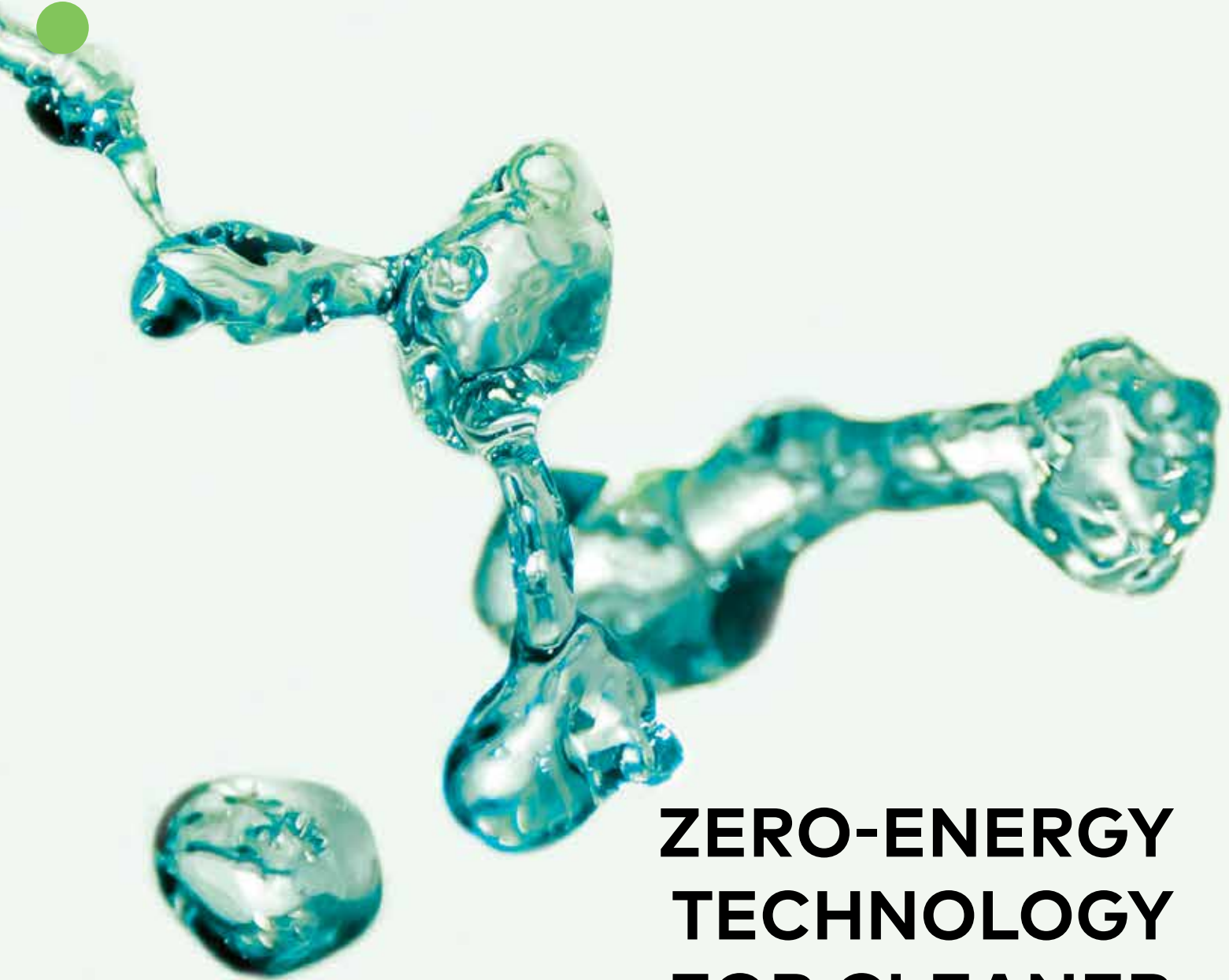


# innovation

Science + Business

Winter 2018



**ZERO-ENERGY  
TECHNOLOGY  
FOR CLEANER  
WATER**

**1.03** International Exhibition Centre Ķīpsala hosts [Career Day 2018](#) of Riga Technical University — the largest event dedicated to issues of students' careers and internships in Latvia. This year it takes place for the fifteenth consecutive year. Every year the event is attended by around 2 000 students from different universities of Latvia to meet business representatives on-site. The [Career Day 2018](#) brings together more than 110 enterprises representing about 30 different sectors.

**7.03** One of [Startup Europe Week events](#) under the title *In Search of Latvian and European Unicorns — Who Can Help?* takes place. The purpose of the event is to inform local entrepreneurs about opportunities and regional activities in the field of startups. Participants of the event — partners of startups and innovation, government representatives, founders of startups, representatives of educational institutions, as well as others will meet and hold discussions. The event will take place in Riga. The event is organised by [Digital Freedom Festival](#).

**9.03** Austin, USA, hosts the Technology Festival [South by Southwest \(SXSW\)](#), which is one of the largest conferences in the United States. From 13 to 14 March, San Francisco, USA, hosts [Venture Summit/West](#) — an event that brings together venture capitalists, investment angels, investment bankers, authors of early-stage business ideas, startups, researchers and representatives from incubators. During their visit in the USA, LIAA representatives together with a delegation from ICT and startups will attend both events as well as a number of business accelerators and incubators such as [Capital Factory](#), [Tech Ranch](#), [Tech Stars](#), [Plug and Play](#), and [500 Startups](#).

**20.03** Liepāja hosts the International Invention and Innovation Exhibition [Minox 2018](#). It will be the first time that there are also regional exhibitions organized in Liepāja, Daugavpils (10 May), Cēsis (1—2 June), Jelgava (8 September), and international exhibition in Riga (5—6 October). The exhibition will give an opportunity to get acquainted with the latest inventions and innovative solutions and to meet their authors. The exhibition is organized with the aim to promote inventors and inventions in Latvia as well as commercialization of inventions. It is organised by the Latvian Inventors' Association, [Association Connect Latvija](#) and Latvian Academy of Science.

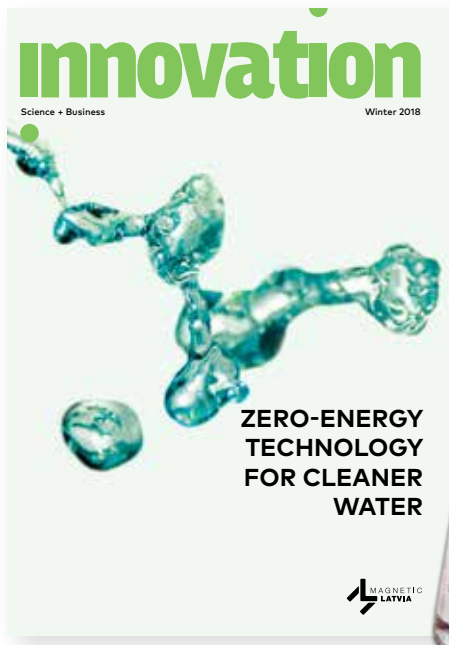


**12.04** Riga hosts the [Magnetic Latvia Technology Conference Deep Tech Atelier](#). International Scientific Startup Conference provides a platform for entrepreneurs, authors of scientific achievements and technology developers, industry representatives and policy makers to hold discussions and share opinions and to participate in [Commercialization Reactor 12th Ignition Event](#), during the course of which entrepreneurs together with technology authors will have practical opportunities to create teams of scientific startups. The conference is organized by LIAA, and takes place in the hotel [Radisson Blu Latvija](#).

**28.03** Tokyo hosts an event of the Global Startup Network [Slush](#). It brings together representatives from startups, investors, partners; it will have inspiring lectures and a broad social agenda. Global Network [Slush](#) annually holds 75 local events, which are visited by more than 40 000 participants. The [Slush](#) philosophy is to help develop excellent younger generation enterprises, which are able to conquer the world.



**16.05** Riga hosts [Social Entrepreneurship Forum 2018](#), the main topic is the attraction of investments. Participants of the forum will have discussions and search for answers to the questions of what a social enterprise should be like in order to attract investors, look at the examples of good practice in Latvia and abroad, as well as explain reasons for failing to attract investments. The forum takes place at RISEBA.



Cover photo — pixabay.com



# INNOVATIONS FIGHTING ENVIRONMENTAL DISASTERS

Ten years ago, problems related to environment were not among the greatest threats to mankind, states the annual Global Risks Report published by the World Economic Forum. In the Report 2018, three out of five risks in terms of impact and likelihood are related to environment — extreme weather events, natural disasters, and failure of climate change mitigation and adaptation. According to experts, the risks are becoming more personal, for example, flood and storms can damage our properties, plastic waste in the oceans is finding its way onto our plates with seafood, air pollution is the cause for respiratory diseases, etc. The way climate is changing can be observed also in Latvia — air temperature is increasing, it is raining more often. Latvian Environment, Geology and Meteorology Centre estimates that in the future, Latvia will have to confront unusual and extreme weather conditions more and more often. To minimize risks related to climate change and its possible consequences, it is important to implement adaptation measures based on research results in all areas of economy. Of the same importance is to make sure that Latvian economy timely transitions to a low-carbon economy, say the experts in the report *Climate Change Scenarios in Latvia*. Introducing stricter environment-related rules usually means new expenses, which are not very welcomed by businesses, as the development of green businesses directly correlates with a country's or European Union's financial support. Nevertheless, there are companies in Latvia acting with respect for environment, use renewable energy sources more often, and introduce technologies that reduce CO<sub>2</sub> emissions. There are also researchers working on developing climate innovations. Innovations are a way of fighting climate change by both developing new technologies and increasing productivity, for instance, using existing resources more efficiently.

## TOP 5

### GLOBAL RISKS IN TERMS OF IMPACT IN THE NEXT 10 YEARS

- Weapons of mass destruction
- Extreme weather events
- Natural disasters
- Failure of climate change mitigation and adaptation
- Water crises

SOURCE: GLOBAL RISKS PERCEPTION SURVEY 2017–2018, WORLD ECONOMIC FORUM

**02 PARTNERS**  
Zero-energy method for cleaner water

**06 PARTNERS**  
Voluntarily stepping outside your comfort zone

**08 PERSONALITY**  
A man of his word. Gundars Skudriņš



**16 ACHIEVEMENT**  
Perfect your expertise

**18 IT WORKS!**  
The future is in Nākotne

**21 SCIENCE**  
The more juice you squeeze out, the better

**26 SCIENCE**  
Search for fuel of the future

**28 GO!**  
Greener snow



Innovations are a way of fighting climate change by both developing new technologies and increasing productivity, for instance, using existing resources more efficiently.

Editor Lāsma Vaivare

## LEARN MORE

How Ķīpsala becomes a green city in the city

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# USING LIGHT TO FIGHT THE POLLUTION

Researchers of Riga Technical University have developed a zero-energy technology for treating wastewater of pharmaceutical companies from a particularly persistent organic pollution, which the traditionally used biological treatment cannot manage

Investments of pharmaceutical companies into the development, including the modernization of treatment plants, show their responsible attitude to the environment. Andris Šutka, Lead Researcher of the Functional Materials Technology Research Laboratory of Riga Technical University (RTU), points out that despite companies preventing untreated industrial wastewater entering into the nature, wastewater from chemical industry often contains organic compounds, which the bacterial or the membrane technology cannot degrade. Their concentration in water after the traditionally used biological treatment is not large, however, once in the nature and aggregating, the effects of pollution may become significant and affect, for example, the human endocrine system. «In fact, the membrane technology and absorption are physical processes that do not destroy the pollution but transfer it to another environment; we mean a technology that eliminates the pollution completely,» he adds.

text / Lāsma Vaivare  
photo / Elīna Karaseva



**INFORMATION**

- \_\_Treatment of pharmaceutical industry wastewater
- \_\_The aim — to develop a technological solution and functional smart coating materials for treatment of wastewater from toxic and hardly dividable organic compounds.
- \_\_Team — Andris Šutka, Mārtiņš Vanags, Alina Neščerecka, David Štēbelis, Guntis Kuļikovskis

SOURCE: RTU

The team of researchers lead by Andris Šutka (from the right) has created and patented a system of iron and calcium compound photocatalysts, which destroys the contamination in sunlight. Mārtiņš Vanags, Researcher at the Institute of Solid State Physics of University of Latvia is also involved in the project.

The technology bears the name of *Z-Surface*. The team of researchers lead by A. Šutka has created and patented a system of iron and calcium compound photocatalysts, which destroys the contamination in sunlight (system of photocatalysts  $Fe_2O_3/Ca_2Fe_2O_9$ ). It is also validated for treatment of different contaminated waters. Clean water is one of the 17 UN sustainable development goals; its realisation takes a number of steps including efforts to limit the release of harmful substances into the water. *Z-Surface* developers anticipate that in the coming years, the European Union might impose a stricter regulation regarding water quality requirements.

Dāvids Štēbelis, an experienced mentor, business strategist and a co-owner of *Alina Ltd*, which manufactures innovative clay additives and has attracted a seed investment of more than half a million euro in the end of last year, has joined the team of researchers in order to turn the results of the research into a market-attractive product. The project is implemented within the programme *Support to the commercialisation of research results* administered by the Latvian Investment and Development Agency (LIAA). The programme is focusing on the commercialization of research results owned by the research organisations. The aim of the project is to develop a technologic solution and functional smart coating materials for removing toxic and

hardly dividable organic compounds from wastewater. It is intended to develop photocatalyst coatings (and reactors), which are active in the visible light, with the aim to use solar light as an energy source for the treatment, as well as to produce a demo reactor, which can be integrated in the factory wastewater system.

