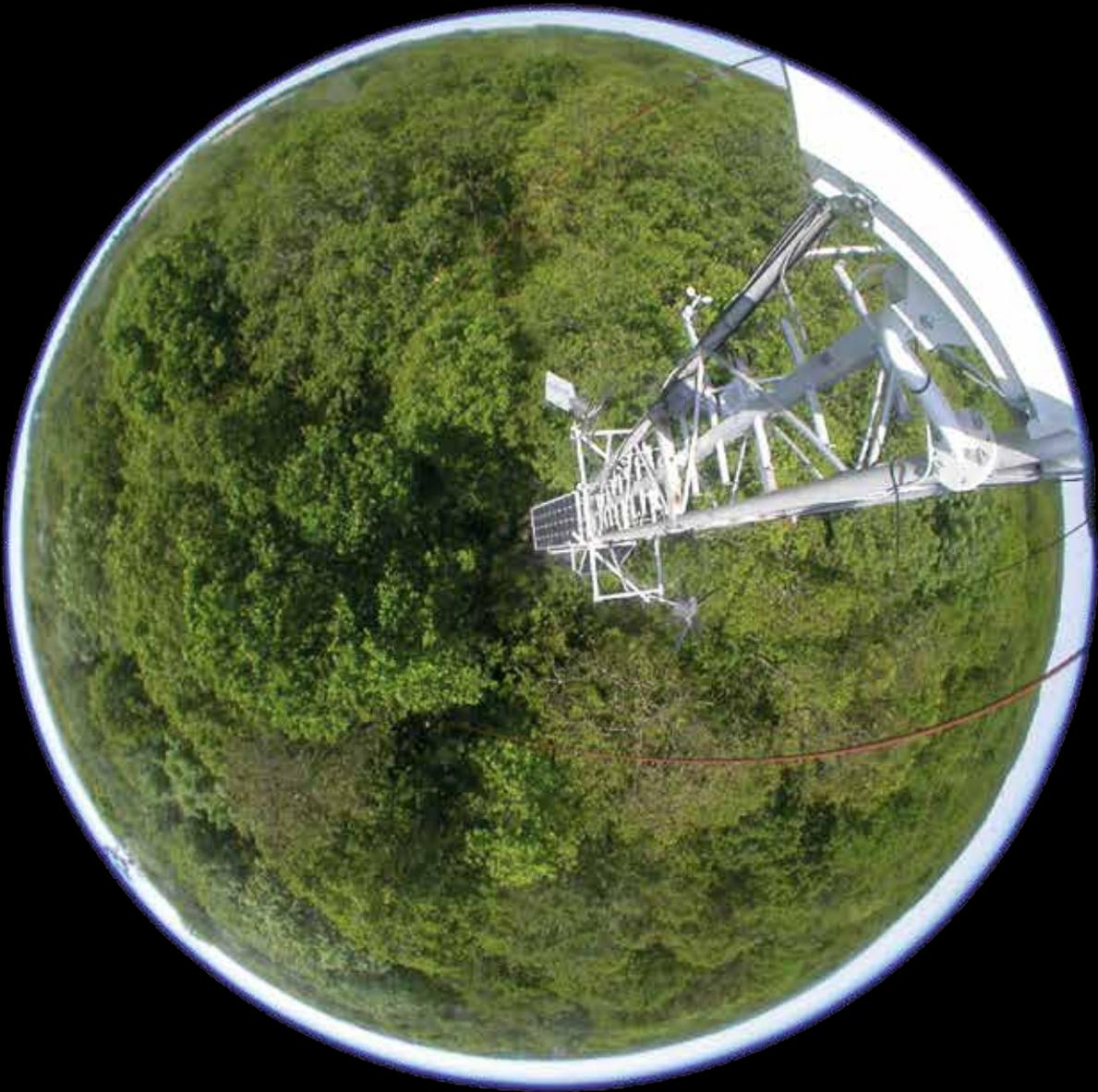


# BIOECONOMY INNOVATION

CommBeBiz Magazine 2016 - 2017



**Preserving the planet as a good place to live**

# BIOECONOMY INNOVATION

CommBeBiz Magazine 2016-2017



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## A knowledge-based shift to a circular economy will change our every days lives

The hope for a more sustainable, resource efficient future rests largely on the bioeconomy. Bioeconomy innovation makes use of our biological resources to create new processes, products and services. This is the entry-point for the 'green' industries and the necessary societal changes on which our future depends. Biobased products will change our everyday lives. By converting agri-waste and biomass into bio-based products such as furniture, textiles, dishes, gadgets, energy, chemicals and even tennis rackets, the six Fs – food, feed, fibres, fuels, flowers and fun – are the essential ingredients for enabling the shift to a circular economy - less fossile-based, greenhouse-gas saving and sustainable.

The future will be shaped by knowledge-based innovation. CommBeBiz, the knowledge transfer and communication initiative, aims at bringing the bioeconomy to business. As such, one of CommBeBiz's tasks is to support EU-funded research projects to make innovative steps in agriculture, food, forestry, marine and various bioindustries. By developing new products, new social initiatives, marketing strategies, processes and organisations, this research provides invaluable contributions to well-being, better health, improved product safety, economic growth and employment. CommBeBiz supports researchers and developers in all phases of their creative processes, ranging from publications, communications training and networking, to expert exchange, testing and coaching for economic and social innovations.

The span of these activities is reflected in this first edition of Bioeconomy Innovation – CommBeBiz Magazine.

**Bioeconomy trends:** This publication covers bioeconomy trends in markets, policy, and research social innovations, which can change our future work and consumption patterns. (see page 4)

**Bioeconomy start-ups:** With pages dedicated to bioeconomy start-ups, the magazine features young bioeconomy entrepreneurs who won a CommBeBiz Award in 2015. The Awards consist of a coaching support package and tailored action plan for the start-ups. The people behind the award-winning and exciting bio-developments are interviewed along with their coaches, in stories focussing on how we will make it to 2030 and beyond. The articles feature groundbreaking innovations, such as novel applications in IT for the agri sector, as well as surprising protein feed products, and energy and water processing techniques emerging from formerly unthinkable methods of waste-conversion. (see page 16)

**Bioeconomy case studies:** Applied bioeconomy research, cutting edge products and eco-technologies are showcased under the chapter 'Bioeconomy Case Studies', which highlights the development and user aspects of EU- funded projects in different fields of the bioeconomy. These case studies from forestry and agri food sectors not only describe the projects' ongoing works and achievements, but also reflect insights of the scientists leading the projects, who pinpoint to the implications of their research for future customers, users and industries. (see page 34)

The objective of all CommBeBiz support actions is to make the bioeconomy visible and tangible, utilising all available paths of knowledge transfer to reach a broader public. The initiative's purpose is to promote a broader understanding of the bioeconomy as one of the key elements for solving today's greatest societal challenges and to maintain the planet as a good place to live. Bioeconomy Innovation – CommBeBiz Magazine 2016 – 2017 aims at getting this message across whilst elucidating and entertaining at the same time.

Yours Sincerely, Sylvia Schreiber, CommBeBiz Media Panel.



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# BIOECONOMY TRENDS

“ Solving the major challenges —  
that`s the real mission ”

Climate change, raw material scarcity, zero-waste, inclusive societies — these are the hot topics where bioeconomy solutions set the trends

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### **UNKNOWN, UNLOVED ?**

A better understanding of the bioeconomy

# I WAS ONCE A PLASTIC BOTTLE



The German sportswear producer adidas, together with the UN initiative 'Parley for the Oceans,' showcased a prototype of a white ocean-waste sneaker with green-stitching at the Paris World Climate Conference COP21 in December 2015. At that time nobody knew when it was going to be possible to purchase the product. In autumn 2016 the first 500 of this line will be delivered to flagship stores worldwide.

The sneaker is composed of green-chemistry yarns and bio-polymer soles, and is produced using a 3D printer. This is the beginning of a branding campaign aimed at spreading the message 'that it is possible to turn ocean plastic into something cool' says Cyrill Gutsch, founder of 'Parley for the Oceans.' The environmental initiative partnered with adidas, a Bavaria-based, stock-exchange-listed firm, so that its global marketing power could push the product forward.

Many textile producers are currently branding eco-fashion as a 'millennials' trend, for those who were born around the turn of this millennium. Marketing experts are targeting this new trend-setting consumer group 'which was raised with the internet and Facebook, using social networks to maximise market transparency and share peer opinions on products,' says Teo Correia, Chief Consultant of Accenture, a global consumer goods and services advocacy firm. The 'millennials' segment tends to favour individual, authentic, sustainable brands 'where the story is right,' Correia explains. This group factors 'good or bad news on a firm's behaviour regarding issues like the environmental impact of production or data privacy, into their purchase decisions.'

Story-selling a 'clean and green' product and the adventures that lead to its creation, is crucial when targeting these rising consumer groups. They may like the stories of tomato stems which create the paper in their notepads, or the fairtrade coffee which has had a long journey from the tropical zones to their cups, but it will be difficult for

**Eco-Fashion:** Sporting goods manufacturers are leading the way for bio-based wearables and gadgets to please the rising consumer group "millennials".

such products to top the story of a champion of African parentage wearing a soccer shoe which was once a plastic bottle littering the ocean. At the Paris COP21 conference, adidas proudly pronounced that, together with the British designer Alexander Taylor, it had created a world first with a shoe made entirely from recycled ocean plastic and nets from an illegal poaching vessel tracked at the coast of West Africa.

### Lightweight, breathable, water-resistant

Marketing experts say that today's bioeconomy is being driven by material innovations combined with an active-lifestyle orientation. Growing numbers of women are drawn to sports fashion. Alongside this trend, new textile technologies are being developed which offer lightweight, more breathable and waterproof fabrics.

According to their spokesperson, adidas is 'using sustainable raw materials such as bio-based materials, polymers and elastomers, to an increasing extent. We use them in combination with synthetic fibres, foam, rubber,

or textile.... What we're talking about is polylactide, bio-based polyamides, bio-based thermoplastic polyurethane and materials such as viscose, Lyocell and Modal. These hybrid materials – a combination of recycled plastics and bio-based components (plastics and/or textiles) – are then used in the production of sports shoes and sportswear. 'If we use biomass, it must come from sustainable sources. That means things like no pesticides, a low water footprint and no competition with food consumption.'

### **Recycling old sports good to new products: re-use the shoe of "Grizou"**

Other sportswear brands like the US firms Nike or Under Armour are turning towards sustainable, clean and biobased materials, too. Nike introduced football shirts which were produced entirely from recycled polyethylene terephthalate (PET). Puma's 'evoSpeed' shirt has a bio-based water-repellent finish combining moisture resistance with breathability.

### **The milk shirt**

Health, degradability and a 'funny story' push the eco-chic fashion sector. A 'milk shirt' made of whey-waste from dairy products, for example, is being produced by the German company, Qmilk. Qmilk, was founded by Anke Domaske, who discovered the process of spinning yarns from milk, when she was looking for non-allergenic fabrics for her father who was suffering from cancer. The tissue

feels like silk, it is non-inflammable and bio-degradable. One of its major advantages is its antibacterial properties.

Other companies involved in eco-fashion are the Dutch fashion brand G-Star which also collaborates with the 'Parley for Oceans' initiative and produces clothing entirely made from oceanic plastic waste. Some of the fashion firms and designers are emphasising the sustainability of the biomass supply chain and have joined the 'Fashion loved by Forest Initiative.' This campaign warns against the irresponsible use of raw materials from forestry.

