to consumers, as medication is often required to cure the diseases. This in turn is harmful for the aquatic environment. Fish feed is therefore an important step on the way to even healthier fish farming.

This is exactly why fish feed producer BioMar is on a mission to find the perfect fish feed composition. BioMar has developed and refined fish pellets since its inception in Denmark in the 1960s and is currently among the world's leading manufacturers of fish feed for the aquaculture industry. Roughly one in four farmed salmon produced in Europe and Chile is fed with products from this company.

#### **Endless Combinations**

Farmed fish must be healthy, so only the best is good enough for fish grown in an aquaculture. Dedicated fish feed researchers are so eager to give fish a superlative meal that they develop and test hundreds of recipes and combinations every year. You might well ask why they put so much effort into creating a tasty fish meal. The man with the answer is Gunnar Molland, product manager at BioMar in Trondheim, Norway. Recipe optimisation is in fact a science in its own right. "We try to develop feed with the best balance of nutrients to meet the nutritional requirements for strong, healthy fish growth while minimising the nutrients that go to waste in the water."

As mentioned, this scaly source of protein is rapidly gaining popularity worldwide. One reason is that more consumers are realising that fish contain many healthy nutrients. At the same time the world's population is growing, and people have more money to spend.

Concerns about over-fishing are constantly tightening the restrictions on the global fishing industry. As a result, opportunities for fishing the world's oceans are dwindling, while the potential for increasing the production of fish farms and marine farms is growing.

#### **Experimental Feed**

Consequently, there are plenty of avenues for BioMar to explore.

"We get new ideas all the time and have to integrate the latest research results into the products. For example, we have recently added probiotics to feed," says Molland.

Probiotics is the term for micro-organisms, including lactic acid bacteria, imputed to have health-promoting properties such as a beneficial effect on the gastrointestinal system. When fish receive a probiotic supplement through their food, they are less prone to disease. Fewer diseases means healthier fish and ultimately a better product.

The fish feed manufacturer's constant goal is to deploy the raw materials available in the best possible way.

"Protecting and conserving the few sources of raw materials in the aquaculture is a significant issue that we as a feed manufacturer do our best to resolve," says Molland.



#### About BioMar

BioMar was established in Denmark in 1962 by a group of Danish fish farmers under the name Dansk Ørredfoder A/S.

In 1988, crops and animal feed company Aktieselskabet Korn- og Foderstof Kompagniet (KFK) – a subsidiary of the Norwegian group Norsk Hydro – acquired BioMar, and the company's international expansion became a reality.

BioMar supplies feed to more than 25 species of fish in about 50 countries worldwide.



as offcuts, fishmeal and fish oil. This may sound a little cannibalistic, but all these raw materials are key food sources for fish in the wild like salmon, trout and cod.

#### More Vegetable Products

The use of marine raw materials is considered sustainable as long as we remain within the natural limits set by the fish populations of the ocean.

Today the total production of fishmeal and fish oil worldwide is relatively stable.

**Protecting and conserving** the few sources of raw materials in the aquaculture is a significant issue that we as a feed manufacturer do our best to resolve.

However, the production of fishmeal and fish oil cannot increase significantly without the risk of harming the natural stock of fish, while demand for fish is climbing. BioMar has responded to the challenge by making it a long-term objective to depend less on marine raw materials

"To reduce the need for fish remains, we are constantly looking for alternative raw ingredients such as vegetable proteins and oils. Bringing this change about is a complex challenge that demands extensive research," explains Molland, but results are already emerging.

"Tests on new, alternative raw materials have enabled us to reduce the content of marine raw materials in our fish feed without jeopardising fish health or growth. Furthermore, several studies have shown that even when fed a diet of mixed fish and vegetable oils, salmon and trout keep the beneficial health effects that humans also enjoy thanks to the feed's high content of proteins, minerals and healthy fatty acids."