**Environmentally friendly**

A. Šutka emphasizes that photocatalyst is not suitable for treatment of highly polluted wastewater. Such pollution needs the traditional, proven methods first, for example, the above referred biological treatment. However, the photocatalyst is efficient in splitting persistent compounds, therefore, it can be applied in the post-treatment of wastewater to catch particularly persistent compounds, which the bacteria have not been able to destroy. «There are also other effective methods, but they are very expensive, consume a lot of energy, and the companies choose to omit the post-treatment,» the researcher continues. In his opinion, the situation could be completely different if the technology was cheaper. «We are working on a zero-energy method, which can be operated with solar light. If we could offer a new solution that achieves results without significant capital investment and is energy-efficient and environment-friendly — it would be a victory!» he thinks. Photocatalyst was discovered already in the 1970s, but only titanium dioxide has been

commercialised as a catalyst. «It prevails (about 95 %) in the photocatalyst market with the total value of one billion. However, titanium dioxide is active only under UV light. Anything else failed to break into the market because there are a lot of preconditions, for example, the used compounds have to be non-toxic, cheap, naturally common, and the method has to be appropriate for industrialization. Our advantage is that the compound consists of non-toxic elements, which widely occur in the nature. Even if our material would spread in the treated water due to some circumstances, it would only become more ferrous and harder, because the compound consists exclusively of iron and calcium,» reveals the researcher. Since these are widely distributed chemical elements, the raw material is cheap.

**Business expert role**

A. Šutka believes that the results of the research can be commercialized, and during the coming years within the programme managed by LIAA they will be used for optimization of the technology and in making decisions on how to use it and to whom and in what way to sell. D. Štēbelis has an important role in deciding on what the final product will be: currently it is estimated that it may be a powdered material for use in a reactor or nano coating of surfaces, which could be used for water disinfection and organic pollution treatment. ●

## THE GREAT AIM AND THE REAL AIM

**DĀVIDS ŠTĒBELIS**

Mentor, business strategist and entrepreneur

Photocatalyst and its application in water and air purification is a promising direction. Assuming that it is possible to purify water from organic and bacteriological pollution using sunlight, this technology can certainly be called sustainable. The circular economy and sustainability planning principles, which assessed the resource re-use, are very well supplemented by technologies such as *Z-Surface*.

Today, it is too early to comment on which of the application directions is most prospective. Each technology has a number of development stages — within the *Z-Surface* research project we still have to define this technology. We have to choose the application with the lowest technological requirements, so that we can maximally shorten the time necessary for the commercialisation of the technology. In our opinion, the destruction of organic compounds in water is our big task, which opens a multi-billion market potential; at the same time, water disinfection is much more realistic because it has less technological requirements, and the disinfection has many alternative solutions at the moment.

If we have to assess the participants of the water treatment market and the supply chains, a number of things become obvious. We cannot be the ones, who cover all functions: produce the photocatalyst, construct a water treatment reactor and sell it to the end customer including the servicing. Without partnerships with industry participants, we will lack resources necessary for entering the market. Within the technology transfer programme, we have assessed these risks and defined our core competence, what we keep to ourselves, and what we give to our partners. Our aim is to define and test the *Z-Surface* technology, as well as to make a small demo plant, which shows the viability of the technology. These preparations are enough to take the first significant step towards the technology commercialisation. The commercialisation is planned by establishing a spin-off company, the main competence of which should be *Z-Surface* production and selling to customers who design, manufacture and service water treatment plants.

My main task is to establish the link with industry, which means that we constantly inquire about the customer needs and problems. I am the man, who meets, talks, and interviews customers. My tasks include ensuring that the decisions about the technology development are based on facts, not assumptions. I rather have to strive to be a quality discussion partner with the research team to provide the customer / market perspective in the planning process of the research.



# Keeping a finger on the pulse

text / Lāsma Vaivare  
photo / Edijs Pālens, LETA

Latvian pharmaceutical giant JSC Grindeks is interested in research and innovative methods of elimination of industrial pollution with a potential of practical application in the sector





The pharmaceutical production is based in on a series of chemical and biological processes; and, in the interests of environmental protection, the company consistently complies with more than 70 binding environmental protection laws, regulations, and requirements, says Elīna Strade, Head of Wthe wastewater Treatment district managerDepartment of JSC Grindeks.

Elīna Strade, Head of Wastewater Treatment Department of JSC *Grindeks* emphasizes that the environmental protection is one of the main corporate social responsibilities of the company. Every strategic project is implemented in accordance with the analysis of environmental aspects. In addition, the company has set long-term objectives for itself – to reduce the energy and water consumption, amount of waste, emissions into the air and atmosphere of workplace environment, as well as the impact of product on the environment, by improving the production and innovation process.

**What motivates the company to cooperate with researchers?**

The process of industrial wastewater treatment is complicated; therefore, the company is interested in topical innovative research and methods of innovative elimination of industrial pollution, which would have a potential of practical application in the sector. *Grindeks* is able to provide researchers with both the research subject – the pharmaceutical wastewater, as well as with information relevant to the research.

**Would JSC Grindeks be interested in the project after RTU researchers have prepared it for commercialisation?**

The applied industrial wastewater treatment technology allows the company to carry out the industrial wastewater treatment effectively and qualitatively, as well as to meet the legislative require-

ments in the area. In future, when the production capacity changes due to the introduction of new products in manufacturing, it might be possible that the existing treatment system of *Grindeks* will have to be supplemented with new equipment or treatment methods in order to, for example, pre-treat separate wastewater types or to degrade a biologically non-degrading pollution. In such cases, application of economically justified and effective technological solutions developed by Latvian researchers would be of interest to *Grindeks*.

**How does the company currently treat the wastewater?**

*Grindeks'* pharmaceutical industry wastewater is biologically treated in the wastewater treatment plant using the five-stage MBBR (*Moving Bed Biofilm Reactor*) system. The organic compounds in the water are degraded using the activated sludge micro-organisms. In degradation of nitrogen compounds, nitrification and denitrification processes are applied. There are laboratories in the *Grindeks* wastewater treatment station, where the specialists of the company control the wastewater chemical parameters and test the microbiological parameters of activated sludge, check the biodegrading capacity of wastewater of the new products, as well as carry out wastewater studies. Laboratories are equipped with modern wastewater study equipment, including the laboratory scale pilot equipment, which can simulate the actual treatment

process, carry out topical studies and develop solutions for optimization of the purification process.

**In 2009, JSC Grindeks implemented an ambitious wastewater treatment modernisation project. Have there been any further innovations/improvements?**

Since 2009, a number of purification process optimization solutions has been introduced. From 2011 to 2015, *Grindeks* was involved in the research project *Biological treatment of water containing pharmaceutical and oil compounds* of Environment, Bioenergy and Biotechnology Competence Centre. In cooperation with Riga Technical University, the study resulted in valuable research data on the activated sludge micro-organisms and their ability to degrade industrial wastewater pollution and the active pharmaceutical ingredients. A methodology for preservation of these cultures in a lyophilized form was developed, and the most effective cryoprotections for preservation of maximum cell viability of each culture was determined. Within the study, the optimum bioaugmentation technology for inoculation of micro-organism cultures in treatment systems after toxic wastewater inlet and/or emergency situations was established, as well as the main bioaugmentation interferences were identified. Based on the results of the implemented project the company managed to optimize the operation of the treatment plant and to raise the wastewater treatment efficiency every year. ●

step 1

BUSINESS PLAN DEVELOPMENT

- Performance of technical and economic preliminary study
- Preparation of commercial strategy



step 2

PERFORMANCE OF SCIENTIFIC WORK AND TECHNOLOGY DEVELOPMENT

- Performance of industrial study
- Experimental development
- Prototyping

step 3

IMPLEMENTATION OF COMMERCIAL PLAN

- Participation in international exhibitions, contact exchanges, conferences and seminars abroad, individual visits, participation in LIAA-organised national stands and trade missions
- Strengthening of industrial property rights
- Preparation of commercial offer
- Preparation of licence agreement and other agreements for transfer of intellectual property
- Submission of property rights patent, signing of licence contract or establishment of company

text / Lāsma Vaivare

# Voluntarily stepping outside your comfort zone

An outside perspective is essential to make scientific inventions attractive to the market, as researchers tend to focus on developing technologies that do not satisfy immediate needs of end users

Krišjānis Nesenbergs, Researcher at the Institute of Electronics and Computer Science (EDI), says when looking back at the first stage of *Support for Commercialization of Research Results*, a program administered by Investment and Development Agency of Latvia (LIAA). During the first stage, ten scientific projects with invited advisors and experienced business people had to develop a technological and economic feasibility study and a commercialization strategy. K. Nesenbergs and his colleagues are working on one of these projects — a 3D-shape sensitive material that can restore its three-dimensional form due to integrated sensor grid. Several years of research have proved that the material could be used in medicine, rehabilitation, sports, as well as in the film, video game and clothing industry. The researchers developed and in collaboration with the rehabilitation centre *Mēs esam līdzās* tested various prototypes. As a result of brainstorming with the industry's business experts the direction of the research has radically changed due to the conclusion that from the point of view of the market the greatest potential lies in using the material for monitoring structur-

al deformations of building constructions. It would be sold as a versatile sensor strip, which could be both embedded in concrete structures and added to the existing constructions of various materials with the aim to track whether and how they change over time, adds Ričards Cacurs, Scientific Assistant at EDI. The product would be useful to builders and construction supervisors. At the moment, the researchers are negotiating with construction supervisors on whether the technology could be used for monitoring bridges as a pilot project.

### The Iron Man experience

*Latvijas Dzelzceļš* have shown interest in using a new type of ultra-broadband radar sensor technology, says Vents Riekstiņš, the business advisor working on developing the second EDI project. It could work as a cheaper and probably more efficient (still has to be tested during the pilot project) alternative to solutions presently used for recording train whereabouts: arrival, departure, trains in motion, continues V. Riekstiņš. The technology allowing to improve or replace existing methods of determining the location of moving objects and in non-contact diagnostics, by

emitting narrow radio impulses into the environment and analyzing their echo, thus determining electrical and magnetic characteristics of objects and the distance to them, has a variety of possible applications. It could be used for security reasons, in health and social care, for example, remote monitoring of patient movement or breathing. And, since electromagnetic waves can spread through obstacles, the radar lets you get the Iron Man experience and see through walls, adds V. Riekstiņš with a smile. There is no significant competition in the market for both products developed by EDI researchers.

### About Challenges

K. Nesenbergs gives a positive evaluation of the commercialization mechanisms created as part of the program administered by LIAA — he says that «it is the most sensible technology transfer tool that the institute has worked with so far», however, scientists and invited commercialization experts do not hide that developing the technological and economic feasibility studies and commercialization strategies was not void of challenges. They initiated a public procurement and invited *Pricewa-*



terhouseCoopers (PwC) Ltd to help with these tasks. It was the first time that scientific staff, entrepreneurs, and professional advisors worked together this way — each of them had something to contribute. The benefit from the collaboration with PwC was that external experts with many years of global business experience worked on identifying the target markets of commercialized technologies and their potential clients. This collaboration let them arrive at specific ideas — what will be the end product of the created technologies at the institute? In addition, «scientists faced a challenge not in the sense that they had to write commercialization plans — they collaborated with feasibility study and strategy developers, while complying with the conditions set by EU funding programs,» concludes V. Riekstiņš. Kristians Karlsons, a business leader who is in charge of the 3D material project, admits that in the end, they succeeded in coming together and preparing all the necessary documents. «This is the first stage of a new process for Latvia, so the most important aspect for all involved parties — LIAA, research organizations, and commercialization professionals — is to learn from these activities, so that future results are even better,» he says.

### Everyone has their own strengths

«If we had to deal with everything on our own... we would have managed, but the results, perhaps, would have been worse due to lack of experience,» admits Aivars Vembris, Senior Researcher at the Institute of Solid State Physics of University of Latvia. The institute wants to commercialize the innovative thermoelectric radiation sensor used in spectroscopy.

PwC also helped the institute to develop the technical and economic feasibility study, commercialization strategy and plan. A. Vembris positively evaluates the advisors' input in, for example, economic analyses, market research and research of potential market outlets. The collaboration and technology transfer program in general broaden researchers' competencies — to be able to comment on what the advisors have achieved, one has to understand basic business principles, learn to speak more about their scientific activity, albeit in a way that is easy to understand. «For example, pitches definitely are not equal to a 15-minute paper at a scientific conference,» smiles A. Vembris. When asked whether researchers act against their free will to deal with new challenges,

he denies, as it is interesting that the collective approach to technology transfer in the institute is perceived as challenge to learn something new. «Research is anything but monotony, we must constantly overcome difficulties, solve problems that we could not have imagined before. This program is also new to us, we have to get accustomed to it, of course, some find it easier, others find it harder,» he admits. At the same time, it does not mean that researchers jump headlong into business, because everyone has their own strengths they should not lose. The LIAA idea about inviting a business leader is appreciated.

### Institute wants to create a spin-off

«There are light sensors with a very high capture speed — they can detect even nanosecond pulses — but they have a narrow spectral region, and there are sensors that can detect a wide spectral region, but their capture speed is measured in seconds. We succeeded in finding out how to create sensors that are both spectrally sensitive and high speed; we have started preliminary development,» A. Vembris explains commercialized technologies. The innovation can be used in various measuring devices. Experts at the Institute of Solid State Physics want to conduct a feasibility study for a global patent application as soon as possible. «The product at its current stage of development has no equals in the world. There is a somewhat similar product that is being praised as the best in the world by the company that is manufacturing it. We have an edge over them,» claims A. Vembris. Protection of intellectual property would allow us to communicate with potential business partners, clients, in a freer way, without the need for non-disclosure agreements. The institute wants to create a *spin-off* company for innovation development, even though it is more difficult than selling a license or a patent, the benefits would be much larger, including the ability to gradually create new jobs, explains A. Vembris. Meanwhile the goal of EDI projects team is to complete the commercialization process and sell the license, but in addition to that, they do not rule out the possibility to establish a company. According to information Latvian Procurement Monitoring Bureau some of other universities and scientific organizations that have won procurements on commercialization strategy development are, for example, *KPMG Baltics Ltd*, general partnership *Civitta Latvija un Civitta Lietuva*, *Enixus Baltija*. ●

## Events

- ▶ **New drugs for treating dementia and epilepsy**  
*Latvian Institute of Organic Synthesis*
- ▶ **Thermoelectric radiation sensor**  
*University of Latvia, Institute of Solid State Physics APP*
- ▶ **Natural thermos package**  
*Riga Technical University*
- ▶ **Purification of waste-water of pharmacological industry**  
*Riga Technical University*
- ▶ **Ultra-broadband impulse radar sensor**  
*Institute of Electronics and Computer Science*
- ▶ **Dynamic electric energy consumption control and data acquisition system**  
*Riga Technical University*
- ▶ **Cascading electromagnetic induction pumps on permanent magnets with stabilised parameters**  
*University of Latvia*
- ▶ **Personalised breast cancer molecular diagnostic test for drug selection and control of the course of disease**  
*Latvian Biomedical Research and Study Centre*
- ▶ **3D shape sensitive textile**  
*Institute of Electronics and Computer Science*
- ▶ **Genetic test for determining infertility causes**  
*Riga Stradiņš University*

SOURCE: LIAA







The impulse for collaboration between businesses and science does not necessarily have to come from businesses, it can be the other way round. I think businesses and science do not have the concept of Muhammad and the mountain.