### **Ten international partners in the HORIZON2020 project 'Sports Infinity'**

Since 2015 adidas, along with nine industrial and academic partners, have cooperated in the HORIZON 2020 innovative action 'Sports Infinity' or 'WRAP' (Waste-Based Rapid Adhesive-free Production of Sports goods). The project is a collaboration of British, Austrian, French and Greek partners all seeking to develop waste-based long-fibre reinforced composites that will enable the automatic production of easily customisable plastic sports goods. The Bavarian manufacturer has already promised to have the ocean waste sneakers produced by robots in a 'Speedfactory' allowing a decentralized manufacturing of personalised goods in the shops – good enough for the individualistic 'millennials.'

“ If we use biomass, it must come from sustainable sources ”

**Adidas x Parley shoes made from recycled ocean plastic waste**



# TO DO WHAT MANKIND ALWAYS DID: CONTROL BIOMASS

## The “Bioeconomy Manifesto” advocates a biobased circular economy

Zero-waste and a real circular economy are building blocks of a sustainable policy agenda. With a “Bioeconomy Manifesto” as holder of the EU Presidency in spring 2016, the Dutch Government vowed for a push in the transition from a fossil-based economy to a biobased economy which could solve major challenges of climate-change, food security, raw material scarcity, jobs and well-being. However, the EU transition would ask annual investments of 5 billion Euro.

**Louise Fresco,**  
President of Wageningen University

“It’s not sufficient any more to simply shout ‘Eureka’ in the lab.

We need a paradigm shift to a bioeconomy doing something together with people”

“With modern photosynthesis we will regain control of biomass”, said Louise Fresco, President of Wageningen University and keynote speaker during the BioEconomy2016 stakeholder conference in Utrecht. According to her “we should have a broader view on processes on this planet”. Each life on earth has started with the sun and the photosynthesis. That’s where the biomass came from. However, the abundance of sun leaves it to plants to build-up biomass slowly and during long-periods. “To raise efficiency of these processes only by 1 percent, we would win a lot,” she pointed out to advocate for optimized photosynthetic processes through new technologies and an optimized use of biomass as cell-factories for proteins in food and feed. The importance of the “blue bioeconomy” providing biomass from oceans is so far unknown and undervalued, Fresco finds. Beside modern photosynthetic processes on land, sea-based biomass will be a rich source for this new kind of integrated producing and consuming.

Flagship projects and pilots, more bioeconomy research and innovation, together with improved teaching on how to better exploit and integrate research results, these are prerequisites for the authors of the “Bioeconomy Manifesto” aiming to kickstart the bioeconomy with making a difference in daily life. “It will be something like creating a complete new ecosystem”, said John Bell, Director Bioeconomy at the European Commission’s Directorate for Research and Innovation, who also urged to speed up the creation of a biobased economy. Bell also pointed to the route for a more successful up-take of biobased products in a circular economy, a paradigm shift in economic cooperation between producers and consumers will be necessary: “It should be an economy working with you, not only an economy doing something with you”, he thinks. The shift to a more integrative thinking and producing is also deemed necessary not to repeat “the mistakes we have done with the old biotechnology”, said President Louise Fresco pinpointing to raising concerns on GMO and biofuels possibly damaging ecosystems. The circular economy, Fresco said, will change everything in our lives such as cars, houses and clothes. And this would be the only way for a sustainable future. But to do things right this time, inclusive economies involving consumers and citizens at an earlier stage of biobased innovations would be the success condition sine qua non.

The “Bioeconomy Manifesto” which was discussed in several workshops during the 4th Bioeconomy Stakeholder Conference in Utrecht April 2016 sets out a roadmap for the development of the bioeconomy. The manifesto puts forward a number of guiding principles and suggests actions that could be “building blocks” for the bioeconomy. It also may influence future EU legislation such as Directives to better handle Zero-Waste and Circular Economy. The renewed Bioeconomy Stakeholders Panel (see hereunder) will develop a final version of the manifesto by the end of 2016.

# WHERE NEXT FOR THE EUROPEAN BIOECONOMY?

**More regional and civil society stakeholders in the new Bioeconomy Panel – Bratislava Conference inspires bioeconomy deployment in Central and Eastern Europe**

If you want to know about the latest thinking in bioeconomy, take a closer look at the topics being discussed by the European Bioeconomy Panel, and the papers this group will issue. The Panel comprises 30 representatives from different policy areas, different business sectors, the scientific community and associated businesses. Selected after a call for applications, the 2016 Panel includes members of active bioeconomy regions, local and regional authorities, farmers and workers' associations, European Technology Platforms, ERA stakeholders and NGOs. This new Panel will put more emphasis on the regional dimension of the bioeconomy, and aims at fostering civil society issues such as public awareness and the incorporation of bioeconomy information into the school curriculum. The Panel's work will focus on topics such as the strategy on the substitution of raw materials, bio-based products, and the circular economy, but also on related issues such as food and nutrition security. It will contribute to the review of the EU Bioeconomy Strategy.

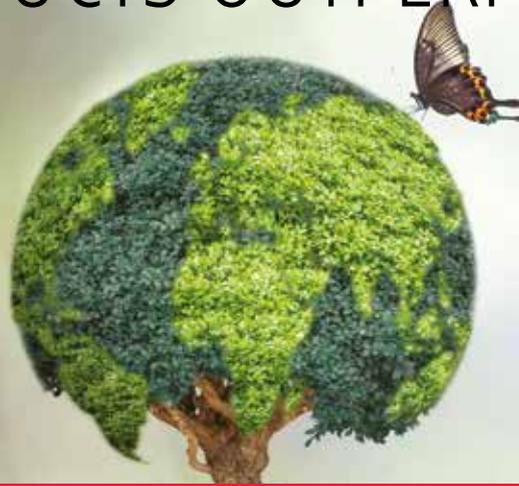
A closer assessment of the bioeconomy potential in Central and Eastern European Countries (CEE) will take place at the Bratislava Bioeconomy Conference on 17 October 2016. It is hoped that this meeting may boost awareness of the opportunities provided by the bioeconomy. The bioeconomic potential for these regions will be outlined in four sessions: agriculture and the food sector; forestry regional biology, inland water and blue growth, and; micro and macro regional approaches in the bioeconomy. Good practice examples of regional development in the bioeconomy, as well as flagship initiatives such as pilot plants and regional demonstration projects, will be showcased during the Bratislava meeting, with an overall goal of inspiring and fostering bioeconomy deployment in regions with a potential for further specialisation in bioeconomics.

The high-level meeting will be held during the Slovakian EU presidency in the second half of 2016. It has been organised by the Slovakian Ministry of Agriculture and Rural Development, the National Agriculture and Food Centre, and the European Commission under the auspices of the Standing Committee of Agricultural Research (SCAR). The conference provides important input for the future orientation of the European Bioeconomy Strategy.

The participants will also discuss how regions can benefit from relevant EU instruments and initiatives that can support regional bioeconomy clusters alongside Horizon 2020, such as the European Structural and Investment Funds (ESIF) and smart specialisation strategies (RIS3). The conference hopes to follow the 4th SCAR Foresight Stakeholder Conference, the 2015 Bioeconomy Investment Summit, the 2015 Global Bioeconomy Summit and the Bioeconomy Utrecht 2016 Conference (see our article: 'Policy Trends: To do what mankind always did – control biomass; The Dutch "Bioeconomy Manifesto advocates a bio-based circular bioeconomy').

For more information on the Bratislava Conference 2016:  
[www.bioeconomybratislava2016.eu](http://www.bioeconomybratislava2016.eu)

# 'SHIFT TO GREEN' - WHEN ALTERNATIVE PRODUCTS OUTPERFORM



**Biobased goods need to be 'sold' to consumers as well as to suppliers of agri-feedstock. This is how the 'BioLinX' initiative works.**

**Modern green products, such as paper made from tomato stems or recyclable bio-plastic packaging, may have a great future in a non-fossil-based economy. However, there is still a long way to go before these bio-based products fill the shops. The support project BioLinX strives to make the advantages known and to help bio-based SMEs to grow.**

Plastic pens made from sugar-beet, shoes with plastic soles made from wood lignin, concrete panels built from aubergine fibres – who could have imagined that the chemical conversion of organic residues or waste could unleash such a cascade of practical consumer goods? Green chemistry makes it a reality: sugars, derived from plants, fibres and wood, are the building blocks for natural polymers, the precursor compound for a myriad of new green products for daily life. A new 'shift to green' label is set to highlight them.

**BiolinX's task is to increase Technology Readiness Level of innovations and decrease the time to market**

Although these new materials may be CO<sub>2</sub> neutral and recyclable, there is still a long way to go before the 'shift

to green' products kick-start mass market penetration. Dennis van der Pas, a Dutch manager from the Green Chemistry Campus in Breda, is well aware of this. As coordinator of the HORIZON 2020-initiative BioLinX, his task is to bring the innovators in the entire value chains together: from feedstock suppliers in forestry or agriculture to the consumer goods producers. 'Often this is more like a fusion of cultures,' says the project coordinator. 'Classic biomass producers in forestry know their own markets best in the furniture or paper industry, for example. But to supply chemistry with their feedstock, this is often completely new for them.' Here the BioLinX platform offers innovation support: networking opportunities, brokerage events, market intelligence, biz-case development and incubation.

**On the road again: How grass waste from tracks is turned into crash barriers on motorways**

Some promising cases can already be seen. In the field of construction materials, for example, there are new building materials based on fibres. An aubergine grower discovered a new process for swiftly extracting the woody fibre from aubergine stems. This fibre can be used as stiffen material in concrete panels for housing. Other examples include using converted sugar-beet as building blocks for fine chemicals, or transforming refined



wood materials into wood-plastic composites for use in the construction sector. A pleasing story also emerges in the Netherlands where grass waste from boundary strips already is transformed into material for crash barriers on motorways.

### **The ‘year of lignin’**

Next year is also referred to as the ‘year of lignin’ which is good news for green chemistry. The wood-cell compound lignin is seen as a ‘blockbuster’ in biomass-based fuel production, while at the same time its sulfonate property acts as a valuable chemical agent in pulp production, dispersants, binders, and complexing and emulsifying agents. A range of EU-level flagship projects are currently being set up to showcase the value of lignin as a resource for boosting product innovations.

By now, many of the most promising cases have reached prototype level. Innovation experts from the bio-based industries know how much effort it takes to bring inventions like these to the markets. It’s not enough just to have a green product. According to the experts, the shift to green requires that these products also outperform and carry an additional value. Before the consumers pay a premium for a green product they need to see some extra benefits; the advantages need to be convincing. More market barriers come in the form of legislation that requires tests which are often based on criteria for conventional products. ‘Instead, the government should act as ‘co-creator’ and make room for experiments, evaluate legislation and stimulate ‘green procurement’ from SMEs’ says BiolinX – coordinator Van der Pas.

Scaling up from prototype to viable product is very capital intense in the chemical industry compared to the IT sector. For an IT product, a couple of hundred thousand euros could fund the development of an end-version, but in the chemistry industry millions of euros are usually required. Investors must therefore take tough decisions and ask for more tests and studies to see a return on their investment.