BioMar's growth business areas include feed for salmon and trout in Norway. Great Britain and Chile. as well as feed for freshwater trout, sea bass and bream in the rest of Europe. Fish feed is produced for all stages of the fish lifecycle and the range includes feed for larvae, fry, grower and brood stock feeds.

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Artwork by Biørn Biørnholt

# Mean Green Algae Machine.

The oceans' algae are on the march. In great open-air raceways or under controlled greenhouse conditions, scientists allow microscopic algae to convert manure and sunlight into – well, you name it: food, vitamins, energy, medicine, even aircraft fuel, making it a raw material for the future.

Glowing a fluorescent green, the 17-metre long pipe system in one of AgroTech's experimental greenhouses looks like a giant, biological neon light. Anker Kuehn, who is conducting research into micro algae production and who is in charge of algae production at AgroTech in Copenhagen, proudly shows off his tubular reactor:

"Full-size production systems are vast, but we think this one's more than big enough!"

In 250 metres of clear plastic tubing, microscopic ocean algae swirl as they grow and divide – single-celled organisms with green chlorophyll that enables them to convert sunlight into chemical energy. Round and round they go in a swirling cocktail of salt water and air under carefully controlled conditions.

"It's a closed system that can be precisely regulated. Add nutrients and  $CO_{2'}$  Extract waste matter such as oxygen. The filter here harvests the algae so that an optimum number are kept in the reactor and can be siphoned off for scientific research," says Anker Kuehn, as he points to the system and explains the technique involved.

#### **Single-Celled Plants**

Researchers at AgroTech are specialised in strengthening innovation and competitiveness in agriculture and green technology, such as in nursery garden environments. "Micro algae production can prove to be a viable alternative to traditional greenhouse products – not least when demand for potted plants is waning. That is why we are looking into the potential for algae production in greenhouses," explains Anker Kuehn.

And housing greenhouse algae production in nursery gardens is not as far-fetched as it sounds. Algae are in fact plants – albeit of the single-celled variety.

"Algae are found in moist environments all over the world. There are about 60,000 known micro algae in the world, but my own personal guess is that there are many, many more," says Anker Kuehn, comparing the situation to our knowledge of bacteria:

"Every time you dig in the vegetable garden, you risk discovering a new type of bacteria and the same applies to the oceans. Every bucketful of water will contain a new type of alga that has yet to be discovered. And remember that the oceans cover greater areas of the globe than the continents."

#### Endless Numbers of Algae with Endless Applications

There are also enormous variations in the tiny organisms that are found in abundance from the Arctic to the Equator. There are algae that release hydrogen, while others sweat oil; algae that are rich in vitamins and other nutrients that can be used in the food industry. There are also algae that are ideal for feed production or fertilizers and algae that contain colouring agents.



## In theory, the sky's the limit in terms of what algae can supply for mankind.

"Some years back, a lot of sweets were pale in colour because manufacturers wanted to avoid artificial food colouring. And some colouring agents like blue, for example, completely disappeared from foods. Since then, bright colours have made a comeback – and some of these new, natural colouring agents are harvested from algae," says the researcher from AgroTech.

Another example of what algae can contain is fish oil. The oils we obtain from fish originate from algae ingested by the fish. Algae production plants are therefore capable of directly producing fish oils.

"In theory, the sky's the limit in terms of what algae can supply for mankind. In much the same way that we can genetically engineer bacteria, we will also be able to manipulate algae to produce a host of biological products. The only difference is that algae solely require fertilizer and sunlight," asserts Anker Kuehn.

#### Land-Based Algae Facilities

AgroTech are by no means alone in identifying algae potential. In recent decades, test plants and commercial production plants have sprung up around the globe.

In Europe, commercial algae production facilities can be found in countries such as Spain, Sweden, France and Germany. Using an algae plant fertilized with flue gasses from a coal-fired power station, Israel-based clean-tech company Seambiotic produces animal feed and omega 3 – fish oil. In Hawaii, the firm Cyanotech converts the powerful sunlight in algae into dietary supplements.