# A MAN OF HIS WORD. PLAIN AND SIMPLE

text / Lāsma Vaivare  
photo / Ieva Leiniša, LETA

«A water strider is entirely sure the Earth is flat, this is how it sees the world. A dragonfly sees the world from a different perspective. This begs the question, are we water striders or dragonflies?»

Says Gundars Skudriņš, founder of the Institute for Environmental Solutions, a well-known businessman who owns forests and grows medicinal herbs. Institute is a scientific non-profit organization where foreign and Latvian researchers, upcoming researchers, and practitioners from various fields are applying possibilities offered by technology to find the solutions for complex environmental problems and sustainable use of natural resources.

«It might seem that what I and my colleagues do is scattered — actually our activities are related to environmental resources and their management. For the joy of linguists, we have even come up with a new term — «zemsaimniecība» (from: *zeme*, Latvian for land/soil; and *saimniecība*, Latvian for economic activity), which has a much broader meaning than the terms «mezsaimniecība» (forestry: *mežs* for forest and *saimniecība* for economic activity), «lauksaimniecība» (agriculture: *lauks* for field and *saimniecība* for economic activity), and «zivsaimniecība» (fishing: *zivs* for fish and *saimniecība* for economic activity), etc. Any agricultural activity affects the fishing industry, forestry affects something else, everything is interconnected. We do not invent problems — the reason for every research is actual demand,» says G. Skudriņš.

**At several events, I heard you saying that to find out which is more important, economics or environment, you must hold your breath. Is it possible to find balance between business and environment?**

Absolutely! For instance, there is a substantial difference in opinions between foresters and environmental organizations, just like between Muslims and Christians, who will never find common ground unless they start thinking logically. Small birds live in large tree hollows, they pick pests that live inside... A birdie eats its own bodyweight worth of food per day, and we can calculate the size of pest reduction and think about potential alternative means. A forester cuts the tree down and brings a bird cage into the woods. Why is such intervention needed?! The nature can solve a lot of issues itself, you have to let it run its course. Humans are given brains, and they should use them and think. Everyone likes to quote Plato, but philosophy is not a story about Plato, but about thinking. A person can either be able to think or unable to, plain and simple.

**Have you found balance between business and environment?**

The best way you can help nature is by doing nothing. If you understand the relationship between cause and effect, there is no conflict between these concepts, there



is no problem to stay balanced. Sit near a field, meditate, think about your future actions, also, be aware that there is no single correct answer, you have to try and do something.

**Is the Institute for Environmental Solutions a story about the sitting and thinking in order to see causality and finding a solution this way?**

Precisely.

**What kind of projects are of current interest to you?**

Lately we have been working on the so-called Great Floods in Latgale. We have analyzed all kinds of data on these floods, and I have to say — it's sad to hear the experts say that the problem lies in the lack of drainage. Floods happen in floodplain or drained swamps. If anyone wants to grow wheat in swamps, he has to understand that once in a certain period it is going to be flooded. Investing in drainage and installing of such a system is only turning the problem into the problem of one's neighbours. For example, Ogre floods do not occur somewhere in Ogre proper, but higher. I am not so suspicious of the small hydropower plant constructed on the river Ogre in the city proper, rather, near the upper course of the river new water masses have appeared, which can get to Ogre in a matter of seconds. So, the cause is somewhere higher, it could be drainage. The moment when science proclaims that the problem can be solved by digging, I say they will dig until they reach the sea. Then there will be another problem — a large number of nitrates will get into the water, as a result we will be subject to paying a fine and closing everything down. It is sad that our state leaders are provided with questionable data, and as a result, incorrect decisions are made. Seeing what happens with floods, we decided that there is too much information, while causality is ignored, there is a lack of clarity as to what really happened. There is no point in blaming decision makers for making wrong decisions, if they were based only on the information they had received.

**Do you receive state funding as a research organization?**

No. Our sources of income are commercial research, European funding programs, as well as donations.

**What are the customers who order commercial research interested in?**

They want clarity. Imagine a situation when every organization has a CEO who receives information from subordinates that have long since understood how to present information to their CEO. When you see the size of the structure of the organization from the bottom to its top, it becomes clear how horribly information can be distorted.



The main resource of our country is people, but they can leave. Whereas the situation in agriculture, however, is much more stable — it is a resource that is permanently here. Agriculture comprises things that have true value. Plain and simple.

GUNDARS SKUDRIŅŠ,  
FOUNDER OF THE INSTITUTE  
FOR ENVIRONMENTAL SOLUTIONS

**Much has been said about the fact that business and science are not on the same page. Is it possible to reach an understanding?**

I do not want to generalize but I sometimes think we lack ethics when we cooperate. If a person is expert in his field and collaborates with an expert of a different field offering his knowledge, both should be moving forward in their respective field and acquiring new knowledge instead of trying to take over the role of the other person. In business, there exists a mutual agreement of the parties — a person working there is a man of his word — plain and simple, however in science it is not always so. Why do we often work with Western research institutes? They have developed ethical standards, so we can hold talks with them without having a risk that they will suddenly turn into *foresters*.

**Have we not yet developed ethical standards or are people here ill-natured?**

It depends on the person. You either are and stay an «individual peasant», or two individual peasants meet and do great things together. While there is a «small king» principle, the problem will persist.

**The Institute of Environmental Solutions is well known for its flying laboratory — a unique remote sensing technology. Do you see it differently from above than when on the ground?**

From above it looks as it actually is. As an allegory, a water strider is entirely sure the Earth is flat, this is how it sees the world. A dragonfly sees the world from a different perspective. This begs the question, are we water striders or dragonflies?

**Speaking rather from the practical point of view than from philosophical, virtually all research conducted by the Institute of Environmental Solutions has output data obtained «from above».**

We used to be water striders, but then we understood that we do not see the whole world, so we learned to fly. It happened in 1999. Our flying laboratory is on the boundary between the known and the unknown. If we want to talk about greater things, we must look at them from above, then we can start understanding. For instance, we had a project about algal bloom at Baltic Sea gulf, we determined volumes, etc. As for the methodology, we should have used a vessel for gathering data. From the plane, we discovered that a certain wind speed would make the vessel move with the same speed as the upper layers of sea water. Which means that the vessel would take samples from the same location all the time.

**The institute also cooperates with the European Space Agency.**

We were able to make our flying observation equipment function the same way as the satellite, which is to be launched into orbit after 2020. We are collecting data today. In fact, we are simulating the satellites of the future.

**Does that mean you are living in the future?**

Yes.

**How did you get it done?**

With the method of doing.

**Team of the Environment Solution Institute is very international. Why so?**

If we conclude that there are no specialists for specific research in Latvia or they do not have enough expertise, we attract foreign researchers and team them up with students, and they acquire a world and European breath. There is no point in working with someone who is well below the average, we would be at that level too. We cannot say that our scientists lack competence, but everyone knows well at which stage in the food chain he or she is, how much the researcher has been cited. Sometimes we are reproached of not attracting local scholars, but what can we do? We need the best possible result. If specialists from other countries have proven to be the best, we learn from them. The best researchers in Latvia are very busy and are not easy to be approached.

**At the beginning of the conversation, you mentioned floods. How was the last season for medicinal herbs grown by your company *Field and Forest Ltd*?**

There is no reason to worry about things you have no control over. I have great concerns over droughts, I have experienced more of those in comparison with rain. In Latvia, there is either no rain at all or rains a lot, for example, the year before last there was no water in wells in Latgale. Why did no one sound the alarm?

Medicinal herbs are a niche product, we export everything for human consumption, cosmetics and pharmacy.

**You had plans to grow milk thistle.**

We collected the local genotypes, sowed them, but we made a decision that we are not going to grow it. We often try new things, gain the experience and decide not to continue. Only cowards do not change their opinions. If by the third or fourth year you are still uncertain about the business, you should not continue. Whereas, if you succeed during your first year, it is bad — it will resemble gambling. If you succeed during your second year — you become arrogant. This is what I say to new entrepreneurs — if you succeed during your first year, it is only thanks to luck, it is not based on your knowledge.

I have heard people who teach economics mentioning the *CandyCrush* computer game as a successful example. Such an example for immature minds does not create an understanding about true values, it creates false idols and, for example, makes crafts, a labour-intensive process and a high-risk decision-making, insignificant. Crafts must be honoured,

and science will be consumed. I do not agree that if you cannot sell your product to seven billion people, you should not start a business at all.

**What are your values?**

Being a man of my word.

**Are we disconnected from nature?**

No. Our land is clean. Cleanliness is our competitive advantage. It just should not be ruined. Here is an example — coastal fishermen complain that flounders are small. Sitting at the table and eating a small flounder, I ask: «Where do you think large flounders come from?» «Well, where... they grow,» is the answer. At the same time fishermen say — we must reduce the mesh size in fishing nets so that we catch more fish. Men, let's take the roe nets and throw them into the sea, maybe then we will understand. If we want to eat flounders, we must comply with the rules of the game — no large flounder has skipped being a small flounder.

**How is the development of the old beer brewery in Cēsis going, where you planned to create an art and science centre?**

In progress. Good cookbooks do not say «bake at 200 °C for 45 minutes», they say «bake at 200 °C until just set». Here it is exactly the same. Anyone can build a building, but to create an ecosystem, which is viable content-wise and financially, we must rack our brains. It looks like we were able to deal with this task, but we do not rush into things. We have not given up the idea to make it a place where new da Vincis will appear due to cooperation between experts from different fields.

We are not trying to think of what we will be thinking of in five years. If we have a correct flowerbed, flowers will grow themselves. I have heard things like «Let's structuralize innovations.» How can you do that? Innovations are a process. They must be allowed to happen. How many people had apples fall on their heads before Newton said it was gravitation? ●



# Business sandbox

As the discussion about developing innovation ecosystems and establishing closer relationship between universities and newly established businesses is becoming exceedingly topical, the issue of entrepreneurial development is essential

# START

When seeing a successful businessperson, people often say — he/she is a born entrepreneur. Professor Elina Gaile-Sarkane, Dean of the Faculty of Engineering Economics and Management of Riga Technical University (RTU), is smiling: she is not a genetic scientist, so she cannot say whether humans are born with genes responsible for natural ability in business, and she cannot attest that such genes exist at all, but most people have an entrepreneurial spirit, the question is how developed it is.

Resourcefulness and entrepreneurial ability are similar concepts, says E. Gaile-Sarkane. «Resourcefulness and entrepreneurial ability by their essence have 19 matching criteria, however, the criterion that relates to the result of human activity differs: entrepreneurial ability usually is to do with solving economic problems and creating new economic value; resourcefulness relates to solving personal problems, problems in any area of social life, and creating new value for oneself and society,» writes Karine Oganisjana, Lead Researcher at RTU Institute of Entrepreneurial Engineering and Management, in her monograph titled *Starpdisciplinārās mācības uzņēmības un uzņēmējspējas veicināšanai (Interdisciplinary training facilitating resourcefulness and entrepreneurial ability)*.

## Various Instruments

«Everyone is born creative, but the circumstances — school, parents, processes around us — influence us and make us the people we are,» says E. Gaile-Sarkane. Students enrolled at the university come from different background, their competencies in practical problem solving, skills and abilities differ. Young people have a lot of talent, but often they also have many limitations and imprints stemming from their past experience stopping them from truly expressing themselves, the Professor continues. Entrepreneurship generally depends on what educational institution the student graduated from as well as on previous educational background. In many schools, pupils have not had the opportunity to develop their entrepreneurship, ability to work independently and/or in a group (team), take responsibility and develop/create something on their own. To encourage entrepreneurship, entrepreneurial ability, and creativity, higher education institutions provide various study programs, make mentoring available, create business incubators, career centres, promote interdisciplinarity, involve students in courses that improve their innovation and entrepreneurial skills, simulate product and service development, motivate them to work in team, etc.

There are two groups of students: those who discover their inner entrepreneurial potential and are ready to start a business and those who choose to become experts in their fields — employees. Both groups are important for balanced economic growth, however, to make Latvia competitive in the global market, the goal is to develop resourcefulness and entrepreneurial ability in the largest possible group of young people.

## It is effective

E. Gaile-Sarkane says that a number of students who received an MBA Innovations and Entrepreneurship from RTU have changed their direction in life, for instance, changed their occupation, started a business. While studying they «evaluated their abilities, skills, changed their point of view, rated their potential, and ultimately arrived at a decision to live the way they wanted to, not the way time or circumstances dictate them to,» she points out. Associate Professor Gundars Bērziņš, Dean of the Faculty of Business, Management and Economics of University of Latvia (LU), stresses that «higher education institutions must be like a «sandbox», where students are not only studying — they should be creative and freely express themselves. We must give everyone the opportunity to try and to



# Components of entrepreneurial **ability** and **resourcefulness** and their characterizing criteria



By creating a comprehensive innovation ecosystem based on long-term support mechanisms for developing creative human resources, and by developing new products and creating high-tech companies, Latvia could become a success story in creating new industries.

TĀLIS JUHNA,

ACADEMICIAN, RTU VICE-RECTOR FOR RESEARCH

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COMPONENTS	CRITERIA
PERSONALITY TRAITS	Purposeful
	Open to challenges in life
ABILITIES	Analytical abilities
	Creativity
	Ability to overcome difficulties
SKILLS	Organizational skills
	Social skills
	Problem solving skills
MOTIVATION	Motivation for achievement
EMOTIONS	High emotional stability
NEEDS	The need for self-actualization
	Need for recognition
PERCEPTION	Thinking
	Self-esteem
	Attitude
LEARNING	Learning
ACTIONS	Identifying opportunities and creating new ideas
	Implementation of opportunities and created ideas
	Having a sense of direction in changing circumstances

SOURCE: KARINE OGANISJANA. INTERDISCIPLINARY TRAINING FACILITATING RESOURCEFULNESS AND ENTREPRENEURIAL ABILITY



There is only one thing that, in principle, distinguishes susceptible people from the rest – they are able to get up one time more than they fell, because the falls are inevitable.