### **Groundbreaking innovation will emerge from the bioeconomy SME and research**

Given today’s restrictive framework conditions for bio-based mass production, most big firms are still hesitant about spending a lot of capital on large system changes. Incremental innovations, such as the improvements of known products are more likely to come from the classic industries, whereas disruptive innovations could come ‘top down’ from both SMEs as well as research and technology organisations or universities. Denis van der Pas is convinced that groundbreaking innovation will emerge in the bioeconomy: ‘It might happen through a revolutionary bio-based change of material use leading to substantial savings, or in a way that we can produce and use energy much more efficiently, which could be triggered through a novel agent, a new process or a material yet unknown.’ Let’s see which promises the green chemistry will offer us...

# DEALING WITH BIO-TOPICS

A FOCUS ON

# SOCIAL INNOVATION

## Green and blue resources require cooperative approaches

The bioeconomy deals with natural environments and the public benefits of ecoservices. Many agricultural, food, forestry and marine networks have started to focus on social entrepreneurship with a view to creating a circular economy with social economy elements.

The concept is old – for many ages there have been those who choose cooperative solutions for organising their food supply, be it through community gardens or by sharing inexpensive food purchase. Many communities have, for years, been establishing health systems based on mutual support and trust.

This concept is new – novel communication tools are creating new services and products which enable new production networks and new societal distribution models. Collaborative waste collection systems and common internet access to international knowledge is giving rise to new services and jobs. For the bioeconomy, these innovations are shaping a new social economy that combines elements of social inclusion and the circular economy and aims at realising the ‘three Rs’: reduce, reuse, recycle.

While social entrepreneurs start to make money with their new business models, social innovation is marked by prioritising clear social and societal elements over individual profit pursuit. ‘We just push boundaries for social change,’ says Louise Pulford, Director of the social innovation network ‘SIX’ (Social Innovation Exchange).

The bioeconomy deals with natural environments and considers ecoservices in terms of their public good. It benefits the agricultural, food, forestry and marine networks to focus on social entrepreneurship. Biomass from remote farms or urban food waste collected

for recycling, can only be handled in collaborative ways, so creating new solutions for these processes requires social innovation. Social entrepreneurs are seizing the opportunities offered by new concepts in food distribution, waste avoidance, environmental management and crowd funding.

There are several hundred social innovation initiatives currently running across Europe. This is a response to surveys within EU-funded projects such as ‘BENISI’ and ‘SELUSI’, which recognise social innovation as part of European innovation systems.

Operating from London, the SIX mission aims at supporting social innovators to increase their creativity and to speed up their learning processes. The support is based on best practice dissemination and networking. SIX helps social entrepreneurs to structure ideas, raise capacities, scale-up, access government funding opportunities or create partnerships on a regional, national or international level. SIX manages a global ‘hive of nodes’ by collaborating with innovation parks, camps and summer schools on a broad range of topics. ‘More and more government teams, commercial and design consultants and investors are coming in,’ observes Pulford.

Many of these nodes exist in what is known as the ‘digital social innovation,’ ranging from open hardware and software to open access of knowledge and open democracy. The social

bioeconomy started around 20 years ago with food banks and rural-urban foodchains such as the Swedish ‘Södertälje Food Society’. The ‘Food Society’ stands for local sustainable food production chains promoting ‘green diets for clean environments’. The ‘diets for a green planet’ were replicated and adapted in Poland, Lithuania and in Spain through social innovators. Fairtrade food from suppliers of southern countries also belongs to social innovation models.

‘Ethiquable’ is a social-eco fairtrade chain dealing with more than 100 products sold in supermarkets in France, Benelux countries and Scandinavia. Belgian branch Sales Manager, Stephen Vincent, explains the social aspects: ‘To pay fair prices to suppliers and to focus on environmentally friendly production of southern natural products is one side of the coin. The other side is to care for fair working conditions on the plants.’ According to him, the environmental and the social goals are not always easy to fulfill while competing with conventional sales. Vincent knows that ‘telling a fair story is key for conscious consumers.’

Blue topics are an increasing focus for the social innovation scene. ‘Valuing the Oceans’ is the name of a social initiative that works with a network of labs (‘CoLABoration’), NGOs and businesses towards better global management of oceans and to place an economic value on the marine ecosystem services for human wellbeing. Another initiative, ‘Public Lab’, supports citizens to measure and to better understand their environment by collecting data on pollution, noise, air and water quality. The initiative aims at providing community learning with a view to empowering citizens to investigate and to raise environmental political concerns of their own.

Preventing cigarette butts from littering beaches was the initial goal of the Portugal-based ‘Green Smokers’ Alliance’, which encourages tourists and beach visitors to collect butts in small bins offered to them. The Alliance was soon using tons of collected butts as feedstock for plastic materials. Manager and founder, Miguel Faria, says, ‘We started with nature preservation, now we are looking for existing technologies and viable business models.’ ‘It’s all about people, peers and connections,’ adds Pulford.

“ It’s all about people,  
peers and connections ”

# STRIKING A CHORD WITH YOUR SCIENCE: THE POWER OF PHOTOGRAPHY

**Áine Regan**, a postdoc researcher with Teagasc, discusses the value of using images to promote and explain research.

Photos evoke emotions in a way that doesn't always happen when we read words alone. The well-known adage that 'a picture paints a thousand words' is well known for a good reason – a single image can be infinitely more powerful than any thesis written. Regardless of how many times I've seen them, I never fail to be intrigued when an online article pops up listing iconic photos which have so powerfully influenced the world's perception of events. A well-taken photo has a way of drawing us in.

In science, imagery has always had an important place. From Leonardo Da Vinci's early drawings of human anatomy to the first x-ray image (the hand of the wife of Physicist Wilhelm Conrad Röntgen), images have always played an important role in illuminating the amazing feats of which science is capable. There are many examples, but a stand-out image for me is one taken in 1995 by the Hubble Space Telescope. 'Pillars of Creation' shows stars forming in the Eagle Nebula and it's arguably one of the most famous images Hubble has captured – not only for its scientific impact, but also for its visual impact.

## Researchers need to make their science interesting and relevant – Science communication has become more visual in recent years

But why are talking about photos and science? What direct relevance does this have for us researchers? We all know that research funding has become increasingly competitive and funders are demanding more return for their money. Most research proposals now require evidence of planned outreach and engagement with the public. Although we refer to the 'public' in the singular, it is in fact made up of a diverse collection of individuals: it includes scientists and non-scientists, shopkeepers and politicians, students and CEOs. There's one common trait that does apply though – people need to first be interested in order to engage.

It's no longer enough to just translate your scientific publication into a press release; we now need to make our science interesting and relevant. In an era of Instagram, Twitter and Facebook, a scientist can very quickly find themselves at the back of the bus trying to talk to the bus-driver – except there's a mass of people in between them posting selfies, shouting out statements of precisely 140 characters in length, and dropping emojis.

So how do we get attention for our research? From infographics through to choreographed dances, science communication techniques have become more creative and more visual in recent years. Science needs to strike a chord with your audience – capturing a powerful image of your research which tells an interesting story can help do this. All of us are capable of taking a picture, and visually documenting our research process might just turn out to be a very fruitful and rewarding experience!. Regardless of the technique used or the content captured, all research images have the promise to present science in a new and interesting light. A research image doesn't have to represent an earth-shattering, eureka moment to be effective, but of course it helps if it's visually appealing. Well-known for show-casing striking images, the National Geographic offers some useful tips on taking good photos.

At the recent SCI:COM 2015 Conference held in Athlone, Ireland, it was interesting to hear the description of science communication as both a science and an art; this is definitely the case for communicating science through images. The art is obvious in the beauty of a well-taken image. The science is well established at this stage too – studies on visual information processing have time and again shown that people respond substantially better to visual information than plain text. Regardless of whether it's your granny or a government official, everyone is initially interested when they see a catchy image. A childhood wonder takes over when we encounter new and colourful images; we want to find out more about the story of the picture. Just remember, the photo can help pique interest, but the science still needs to be solid for that interest to develop into a meaningful impact!

Get snapping and good luck!

# UNKNOWN, UNLOVED?

**A survey reveals: the term “bioeconomy” is not always well understood by society. Science journalist Senne Starckx finds a better way to explain it to the public on his blog.**

I admit. When I hear the term ‘bioeconomy’, I automatically think of biofuels – fuels like ethanol and diesel that are not produced from oil but from entire crops or agricultural waste. Those are indeed part of the bioeconomy, although the term covers a much wider field than energy production alone.

One could say that the bioeconomy comprises those parts of the economy that use renewable biological resources from land and sea – crops, forests, fish, animals and micro-organisms – to produce food, materials and, yes, energy.

The fact although that the term is not so well understood by society – and even among experts – is probably a mere consequence of the lack of a real definition of or agreement about what actually is the bioeconomy. And that is in return a consequence of the numerous scientific disciplines that come together in the bioeconomy: plant biology, microbiology, entomology, forestry, genetics, physics, engineering, marine science... Name a discipline and there’s a connection with the bioeconomy. And although scientists accept that they are working under the umbrella of the bioeconomy, they all have their own interests and ideas and put their own accents.

## **Bioeconomy – an important “zero-waste” concept**

According to Stefan Schuurmans Stekhoven, an advisor at the Dutch Agentschap NL specialized in biodiversity, chain efficiency and ‘green deals’, activities in the bioeconomy are very often connected with sustainability. Schuurmans was part of an expert meeting organized by CommBeBiz on communicative aspects of the bioeconomy, held in Utrecht on 11 April 2016. ‘But there are indeed parts of the bioeconomy that are not sustainable at all’, he says. For Schuurmans personally, the bioeconomy deals with the challenge of getting more out of plants, so that less or even no waste is produced and more bio-based materials are used.

This ‘zero waste’ concept is an important aspect of the bioeconomy, thinks Suzy Renckens, who works for the Bio-Based Industries Consortium. ‘I regard the bioeconomy as a form of circular economy, where no waste is produced and everything is reused.’ Renckens likes to add that the bioeconomy is also inherently fossil-free. ‘In the bioeconomy we’re shifting away from petroleum-based production.’

That the term ‘bioeconomy’ is not at all or only poorly understood, seems clear after a recent CommBeBiz survey among scientists, industry representatives, policy players and other stakeholders. The survey was held online from mid-February until the end of March 2016. The main result from the survey is that the active perception, awareness of and knowledge about the bioeconomy to the broader society cannot be taken for granted. This is even the case among experts, as one out of ten respondents connected the bioeconomy with the clearly wrong answer ‘organic products and markets’, or just replied ‘don’t know’.

The questionnaire also showed a still negative perception concerning GMO’s – you could say this is the term to avoid when talking about the bioeconomy – whereas themes such as biofuels, functional foods and ecological balance were perceived more positively.

So how to inform the broader public better and demonstrate the relevance and usefulness of the bioeconomy to the individual consumer, and its impact on society and the overall economy? One way is to merge the common information channels (popular media, NGO’s) with sources that enjoy great credibility, like expert media, public authorities, research institutions, etc. (this is also a result from the CommBeBiz survey).

That merger won’t be easy, as the survey indicates a real perception gap. Another sad results from the survey: we journalists seem to enjoy a rather low credibility, however on the other hand we seen as most relevant to spread understandable bioeconomy knowledge to a wider outreach. How can we escape from this Catch-22?



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# **BIOECONOMY START-UPS**

“ Start-ups are on their journey from innovation to reality ”

CommBeBiz Award winners receive intense coaching. The testimonials tell the stories of the people behind the excellent bio developments as well as the stories of their coaches.