More than anything, it is the potential of algae to produce energy that has sparked scientific interest. A Boeing aircraft is currently undergoing trials with algae-based jet fuel. And in El Paso, Texas, Vertigro Joint Venture has shown that it will be possible to produce oil from algae corresponding to more than 100,000 litres per cultivated hectare.

However, scientists are not just experimenting with different types of algae, but also with different types of production. In some places, algae propagation takes place in open-air raceway systems where the water is continually agitated, while in other places, such as at AgroTech, the algae mix is pumped through closed tubular reactor systems located inside a greenhouse.

Both methods have their advantages. The open systems are relatively cheap to set up, but on the downside, they are vulnerable to pollution if a gull happens to leave its droppings in one of the vats. The closed systems are, of course, more expensive,

but offer a higher degree of control. Predators can be kept at bay and high-value algae can be cultivated and harvested under completely sterile conditions.

#### A Fuel Computer for Algae

"This kind of plant is expensive to build, and this is where we try to make a difference with AgroTech's research in micro algae production. One thing is what algae can theoretically achieve in a greenhouse production plant environment. But it is guite another matter whether we can achieve high enough output to warrant investment," says Anker Kuehn.

According to the algae researcher, what is lacking is precise knowledge about the yield of the numerous types of algae under different greenhouse conditions. Calculations are solely based on laboratory tests and estimates.

"You might liken the situation of companies today to that of buying a car. The brochure states that the car drives a certain number of miles to the gallon but this is measured in a controlled situation, which doesn't necessarily correspond to daily driving," explains Anker Kuehn.

"We're developing a kind of 'fuel computer' for algae production. Our goal is to obtain empirical data that an interested nursery owner can base budgets on."

The algae 'fuel computer' consists of a scientific arrangement whereby light, temperature, algae concentration, nutrient composition and other parameters can be continually regulated for numerous types of algae. The results are then compared with the simulated production facilities in the 17-metre long reactor.

"I'm convinced this will help the nursery sector to establish this form of production," concludes Anker Kuehn, as his gaze falls on the long, fluorescent, green tubes.

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# When Did the **Big Ideas Happen?**

#### 15.000 B.C.



#### 10.000 B.C.



THE BOW AND ARROW - The first tool superior to man. Faster than the arm and thus more powerful than the spear or stone.

#### **FARMING** – Created by prehistoric hunters in the transition from nomad to settler. Farming marked the end of man's restless wandering

#### 1.100 B.C.

1928



**NAVIGATION** – The Phoenicians are credited with navigation thanks to their use of the North Star. They also knew a great deal about wind and currents, knowledge they guarded with their lives.



**ELECTRICITY** – The Greek mathmatician Thales makes a strange discovery. He rubbed a piece of amber against an animal hide and noted that brilliant particles attached themselves to the hide.



**PENICILLIN** – Discovered by the British doctor Alexander Fleming. Used to treat wounded soldiers during WW2 and released for general use in 1948.

1991

600



THE INTERNET - Invented by Tim Berners-Lee with the original aim of knowledge sharing among researchers at CERN. He decided that his invention should be accessible to everyone and based on free technologies.









THE WHEEL - No hit list of ideas is complete without the wheel. One theory is that the wheel originated from the potter's wheel. This is somewhat uncertain, as all the first wheels were made of wood.



#### 1450



THE PRINTING PRESS - Invented by the German goldsmith Johannes Gutenberg. Just five years later, this unfortunate man went bankrupt and was forced to hand over his printing works to his creditor, Johann Fust.

#### **The Future**



ANY IDEAS? - Give us a glimpse of what might be the great new idea of the 21st century. Send your ideas to the editor at editor@pv.eu.

Great sound and Scandinavian design are the cornerstones that allowed Danish Libratone to go from promising start-up to international key player in the wireless sound industry in less than 5 years.



In 2009, Danish start-up Libratone was founded on the idea that great, wireless sound should have an aesthetic exterior to match the sound quality.