GUNDARS BĒRZIŅŠ

ASSOCIATE PROFESSOR DEAN OF THE FACULTY OF BUSINESS, MANAGEMENT AND ECONOMICS OF UNIVERSITY OF LATVIA

make mistakes, too. It is very important, as we live in a society where making mistakes is not allowed, but just like life itself, business without mistakes is unheard of. Studies in university provide the possibility to understand, accept, and learn to overcome that. At the same time, you must understand that development of entrepreneurial abilities is important for everyone, even those who do not plan to start a business. Because such character traits as the ability to take initiative and take on the risk of loss are important for any adult. It is essential that an employee is able to implement ideas and understand the employer's goals and how to carry them out, knows how to communicate effectively and convince others of one's ideas.» He strongly believes in business incubators at universities and in their activities. «And, if their activities are integrated into the study process, like it is in LU Faculty of Business, Management and Economics, the result is very good. LU Business Incubator for students comprises 24 real companies that last year already created around 100 jobs and generated a turnover of almost EUR one million,» G. Bērziņš is contented.

### A place in the innovation ecosystem

Abilities, knowledge, and infrastructure are some of the reasons that could turn universities into centres for innovation and establishing businesses. Minister of Economics Arvils Ašeradens points out that «at the moment we can observe connections developing between high-

er education institutions and startups. However, it is important to note that the missing elements in both of them are possibility of pre-acceleration, as most startup team members gain their first experience and knowledge in accelerators; as well as educational models, especially STEM programs, which are not connected with business training models, therefore often being a stumbling block in commercialization of scientific ideas and creating new science-based startups. It has to be noted that excellent initiatives were successfully put into action at RTU, where programs of *Dizaina fabrika* and *IdeaLab* offer support for student startup ideas, and at LU, where LU Student Business Incubator employees opened a blockchain pre-accelerator. Ecosystem representatives see these activities as one of the ways how higher education institutions can contribute and add value to the development of the industry.» The minister also believes that universities should, firstly, raise awareness of team members of startups about how the ecosystem works, and secondly, they should be open to commercialization of scientific opportunities and be able to involve startups — carry out collaborative research, based on the needs of startups. Research and projects that are carried out at higher education institutions in collaboration with experts from various industries is a great opportunity for creating new companies. World experience shows that higher education institutions can be profitable and investing in newly established com-

panies created at universities is a good idea, states A. Ašeradens.

Referring to the conclusions drawn from the first community forum of newly established companies, he says that most likely higher education institutions will be able to successfully join the ecosystem of startups, but to achieve that, they would have to change their opinion of higher education institutions. The minister says that it is time for the universities and also government institutions not only to listen, but also join in and start doing, for instance, by creating centres for startups, communities, various pre-acceleration programs, but it is important for universities not to compete with each other about their activities.

### The role of early support

Academician Tālis Juhna, RTU Vice-Rector for Research, points out a serious problem in Latvia — support at an early stage: developing skills for creating new companies, developing prototypes for new products. It is unbelievable that financial resources for this kind of support are available in the form of a loan, as the risk of funding not being returned is too high. This is why Latvia needs to establish an innovation fund, which would function as a long-term grant system, he thinks. «At the moment, we are developing an idea that would let us form strong teams of innovative people, students, and researchers for startups. We will then work with these teams and prepare them for faster growth in the following development stage. The university will provide the

teams with training and mentoring, a Science and Innovation Centre will be created where they meet companies, investors helping them develop their business idea. The university could also ensure that the teams receive help of researchers, laboratories, and, while searching for partners, and investors, the university name could help them get their foot in the door,» reveals T. Juhna. Using this model, the university will be investing its intellectual resources and have the right to become the shareholder of the startup. The business idea would be developing successfully and attract investors, the university would receive funds and invest them in the ecosystem, by doing so it would create and develop more and more science-based and technology-based companies with high added value.

G. Bērziņš believes that «university infrastructure, for example, laboratories, prototyping and design studios, is almost the only opportunity for emerging of newly established companies that take producing seriously, are innovation-based and cost-intensive, because in the early stages it is rare for anyone to have that many personal resources, and banks or investors are not interested in giving money so early. In turn, it is not possible to have concentration of interdisciplinary knowledge and topical research in private sector or other forms of state aid to the same extent as at universities.»

### Why focus on business?

Appropriate training is considered an important factor that can affect the success of a newly established company, but the opinion on its influence varies in different age groups — people aged 50 to 59 think it is more important than those who are 20—29 years old. The conclusion is given by Associate Professor, Director of Ventspils International Radio Astronomy Centre Valdis Avotiņš, LU Professor Biruta Sloka, Researcher Ināra Kantāne and Lead Researcher at Latvia University of Agriculture Elita Jermolajeva, who carried out a research about factors motivating people to start business in Latvia. The publications conclude that success is very dependent on good customer service, excellent reputation, charisma, friendly attitude towards customers, and good management skills. Whereas, evaluation of factors motivating people to start their own business in Latvia allowed to conclude that people are greatly influenced by the desire make their own decisions and increase their income. ●

# Marking Latvia brighter on the world map

In order to create a long-term image of Latvia as an internationally recognized place where scientific research based startups are developing, an international conference of scientific startups is being held for the first time

The Investment and Development Agency of Latvia (LIAA) in collaboration with commercialization platform *Commercialization Reactor* are organizing *Magnetic Latvia Technology Conference Deep Tech Atelier*. It will take place from 12 to 14 April and will be devoted to the creation and development of international scientific startups, offering not only a platform for the discussions and opinions of entrepreneurs, authors of scientific achievements and technology developers, industry representatives and policy makers, but also implementing the *Commercialization Reactor 12th Ignition Event*. Entrepreneurs will have an opportunity to create a team of startups together with authors of technologies. It is also planned to organize ten presentations on new scientific achievements and technology, provide practical training and training for the creation of new companies. The initiative was launched to promote Latvia as a place where scientific research based startups exist and are developing, which are able to attract the attention of high-tech industry representatives and promote the emergence of sustainable, science-based and research-based startups in Latvia. The event also aims to identify the most effective ways in which such kind of companies can develop, commercialize their products, engage with global industry representatives, and attract capital. More information on [www.deeptechatelier.lv](http://www.deeptechatelier.lv).



The event is yet another initiative of LIAA with the aim to promote innovation, technology transfer and the development of new enterprises. We will be glad to see at the conference young entrepreneurs, researchers, industry representatives, investors, and general audience, and we hope that with time it will bring about practical results benefiting society.

ALEKSEJS KORŅEVS,

DEPUTY DIRECTOR OF TECHNOLOGY DEPARTMENT OF LIAA



# PERFECT YOUR EXPERTISE

From a knowledge-intensive startup to a part of global giant, from the research centre to the mass producer – Schaeffler Baltic Ltd draws its own development path

At the end of 2015, it was reported that *Schaeffler* group, manufacturer of automotive and other industrial components, had bought Latvia's nano-coating enterprise *Naco Technologies*, which was immediately announced as a success story. There are not many cases of sold startups in Latvia. Being a success story imposed an obligation for the enterprise that was renamed *Schaeffler Baltic Ltd* after the transaction, which they seemed to have coped with up to now. At the end of last year, the high-speed ion-plasma magnetron sputtering equipment developed by the enterprise was announced the winner of the competition *Export & Innovation Award in 2017* in the category *The Most Innovative Product* organized by the Investment and Development Agency of Latvia (LIAA) and the Ministry of Economics. Currently the *Schaeffler Baltic* competence centre is operating in Riga, new surface coatings are being developed, a tribology laboratory has been established where interaction of different surfaces is being tested, and which is used by well-known automotive companies, for example, *Jaguar*, *BMW*, etc., mass production is to be launched in the next few years.

## Wants to develop in Latvia

Nano-coating of *Schaeffler Baltic Ltd* allows longer service of components, improves their wear resistance and reduces friction. As the electromotive industry develops, there is ever increasing demand for

## BUSINESS CV

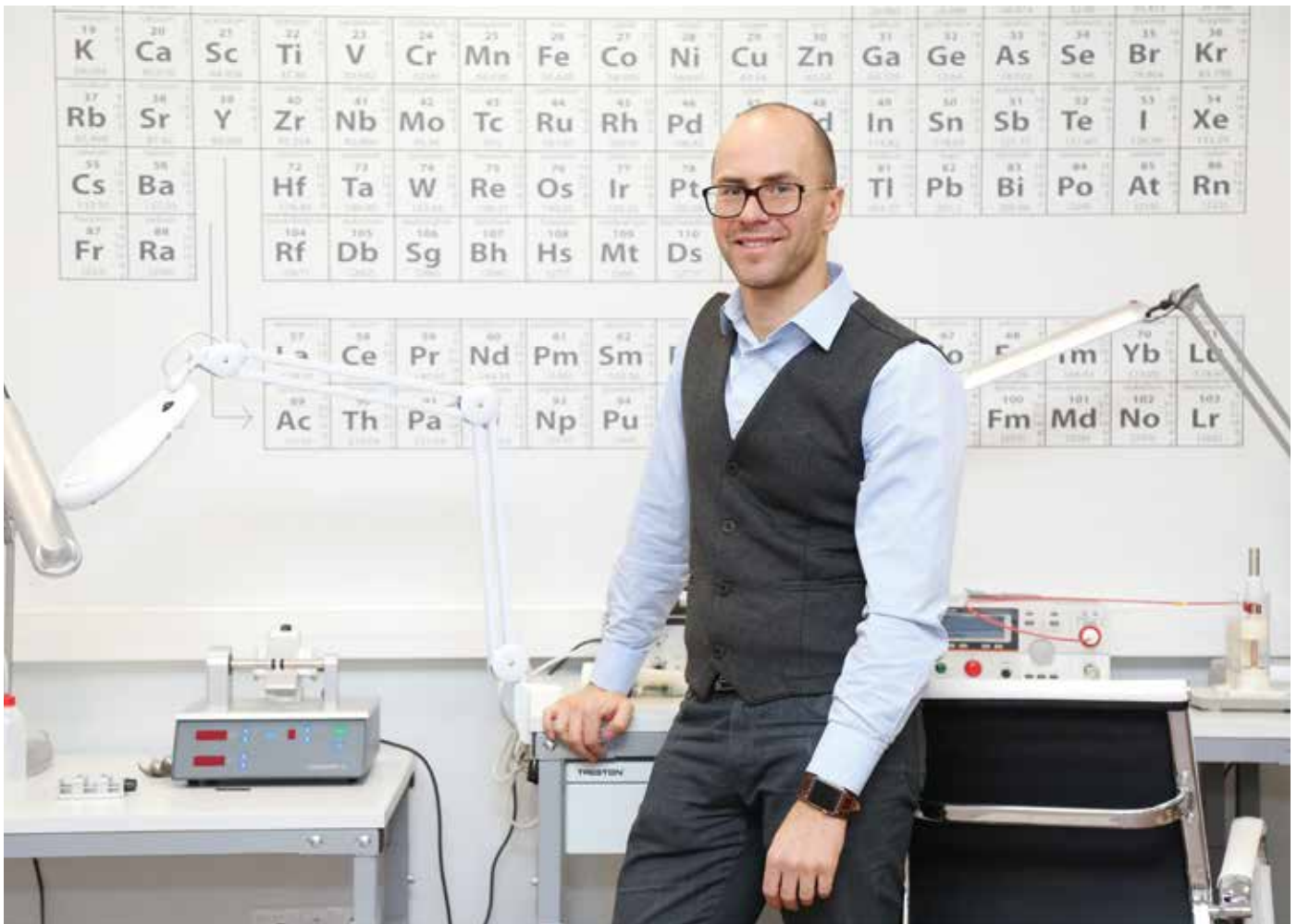
- *Schaeffler Baltic Ltd*
- Sector — Metal surface treatment and coating
- Owner — *Industriewerk Schaeffler INA-Ingenieurdienst GmbH*
- Turnover in 2016 — EUR 564.3 thousand
- Number of employees — 10

SOURCE: SCHAEFFLER BALTIC LTD, WWW.CREDIWEB.LV

effective electro-insulating coatings, says Aleksandrs Parfinovičs, Board Member of *Schaeffler Baltic Ltd*. The high-speed ion-plasma magnetron sputtering equipment, in simple terms, allows the coating to be applied in constant quality to a large number of components. The technology works in vacuum environment, the size of camera limits the size of the components to be covered, therefore at present it is not possible to cover very large components. At the moment it is too early to anticipate large production volumes, emphasises the Board Member of the enterprise — it is mostly research that is going on, and the equipment is mainly used for the development of nano-coatings. «We are at the pre-production stage,» says A. Parfinovičs. He would like to develop a continuous mass production here in Latvia — closer to specialists, who are very important in the initial period.

## To meet the right one

The beginnings of the coating technology are to be found outside Latvia — in Bochvar Russian Scientific Research Institute of Inorganic Materials. *Naco Technologies Ltd* was founded in 2010 and is considered to be one of the first enterprises of the research-based technology commercialization platform *Commercialization Reactor*. A. Parfinovičs met a number of researchers in the *Commercialization Reactor*, however, the only one agreeing to the commercialization was Professor Valērijs Mitins, who also has experience in business from the 90s in Russia. «Even if there is a very good idea, it is hard to create something if there is no proper collaboration with a researcher. With Professor Mitins it was clear from the very beginning — it is going to be a fruitful collaboration, he understands that he will not be able to devote himself merely to research, he will have to go to enterprises and tell about his invention, he will have to explain the technology to those, who have never heard anything about it before. His personality was attractive to me. Many scientists are afraid and do not want to share the invention, which does not help collaboration,» A. Parfinovičs shares his experience. In his opinion a common language can most successfully be found if a researcher has some understanding of business and an entrepreneur is technology oriented. He admits — this is my weakness, but I have great support from father, Eduards Parfi-



We have to think globally, we had a list of the big enterprises of the world that we visited and had discussions.