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# DISCOVER THE EXCITING CONSUMER QUESTIONS

2016-2017 | COMMBIBIZ MAGAZINE



## VIZZATA

offers a survey platform for consumer  
dialogue and open innovation

### Award Winner Interview with **Usha Sarma**, *Business Development Manager*

#### How would you describe the VIZZATA product concept?

**Usha Sarma:** With Vizzata we can survey consumer opinions on products, services and policies. It is an online-survey tool, and the real novelty is: Consumers and stakeholders, like patients and carers, are enabled to relate not only their experiences with a product or a treatment, but to stay 'on board' by giving constant feedback. The online platform allows to capture the ideas and questions the target audience has and to start a dialogue. We actually offer more of a conversation tool than a conventional online survey. This adds value to an open innovation process.

## What does the new survey platform look like ?

**Usha Sarma:** We work with text, images, audio or video. These chunks of information are offered to the respondents and they are given the opportunity to make comments on these info-bits and ask questions. Placing particular value on the questions that respondents have is an important and novel function to online survey methodology. This often offers new perspectives that the survey designer had not even thought about.

## Who will pay for the development?

**Usha Sarma:** The list of possible beneficiaries is growing, we have corporate clients in a number of sectors including fast-moving consumer goods - the so-called F.M.C.G. Interested parties also come from healthcare and medical technology, charities, government bodies and research funders. Some of these potential clients have already commissioned studies with great success. By capturing stakeholder and consumer responses to new developments paying clients can see, in an iterative process and early on, whether there is acceptance and demand for a product, process or policy. This means that the development can incorporate the end-user's input, saving time and money.

## Are there also benefits to the survey participants ?

**Usha Sarma:** The VIZZATA platform allows consumers to see their influence and immediate results of their comments. This means that the participants of the survey are assured that their individual opinion is heard. Allowing participants to contribute in their own space online, individuals of all abilities can be enfranchised. This includes for instance participants who are hearing impaired or those with limited mobility. Some IT knowledge and online access is required, but study leaders can design studies such that this can be accommodated. The VIZZATA platform can also be used as a basic decision tool to more precisely identify focus groups to work with at a later stage.

## Can Vizzata support communication campaigns ?

**Usha Sama:** Of course, it is the right instrument to test and refine communication materials – early feedback from members of the target audience can be collected before a communication manager creates a buzz in an awareness-raising campaign, for example

## How do you raise the audience?

**Usha Sarma:** VIZZATA has a wide variety of usefull areas. Among the first areas of use was in food safety where we learnt from consumer networks being information seekers in emergency cases. Working with consumer networks, the VIZZATA concept can be adapted to any industry where disaster avoidance, mitigation and reputational risk occurs. Another application is patient research involved in the development of new therapies and health care. Here we hope to build a network of patient and stakeholder groups around various conditions. We are currently exploring hearing loss, arthritis and breast cancer, but this is only the beginning. We hope to add more patient advocacy groups to this.

## What is the biggest challenge?

**Usha Sarma:** There are a number of opportunities and options to have VIZZATA participate in research or in a product development process. In many cases pilot work and project proposals are a good way to include proposed VIZZATA studies. To enable this, we are considering sector-based business development support, as each area – food, healthcare, FMCGs and so on – benefits from individuals with sector knowledge and contacts. However, to fund this a solid financial footing is needed. We hope that widening adoption will entail commercial success and company growth that will mean more manpower to spread and establish VIZZATA studies as a “go-to” platform for stakeholder engagement.

## What are your plans to grow the business?

**Usha Sarma:** It might be an option to join a larger opinion-research firm where VIZZATA technology would be a feature on a dashboard. However, VIZZATA will always want to maintain the option of a stand-alone survey tool for our clients. We are exploring a focus on business development but also possible investment if the partner has an understanding of the business, timelines and its long-term potential.

## That's where the CommBeBiz coaching is coming in?

**Usha Sarma:** Exactly. Together with the Hungarian EBN coach who specialises in agro-ICT we are exploring possible business-plan models We also expect to identify and explore novel sectors which we may not have considered to date. Sector expertise and growth are the elements we would like to explore with the mentor

## Do you already see fields where VIZZATA technology could generate income ?

**Usha Sarma:** In health and food we can see already very promising areas. These are licensing and project related VIZZATA studies. We also are establishing relevant stakeholder groups in the health and food sectors as an audience to offer for consumer research. We already see paying customers ranging from government agencies, those funding research and commercial clients.

## Will the technology also see future generations of survey tools?

**Usha Sarma:** Our value definitely lies in collaboration: there are a number of interesting people who have expressed an interest in early trials or pilot demos. VIZZATA is an elegant tool that allows grass-roots views to be heard by ‘the powers that be’ by presenting individual opinions in a clear and useable format. We are pleased that an EU-funded project, which allowed us to develop the online-platform, will have a future impact on research and translation as well as on economic growth and societal change in Europe.

**Thank you for taking the time to respond !**

# INTERNET-OF-THINGS CONNECTS FARMERS AND CLOUDS

## INSYLO:

A smart device allows silos to be controlled from the beach

The smart-agri innovator Jaume Gelada, 48, is set to revolutionise the farming sector. A solar-powered sensor device could soon enable farmers to remote-control thousands of agri-silos where animal feed is stored. At the moment, the farmer has to climb up a ladder and check the state of stock container by container – a time-consuming, cumbersome job. The internet-connected INSYLO gadget automatically measures, and allows farmers to control their stock online, offering data tracking as well as huge savings in logistics and labor. ‘Actually a farmer can control his silos by smart phone from a Caribbean beach,’ jokes Jaume Gelada. UBIKWA, the name of Gelada’s innovative firm, has won a CommBeBiz 2015 coaching award for this development.

Gelada, who has already founded several start-ups, is now CEO and co-owner of UBIKWA firm. The idea for the new INSYLO device came to him when working with his former company where the computer specialist spent several years inventing technology to optimise logistic routing for feed suppliers in livestock-breeding regions. With more and more clients asking for data-based control solutions to optimise their feedstock supply chain at affordable costs, the entrepreneur was inspired to create a solar-powered device that can perform automated on-site controls of feedstock quantities and qualities within the silos. Once installed on the roof of the silo, the device checks the stocks, collects data and sends them to the network, offering the basis for optimised farm management. The full connected internet-of-things philosophy brings an added bonus: with a plug-in-gadget, installed in five minutes, silos can be linked between them, forming an extended mesh network and allowing Internet connection in zones with poor or none coverage.

### On-silo sensors can send data without being connected to electricity power networks due to new internet standards

Communication software transmits data and stores them in the cloud for further analysis and management. ‘With decentralised and smart-sensor technology we can offer full vertical solutions to our future customers,’ says the UBIKWA-CEO. To date, the technology has been developed for animal feed silage, but INSYLO has already attracted the interest of other customers asking for the

technology to be adapted for other commodities. The full scope of the market is still waiting to be discovered.

Here, the CommBeBiz coaching prize comes in: it will help Jaume and his team to analyse the international outreach. ‘We will benefit from the EBN-mentors’ experience, and from the European Business Centre’s networks, to bring new contacts to our company on the international field.’ The start-up’s goal is to expand employees and sales in the years to come, from the current nine employees to 250 people in 2020, operating first in Spain and the EU but expanding to USA, Brazil and China.

### Data can be sent without connection to a power grid

Many portable devices linked with a grid could cover huge agricultural areas such as those found in South and North America. Due to the new “6LowPAN”-internet standard, on-silo sensors can send data to the internet without being connected to electricity power networks. This would cost 50% less than traditional technologies. According to the CEO’s estimations, one sensor would cost under 450 euros, and optional fees for software and services would be added. The optimised logistic cycles provided by smart-agri technologies would benefit the operations of larger feed- and supply chains.

A roll-out of INSYLO devices is planned for 2016, with an estimation of 600 devices for the Spanish market, where initial paying customers have already been acquired. The strategy for the years to come is to realise more contracts and improved manufacturing and marketing. For the moment, INSYLO organises its own distribution. However, for a larger customer base the company would need distributors and service providers elsewhere. ‘Our philosophy is proximity to the customer,’ says Gelada, ‘we want to guarantee a replacement of the device within 48 hours.’ To build up distribution-nets in different countries and to grow, the key is a well planned internationalisation strategy. Award winner Jaume Gelada expects to learn how to achieve this from the CommBeBiz-supported business coaching with European Business Network (EBN) mentors, and from the access it provides to a plethora of European platforms that will supply the right relationships – and fresh growth money ■

# Pesticide Control in a BOX



Better food safety through  
**FOODSCAN biosensors**

It looks like a suitcase. Inside the hard box are little bottles, Petri dishes containing test cultures, a rack of dropping glasses, sensors and electronics in a unique test device. In fewer than three minutes this set of biosensor-based technologies is able to check if a food sample is contaminated or free from pesticide residues. This portable technology, known as 'FOODSCAN', benefits food manufacturers and consumers alike. FOODSCAN was awarded the CommBeBiz coaching grant in 2015 for its novel bioelectronics approach and well-structured business plan. 'We are looking forward to the new solutions and contacts, the coaches from the European Business Network will lead us to,' says manager Janos Petrusan.

Petrusan, 38, is Head of Research Coordination and Product Management at IGV Ltd., an applied research-based food process and lab-analysis company near Berlin. He is convinced that the FOODSCAN device will meet a real market need. 'We already see a lot of requests from food and feed importers, from inspectors at ports and food markets and even from the tobacco industry,' says Petrusan. Each week potential clients from as far as the USA pre-order between 100 and 1,000 devices.

However the food chemist originally from Romania, and his colleagues from the consortium of the EU-funded FOODSCAN project want to sign off on the technology while finalising the necessary certification procedures, before they roll-out the product to market.

The detection technology proposed by FOODSCAN is primarily based on the bioelectric recognition (BERATM-technology) of several groups of harmful substances that come with pesticide-treated fruit and vegetables, such as organophosphate, carbamate and pyrethroid pesticides.

To receive results in real-time, the food, but also cork and wine samples are combined with sensitive antibody cultures. If the samples are

contaminated, the test cultures will develop antibodies as a reaction. Next, the biosensor in the test-box analyses the type and number of these antibodies, and electronics translate the bio-data into easy-to-read test results displayed on the device.

## The basic biosensor technology was discovered in Athens

The basic technology was first discovered at the Agricultural University of Athens where the core patents are held by Prof. Spyridon Kintzios. A consortium of SMEs, such as IGV, a bakery manufacturer, wine and cork producers, different analysis laboratories, and instrument developers have further elaborated on prototyping and designing the test device. They now hold the constructive patents rights.

Together they have the right to exploit and to further develop the technology. According to Petrusan, who is the exploitation manager of the EU-funded project with the acronym FOODSCAN, the early adopters will include inspectors, labs, and manufacturers of fruit and vegetable products, as well as importers from Asia in the wine industry. 'There have been many issues with pesticide-contaminated corks,' Petrusan confirms, 'before a wine-bottler buys corks in bulk, he can check the compounds with our portable device.'