Libratone's founders believed that sound systems should take center stage in your home instead of being confined to the corners of the living room, an eyesore in otherwise aesthetic surroundings. They wanted to liberate sound from the constraints of cables and make a sound system that catered to the modern, designconscious consumer.

#### **Carving Out a Niche in Wireless Sound**

Shouldering one's way onto a well-established, highly competitive market such as the market for sound systems might seem daunting to most start-ups, but Danish Libratone knew they had a competitive edge that few others could match at the time: great, wireless sound combined with sleek, minimalist, Scandinavian design.

The market for sound systems used to be more targeted at men, with performance being the main selling point. By widening their user segment to include design-conscious consumers, Libratone carved out a niche for themselves in a tough market:

"As a company in the market of wireless sound systems, we managed to stand out with our amazing sound and unique design and establish a strong brand that people recognize when seeing our products. We succeeded in doing so by identifying a mega trend at an early stage as well as an unexplored gap in the user segment," says Tommy Andersen, founder and former CEO of Libratone.

#### A Serious Image with IPR Protection

New patents in the acoustics design of loudspeakers are few and far between, yet while their new, one-cabinet stereo speakers were still on the drawing board, Libratone's founders recognised the need for an all-round IPR strategy.

In collaboration with Plougmann Vingtoft's patent attorneys, they formed a strategy that targeted patents, design protection and trademarks. This, of course, protected their innovative products. Just as importantly, though, it showed potential investors that here was a serious contender with unique technical developments to back up the fancy design.

And the strategy paid off. Not only did Libratone manage to secure technical patents and attract investors - they also bagged a co-branding partnership with Apple.

#### Partnership with Apple

Ever ambitious, Libratone's founders pitched their idea to Apple before their product was even in production.

Apple immediately recognised the similarities between the two companies' design aesthetics and target users and agreed to a co-branding partnership that opened the doors to the American market for Libratone at a very early stage.











Over time, Plougmann Vingtoft's experts have helped Libratone patent three product lines: Live (2009), Lounge (2010) and the latest model Zipp (2015).

The Live speaker from 2009. Photos: Libratone





Libratone developed their products to be compatible with Apple's wireless software and devices, and their products were soon launched in Apple's online store.

#### 360 Degrees of Sound

Libratone were among the first to offer a 100% wireless sound solution. Since then, Libratone have continued to develop their technical products and design, staying in the vanguard of developments in wireless sound and conquering market shares along the way.

What Libratone's speakers lack in decibel compared to some of the other players in the field, they make up for in their array of features catering to modern living.

Each of their iconic, portable wireless speakers can disperse the sound around an entire room thanks to Libratone's patentpending 360° FullRoom™ sound system. Up to 16 speakers can be combined to a multi-room sound system and are compatible with the most common wireless sound software, devices and streaming services. Everything can be managed from an app or

from the one button control system on the speakers themselves.

#### Towards a Market Leading Position in the World of Sound

Today, wireless sound system manufacturers across the board are focusing more and more on the aesthetics of their products. That has not dampened Libratone's success, however. Their product design has found great favour with Asian consumers, and in 2014, the company was sold to a Hong Kong-based investor group.

The financial and business resources provided by the new owners will allow Libratone to increase their product innovation, geographical expansion and brand building worldwide. The goal is to become market leaders in the global industry of wireless sound systems.

The Danish-based management and employees of Libratone will continue as before, constantly pushing the frontiers of sound design.



The connection with the famous Danish fairy tale author is said to have played a part in the company's success in Asia where Hans Christian Andersen is held in great esteem.

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#### Did You Know ...

• Libratone's name is derived from the words 'liberation' and 'tone'. The name thus encompasses the company's founding philosophy to set sound free through a wireless sound system.

• Libratone's logo depicting a nightingale was inspired by Hans Christian Andersen's fairy tale about a nightingale that is caged and loses the will to sing until it is finally set free.

Once upon a time, butchers relied on their gut feeling to determine good flavour, but guality-conscious consumers demanded an end to human error, which is why meat scanning technology has taken over.