ALEKSANDRS PARFINOVIČS, BOARD MEMBER OF SCHAEFFLER BALTIC LTD

novičs, a technical director, who «assesses whether the solution is technologically interesting, in turn I understand whether I can make a business out of it and convince the investor.» Prior to receiving the purchase offer from *Schaeffler* he had to convince investors more than once. He now tells prospective entrepreneurs that almost every six months he has asked for money from financial sources. «No one gives you enough money to successfully run your business for a year. Risks are too high. They prefer giving half the amount you need and then watch if you survive or not. If you survive — they invest more,» he remembers. Funding was attracted from the financial institution *Altum*, venture capital funds *Imprimatur Capital*, *Proks Capital* and *ZGI Capital*. According to information portal *Labs of Latvia* a total of EUR 1.4 million have been attracted. When asked what he sees as development

opportunities for knowledge-intensive enterprises in Latvia, he says — they need smart people and a lot of money. There are still good specialists in Latvia from the Soviet era, there are also knowledgeable young specialists, however, one cannot compare the funds invested in the training of industry professionals, for example, in Germany, with the situation in Latvia. However, you cannot say that there are no enterprises to be proud of. A good example is the high-tech enterprise *Sidrabe*. We do not necessarily have to set the goal to become a giant, a good way is to perfect expertise in a narrow specific sector, to work globally, to ensure that the orders from all over the world are fulfilled in good quality, A. Parfinovičs says.

#### Looking for new ideas

The contract with the *Schaeffler* group came slowly — collaboration began in

2012. Asked if it is true that the industry's big players are looking at what startups are doing, since acquisition of a startup is often more profitable than maintaining a large research department, he agrees. «Culture of a large organization — procedures, administrative burden — impedes freedom of thinking and hinders creativity. A researcher needs freedom to create,» says the Board Member of *Schaeffler Baltic Ltd*. *Schaeffler* has established a department dedicated to identifying the ideas of startups, and a person from this department was involved in the transaction of *Naco Technologies Ltd*. The opportunity to see what kind of innovations are in the Baltic region is the reason why *Schaeffler* plans to attend the International Scientific Startups Conference *Deep Tech Atelier* in Riga. If an enterprise is causing interest, it cannot be ruled out that another transaction follows. ●



«If I cannot produce it the way I want — without colour additives and preservatives — I would rather not to develop the idea further, because I see no point in making another sweet sugar water available in any store in large amounts,» says Rolands Briņķis, the owner of Dabas Dots Ltd.

text / Lāsma Vaivare  
photo / Gundega Preiss

# The future is in Nākotne

After collaboration with researchers and testing of new flavors using brain response measurement, *Dabas Dots*, a company producing beverages made from fresh berries, is starting a manufacturing process and planning to export their products



We will brew tea, squeeze juice, have a dryer, freezer, storage, pasteurizers and equipment for converting pomace, because I want to achieve zero waste production, comments Rolands Briņķis, the owner of *Dabas Dots Ltd*, while giving a tour of his new production facility in *Nākotne*, situated in Jelgava Municipality. He is a true patriot — just as his father had taught him when he was a mere child — and he highly values Latvian natural riches. With the help of researchers and technologies he managed to combine natural wealth — herbal tea and organic berry juice — in a product called *Dzeramais* that has been on sale since the beginning of last summer, available at several stores and gas stations. «*Stockmann* bought our products thanks to our presentation,» says R. Briņķis being happy with the progress. The company sees their products on menus of school cafeterias and catering companies, however, the biggest growth is expected from the markets outside Latvia, for example, Scandinavia, where both product philosophy and packaging would be better understood.

### Untapped potential

R. Briņķis is interested in marketing. He is a Riga Technical University (RTU) graduate with the Diploma in Logistics, Economics, Customs and Tax Administration and has experience of a sales representative for major food and beverage manufacturing companies. What made him to change his life? As he is training in endurance sports, it has been important for him to restore his body organically, so he used to consume, for example, cranberries with honey adding tea to it, and experimented with various tea and berry combinations. «This is how I got the product, which is pretty simple — tea and freshly squeezed juice,» he reveals. The drink has no added sugar, the sweet taste is there thanks to honey or fructose. Almost all raw materials are of local origin — the company uses herbal tea from *Rūķīšu tēja* with berries and fruits grown in various farms. Only a small portion of berries is bought in Lithuania. The owner of *Dabas Dots Ltd* has done market research and came to a conclusion that markets in Latvia and Scandinavia lack a beverage with this kind of concept. He identified the demand and hired researchers, as he believed that one should be doing what one does best. Assessing cooperation between business and science in Latvia in general, he admits that there is «untapped potential», even though the added value of the product grows as a result of collaboration.

### Praising responsiveness

Drink recipes were developed in collaboration with Latvia University of Agriculture (LLU); Rīga Stradiņš University approved the product's health benefits; personnel of the Faculty of Geography and Earth Sciences of University of Latvia gave evaluation of potential groundwater resources and their quality on the property situated on Zemgale plains belonging to R. Briņķis' father. This water is intended for use at the production facility. At the moment, the manufacturing is outsourced.

The entrepreneur enjoyed collaborating with researchers — the universities were responsive and showed interest. In the beginning of this year, one of LLU students, who started collaborating with the company when she was writing her Bachelor thesis, was hired by *Dabas Dots Ltd* as a technologist. She is continuing her studies and writing her Master thesis on the use of berry pomace. Right now, it is a very important topic for the company — potentially they could make organic sports nutrition or remedies for people who suffer from diabetes.

#### BUSINESS CV

- *Dabas Dots Ltd*
- Founded in 2016
- Owner — Rolands Briņķis
- Turnover in 2017 — around EUR 80 000

During the development of *Dzeramais*, the biggest challenge was to improve its shelf life without adding any preservatives. Together with LLU personnel, they tested various packaging materials and came to a conclusion that the best option was Tetra Pak. They found a partner in Germany who believed in their idea and had agreed to package a smaller batch of beverages than average. Microbiologically safe aseptic packaging of beverages ensures that the contents stay fresh for a year. The beverages at the new production facility in *Nākotne* are going to be packaged in glass bottles and bag-in-box containers, which will have shorter shelf life, but at the same time, lower production costs; Tetra Pak packaging is still going to be used for *Dzeramais* in Germany. So far, two batches of beverages have been manufactured — the third, which may feature beverages with new flavours, R. Briņķis plans to produce at his production facility this spring.

### Find out the Truth

There will be no office space in the new production facility, the owner of *Dabas Dots Ltd* is feeling great at Jelgava Business Incubator belonging to Latvian Investment and Development Agency (LIAA) — the window overlooks the river Lielupe, LLU is almost within arm's reach, he is surrounded by active and ambitious people. R. Briņķis likes that once a year this place ranks the work he has accomplished comparing it with previously defined objectives. It is similar to school — only successful students pass their classes. R. Briņķis is smiling — he likes studying. Incubators offer knowledge and various events. In the incubator, he gained an entirely new experience — they carried out an experiment while testing new flavours, namely, they connected special sensors to peoples' heads and fingers to gauge brain and body responses. «This way we receive a deeper, more honest answer. The answer may be based on emotions, for example, one can say they like our drink, to be polite, but in reality, it did not taste that good at all — sensors and computers do not lie,» R. Briņķis shares his impressions.

He had to slightly adjust his views — even though he had the impression that physically active people would be interested in the product, which was featured at various fairs and events last summer, it turned out that mostly young parents, children, and women enjoy *Dzeramais*. R. Briņķis is not at all upset about that, he wants to offer the opportunity to carry the meadow in one's pocket to the widest audience possible. ●

text / Lāsma Vaivare  
photo / Gundega Preiss

# Knowledge-based companies are growing in number

In Jelgava, a city rich in manufacturing traditions, new companies see value in manufacturing organic food

At the top of the list of the largest companies by revenue in Jelgava proper and Jelgava County are the companies that purchase agricultural products and manufacture food. Among the companies of Jelgava Business Incubator of Latvian Investment and Development Agency (LIAA) food industry is actively represented, followed by cosmetics, IT and household chemicals companies, comments Agnese Oļševska, who is working as a senior project manager at the incubator. Jelgava has all the prerequisites for developing food business, considering the presence of Latvia University of Agriculture (LLU) in the city, she adds. LLU lists agriculture and agrobiotechnology, modern animal husbandry technology and food technology, food quality and safety as the main areas where the university collaborates with businesses in developing new products and technologies.

A. Oļševska mentions a trend of emerging knowledge-based companies as the development of such companies is one of the incubator's objectives. The incubator organizes training programs for the companies, which are taking part in the incubation process, a special series of events — *Īstā telpa* — for implementers of innovative process, students, inventors, researchers, manufacturers, entrepreneurs, etc. It makes the incubator a comfortable environment not only for entrepreneurs, but also for researchers, so that both sides have a better opportunity to meet, create common values, dispel myths about either party's narrow and self-serving interests in projects. A successful and productive relationship between researchers and entrepreneurs is possible if there is a long-term collaboration, says the senior project manager.

*Dabas Dots Ltd.* was one of the first Jelgava Business Incubator companies to develop a product in collaboration with researchers and entrepreneurs. It was followed by *Zekants Ltd* with their brand

*Pupuchi*, says A. Oļševska. The company manufactures new generation snacks – fava bean chips. LLU reported that students of the Faculty of Food Technology tested the product and studied its packaging conditions and quality during shelf life. A. Oļševska also mentions *Medrego Ltd*, a company that offers stem-cell therapy for animals for treating arthritis and soft tissue injuries. During its first year of operation Jelgava business incubator has provided incubation support for 16 teams and pre-incubation support for 39 teams.

The incubator not only educates its participants — knowledge transfer events are centred on digital transformation of companies, development of leadership and management capabilities of entrepreneurs, and practical sales skills — but also motivates them to be even more active and goal-oriented. A. Oļševska says that once a month, everyone comes together to share what has been achieved and what is intended, thus creating a strong community where everyone supports each other. In turn, small colour-coded electronic building blocks — *littleBits* — which one can use and combine in various ways in the creation of technological innovations, is one way to stimulate entrepreneurship of young people. At the incubator, special events are held for the new generation of future entrepreneurs. ●



The development of knowledge-based companies is one of the incubator's objectives.

AGNESE OĻŠEVSKA,

SENIOR PROJECT MANAGER OF JELGAVA BUSINESS INCUBATOR

## INFORMATION

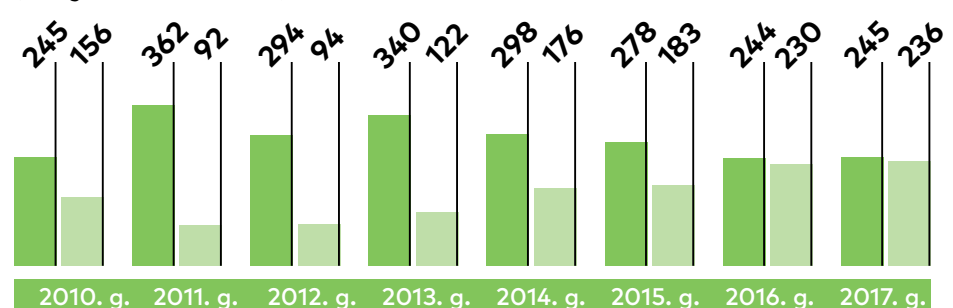
— Jelgava Business Incubator opened on 27 January 2017.

— The Incubator covers activities in Jelgava proper and Jelgava Counties Ozolnieki, Dobele, Tērvete, and Auce.

SOURCE: LIAA

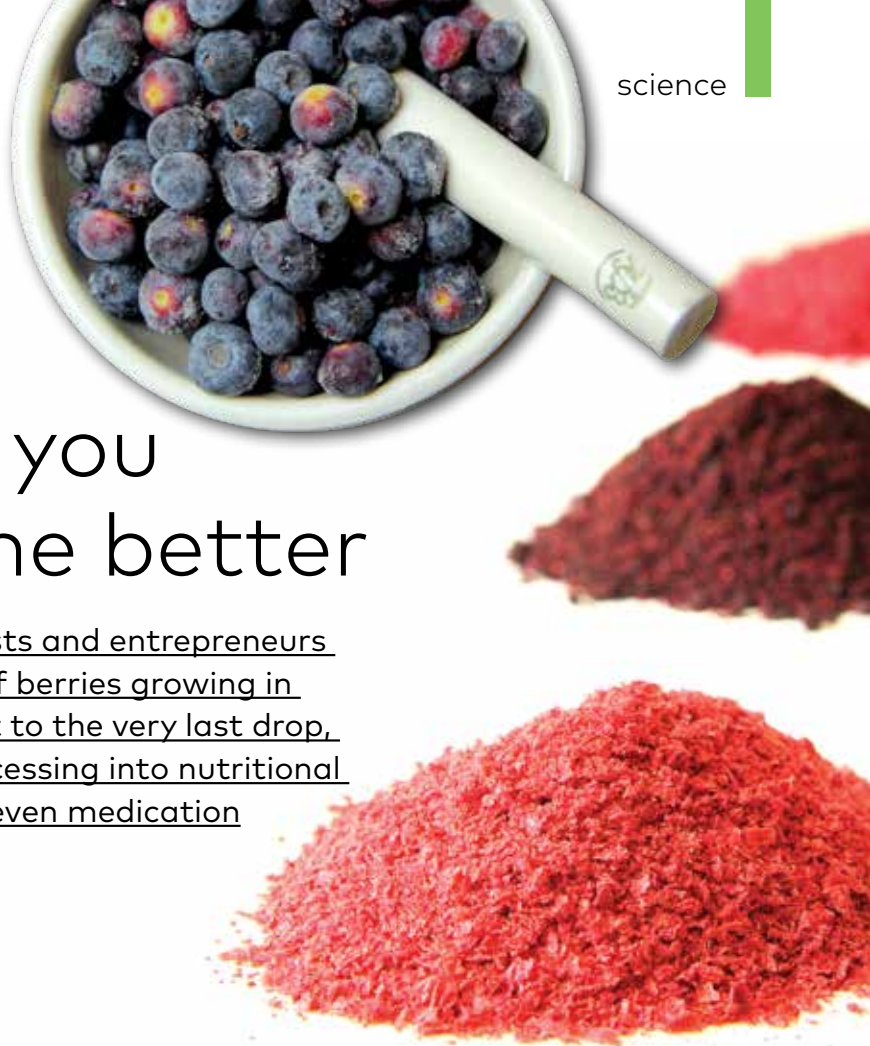
## Dynamics of company registration and abolishment in Jelgava

(■ registered ■ abolished)



SOURCE: LURSOFT

text / Lāsma Vaivare  
 photo / Toms Grīnbergs, University of Latvia,  
 SIA Silv EXPO publicity photo



# The more juice you squeeze out, the better

A collaboration of Latvian scientists and entrepreneurs brought about plans to use the power of berries growing in Latvian forests and swamps — and do it to the very last drop, turning pomace left over from food processing into nutritional supplements and in the future possibly even medication

Do you remember your grandmother telling you to eat fruit with its skin? Nutritionists also remind us about the valuable substances found in fruit, vegetable, and berry skins. «Skin is the most valuable part,» agrees Ruta Muceniece, Professor at the Faculty of Medicine of University of Latvia (LU), who together with colleagues and *Silv EXPO Ltd* attracted financial support from the European Union (EU) and is searching for ways to efficiently use waste products — berry pomace remaining after the juice production process.