## FOODSCAN is not interested in buyers, but in new partners

Portable test-kits already on the market cost between 8,000 and 60,000 euros. The FOODSCAN box will be available at a much lower price. This prospect of ensuring better food safety at affordable prices is raising more and more interest from a wide range of clients, but for the moment, Petrusan has to dampen their hopes. He estimates that a validated and certified FOODSCAN detector will not be fully marketable for another two years. 'We are already at Technology Level 9,' he says, 'which means that it works. But there are still many steps

to go before we are market-ready.'

FOODSCAN intends to broaden the control portfolio so that mycotoxins can be checked as well as pesticides. To further develop the scope of the product, the consortium has submitted a proposal to the EU Fast Track to Innovation. Markets at ports and sales-points of imported commodities

These improvements will expand the client group and include companies working in large markets in fruit trading, ports, the sales-points of imported commodities. Already, Asian raw material buyers for agricultural and industrial food manufacturing, but also almond and pistachio exporters have expressed an interest.

The certification stage still needs to be completed. This means that the device has to comply with various industrial standards (e.g. HACCP standard), Ring-trials at different labs need to be finalised, and the system validation needs to be endorsed by experts.

## Take the idea to an entrepreneurial world

Finally a spin-out for sales and marketing should be developed and hardware manufacturers will be contracted for a scaling-up. Last, but not least, investment needs to be raised for growth. 'We are not interested in buyers,' Petrusan says, 'just in new partners.'

In the meantime, the chemist and FOODSCAN manager will not only finalise his PhD studies in food chemistry, but expects to benefit from the CommBeBiz coaching. He is looking forward to be mentored by a coach from the European Business Network (EBN), who will take the idea to an entrepreneurial world that he cannot access on his own. Petrusan says: 'The EBN coaching is good because we are staying tuned-in. We expect some interesting. During coaching, an action plan will be drawn up to develop a framework for certifications, new links to certification bodies, experts, and international partners. ■

# GRASS GROWS ON ITS OWN: BEEF FARMERS HARVEST ENERGY

2016-2017 | COMMBeBiz MAGAZINE



Irish grasslands-a  
resource for biogas

Himanshu, an energy researcher working in Ireland, is thinking about the big leap. The 32-year-old expert, originally from India, is currently elaborating a software tool for biogas farming which will facilitate beef farmers' decisions to become energy harvesters. The tool enables them to calculate the profitability of installing plants to deliver electric power by converting fermented grass to biogas on their land. An innovation prize Himanshu won at a competition with the EU-funded project 'CommBeBiz' in 2015 will help him to step up soon. For his excellent software idea for in the field of bioeconomy, Himanshu has been granted tailor-made business coaching from the Irish Business and Incubation Centre (BIC) in Waterford. The young entrepreneur will work with the BIC-business developers to create an individual action plan to take him from concept to 'investor readiness'.

The cliché 'one size fits all' is not a good fit for the bioenergy field. Biogas plants, which currently come as add-ons for farms that generate surplus feedstock such as maize, straw, slurry, grass or other organic waste, contribute to lower greenhouse gas emissions compared with fossil fuels because the organic waste allows CO<sub>2</sub>-neutral energy production. Yet, types of feedstock and their energy content vary from country to country, as do waste collection systems and infrastructures. These factors create different settings and result in considerable variance in the basic data for biogas plants. Himanshu is currently modelling a specific scheme of algorithms to suit Irish conditions with plenty of grassland and slurry.

The researcher is convinced that his agri-software will not only make a difference to individuals, but will also help smaller farmers to scale-up by joining forces: 'Our software will also allow calculations for a group of farms to start bigger plants in a cooperative.' The scaling-up could help to establish a more efficient

circular economy where waste on bigger scales is converted into energy and money. Himanshu's specific cost calculation software, allowing farmers to see the particular input and output scenarios of a planned installation, should enable them to take the appropriate investment decisions.

Big biogas countries like Germany or the Netherlands already have calculation tools like this, but Ireland does not. Software tailored for specific Irish agricultural conditions would be a novelty on the market. 'We try to bring something new to the Irish beef farmers,' says Himanshu. So far there is no biogas software tool for grass and slurry, the main by-products of beef production and potential feedstock for bioenergy. Himanshu's arguments are convincing: 'The best individual benefits of biogas plants are savings in time and labor,' he points out, 'because the grass grows on its own.'

There is still a long way to go. The software development must also cover different combinations of feedstock depending on seasonal supply. In winter, for example, slurry fertiliser might not be brought to the field, instead it could go into biogas fermentation. In summer, a surplus of grass results in a different composition in the plant's output. The tool should have the ability to calculate a consistent full-year supply chain.

**Still many research questions: How to make different types of feedstock, varying infrastructures and workflows on farms suitable for biogas plants**

The young entrepreneur, who wants to finish his PhD before funding a start-up, is convinced that his product would deliver the best pay-off for farm cooperatives. The 'future clients' could include individual harvesters, as well as agencies or companies that supply feed. Finally, the biggest boost for biogas in Ireland

would come from the government, if it makes up its mind to publicly fund biogas plants as Germany and the Netherlands have done. It was during his involvement as part of the research team on the EU-funded project ATBEST that the inspiration came to Himanshu. 'My idea for the tool came up spontaneously,' he says. In the project scientists and energy experts from four countries are investigating different aspects of biogas, such as improving competitiveness and increasing the sustainability of the biogas industry in Europe. For his PhD thesis, Himanshu is investigating how workflows on beef farms can be made suitable for biogas procedures. The data gained from this research will feed into his calculation software. He works for the Irish food and agriculture agency Teagasc, which could provide a business model for his tool.

Other commercialisation routes for the calculation tool are foreseeable. To identify them, the award-winning bioeconomy researcher very much welcomes the coaching offered by the BIC as part of a pan-European business developers' platform, the European Business Network (EBN). For Himanshu's individual action plan to be set up in association with the coaching network, the first step will be to develop a business model identifying different customers and channels. Based on this, an analysis of strengths and weaknesses will be done, followed by market

and investor research, including prize schemes and a plan for promotional actions. Himanshu concludes: 'The CommBeBiz coaching will be very important for my personal development. It offers knowhow and will enable me to realise my business ideas step by step. And I have plenty of new ideas.' The young entrepreneur is already thinking of the next big steps: expanding, with new ideas, to other EU markets as well as to India, the USA and China.



Agri-software ATBEST becomes  
'investor ready' through coaching

# HOW TO **FEED** THE WORLD?



2016-2017 | COMMBE Biz MAGAZINE

DEALING WITH  
INSECT PROTEINS,  
**PROteINSECT**  
offers new perspectives to investors

## Award Winner Interview with **Edward Barnes**, *scientist*

Many studies predict that the planet's population will grow from its current seven billion, to ten billion people by the year 2050. Along with this will come a growing 'protein hunger', generated by emerging countries with fast-growing middle classes in the southern hemisphere in Asia, South America and Africa. To meet these needs in a sustainable way, unconventional routes have to be taken. Part of the solution could lie in insect protein that stems from specifically reared and rendered fly larvae, which can be used as a feed ingredient in farmed fish, poultry and pig diets; the protein source for humans. According to the environmental scientist Edward Barnes, 37, senior manager at the UK-based Minerva Communications Ltd., it could be a very promising method: 'Proteins from fly larvae have the potential to deliver high-value feed for animals and help to alleviate Europe's dependency on imported soy and fishmeal', the researcher says. As a project manager in the EU funded 'PROteINSECT' project he won one of the 2015 CommBeBiz Awards, and will be coached by the Portuguese experts from the Business and Innovation Centres (BICs), specialising in Bioeconomy.

## What is the baseline story behind PROteINSECT?

**Edward Barnes:** It's a story of circular economy. The project is looking at fly larvae as a protein source for animal feed. It investigates how these larvae can be best reared in large quantities on organic wastes such as manures that come from intensive agriculture. At the same time the low-value waste can be reprocessed and re-used in the agriculture as a soil improver. So, the circle closes.

## How can fly larvae be protein suppliers?

**Edward Barnes:** Research found that the fly larvae show an amino acid profile that constitutes a high value protein. The larval protein is comparable to fish meal protein that is still fed to husbandry animals in huge amounts. Globally, one-third of caught fish still goes to animal feed. If agriculture and fisheries are to close the predicted 'protein gap' by 2050, it is preferable that fish stock is protected in order to safeguard the population, and that caught fish go directly for human consumption.

## What does this research have to do with future business?

**Edward Barnes:** Insect protein could provide a viable alternative for fish meal in animal feed at significant concentrations. This could be very interesting for Asian, Caribbean and Pacific countries, for China, as well as for the EU market. In Africa the action 'Fish for Africa', together with its leading economic institute in Mali as project partners are very interested in further developing small scale breeding and rearing methods benefiting African poultry production and aquaculture such as the tilapia fish production. In Europe industrial scale insect meal or processed protein could also be used in pig and poultry production and aquaculture applications such as salmon farming. Additional benefits could be achieved through the selling the insect-based by-products such as insect oils and chitin. To insects on their plates, people often say 'Yuck!...

## Who would the future customers be?

**Edward Barnes:** Key opinion leaders come from EU-feed manufacturers striving for a lesser dependency on imported soya and fishmeal. Other client bases are veterinary research, agri-food and pet-food manufacturing, and supermarket chains that want to be among the early adopters. The insect meals are already sold on Chinese markets and as pet and wild bird food in Europe.

## What added value does PROteINSECT bring to interested stakeholders?

**Edward Barnes:** The basic idea is to improve the state-of-the-art insect protein generation. The project is led by the scientist and entomologist Elaine Fitches, who works for FERA Science Ltd, in York. They have brought together 12 partners from different countries. Now they are looking to optimise larval rearing methods on organic wastes in different countries including Africa, China and Europe. They are running feeding trials with crude and refined insect meals and case studies globally as well evaluating by-products for use as fertilisers as an alternative approach to waste management. PROteINSECT has also conducted analysis of the quality of insect meal and extensive safety screening providing evidence to the European Food Safety Agency (EFSA) for the risk assessment of the use of insects in animal feed..

## Where are the main hurdles?

**Edward Barnes:** It's the EU-legislation. Remember the BSE-crises – mad cow disease – which triggered the principle 'no animal feed to animals'? Insects were not included when this basic principle was galvanised into the EU feeding-regulations. PROteINSECT is therefore working with the EU Commission and the EFSA, having made a full assessment of the required legislative changes, to provide state of the art evidence to support the required risk assessments for potential legislative change. One principle will remain: Once insect feed is allowed, it will not go to vegan ruminants, only to those animals that naturally eat insects such as fish, chicken or pigs.

## Envisioning insects on their plates, people often say 'how disgusting', or simply 'Yuck!...

**Edward Barnes:** PROteINSECT is mainly concerned with insects for animal feed, not for human consumption. But one should not forget that in many third-world countries insects belong to the daily menu, i.e. in parts of Africa or Asia. In the Netherlands or in Belgium some types, i.e. meal worms, are allowed for sale for human consumption. You can buy them in the supermarkets there. In the EU a 'novel food regulation' is underway, which intends to enlarge human applications. And there is already a 'grey' market for insect protein powder in high-energy bars or in special products for athletes. The 'yuck-factor' is fading.

## Who would benefit most, if insect-based nutrition becomes a daily-life phenomenon?

**Edward Barnes:** For pet food, which is not subject to the same legislation, the production is already gaining momentum in Europe. Farmers will benefit most, when they can establish factory-like plants rendering the source material for the insects in automatic processes, coming from plant waste and manure generated by the intense agriculture, adjacent to their farms. The farmers going for this add-on could rear the insects, dry them in drying chambers and sometimes even extract the proteins. By doing so they can become high-end producers. It could offer them a good income.