# The Science of Yum.

A light touch of the palette knife releases juices from every pore. Two buns hug the burger and moments later the succulent. grilled minced beef melts in your mouth, sending meaty flavour and a wave of pleasure from palate to brain to stomach.

However, before getting that far, the burger has been X-rayed by one of the technology company FOSS's numerous scanners to check its fat content - for without fat there can be no flavour. All within reason, however, for no one likes to see their raw meat shrink to half the size in a pool of melted meat fat when they fry it in the pan. It is therefore essential that producers are able to control the fat percentage of their meat.

"A lean cutlet fried too long in the pan is tough and lacks flavour. In fact, it is almost impossible to tell the difference between chicken, pork and beef if you remove all the fat. That's where all the flavour is," explains Poul Erik Simonsen, Market Manager for FOSS's meat segment.

Abattoirs and meat producers have traditionally used their judgement. The butcher looked at a piece of meat and made an educated guess. In other words, minced beef with a 15-20% label could contain anywhere between 5 and 30% fat. But random sampling provided the only guarantee. This does not sit well with modern, price-conscious consumers who want to know exactly what they are paying for.

#### X-Raved Meat

In 2002, FOSS's engineers came up with a solution to the problem – a dual source X-ray analyser that can scan large quantities of meat in seconds to determine its fat content. The industrial meat scanner was dubbed the MeatMaster.

"It got off to a difficult start as we had to convince producers of the value and timesaving benefits of a machine costing nearly 350,000 Euros. It took between three to four years before they committed to investing, but today the scanner is in use in over 100 different companies around the world," says Poul Erik Simonsen.

The MeatMaster is a large, grey metal box with a conveyor running through it. It is fully automatic and can determine the fat

content of meat with almost 100% accuracy and subsequently sort the meat by fat content. The X-ray beam is picked up by a camera located at the bottom of the machine, and by determining the energy loss of the beam as it passes through the meat it is possible to calculate bulk density, which in turn reveals the fat content.

"The real invention is the calculation principle behind it, which we have patented – the maths that allows us to convert the energy difference in the light to a fat percentage," says Poul Erik Simonsen about the innovation.

#### **Quality Dining**

Burgers are not the only food product FOSS has under scrutiny. In fact, they have machines that carry out quality control on everything from sausages to wine.

In the case of wine, the company employs an ingenious solution whereby small wine samples are placed in the WineScan, which then analyses the sample for acid, sugar and alcohol content in under a minute.

"We get involved before the grapes are even harvested, particularly with regard to monitoring sugar content. The higher the sugar content, the riper the grapes. We're involved at 5-6 different stages of the process from fermentation to bottling," explains Market Managers for Wine, Morten Aae Olander, talking about the applications of the WineScan.

This is demonstrated in the laboratory, where a pipette is lowered into a small metal beaker containing a wine sample. The wine is then drawn up into the WineScan machine. This time it is not X-rays but infrared light that reveals the product content. The results appear on the monitor 30 seconds later. The alcohol percentage reads 10.82 – which is rounded up to 11 on the wine carton.

"We market it as an aid to human judgement, because the human taste buds are far more sophisticated than analytical techniques. It's a kind of symbiosis between man and machine," savs Morten Aae Olander.

#### **Controlling Sulphites**

Winemakers have always had a love-hate relationship with the so-called sulphites (Sulphur dioxide, SO<sub>2</sub>).

This is the most common additive in the wine industry used to control fermentation and ward off unwanted bacteria. Sulphite content, however, is difficult to measure and dose properly, which is why it was heralded as a breakthrough when FOSS launched its WineScan SO<sub>2</sub> in 2011. The machine can measure the level of sulphur dioxide in a few minutes on-site at the producer's facility.

At a conservative estimate, 80% of all wine at one time or another has been analysed by FOSS's Wine Scan equipment.

WineScan often proves indispensable in the fermentation process.