## The power of local berries

«The goal of the project is to develop methods of creating new high-value-added products from pomace of *Vaccinium* berries, moreover, using an environmentally friendly method — supercritical CO<sub>2</sub> extraction. We have developed the extraction methods, samples of substances have been obtained, researchers from the Faculty of Medicine are carrying out research on pharmacological activity, and *Silv EXPO Ltd* are doing the market analysis,» says Māris Kļaviņš, Professor at the Faculty of Geography and Earth Sciences of LU. The genus of *Vaccinium* berries includes blueberries, bog bilberries, blue huckleberries, lingonberries and cranberries. Overall it has around 450 berry species. The nutritional value of berry pom-

### INFORMATION

— *Vaccinium* berry processing — green technologies and innovative, pharmacologically described products for biopharmaceuticals

— Implementation period — February 2017 — January 2020

— Goal — to develop an innovative and efficient health promoting product within the framework of knowledge-based biopharmaceuticals

— Partners — University of Latvia, *Silv EXPO Ltd*

— Financing — University of Latvia — around EUR 645 000, of which EUR 548 200 is ERDF funding

SOURCE: UNIVERSITY OF LATVIA

ace is relatively low, at the moment the efficiency of use is also low, the Professor continues. Berry pomace is sour, it is impossible to use it to feed animals, a small part is used as tea additives, some make berry powder. Consequently, obtaining purified biopharmaceuticals is positively evaluated in terms of valorization and circular economy.

*In vitro* test results show that provisions are made for selecting the most effective classes of biologically active substances and identifying the most promising therapeutic fields of application, as well as determining the required dosage. It is expected that the project will result in an innovative science-based nutritional supplement with standardized content and therapeutic effects, not excluding the possibility of producing medication in the future. The optimal form of the finished product is still considered, but Ilona Vanaga, R&D manager of *Silv EXPO Ltd*, says that they could use liposomal delivery form, which ensures increased product's bioavailability. A liposome is a small vesicle with a lipid bilayer or micelle that encapsulates active ingredients and successfully transports them through the digestive tract, shielding them from gastric acid, for example. Which in turn ensures that the active ingredient works as intended and where intended. I. Vanaga adds that the company has already created the liposomal form of fir-needle extracts as another project and the technology is applicable here as well.

*Silv EXPO Ltd* pays great attention to active ingredients of Latvian spruce and pine needles — polyphenol, silbiolum, chlorophyllin — and their efficient use in health improvement.





After extraction of juice from berries a lot is left over, indicates Scientific Assistant of the Faculty of Geography and Earth Sciences Linards Kļaviņš and Laboratory Assistant of the Faculty of Geography and Earth Sciences Lauris Arbidans.



Professors of the Faculty of Medicine Ruta Muceniece and Researcher of the Faculty of Medicine Jana Namniece are actively engaging in research.



The company is engaged in scientific research, pharmacoeconomic research, in creation of natural raw materials and new extractives starting from the idea up to the technology, Uģis Klētnieks, Development Director of *Silv EXPO Ltd* introduces his company. The company is interested in using natural substances in order to delay aging processes, improve sports achievements, for treatment and prevention of oncological diseases and improvement of immunity.

**For various ailments**

«We are focusing on two substance groups — lipids, including berry oils that we are still working on, and polyphenols,» says M. Kļaviņš. Whereas R. Muceniece adds that at the moment they «have been focusing on antioxidants and how these extractives help cells survive under oxidative stress, as well as their antidiabetic properties. A cell may experience

oxidative stress due to a variety of agents, imbalance of oxidation-reduction causes appearance of more free radicals. In parallel we are researching how isolated active ingredients affect the differentiation of stem cells into fat cells — chondrocytes. We have started research on anti-inflammatory effect.» Research description states that the aim is to search for effects of the substance in models of inflammation, aging, hepatoprotective actions, oxidative stress reduction, etc., as well as to research intracellular signalling, mitochondrial and DNA integrity, as well as energy production. Asked about the results of the research carried out thus far, R. Muceniece says that berry extractives have good qualities. However, it might be problematic to standardize berry extractives — their composition may vary depending on weather, period, and location when and where the berries were collected. Still, if one wants to man-

**INFORMATION**

**OTHER IDEAS**

— *Smiltēnes piens Ltd* create whey protein drinks from whey – a liquid that has remained after dairy processing, which usually turns into production waste or is used in animal husbandry.

— *Valmiermuižas alus Ltd* use malt residue, a by-product of brewing beer, in producing sweets, and by adding other raw materials they bake cookies.

— *BIOLAT JSC* obtain extractives from pine and spruce needles, which remain as waste at felling areas. These extractives are used to produce nutritional supplements and skin care products.

SOURCE: MINISTRY OF AGRICULTURE



Silv EXPO Ltd is interested in using natural substances for delaying aging processes, strengthening immunity, improving sports achievements, and preventing oncological diseases, says Uģis Klētnieks, Director of the company's development department.

**LEARN MORE**

**Follow berry pomace research process in the photo gallery**

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[/magazineinnovation](https://www.facebook.com/magazineinnovation)

ufacture products, their properties must be constant, or, quoting I. Vanaga, «Every package must be effective, not every second one.» To ensure constant quality and volume of output, the solution might lie in berry cultivation or specific fractionations and purification of the extractives. Even this will be the benefit from the project — knowledge for pharmaceutical and chemical industries, says U. Klētnieks, at the same time admitting that plants that grow in the wild have a tremendous power. Wild plants are geared towards survival, they know how to protect themselves from UV radiation, fluctuating temperatures, wind, hail, rain, and other plants wanting to replace them. Will these abilities be commercially available as pills, capsules, or other forms? Even though no one is in a hurry to promise mass production at the moment, a pilot batch of knowledge-based food supplements must be ready within two years. ●



## Smart way of using biological resources

**DAGNIJA BLUMBERGA**

Professor, Director of the Institute of Environmental Protection and Heating Systems of Riga Technical University:

It is globally considered that biotechnomy is a fundamentally new smart approach in using biological resources, there is no doubt that its importance will increase over time. The goal of biotechnomy is the smart way of using biological resources, creating high-demand high added value products with the help of technology instead of disposing of them at landfills or burning them. As a result, the products are environmentally and climate friendly, as well as socioeconomically and economically justified. The philosophy of the biotechnomy is rooted in the idea of optimizing the benefits based on the available biological resources, available and projected technological levels and economic conditions. You can come across raw materials for biotechnomy manufacturing in Latvia everywhere, and their range is very wide, including the flora and fauna of soil and of water, as well as waste — not only household waste, but also, for example, industrial gas emissions and by-products and remnants of agricultural production. By converting biomass, we can obtain energy, building materials, food, medication, cosmetics, chemicals, textiles, and other products.

There has been public debate about the problem of increasing accumulation of waste tires. Usually they are made from a mixture of natural and various synthetic rubbers, fillers, and other substances. Tire decomposition is a long process, it is important to find solutions to the problem by turning them into high-quality products using appropriate technological methods. Our researchers have been working on this problem for several years. Let us look at another example — wood. Wood covers half of Latvia's territory and is the most widespread group of biological resources with a great hidden potential for use, however, presently approximately 50 % of harvested timber is used as fuelwood, 30 % as sawn timber and building materials, and 20 % of timber is used for making 20 thousand various products. Timber is mostly used to produce energy, but global scientific research shows that it has a potential for creating a number of high-quality products with significant high added value. The research carried out at RTU Institute of Environmental Protection and Heating Systems confirms that large-scale use of timber for acquiring fuelwood and sawn timber is not sustainable. This is why we must think in two directions, of which the need to take the wood industry to the next level in order to manufacture products with high added value would be the most important one. We must improve subsidiaries that are ready to manufacture, for example, heat insulating materials from conifer shoots, betulin from birch bark, or furfural from wood chips. ●





One of the pros of phytoremediation is the ability to create an aesthetically pleasing environment during the cleaning process, says Jovita Pilecka, scientific assistant at Forest and Water Resources Scientific Laboratory of Latvia University of Agriculture (LLU), and Daiga Zigmunde, Professor and Dean of the Faculty of Environment and Civil Engineering at LLU.

# LEAVE IT TO NATURE

*text / Lāsma Vaivare  
photo / Gundega Preiss*

Skilful planting of selected plants in contaminated soil instead of excavating it – Latvia and Lithuania have plans to conduct a pilot study to find out the efficiency of such a remediation method



## BENEFIT – ORDERLY ENVIRONMENT

**ILONA IGONEVA**

Head of Development and Real Estate Department in Ludza Municipality

Benefit for the Municipality – former Ludza linen factory and its territory of 8.9 hectares is going to be put into shape. Right now, it is abandoned and there is no economic activity there. We are going to remove the abandoned structures and buildings, cut trees and bushes, remove tree stumps, fill potholes, collect waste, level the area and plant the plants. We are going to develop proposals for arranging the territory within the framework of the project to facilitate its becoming part of the economy, reducing the current negative impact on the city's visual perception and surrounding properties. We are going to carry out an analysis of the soil taken from the territory surrounding the linen factory in order to find out if it is contaminated and to define what kind of contamination it is. We are going to take samples and assess the existing constructions in the territory as well as the factory's operating principles, and previous use of buildings. Ludza Municipality has no record of contaminated territories.

Latvia's map of contaminated and potentially contaminated locations is scattered with tiny dots: landfills, Soviet-era army bases, former kolkhoz warehouses, gas stations, petroleum storage sites, manufacturing and commercial locations, container ports, boilers, etc. Environmental remediation is expensive, in some cases even technologically challenging. If the soil is not deeply polluted and its concentration is not abundant, remediation can be entrusted to plants, for example, willows help fighting petroleum contamination, and sunflowers are effective against heavy metals, says Jovita Pilecka, scientific assistant at Forest and Water Resources Scientific Laboratory of Latvia University of Agriculture (LLU). It is also possible to use other plants in environmental remediation, such as fescue, white clover, alfalfa, hybrid poplar trees, hybrid willows, etc. — the list in the monograph *Fitoremediācija: izmantošanas iespējas Latvijā* compiled by LLU researchers is quite long. In addition, according to the information given by the university it is possible to use plants not only for soil remediation, but also for cleaning land surface, groundwater, and even the atmosphere. Plants help fighting biogenic elements, heavy metals, petroleum products, pesticides, and other chemical substances. Truth be told, even though this method is relatively cheap, it is time-consuming.

### Experiments in Sweden

Several years ago Ilze Rukšāne, a landscape architect together with her neighbourhood residents in Sarkandaugava created an experimental phytoremediation garden, focusing on restoring the body of water in Sarkandaugava. This spring it is scheduled to start a phytoremediation project in several locations — Ludza, Kupiškis and Ignalina. It will be a Latvian-Lithuanian cross-border cooperation involving LLU experts of different fields, says Daiga Zigmunde, Professor and Dean of the Faculty of Environment and Civil Engineering at LLU. Soil analysis will help to select and cultivate the most suitable plants and the best way to plant them in order to create a picturesque outdoor space will be developed. D. Zigmunde emphasizes that one of the pros of phytoremediation is the ability to create an aesthetically pleasing environment during the cleaning process. This is why it can be used, for example, to reduce pollution in cities including locations near streets, creating suitable plantations zones.

Orrefors, a city in Sweden famous for glass recycling in the past, still has large amounts of heavy metals in soil, including lead and arsenic, and is already «employing» plants — last year a LLU expert assisted in creating an educational phytoremediation park. «We scanned the soil and found pits filled with glass. We took soil samples, sifted through and studied its contents — there were metal pieces, waste, glass,» says J. Pilecka, who took part in creation of the park. LLU experts selected the plants and the students came to plant them, we also received guidance from the landscape architect responsible for the designing of the park. This year it is envisaged to continue the collaboration.

### How do we close the cycle?

What happens to plants after they have done their job? When a season ends, the plants must be removed and disposed of so that contamination does not return back to the environment. D. Zigmunde says that the most efficient way would be to burn them. For the time being there are many unanswered questions: where could we do that, do we need specialized equipment, can the energy that comes from burning plants be used for anything useful, can we use it in heating, etc. These and other questions confirm that there is a lot to be researched. ●

# Search for fuel of the future

text / Dita Arāja, Lāsma Vaivare

photo / Elīna Karaseva, Gundega Preiss

«Biofuel search is nothing new. 100 years ago, when there was no oil refining yet, people tried to run internal combustion engines with turpentine, ethanol, but then it turned out that oil products are the best. Now we are back to searching for the best biofuel, not because of the technical characteristics of engine, but for the ecological reason»

Says Valdis Kampars, Professor of the Faculty of Materials Science and Applied Chemistry of Riga Technical University (RTU).

## It will decrease, but slowly

Modern transportation is not sustainable and sufficiently diversified. According to the European Commission's Report *State of Art on Alternative Fuels Transport Systems in the European Union*, most of the European Union (EU) energy consumption in road transport (about 94 %) is still petroleum-derived fuel. Significantly better situation is observed in rail transport, which continues to be electrified, while air transport is the most dependent one. Moreover, most of the essential oil products are imported into the EU, therefore the dependence on external supplies is huge. Projections in the report suggest that oil resources and its products will continue to remain the main source of transport energy, however, with the development of alternative forms of energy, their importance could slowly decrease reaching 88 % in 2030 and 84 % in 2050 of energy needed in the EU transport sector. The use of oil resources and their products is also one of the key

factors contributing to the emergence of greenhouse gases (GHGs).