## Any environmental benefits?

**Edward Barnes:** It's land saving. To produce a kilogram of insect protein contributes to the reduction of land use by 200% compared to the land-use needed for the production of a kilogram of beef protein. In addition, the manure left will be a valuable fertiliser for soils.

## What does the protein end-product look like?

**Edward Barnes:** Like animal feed looks today, pellets or flours. For ingredients in bars it would come as a powder. We are working on a future-demand concept.

## What can a research project expect from the BIC mentoring?

**Edward Barnes:** PROteINSECT has come to its last phase. We are pulling together a core document for capital investment purposes. The mentor should help us to convince, and to gain, capital investors.

## What next steps are to be taken for the future of insect feed ?

**Edward Barnes:** There are a lot steps still to climb. A new engineering design is needed to reduce energy and labour intensiveness and to refine protein extraction methods. The project took the state-of-the-art further. Agri-protein producers and traders now have to step in. And the best is yet to come: latest consumer perception surveys showed that 80% of the respondents were very much 'pro' insect feed. We are quite optimistic about raising more projects and the money to do so from investors soon.

## Thank you very much for taking time for the interview.

# RECYCLED WASTEWATER MAKES CROPS FLOURISH

**'Treat & Use'** engineering technology supports dry agri-regions

When agri-chemist **Antonia Lorenzo**, 43, founded her company 'Bioazul' in 2003 her priority was to find water engineering solutions for urban and industrial services. Her firm deals with different areas related to water and environment ranging from technology development to marketing and finance. Based in Malaga, Bioazul has become known across the EU as an expert in wastewater recycling and, as such, a sought-after partner in many EU-funded research projects. One of these projects was Treat & Use. This project has demonstrated solutions for treating urban wastewater and turning it into a valuable resource for agricultural crop cultivation. As a consortium member, the chemical engineer **Rafael Casielles**, 36, has coordinated the Treat & Use project with Bioazul. In 2015, the water recycling project has won a CommBeBiz Business Award.

## Award Winner Interview with **Rafael Casielles and Antonia Lorenzo** , *engineers of Treat & Use*

**Who will benefit most once the Treat & Use technology goes on the market?**

**Rafael Casielles:** Farmers in water-scarce regions such as Southern Europe or North Africa will see the advantages of our technology soon. They will gain 'reclaimed water' that, once treated and rendered, is no longer waste but a valuable resource: clean water containing nutrients to fertilise the soil and thus save extra expenses for the water users. The environment will also benefit. In Europe currently 10% of wastewater is not treated and remains unrecognised as a resource.

**How does the technology work?**

**Rafael Casielles:** It is a multi-step process. During the first two phases the wastewater is treated physically and cleaned biologically. In the third stage the water is pumped through membranes that keep pathogens back, which is very important for the safety of fruits and vegetables irrigated. After this phase we already have high quality clean water. In the fourth stage, we analyse the crops and the available water in the area. After that we adapt the reclaimed water to the local situation. The treated water still contains fertilising nutrients.

**Which plants is the recycled water most suitable for?**

**Rafael Casielles:** For the irrigation of tomatoes for instance you need no extra

fertiliser when using water that has been treated with our system. But, if necessary, we add more nutrients or we mix the preparation with more pure water to reduce the concentration.

**Are there any demonstration plants already working?**

**Rafael Casielles:** Yes. Treat & Use already operates a 30-cubic-metre pilot plant for tomatoes. Now we have developed to a stage where we can treat ten times more in a prototype.



### What challenges do you face to moving up to bigger sizes ?

**Antonia Lorenzo:** From the perspective of our company, in order to grow we have to invest in new developments and to increase our turnover. Whether we will look for an investor to join the firm or take a loan from the bank will be a strategic decision. It has not yet been decided. But to produce the marketable product we will definitely need financial support.

### How do you expect the demand to increase ?

**Rafael Casielles:** We have just started with a new EU research project called 'RichWater'. With this we are moving towards a Technology Readiness Level of 9. This means that our technology will be validated and working in real environments. RichWater could also be the future brand's name. Basically we are working on a commercial prototype processing 150 cubic metres a day. This is a real-world solution for a farm.

### Dealing with urban wastewater, do your future customers have to be close to cities ?

**Rafael Casielles:** Not at all, we can irrigate any site. We do not transport the water, but a piping infrastructure can bring the water to the agricultural site where it is treated. This would need the support of public authorities but this support could be given in many regions since authorities have an interest in our developments, for the benefit of cooperatives or groups of farms in dry areas.

### Did you start in a specific area ?

**Rafael Casielles:** Our test site is located in the region of Axarquía in southern Spain. Here we are dealing with a region where the farmers export high-value fruits such as avocados, mangos and other subtropical crops. This agricultural region is water scarce and has little rainfall. In summer crop producers even fear watercuts, because the region contains the popular tourist location of Torre de la Mar and so has to compete for water with tourism.

**Antonia Lorenzo:** We think that this would be a prime market to start with once our systems are operational. The income of the farmers in this region is fairly high. They want to increase their production, but water is the bottleneck. After being successful here, we can start to replicate the system and expand to other dry regions in Spain and North Africa.

### What price will one installation retail at ?

**Antonia Lorenzo:** It depends very much on the size and on the crop. One treatment installation of 40 m<sup>3</sup>/ day of capacity could cost approximately 100,000 euros. It would profit a farm or a group of farms cultivating high-value products where water is the limiting factor.

### Where do you see the Bioazul company in five years' time ?

**Antonia Lorenzo:** Our idea is to be able to sell five to ten systems per year, with an increase of 10% every year. But for this we will need more employees. We are currently working with three engineers and two project managers. Here also, growth and seed money is the key.

### Are there any other barriers to take-off ?

**Rafael Casielles:** The biggest hurdle is a bureaucratic one: a farmer that wants to use the reclaimed water needs a licence. The authorities are still reluctant to issue these licences. There is a lack of clear EU directives on the handling and safety of re-used water for crops for food products and as animal feed. Currently Brussels is working on guidelines for the re-use of water. But a clear regulation would be much better.

### Could the CommBeBiz Award, which includes coaching from a European Business Network coach, do something here ?

**Rafael Casielles:** The coaching will help us in many ways. We will definitely need a marketing and sales strategy. We will also try to figure out potential markets. And there are some financial issues to be solved, as Antonia has already pointed out.

**Antonia Lorenzo:** I hope to make a maximum gain from the coaching. Though I am not sure if it can help to solve the bureaucratic reservations toward regulations, the clear benefit of the action plan we will elaborate on with the mentor is to find a future strategy for the company. The product needs to be registered as a brand. The coach should show us how to approach that. In the mid-term we will have to decide whether we assemble the system pieces in-house or if we licence the production to a manufacturer. I am optimistic about receiving the right strategic advice on these questions.

**Thank you very much for responding to our questions !**

# GETTING THE **BIO-BIZ** STORY RIGHT TO **TELL** AND **SELL**

## The BIC in Waterford, Ireland, coaches researchers and start-ups

'People are not born as entrepreneurs,' says Carole Thurston, one of three business consultants at the South East Business and Innovation Centre (BIC), in Waterford in the south of Ireland. Being a not-for-profit, Limited company, the BIC advises and coaches future entrepreneurs on commercialising their business ideas. 'A creative brain and a business idea with the potential to generate revenue are basic elements you need to become an entrepreneur,' Thurston relates, 'this has to be combined with determination to succeed, strategic planning and resources.'

The BIC in Waterford is part of the EU-wide European Business Network (EBN), which facilitates entrepreneurs and their companies to find contacts beyond their own borders. Now, several award winning research projects in the bioeconomy that are part of the 'CommBeBiz – communicating bioeconomy to business' project will be coached by the BIC. To start with, the mentors in Waterford invite their mentees to basic sessions where a plan of action is drawn up and an outline of the business model and the value it offers potential customers is created using – the 'Business Model Canvas'. This 'Canvas', helps the entrepreneur to describe their business in terms of the value for customers and the internal resources required to run the business efficiently. The method is applicable to all fields of economic life, not only to bioeconomy. It assists in the development of the business model and assists in the drafting of an investor ready business plan.

Mentor and mentee undergo this reflective exercise together to achieve an overview business picture. During the exercise they explore basic answers to questions around potential customers and channels to market, as well as around possible partners. All elements are put together in a template-document that needs to be completed to visualise the canvas. This shows a logical path for a concept or a market-ready development to enter the sphere of commercialisation. Here, the typical questions are: Who would be the best target customers? Where could seed capital come from? What value are we creating for customers? What are the main costs to the business?

After the first few sessions when people start to see the potential of becoming entrepreneurs, mentor Carole Thurston believes that she has done a good job. Thurston, a former IT systems manager and start-up founder, has been a consultant for 15 years. She has seen all levels of Technology Readiness – from concepts to investor-ready products.

According to her, one of the most difficult phases is to convince an academic that the biggest problem to solve is not 'the next algorithm', but to identify potential customers who would pay for the service or product. In such cases she starts to make the academics appreciate the business world, where practical solutions need to be found and where potential customers or investors with minimal time need to be pitched to strategically.

‘Before you make money, you first need to either solve problems or provide entertainment or pleasure,’ Thurston teaches her mentees.

**Each feedback from a potential client helps to refine the story again and again**

The pitching stage is like an ongoing market test. Academics and practitioners alike have to learn to present with the right pitch and to sell their story and the product in a pressurised environment. Each set of feedback from a potential investor or a potential client helps to refine the story again and again. ‘With the right coaching,’ Thurston highlights, ‘the majority of mentees should be able to speak with confidence and authority.’

Researcher consortia of single-owned companies that already have a demonstration product or are even further along the line, are advised, where appropriate to also present at trade fairs and events where their target audiences are most likely to be found. Others may first need market research, or to identify an industry partner, in order to climb up the ladder of Technology and Market Readiness. The BIC in Waterford can support this, not only because it is linked to the pan-European BIC-networks as part of the EBN, but also because it works closely with the

government agency ‘Enterprise Ireland’, which has specialist databases and many global foreign offices to link international contacts.

**Kick-starts from the South East Business Angels**

One of the options for young entrepreneurs to scale up their business, is accessing seed capital: this can be accessed through Business Angel networks, who provide risk-capital. South East BIC has assisted in raising €4.4M from their South East Halo Business Angel Network to kick-start young Irish companies, they have also utilised this money to leverage another €5.4M in funding from other sources including banks. After having gone all the way from business planning and product development to raising seed-capital a business goal for an innovative start-up will be to achieve a turnover of one to one and a half million euros within the first three years, ‘Turnover above this sum in the first three years can realistically only be achieved with EU-wide sales, or success in other international markets,’ Thurston says. The South East BIC, with its specialisation in Bioeconomy sector SMEs, has witnessed many success stories, and there are still more to come



Coaching and management for young businesses

# BIOECONOMY START-UPS WILL CREATE BETTER LIVES

A European reference in helping bio-biz firms –  
**BICMINHO** Coaching and Incubation Centre, Portugal

**Nuno Gomes, CEO:**

“ Youngbio-entrepreneurs think classic. They are very much focussed on a perfect research cycle and the technical viability of their innovative idea. Their personalities are really different compared to those of ICT people who think in terms of end-user applications from the start. As coaches we have to teach “market” and “end-user-thinking” to the bio-entrepreneurs to promote them and their developments.