"WineScan can guickly detect whether fermentation has stopped if the sugar content is still high but the alcohol content is unchanged over time. It can also see whether the level of acetic acid has risen, which suggests the presence of acetic acid bacteria," says Morten Aae Olander, who for all this cannot give a surefire recipe for successful wine. Just as with burgers, FOSS's goal is to ensure an end product that meets the needs and preferences of consumers.

"We can guarantee that the grapes collected from over 100 different farmers and delivered to the same cooperative will be sorted correctly according to guality, and that the wine in the different vats is the same," explains Morten Aae Olander. This is the customer's guarantee that the bottle lives up to the guality and taste on the label.

#### Bacon, Sausages and Ham

FoodScan is more of an all-round machine, which measures the fat, protein, salt and water content of meat and dairy products in less than 50 seconds. It is intended as a useful aid for small producers and is smaller and less bulky than its big brothers, the MeatMaster and WineScan

the dinner table.



"It can analyse small samples of up to 200 grams to check that everything is okay. Should the sausages contain 75% meat or is the salt content in the bacon too high?" says Poul Erik Simonsen.

It is handy enough to sit on a table and resembles something between a safe and an industrial dishwasher.

"It can also be used for monitoring in supermarkets or by the food authorities, for example. In principle, it can do the job of laboratories due to its high accuracy and it can analyse products far guicker than traditional analytical methods," says Poul Erik Simonsen.

FOSS is one of the world's leading developers of analytical tools for the food industry and you can be sure that most of the world's steaks, sausages, wine and cheese have been under the company's spotlight at some point en route from the farmer to

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# Better than Humans.

Picking things up from a box may sound easy, but for a robot it is a surprisingly complex task – which is why bin-picking is an area of industry that still requires humans to perform taxing, repetitive work. Scape Technologies is the first company in the world to develop a bin-picking technology that can compete with humans.

Subject



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Watching one of Scape Technologies' robots pick up a metal tube is a bit like watching a bird catch a worm. First, the robot looks into the box where the small metal tubes lie all higgledypiggledy. Then it turns its head, moves closer, hesitates for a moment before putting its head inside the box, grabbing the tube and picking it up. Its movements seem almost lifelike.

The robot is a standard industry model, but the brain - the piece of software that controls the robot's movements and artificial sight – is guite unique. The program was developed by Scape Technologies who have moved the boundaries for what is possible for an industry robot by virtue of their flexible, fast bin-picking technology.

"The uninitiated onlooker may find it hard to grasp the importance of this, as the robot's capabilities correspond to that of a three-year-old child – but until now, bin-picking has been seen as the last big automation challenge – often referred to as 'the Holy Grail' of automation," says René Dencker, who in 2004 co-founded Scape Technologies and today holds the position of Chief Technology Officer (CTO) with the company.

#### Easy for Us – Difficult for a Robot

For a human, moving an object from one place to another is a simple task but for a robot it is an incredibly complex one.

First, the robot must see the object, recognize it and determine its position - all the while ensuring it does not collide with the box or other objects inside the box. It must then move swiftly and precisely towards the object, grasp it and lift it up. Each time the robot reaches into the box, it must recognise the object it is looking for while simultaneously calculating a new movement path, which takes time and computing power.

That is why bin picking has long been a slow, expensive and problematic process, and it is one of the few areas in industry where men and women still perform arduous, repetitive work tasks. Having said that, things are unlikely to stay this way, as Scape Technologies' software has made it possible to create a robot that is both flexible and fast.

#### A Formula for Artificial Sight

The idea behind the technology took shape as part of René Dencker's PhD project at the University of Southern Denmark. Together with his tutor, Professor Ivar Balslev, he devised an algorithm – an advanced mathematical model – that would equip the robot with artificial sight. Using camera images, the algorithm made it possible for a robot to identify an object and determine its position - without being tricked by objects that overlapped, light, reflections and objects that were interconnected.

"And even more importantly: we discovered how to do it quickly. Using such an algorithm made no sense if it took the robot five minutes to pick up an object – it had to be able to do it in five seconds," explains René Dencker.