Latvia is committed to ensure that the share of energy from renewable energy sources in transport in 2020 is 10 % of final energy consumption in this sector. Achievement of this goal is not working out though, although almost ten years ago a mandatory 5 % biofuel additive for fossil fuels was set. True, with the exception — it may not be added to diesel fuel used in arctic and severe winter conditions. At the same time, no limitation was set on the trading period for arctic diesel, so the fuel traders continued to trade in arctic diesel during the summer time. This resulted in a situation when the actual amount of biofuel consumed in Latvia even decreased, informs the Ministry of Economics. In order to change the situation and bring Latvia closer to the goal, Regulations of the Cabinet of Ministers were amended, specifying that from 15 April to 31 October, both in moderate climate and arctic and severe winter conditions, diesel fuel can be traded only with the addition of biofuel of at least 4.5 %. It is also stipulated that in order to meet the mandatory admixture requirements, from now on also parafinized diesel fuel

from biomass can be added to diesel fuel. Arnis Janvars, Board Member of the Latvian Biofuels and Bioenergy Association, believes that with these amendments the situation in the sector will improve. At present, only two enterprises — *Bio-Venta Ltd* and the society of agricultural services cooperatives *Latraps* — produce biodiesel in Latvia, and the latter does not operate permanently but only fulfils orders, says A. Janvars. The oil from rapeseed, mostly grown in Latvia, is used in production. This fuel is sold outside Latvia.

## Researched for years

Researcher V. Kampars who already for many years has been leading the research on biofuels at RTU, admits that there is a lack of big enterprises in Latvia that would see biofuel as their long-term market product and through its development purposefully invest in biofuel research. Currently RTU chemists are working on the improvement of the technology of extraction of the first generation of biofuel — biodiesel, trying to extract second-generation biofuel from straw and wood residues, as well as preparing to study the extraction of biofuel from harmful emissions — carbon dioxide (CO<sub>2</sub>). It should





The goal of all biofuel research at RTU Faculty of Material Science and Applied Chemistry is to acquire new knowledge, explains Valdis Kampars, Professor of the Faculty of Materials Science and Applied Chemistry of Riga Technical University, and young scientists.

be noted that Europe has set a course towards modern biofuels — reducing the amount of biofuel and bioliquids produced from food and feed crops in favour of raw materials that are not direct competitors for food and feed crops. A. Janvars says: «It is a good wish, however, there is not enough raw material in the Baltics to mass produce second-generation biofuel. Do we want to import raw materials from other countries and become a disposer of waste of others?»

For a long time, RTU researchers focused their studies on biodiesel — the first generation of fuel from vegetable oil — because it is currently the only fuel for production of which there is the required technology in Latvia. «In fact it is the main biofuel in Europe, but it has to be admitted that diesel fuel production does not count as a trendy direction, because of the use of expensive raw material — vegetable oil,» explains V. Kampars. Oil as a raw material accounts for 85 % of the biodiesel prime cost. However, the professor doubts that in the near future any new biofuel could take the place of biodiesel, because there is no technology that could replace this precious fuel. True, apart from biodiesel the second most com-

mon fuel is bioethanol, which is extracted from sugars or starch (wheat grains). The best and cheapest is considered to be bioethanol produced from Brazilian sugar cane, while in Europe it is extracted from wheat grains, which makes the prime cost of its production several times higher. Studies have shown that energy gains and emission reductions are not as high as in the case of biodiesel production, therefore Europe is focusing on biodiesel. «Of course, if produced from raw materials that are used in the food industry, it is just as bad as production from oil,» V. Kampars explains.

RTU plans to continue researching oil as a raw material also in the next few years, with the aim to search for new options for the extraction of biofuel. One of them is using a reaction called transesterification, as it does not result in glycerine, but the extracted product is biofuel. «This direction has been relatively little studied, and when reviewing the literature, it seems that we have carried out a lot of research that makes us one of the leading centres in the world. The future of the direction will depend on the results achieved over the next two years,» says the Professor. Also, the research is carried out on the

possibility of taking a step further in oil treatment and converting oil production residues into biofuel, thus replacing the high-quality raw material and reducing the prime cost of production. Biodiesel consists of fatty acid methyl or ethyl esters. Not only biodiesel can be extracted from vegetable oils and fats, but also fuel consisting of hydrocarbons similar to petroleum fuel. Aviation is most interested in it, since no other biofuel has been suitable for this purpose yet. The infrastructure of oil refinery facility is used for the practical realization of the process.

Norway (oil refining and trading company *Neste*) is the closest country to Latvia, where renewable hydrocarbons for transport needs are produced using such technology, says Kristaps Māliņš, Lead Researcher of RTU Institute of Applied Chemistry. He is testing and developing heterogeneous Ni, Mo and Platinum group metal catalysts for this process within the Post-doctoral Research Aid project (1.1.1.2.16 / I / 00001) co-financed by the European Regional Development Fund. The research is carried out with rapeseed oil from Latvia and its production/refining by-products (soapstocks), in order to produce renewable hydrocarbons with



Currently, there is no green fuel and mobility solutions that are cheaper and could out-compete fossil fuel, admits also Professor Gints Birzietis, Head of the Scientific Laboratory of Alternative Fuels of the Latvia University of Agriculture.



high purity and added value not only from edible oil, but also from low-quality and cheap raw materials. The Institute owns a unique high-temperature and pressure autoclave/reactor system, the only one in the Baltics that can efficiently evaluate the activity of catalysts developed by RTU for the synthesis of hydrocarbons from vegetable oils or animal fat containing raw materials.

### Costly and complicated

RTU has also focused on the research on second-generation biofuel. It is being studied how biofuel can be obtained from biofuel biomass containing lignocellulosic material — agricultural and wood-processing waste, straw, which is a perspective raw material in Latvia. Studies are carried out using biomass catalytic pyrolysis. «The only way to achieve something is by finding good catalysts,» says Professor Kampars. The aim of the research is to extract high-quality bio oil from lignocellulose, processing of which in turn would lead to production of fuel. V. Kampars regards that this direction is very promising and should be developed, but notes that the process from bio oil to a real product is not easy, because the technologies are very complicated and expensive. However, there might be good opportunities for collaboration with a sufficiently large charcoal producer, as bio oil is also produced in this process.

Linda Mežule, Associated Professor of the Water Engineering and Technology Department of RTU, who was announced RTU Young Researcher of the Year 2017,

admits that lignocellulosic biomass and agricultural waste are energetically valuable raw material, however, its full use is limited by relatively expensive production and substrate costs. «The existing technologies are very complicated and costly, pilot factories are big,» she says. One of the factors that is increasing costs is the transportation of raw materials — supply for production is expensive. Therefore, RTU researchers are developing a technology that is compact, mobile and in addition relatively simple. This technology has another benefit — it is environmentally friendly, namely, the production process does not use hazardous or environmentally harmful processing techniques. Namely, biomass is crushed, boiled, enzymatic hydrolysis is carried out, fermentation sugar is removed and enzyme recirculation is provided with special membranes. Sugar solution obtained in the process is to be further used in the fermentation process to produce bioethanol or biobutanol.

RTU chemists have decided to try their forces in yet another promising direction, use of air pollutant carbon dioxide or CO<sub>2</sub> that could be converted into methanol in the catalytic process as a raw material. «CO<sub>2</sub> could be taken from producers and recycled into fuel — it would be a circular economy. Methanol is poisonous to humans, but it has many benefits as the raw material in chemical industry and as fuel — it does not get damaged and can be used to convert chemical energy into electrical energy without running a generator,» explains Professor V. Kampars. So

far, CO<sub>2</sub> studies have started, because the procurement of special equipment necessary for testing catalysts is yet ongoing. CO<sub>2</sub> conversion is not classified as a type of fuel production, but is falling into to the category of so-called green technologies. V. Kampars explains that the final product of CO<sub>2</sub> conversion does not necessarily have to be fuel; it can be any other product, such as a polymer. The most important thing is to find a way to convert harmful emissions into a valid product.

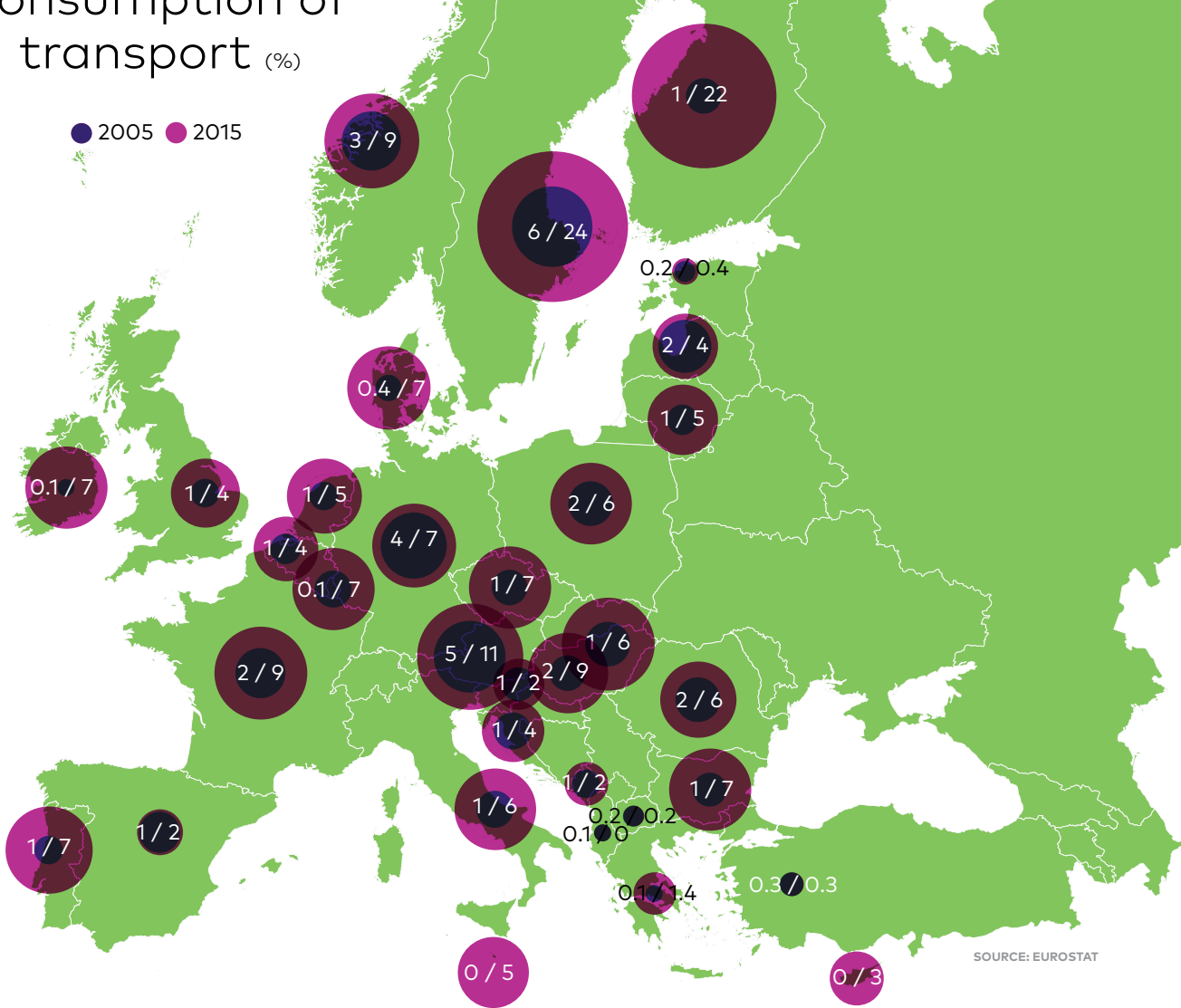
### You must continue to strive

The current practice has proved that it is not easy to find efficient and cheap second-generation biofuel raw materials and technology for green fuel to be able to compete with oil products, admits V. Kampars. Currently, there is no green fuel and mobility solutions that would be cheaper and could out-compete fossil fuel, admits also Professor Gints Birzietis, Head of the Scientific Laboratory of Alternative Fuels of the Latvia University of Agriculture (LLU). Without motivating/mandatory mechanisms, such as requirements to achieve a certain amount of green energy, increase mandatory admixture, etc., significant changes will not be easy to achieve, although he thinks that in future society will have better awareness of the fact that it is worthwhile to pay more for green, as it results in cleaner and more sustainable environment. Past experience has shown that while there is support available, more attention is paid to alternative types of fuel, which applies both to the purchase of electric cars and

# Share of renewable energy in fuel consumption of transport (%)



● 2005 ● 2015



SOURCE: EUROSTAT

the introduction of charging infrastructure, as well as to biofuel production.

### It would be interesting to check

If second-generation biofuel produced as a result of scientific research were available in sufficient quantities, we would be interested in assessing its properties in operation — how a motor vehicle operates when using biofuel, what should be improved, etc., tells G. Birzietis. The laboratory is conducting research on the effects of various factors on engine traction and power characteristics, fuel consumption, emissions of harmful components of exhaust gases, analysis of car operation with both fossil and various types of biofuels, etc., not only for scientific, but also for business needs. In the future, the range of research is to be further expanded.

G. Birzietis says that LLU collaborates with the oil refining and trading enterprise Neste, including the testing of its produced renewable diesel or hydrogenated vegetable oils, as well as fuel *Pro Diesel*, which contains hydrogenated vegetable oils. Neste reports that HVO is obtained by hydrogenating various products from plants and animals — palm fruit oil, animal and fish oil residues, rapeseed and soya oil, algae, germs and other raw materials. It should be noted that last year the enterprise reported that Finland started to market 100 % renewable diesel fuel, and this year has been recognized by Canadian financial enterprise *Corporate Knights* to be the second most sustainable enterprise in the world.

Other fuel enterprises and manufacturers have also approached the LLU Alternative Fuel Scientific Laboratory to test

the effectiveness and impact of some additives. G. Birzietis admits — it happens that enterprises are very cautious when sharing information about the product being tested. In his opinion, more mutual trust would enhance productive collaboration.