This requires a personalized business mentoring. They are our favourites because they work with life, and we help them to give life to their projects. Supporting them, we really feel we are creating a better world.

”





## “Bioeconomy Innovation” talk with **Nuno Gomes**, BICMINHO, Portugal

### **Nuno, how long have you been coaching bioeconomy businesses?**

**Nuno Gomes:** I have been in business coaching and mentoring since 2001. Although we support with our Centre business projects from every sector, the Agro-Food, Maritime and Life Sciences are very important in our region. So, since 2009 we have been working intensely in this sector, namely in supporting several bio-entrepreneurs to create their own business and to promote the export of their products. And, to complement, we have been helping entrepreneurs and SMEs from bioeconomy sector to apply for public funding, National and European.

### **Is there a success model for bioeconomy start-ups?**

**Nuno Gomes:** Yes, there is. We apply the EU-BIC methodology adapted to this particular sector and help bio-entrepreneurs in every step of the start-up process. Bio-entrepreneurs and bio-businesses have specific difficulties that require a personalized business coaching support. They need a special attention. We are working today with a success-rate of 92%, a good benchmark for all start-ups once they have survived the first three years. We coach and mentor them with a clear goal to transform their innovative ideas into viable, successful and sustainable business projects. On top we offer management and market counselling and financial support. Clients and investors are still rare in the initial phase of a business, therefore, by doing so, we prevent future problems that can be caused by obstacles in the founding-phase, better known as ‘death valley’.

### **Do you see specific problems typical to bioeconomy foundations?**

**Nuno Gomes:** Sure, I do. At the core of bioeconomy foundations we are dealing with living

beings. So businesses like these require a lot of attention and hands-on involvement and commitment. This obliges us to consider the ethical aspects of business as well as specific market conditions. There may also be regulatory requirements that we don’t find in other markets, such as food safety or quality assurance. Bioeconomy clients are generally quite sensitive and very demanding, because the products relate to food, fresh produce, quality and health. But we always enjoy helping bio-businesses. It is very challenging and we learn a lot with them. They are our favourites because they work with life, and we help them to give life to their projects. By supporting them, we really feel we are creating a better world.

### **What distinguishes young bioeconomy entrepreneurs from other groups?**

**Nuno Gomes:** They really have different personalities. Compared for example to ICT, bio-entrepreneurs have a more classic approach very focused on their research and mainly concerned with technical viability. ICT people are at the other end of the scale. They are generally dynamic mavericks who think in terms of end-user applications before they start their product development process. This is something that we really need to help bio-entrepreneurs to learn. They have to think in terms of market, so that their research can lead to a product that serves consumers’ needs. And, consequently, in the end, be really effective and improve people’s lives.

### **Any specific methods you apply ?**

**Nuno Gomes:** In BICMINHO our coaches recently started to introduce ‘design thinking’ coaching models, encouraging entrepreneurs to consider potential clients at the start of research and product conceptualisation. It might pay-off to involve consumers at an early stage of the innovation process. As co-creators clients and end

users can play an active role to influence and to improve developments. The “end-consumer thinking” is the key for a bio-entrepreneur’s success, because his studies already contribute to the other necessary technologic and scientific expertise.

### **What do you think about investor-interest and venture capital in the bioeconomy ?**

**Nuno Gomes:** There are enough investors but not enough in the bioeconomy field. Investors are always looking for fresh businesses, but they don’t have enough expertise and experience about bioeconomy. It is up to researchers and universities to publish their work and to communicate bioeconomy results to society. The long time-to-market periods in this field – ten years on average – are of course an obstacle compared to only two or three years in other sectors like ICT. And then, to make things even more difficult, there is also a higher risk in bioeconomy developments. They often require long-term approvals and real-life trials, which struggle to keep up with changing markets. The venture capital interest is focused on return-of-investment thinking. It is not so easy to find sustainability-minded investors, but when the business idea is good and convincing, a new or even disruptive bioeconomy product can enjoy a much higher and enduring success.

**Many thanks for taking time to respond!**

# BIO EXPRESS

## Nuno Gomes

Was born in Portugal in 1978. He holds a post-graduate degree in Enterprise Recovery and a European Diploma in International Management specialising in International Trade from International School of Economics of Rotterdam. Nuno Gomes is the CEO of BICMINHO, the EU Business and Innovation Centre (BIC). He is also the Executive Director of the Portuguese BICs Network and a founding member of PTBAN – Business Angels Network. BICMINHO is a non-profit business support organization certified by the European Union for the promotion of Entrepreneurship and Innovation. The centre helps existing SME to modernize and to internationalize, as well as start-ups. The start-up support has two main goals – to help people to create their own company and to give them management advise during the first three years through incubation. Recently, Nuno was elected as Chair of the Bioeconomy Special Interest Group of EBN, the European Business Network and he was selected as expert for the agro-food sector of the Regional Authority of North Region of Portugal. He also works as external expert and evaluator of EU Projects and as Ministry of Education-accredited teacher trainer. Nuno Gomes speaks Portuguese, Spanish, English and French.

# THE IMPORTANCE OF TECHNOLOGY TRANSFER

**MARION PERRIN,  
EUROPEAN BUSINESS NETWORK (EBN)**

Increasingly, researchers within universities and research centres are being encouraged to engage in technology transfer activities. But many researchers might rightly ask the question - what is technology transfer? We go into some more detail to explore and shed light on the concept of technology transfer.

Simply put, technology transfer is the process of developing practical applications from the results of scientific research. Publishing scientific findings in a research paper is an important step but it does not guarantee that the right person or organisation will notice the researcher's discovery and continue developing it into a tangible product that will reach the end users. The main aim of technology transfer is to take fundamental scientific discoveries and turn them into marketable products so that the general public at large can benefit from the research as quickly and efficiently as possible. The successful transfer of technologies is playing an increasingly important role in the process of innovation. The principal goal of technology transfer in the middle and long-term for society and the national economy is to create a partnership of cooperation between academia and the private sector.

Before engaging in commercialisation of their research/ findings, researchers have to be aware that it is not an easy task to transfer their technology: it actually is quite challenging considering all the factors to be kept in mind, such as finding the right interlocutor, communicating efficiently and properly the innovation behind the findings, keeping the intellectual property right (IPR) and being involved in the development phase. Finally it can be a real challenge to match research technologies with companies and entrepreneurs who can commercially exploit it.

Probably the most crucial challenge - from the researcher point of view - is the reassurance that the technology underlying the invention/finding is appropriately protected via Intellectual Property provisions which are

not always that easy to understand - also, licensing and royalty agreements are often difficult to negotiate and can be time consuming. But this should not prevent researchers and industry from finding a way to collaborate and exchange knowledge and expertise.

Successful transfer of technologies became an absolute priority on national and regional political agendas, even more after the launch of the EU's funding program - Horizon 2020, which states on their website that it is "the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020). It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market"

In line with this principle, CommBeBiz in July 2016 finalized its second Annual Awards providing practical support to EU-funded research projects across Europe with business innovation potential and able to address societal challenges. Entering the Awards is a valuable opportunity to test and validate the potential of research projects ideas, thanks to the support that the winners will receive from European Business Network (EBN) bioeconomy experts in order to make the innovation coming from the projects sustainable and impactful. 2016 winner projects were announced during ESOF2016 in Manchester at the end of July 2016. A chance to pitch projects and their exploitation potential to an audience of business innovation centres, investors, potential partners and big companies will be given during the next EBN Congress 28th - 30th September 2016 in Portugal. And: The next round of CommBeBiz Awards is coming soon. The 2017 awards will be launched at the beginning of 2017. Don't miss the opportunity to enter the world of bioeconomy innovation by winning a full support package for an individual action plan. More information via e-mail to Laura Lecci (laura.lecci@ebn.eu).



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# **BIOECONOMY** CASE STUDIES

“ Facilitate more interaction between  
research, industry and policy ”

Communication between many stakeholders on project outcomes is key.  
The bioeconomy case studies give first-hand information for these exchanges.

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**A NEW LIFE FOR EUROPEAN AGRO-FORESTRY WASTE:  
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**GIVE PEAS A CHANCE ! THE EUROLEGUME PROJECT**

# A new life for European agro-forestry waste

## THE STEAM BIO PROJECT

Superheat-steam devices packed on vehicles driving through forests and farmland will soon start a novel processing of valuable bio residues. Steam and heat condense straw, wood and prunings resulting in products for biorefineries which convert these materials into green chemicals and energy. The condensed biomass – reduced in size and weight - can easily be transported from remote areas to the coastal refineries. It can create a cascade of new job opportunities in rural Europe. The project's name: Steam Bio.

Residues from agriculture and forestry, for instance straws, prunings and forestry thinnings currently are wasted or used inefficiently in Europe. Currently imported wood supplies from North America and other regions are required to help meet the growing demands for bioenergy with supply competition emerging from East Asia and elsewhere. Concerns increasing on the environmental impact of imported supplies there is an increasing need to find new local supply further pressure is emerging on new and local sources of ligno-cellulose rich biomass.

Potential available and currently under-utilised ligno-cellulose in Europe includes the estimated 100 Mtoe of agricultural residues. However, these residues and forestry residues are not in a form that can be readily collated and used by a large scale bioeconomy. The EU funded SteamBio project is investigating making this indigenous forestry and agricultural a feed supply for the bioeconomy; a technological approach on how to recover, stabilise and make it available in a form that can be readily used.

### A novel technology approach for torrefaction

Abundant forests and farmland with a wealth of biomass are located throughout remote regions of Northern and Southern Europe. The logistics involved in transporting these abundant yet untapped biomass resources to refineries in the industrial zones are typically challenging and expensive.

Mobile treatment units as demonstrators: The SteamBio project will provide a demonstrator mobile superheated steam-treatment unit for biomass, to enable increased energy-density and decreased volumes. The core-technology will process agro-forestry residues. Bulk tonnages will be processed using superheated steam at temperatures of up to 300 C, reducing water content from over 40% to less than 5% and allow uncovered transport of lorry loads of stable biomass to industrial customers. In SteamBio the

torrefied biocarbon will be demonstrated as a coal replacement for an industrial lime kiln and as a carbon source in pilot scale biorefineries. Recovered condensate from the superheated steam process has already been shown to contain commercially relevant quantities of biochemicals, additional to the torrefied biocarbon mass that can be used as a biofuel and in biochemicals.

Engineered device will be made available located in remote areas to process the material in-situ and according seasonal demand.

The disruptive technology approach will deliver pure, non-contaminated biomass products. The condensed steam will provide a source of volatile biochemicals and water suitable for irrigating farm land. Torrefaction is a thermal conditioning process that



© STEAM BIO



makes biomass water resistant, with higher calorific values and easier to store and transport. The SteamBio torrefaction approach offers advantages over established torrefaction approaches which use flue gases as heat exchange medium; SteamBio uses superheated steam. Superheated steam processing is an energy efficient means of heat transfer. It has been developed by one of the German Fraunhofer Institutes into a continuous industrial drying process. The outputs are all not contaminated, enabling economic recovery of solids, liquids and gases. The process has been demonstrated in other applications as being scalable without any loss of efficiencies. SteamBio capitalizes on forerunner projects including BioEcoSim and EuroPruning.