At the time, the innovation and investment firm NOVI became aware of René Dencker's PhD project, and with their financial support, René Dencker and Ivar Balslev were able to set up Scape Technologies in 2004.

Ivar Balslev's and René Dencker's algorithm provided the newly founded company with an excellent platform for developing artificial sight for robots. But if the artificial sight was to prove useful to industry, they also had to devote their attention to the rest of the bin-picking process: They had to teach the robots to move and grab.

From the beginning, Scape Technologies have tried to enhance the usefulness of their research, and since 2009, they have collaborated with the Danish National Advanced Technology Foundation. They have developed specially designed grippers that can reach into every corner of the box to be emptied. They have replaced 2D cameras with their own lightweight, mobile 3D scanners and focused on avoiding the most common pitfalls when a robot continually has to calculate new movement patterns.

"In contrast with many others only focusing on visual recognition, we have solved the entire process," says Søren Bøving, CEO of Scape Technologies.

One of the major challenges has been to produce a piece of software that is not limited to one single type of object at a time but which is flexible and can be adapted to numerous production environments without too much reprogramming.

"Normally, bin-picking robots are highly specialised and reprogramming them is a complicated process. We have come up with a standard solution – an off-the-shelf product that can be used by everyone. This greatly reduces the cost," explains Søren Bøving.

Søren Bøving.

The technology can be used in all companies that receive boxed parts which are components in the production process. To date, Scape Technologies have received a great deal of interest from the German automotive industry, where sorting all the bits and pieces from sub-suppliers is a daily occurrence, and many factories in Germany are already using Scape Technologies' software.

#### From Algorithms to Off-the-Shelf Product

#### **European Demand**

"The robots typically take between five and ten seconds to pick up an object and pass it on, depending on the object to be picked up and the degree of precision with which it must be handled - and that is pretty fast," says Søren Bøving.

"If you put a man next to a robot, the robot will be slightly slower. However, the robot can keep going around the clock without a break and that means that in the long run, robots are faster, and you may be able to save the cost of three workers," says

"In short, we provide a unique product. There are companies that can deliver the vision component but it's also about controlling the robot and picking up the objects. All three areas must be addressed and we are the only ones offering this as a standard solution," concludes CEO Søren Bøving.



# **Every Country Needs Its Farmers.**

#### Food researcher Professor Jens Adler-Nissen explains the need for locally-sourced food for a sustainable future.

Most weekdays at around 3 pm, the fresh, semi-prepared meals in the British supermarket chain Marks and Spencer are sold out. Their lamb shish kebabs, chicken arrabiata and salmon fillets are a big hit with busy families with young children and career singles looking for quality on the dinner table but who do not want to spend more time cooking than it takes to turn on an oven. According to one of Denmark's most renowned researchers in food technology, Professor, Dr. Techn. Jens Adler-Nissen from the National Food Institute at the Technical University of Denmark (DTU), this British model is gaining acceptance throughout the West, placing new demands on the industry. Out with bland junk food and in with locally produced delicacies.

"There is a growing demand for hot meals, as families still view dinner as a key focal point, but they want to avoid the hard work. That's why fish has to be oven-ready, vegetables processed and lasagna ready-made. But consumers still demand quality, which requires short logistic chains," he says.

That is why farming needs to be preserved in local communities.

"Europe is incredibly fertile and robust so we might as well cultivate crops here. After crude oil, food is the most transported commodity, so from a sustainability standpoint it makes sense. But no one is suggesting growing bananas on the Faroe Islands. Tropical fruits should be grown in the right climate just like any other produce. We're not looking to reduce global trade."

The short route from ground to table is one of two reasons for keeping food production close to consumers. The other reason

is that if Europe is to make a living from innovative minds, it will require an underlying production apparatus. It is therefore a mistake to view the food industry as an old-fashioned, disabled dinosaur, which might as well uproot itself and move to somewhere vastly cheaper, like Asia or Africa.

"One of the biggest challenges facing Europe is maintaining jobs in agriculture and the food industry, for if we end up outsourcing those jobs we will lose the ability to innovate. The two are inextricably linked," says Jens Adler-Nissen.