He believes that in the future the transport sector will use electricity, hydrogen, also biofuel in certain circumstances. Also, the Latvian Bioeconomic Strategy 2030 states that the production of biofuel is mostly considered as a transitional resource while electrification of vehicles is developing. At the same time, biofuel could be used in the future in cases where the introduction of electrification is complicated. «Technology is not ready yet, we cannot jump into the distant future, the intermediate stage must be gone through without affecting the environment,» concludes G. Birzietis. ●

# GREENER SNOW

In spite of erratic winters in Latvia, a newly established company *Snowision* showcases at a ski resort in French Alps the possibility to manufacture artificial snow in a way that is noticeably cheaper and more environmentally friendly



Maintaining high quality ski slopes that are dozens and hundreds of kilometres long costs a lot of money, which is paid by owners so that connoisseurs with a taste for winter sports would not search another resort. Producing artificial snow for a big resort can cost up to EUR 3 million a year, informs Aleksejs Korabovskis, CEO and co-founder of *Snowision Ltd*. The company has developed a prototype for a technology that uses sensors to measure microwaves — it allows remotely detect snow volume, density, and temperature, which in turn allows predicting snow «behaviour», for example, its melting speed. By using specially developed software, resorts can receive this information in real time and quickly decide which locations and to what extent need strengthening of the snow cover. *Snowision Ltd* estimates show that to produce snow only when it is necessary in the locations where it is necessary would reduce expenses by 40 %.

Since last year, the prototype has been tested in collaboration with a consultant — French company *Dianeige*, at a ski resort in French Alps. The resort keeps operating as usual, which at the end of the season will allow to compare the amount of the produced snow with calculations based on sensor data on the rational amount of snow needed. The resort has expressed readiness to buy the product if test results confirmed that they have saved money, says A. Korabovskis. This will be the company's first step: their plan starts from the moment they sell the first finished product, and during the next seven years they want to reach a turnover of EUR 500 million and equip 500 out of approximately 5000 ski resorts with their sensors. The target market of *Snowision Ltd* are ski resorts in Europe, North America, and China, it does not include Latvia. A. Korabovskis says that in North America the society is putting pressure on winter sports recreation providers to reduce water consumption in manufacturing artificial snow. It is important to note that manufacturing of snow is also energy-intensive.

Previously conducted tests were performed at a weather station beyond the Arctic Circle in Finland, which helped refine the prototype.

## Smaller and cheaper

*Snowision Ltd* is one of the companies arising from an international *deep-tech* commercialization platform — *Commercialization Reactor* — based in Latvia. There A. Korabovskis met researchers Alexander Feigin, Alexander Shvetsov, Vitaly Ryskin, Mihail Belikovitch, Dmitry Muhin, and Lev Fedoseev working at the Institute of Applied Physics of the Russian Academy of Sciences in Nizhny Novgorod, who made the sensor. Even though microwave diagnostics are known worldwide, evaluation of snow parameters is a new application type. Furthermore, the newly developed sensor is unique due to its small size, which makes it noticeably cheaper and appealing for the market.

A. Korabovskis says that the technology can be used to develop sensors for measuring atmospheric temperature, ozone levels, and predicting thunderstorms, however «the market potential for all of these applications is small. We carried out market analysis, met people from the industry that attested that if we managed to create a product, ski resorts would be interested in it.» Snow depth can be measured with other methods, the most popular method being a GPS sensor attached to a snow tractor and showing its position above the ground. «It is impossible to calculate snow mass if you only have information on snow depth and do not know snow density — it does not allow to predict the time for the snow to melt,» adds the CEO.

## Believe that you can make it

*Snowision Ltd* is not the first startup of A. Korabovskis. He is interested in forming scientifically-based companies, even though he has not always been successful — three startups





*Snowision Ltd* target market does not include Latvia – in recent years the winters have been poor, we also do not have appropriate high mountains with ski slopes that are dozens and hundreds of kilometres long, admits Aleksejs Korabovskis, CEO and co-founder of *Snowision Ltd*.

quickly ceased their operation. *Snowision Ltd* has been in development for four years, in parallel A. Korabovskis is involved in working on two more new ideas – development of a cheaper OLED technology using lanthanide compounds, and a compact neutron generator (*N-Capture*). The OLED technology is being developed by *Evoled Ltd* who are collaborating with Lomonosov Moscow State University, the Institute of Solid State Physics of University of Latvia, and Fraunhofer Society in Germany, receiving investments of up to EUR 385 000. *Snowision Ltd* have attracted investments amounting to EUR 65 000 from private investors – angel investors and venture capital fund *Imprimatur Capital*. Funding for product development was attracted by joining startup accelerators. At the end of 2017, the company concluded its membership in a startup accelerator led by *Climate-KIC* – a climate knowledge and innovation community. Last year they won the competition in *French Tech Ticket* program, receiving support in developing their product and the opportunity to grow in one of the business incubators in France. Participation in international startup accelerators lets A. Korabovskis compare ideas in Latvian startups to those in other countries. He believes that Latvia has a higher scientific potential, teams have researchers that are as active as entrepreneurs.

### Measuring from above

Continuing to develop the product, the team plans to make their software more user-friendly and build it according to their wishes. To make one sensor cover a wider area, they intend to use drones.

When asked whether he himself enjoyed winter sports during product development at ski resorts, A. Korabovskis admits that he is a beginner skier. He experienced a situation when a potential client grabbed his skis and said – I'll meet you at the foothill. What an adventure that was! ●

### BUSINESS CV

- *Snowision Ltd*
- Established in 2014
- Owners — Aleksejs Korabovskis, Andris Pētersons, Alexander Feigin, Alexander Shvetsov, Vitaly Ryskin, Mihail Belikovitch, Dmitry Muhin, Lev Fedoseev, investors
- Turnover in 2016 — EUR 0

SOURCE: SNOWISION LTD



Unused snow at the end of the season is a waste of money,"

ALEKSEJS KORABOVSKIS,  
CEO AND CO-FOUNDER OF SNOWISION LTD.



# Climate benefitting from business

text / Lāsma Vaivare

Participation of Riga Technical University in Climate-KIC, a knowledge and innovation community at the European Institute of Innovation & Technology enables Latvian students, researchers, experts, and startups develop their business skills, at the same time creating climate innovations

This year *Forbes* magazine's *30 Under 30 Europe* list this year includes six *Climate-KIC* innovators and three innovators supported by *EIT Digital*, a European Institute of Innovation & Technology (EIT) community, reports EIT. Among them you could find, for example, *Pydro*, a company recently established by Mulundu Sichone famous for creating a compact recovery technology that helps determine leaks in water pipe networks.

## Ready to start

At the moment, Latvian green technology business idea authors are invited to join the *Climate-KIC* accelerator carried out by the Design Factory of Riga Technical University (RTU). Last year ten companies joined the program: *Droneplan Ltd*, *CAD-works Ltd*, *Snowision Ltd*, *Earth Pumps Ltd*, *Adia Nanotech Ltd*, *eHarv*, *Alternative Plants Ltd*, *Nivetap Ltd*, *Adaplab Oil & Gas Ltd*, and *AirBoard Ltd*. They belong to diverse sectors of activity, including development of technologies intended for energy production, innovative aircraft technologies etc. During four months of incubation, six out of ten companies «launched their prototypes onto the market for testing or selling,» comments Project Manager Liene Rubina.

According to Raivis Nīkitins, CEO of the newly established company *Adaplab Oil&Gas*, the groundwork had been started before they joined *Climate-KIC*, they had already launched the first software product onto the market and started the acceleration program with the next product — adaptive solutions. Based on the innovative technology *Adaplab Oil & Gas* develop adaptive/self-regulating software solutions for industrial controllers that facilitate efficient control of complex in-

dustrial processes; industrial controllers provide a mechanism that acts as a base for any automated system. R. Nīkitins reveals that «financial support and the help of industry experts and mentors, who assist in finding answers to questions, are essential for developing ideas for all startups. *Climate-KIC* offers both. It provides high-quality mentoring and training sessions, where you also develop your presentation skills. The program also helps better understand your product, business model and clients,» During the acceleration program, the company also managed to find a partner in Latvia: they signed an agreement and started to test their products; moreover, they won over a foreign industrial giant.

In parallel with the *Climate-KIC* accelerator, RTU also carries out the *Climate-KIC* pre-incubation program *Greenhouse*.

Another opportunity to develop your business idea is to join the largest European green business ideas competition *ClimateLaunchpad*: its goal is to support progressive business ideas, helping them grow into global sustainable businesses. At the moment, applications are accepted for participation in the competition. Researchers, students, and entrepreneurs from more than 35 countries submit their ideas for the competition, which is another EIT initiative. Last year, a startup from Kenya won the international competition: their idea was to use waste in creating a mixture of ethanol, cellulose, and water – liquid fuel with the goal to reduce Kenya's dependence on imported petroleum products. At the international competition, Latvia was represented by *Alternative Plants Ltd*, a company that uses plant stem cell in developing active ingredients for cosmetics.

## Leaving the downtrodden path

At the moment, it is possible to apply also for *Pioneers into Practice*, a program of reciprocal learning, which is the leading professional mobility program focused on reducing climate change uniting industry representatives from various industries, small businesses, universities, scientific institutes, government institutions and non-governmental organizations. Climate change innovators, who want to gain an understanding of bioeconomics, basic principles of circular economy, a systematic approach to innovation and obtain hands-on experience in working with leading institutions in Latvia and Europe, as well as businesses that wish to offer internships to leading professionals across Europe can submit an application.

*Climate-KIC* accepted RTU as part of their community at the end of 2016.

## Supported previously

Previously green technology companies could receive support from the Green Technology Incubator. It was a joint project of RTU, University of Latvia, and Industrial Development Corporation of Norway *SIVA* with the aim to provide support and promote entrepreneurship related to innovations in green manufacturing. The joint project was funded by Norway Grants for Green Industry Innovation, which concluded last year. Green Industry Innovation have supported more than 102 projects developing and creating environmentally friendly products and engineering solutions, their total value exceeding EUR 10 million. *Alina Ltd*, an innovative clay additive manufacturer, and *Vizulo Ltd*, LED lighting manufacturer are among the companies that flourished at the Green Technology Incubator. ●

Scientists from the Massachusetts Institute of Technology (MIT) named ten technologies, which achieved a huge breakthrough in 2017. Although some of them are still at the research stage, it is anticipated that these developments will come into our life very soon. Here are six of these technologies

### Self-Driving Trucks

The US is developing a technology that, based on data received from radars, video cameras and laser sensors, would allow trucks to travel on the highway without the help of a driver. Technology developers hope it will dramatically lower freight costs and the number of accidents caused by human error. Although the driver's presence in a truck will be needed in the next 10 years, the developers believe that the technology would allow the driver to do other things or even sleep during a trip. This means that the freight can be in transit without interruptions. The current version of the available technology costs around \$100,000, but the San Francisco-based company *Otto* is working on about 10 times cheaper version.

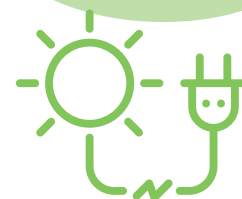


### The Winning Walk of Face-Detecting Systems

Face-detecting technology, which is used both in the service sector and for security purposes, is expanding quickly in China. The system developed at *Face++*, a Chinese start-up valued at roughly a billion dollars, makes it possible to use face as the only authentication tool for money transfer on *Alipay*, which is used by around 120 million people in China. In some restaurants, *Face++* is used as a payment method, and allows addressing clients by name when they enter the door. According to researchers at Peking University, the market of face-detecting technology is huge and its potential – enormous. Face-detecting technologies are also used in paid events at the access control point, as well as for security purposes at entrances to apartment buildings. China is distinguished by its relatively compliant attitude towards surveillance in public places, and is therefore particularly friendly towards the proliferation of these technologies.

### Doubling the Efficiency of Solar Panels

MIT scientists are hoping to double the efficiency of solar panels. The currently used photovoltaic panels are able to capture only visible light, which together with other factors means that they cannot absorb more than 32% of solar energy. MIT scientists have developed the technology that captures all the energy in sunlight by first turning sunlight into heat. As temperatures reach around 1,000 °C, the adjacent emitting layer radiates that energy back out as light, now mostly narrowed to bands that the photovoltaic cells can absorb. Currently, the cost of certain components is relatively high, and it works only in a vacuum.



### Breakthrough of Gene Therapy

Fundamental problems holding back successful use of gene therapy have been solved, and scientists are currently working on gene therapy for 40 to 50 different diseases. The regulator in Europe has already approved gene therapy *Strimvelis* for the treatment of severe congenital immunodeficiency and *Glybera* for the treatment of a disorder that makes fat build up in the bloodstream. Gene therapy for treatment of a progressive form of blindness could soon be introduced in the United States. Although Harvard geneticist George Church has said that someday, everyone may be able to take gene therapy to combat the effects of aging, progress is now being made in the fight against rare diseases, where the guilty gene is clearly identified. In the most common but complex diseases like diabetes, cancer or heart problems, where the agents of the disease may be different, the development of gene therapy will be much more complicated.

### The Nerve Bypass

A remarkable progress has been made at using brain implants to restore the freedom of movement that spinal cord injuries take away. Scientists have succeeded in connecting brain implants that detect signals from neurons with a hundred hair-size probes, and electrodes implanted in muscles that stimulate movement. At the Case Western Reserve University, in Cleveland, scientists implanted such a system into a volunteer that succeeded in restoring movement of his hands and wrists after paralysis. Scientists in a similar way hope to reverse blindness and restore memory lost due to Alzheimer's disease, but for the time being, the progress of the research cannot get out of the laboratory.



### Computers and Robots Learn by Themselves

Unlike the traditional programming, where precise instructions are given, scientists develop systems where computers and robots learn by themselves to solve certain problems. The goal that the robot or its virtual version tries to experimentally solve is defined, for example, if the goal is to win the computer game, then the system learns from situations that prevent the goal from being achieved and, in each subsequent retry, it tries a new way to accomplish the task. Although the simulated machine learning process generates a large amount of data and for the time being such educated devices still do not know how to cope with more complex situations, which consist of several tasks, scientists believe that in the next few years we will encounter virtually trained self-driving vehicles and robots on the streets that will help in everyday activities.