#### **Academics in Production**

Daily supplies of refrigerated fresh food place high demands on innovation.

Production needs to be flexible and willing to adapt, because the food-loving public will not be fobbed off with a dreary food selection.

"We want new things in the home, in the canteen, in nursing homes and in schools. A 14-dish food cycle won't do the trick. We view eating as an enjoyable experience and it is up to the supermarkets to keep on supplying new variations. This is, of course, a rich country phenomenon. The poor farm workers of Latin America are forced to live on a diet consisting mainly of tortillas and beans every day," explains Jens Adler-Nissen, touching on the subject of food consumers of the future.

As he sees it, the solution lies in breaking with the traditional approach to production. Operators need to be given more say and the knowledge level must be raised.

"I've helped a great many university graduates on their way and I am particularly pleased when we are able to find them jobs in the production department of a small or medium-sized company. They can help to raise the general knowledge level among production staff so they are capable of more than just looking after a machine." When it comes to food, each little village doesn't have to be self-sufficient, but each country needs its farmers.

#### The Grand Old Man of Food Research

Professor Jens Adler-Nissen (1946) has devoted himself to the science of food technology for over 40 years, both in industry and in the academic world. He has ten patents to his name, including a patent from 1999 for the continuous wok, which can stir-fry meat and vegetables in industrial food production. He has headed several research centres at the Technical University of Denmark (DTU) and his main focus area is developing improved methods for producing healthy, tasty foods. In 2010 he received the Danish Order of the Dannebrog.

He is seeing a growing change in attitude and he is in touch with several companies where executive management has started to delegate responsibility.

"In these companies, production is given a plan for the coming week stating what and how much needs to be done, and the production staff decide for themselves how best to do the work. Of course, this places great demands on the level of education within the department," says Jens Adler-Nissen.

Freshness and quality are the means to satisfy consumers of the future in the West, but what about the nine billion mouths that will need feeding in 2050?

#### Ice, Roads and Peace

Jens Adler-Nissen's message is the same: agriculture must be maintained in the local community. It is as much the lifeblood for 'Northerners' as it is for 'Southerners'.

"Hungry mouths can't be fed using European food imports, unless of course we're talking about emergency aid. Back in the 1960s, the USA had a massive maize surplus, which was exported to Kenya. This resulted in the local maize in Mombasa becoming more expensive than that of the US. Kenya's infrastructure was simply so underdeveloped that it was cheaper to transport the maize from the other side of the world."

Food technology development of the future is therefore as much about the factors linked to food as the raw materials themselves. Better infrastructure, easier access to water, equipment that is easier to clean, better refrigeration, higher levels of knowledge in the workforce, and in some countries, something as fundamental as peace. "Seen through Western eyes, it is often traditional changes that are needed. A railway, electricity or simply ice. Southern India has always produced large quantities of fish, but it was only when it became possible to chill them using ice that a major market opened up."

There was a time when the fish could simply be transported to the nearest village, but with increased urbanisation comes the need for better infrastructure.

"In 2009, we reached the point where more people live in cities than in rural areas worldwide. This places great demands on logistics and agricultural development, which needs to move from local self-sufficiency to market production and is something many countries have overlooked," asserts Jens Adler-Nissen.

#### Sustainable Food

While the West should not channel its food surplus to the developing countries, Jens Adler-Nissen sees a great potential for selling know-how.

"The export of abattoir technology is becoming almost as important as the meat exports themselves. We can't supply meat to the whole world so why not make a living teaching others how to slaughter their livestock? We have the experience and will continue to be leaders in the field. But only because we continue to produce."

The future scenario where western agriculture and industry die out as the West tries to outcompete Asia's booming industry using creativity is pure fiction, according to Jens Adler-Nissen. In fifty years' time, Europe's countryside will still be graced by farms and fields.

"When it comes to food, each little village doesn't have to be self-sufficient, but each country needs its farmers."

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