The end-products will consist of torrefied carbon rich lingo-cellulose derived from sustainable European agro-forestry sources for use in biochemical production or bioenergy generation, biochemicals recovered from condensate and water for irrigation of farmland all without polluting emissions (gas or liquid).

### Testing and scaling-up

Assorted agro-forestry residues are currently being assessed to enable according to techno-economic validity across Europe. From this selection six different sources of materials will be demonstrated at an industrial scale in-situ during 2017.

Tests are currently being undertaken to optimise the processing conditions for each selected agro-forestry material to maximise value of the outputs. These assessments include the determination of biochemical and bioenergy yields for each source, stability under storage and transport and overall valorisation strategies.

### Demonstration units in Spain from 2017

The engineering design and build phase of the mobile steam unit will result in a demonstration unit being operating at various selected locations in Spain from February 2017 to January 2018. These demonstrations will be available for people to visit and learn more. The mobile unit is to process 500 kilo biomass per hour. Over ten tonnes of each selected material will be processed

during the demonstration phase. This techno-economic validation during the project demonstration will facilitate subsequent post project commercial operation of both mobile units and fixed units with potential for outputs in excess of one hundred and twenty thousand tonnes per year. Life cycle assessments will complete the research process to validate the SteamBio effects on the environment and improvement of energy balances of transport.

### Forest owners, harvester, paper & pulp, chemical and energy industry

Future clients will be public and private forest owners, harvesters, rural logistic companies for transport and storage, energy plants, biochemical refineries, paper and pulp recyclers.

“The Steam-Bio work is very exciting as it will enable the sustainable use of biomass residues from our indigenous European forests and farm land in the production of green chemicals and bioenergy. We really want to put something on the ground for rural areas. It’s about engaging investments and local communities as part of the bioeconomy.”

**Huw Parry**, *SteamBio Business Developer*

Business models are currently being developed for SteamBio to be adaptable to local rural requirements leading to a new „localized rural empowerment“ , creating many opportunities with pre-and post handling platforms for steam-treated agro-forestry waste streams – increased in energy density and with decreased volumes. The project develops robust business strategies for widespread market replications. SteamBio is keen on talking with potential investors along the value chain along with potential first adaptors, users of the technology.



INFO: [www.steambio.eu](http://www.steambio.eu)

# NATURE TO IMPROVE CHEMICAL INDUSTRY

Using protein-engineering tools in order to create better and safer products for the industry is the drive behind INDOX. The EU funded bioeconomy project is dealing with oxidative enzymes recovered from fungal genomes and engineered toward targeted catalytic activities and robustness for industrial use. The engineering approach includes rational design and directed evolution strategies to meet many important challenges of the chemical industry such as safer and cleaner substances in agriculture, pharma and plastic industry.

Basically all processes in life are influenced by “redox reactions”. The chemical principle of oxidation and reduction steers the corrosion of metals and the cellular respiration. Many industrial processes - also driven by oxidative reactions - often use harsh and potentially dangerous chemicals in extreme reaction conditions and produce undesirable side products. The INDOX project, and its forerunner -project PEROXICATS demonstrate that there are natural alternatives coming from fungi and other microorganisms, the so-called microbial oxidoreductases. These enzymes offer exploitable sources and new routes for redox transformations in the industry.

However, the limited availability of robust oxidative biocatalysts is one of the main bottlenecks for the development of a green chemical industry. INDOX therefore provides industrial case stories to demonstrate the efficacy of tailor-made oxidative biocatalysts and explores the industrial applicability for more cost-effective manufacturing. Up to now, several patents and more than 50 scientific publications have been derived from the project results. Moreover, based on some of these results a new consortium has been built with industry partners truly interested in the implementation of this enzyme technology in their production processes.

## Improved biocatalysts for agrochemicals, pharma products and renewable polymers

Fungi involved in the natural decay of lignocellulosic biomass such as wood or straw are a well-known source of oxidoreductases. Now, INDOX focuses on the use of optimized oxidoreductases on targeted oxidation reactions, and to establish the processes scalability, sustainability and cost-efficiency versus chemical conversion processes.

The novel enzymes in the project will help to better produce agrochemicals and active pharmaceutical ingredients, polymer precursors and functionalized polymers for pulp and paper industries and intermediates for the textile and cosmetic industries (dye-stuffs and fragrances). Current industrial applications using oxidative enzymes are limited to amounts of less than 20%, mainly due to the limited compatibility of naturally available biocatalysts with the rigorous process conditions in industry (high substrate concentrations, use of solvents, strong oxidative conditions). The INDOX-researchers address these bottlenecks by enzyme engineering and process optimization using state-of-the-art technologies. Thus, suitable oxidation and oxyfunctionalization bioprocesses in optimized systems will be developed and demonstrated.

## Research on screening and engineering



© INDOX



# INDOX: ON THE WAY TO MORE ECO-FRIENDLY PRODUCTS

Screening of fungal genomes and cultures has led to the identification of more than 3000 oxidoreductase sequences. Promising candidates have been improved with enzyme engineering tools towards enhanced catalytic activity, substrate specificity and adaptation to bioprocess requirements. Industrial case studies in the project are demonstrating the efficacy of oxidative biocatalysts in many applications. .

The lab-scale research done so far has provided proof of concept for dozens of target reactions such as oxyfunctionalization of aliphatic and aromatic compounds, coupling of phenols and other aromatics to produce polymers and dyes; decolorization of dyes and oxidative modification of lignin. The companies involved are evaluating the technical and economical viability of a few selected bioprocesses.

Six **highly specialized SMEs** in the areas of fungal enzymes, computation, biotechnological processes, enzyme immobilization, industrial dyes and chiral chemicals are cooperating in the project with a **world-leading company in the sector of industrial enzymes** and a **large company of the chemical sector**. Nine **research/academic partners** are contributing with their expertise in oxidoreductase research including genomic screening, structure-function studies, rational and computational design, directed evolution, enzyme stabilization and immobilization, reaction mechanisms, and production of different compounds of industrial interest, among others.

## Future INDOX applications and clients for industrial & household goods, food & fashion

All sectors encompassing industrially relevant oxidative transformations are targeted, i.e.: agro-chemicals, pulp and paper, pharmaceuticals and household chemicals, textiles, cosmetics, dye stuff and fragrances as well as food and drink. Considering the inherent ability of fungal oxidoreductases to modify lignocellulosic biomass, INDOX applications will also be seen for the sustainable production of fuels and chemicals in biorefineries based on lignocellulose feedstocks. Clients for the novel enzyme technology will be chemical industries, pharma, food, fashion, paper

industry, bio-refineries.

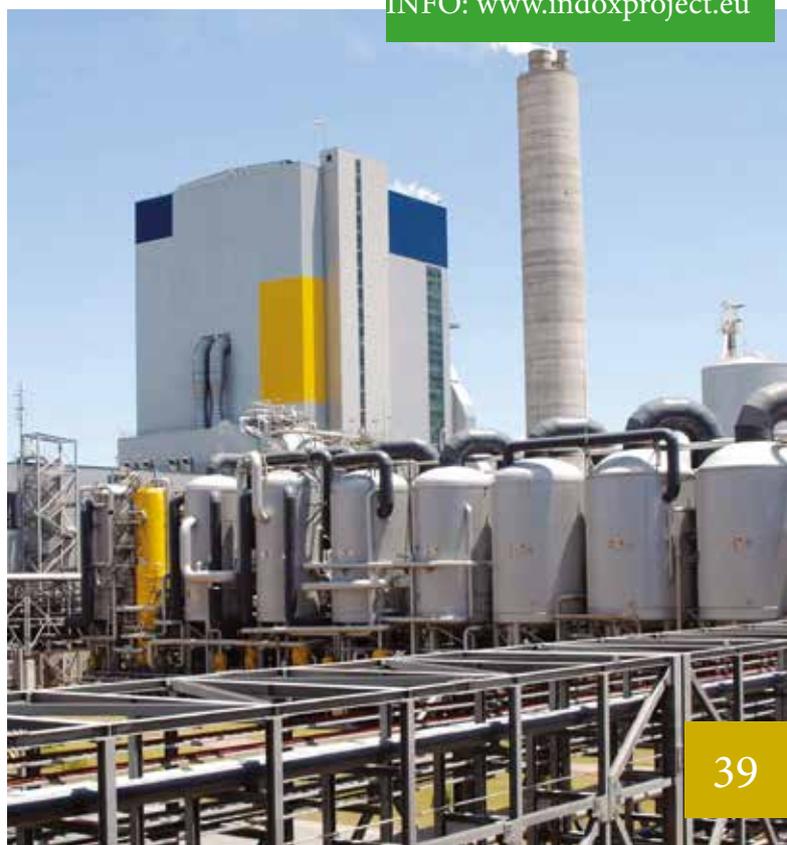
## Promotion & new projects as next steps

A range of novel and tailored enzymes will come to the market as innovative products very soon after the end of the project. This will increase the yield and production of eco-friendly high-value products. The industrial manager of the consortium belonging to the world-leading company in the sector of industrial enzymes will promote the results and the use in bioprocesses. This will include current customers as well as other potentially interested companies. A new EU funded research project will start right after the end of INDOX, funded by the Bio-based Industries Joint Undertaking initiative.

“Our goal with INDOX is to develop a novel enzyme-technology which enters more sustainable and cost-effective routes for the chemical industry.”

**Angel T. Martinez**, *Project Coordinator*

INFO: [www.indoxproject.eu](http://www.indoxproject.eu)



# GREEN DAIRY – HOW YOGHURT AND CHEESE CAN BE PRODUCED SUSTAINABLY

## SUSMILK OFFERS INNOVATIVE ECO-SOLUTIONS FOR A MORE EFFICIENT TRADITIONAL INDUSTRY

Dairy products are part of our daily lives as well as dairies, which are one of the most traditional businesses that process milk and cheese. However, the traditional sector needs an update towards more sustainability, since it consumes too much energy, too much water and emits too much CO<sub>2</sub>. The SUSMILK project develops eco-tech-components for use in existing dairy infrastructures.

### Greening a traditional sector and an established industry

A total re-design of traditional milk processing is on the move: Solar panels and biomass boilers can be used in dairies for a resource efficient production of milk products. Absorption chillers can utilize waste heat streams to chill the dairy products, waste water can be treated and re-used. The objectives are savings in energy, water, CO<sub>2</sub>-emissions and cost.

Before milk gets from the cow into the bottle or carton, its processing is characterized by a multitude of heating and cooling processes. The infrastructures are often used in the foodstuffs industry for up to 30 years. The dairy industry in Europe is a real heavyweight: 13 % turnover of the total food and drink industry in Europe are produced here, 140 million tons per year of raw milk are processed and 18,400 GigaWatthours energy are needed. SUSMILK aims at a re-design of the whole milk processing infrastructure to minimize energy and water consumption.

### A three-pillar solution with eco-tech processes and waste treatment

First pillar: energy converting technologies spanning heat pumps, absorption chillers and solar heat technology and biomass heating. Waste heat is utilized especially for dairy demands and renewable energy/heat is integrated into the infrastructure. This can lead to a significant reduction of the overall energy consumption of the European dairy industry.

Second pillar: (pre-)concentration of milk. Milk (pre-)concentration via membranes is carried out at significant lower temperature compared to the conventional concentration process via evaporation. This can also lead to a quality-push for the milk product because the new process means less stress for the milk and, hence, better milk concentrate quality. Moreover, the new process allows to create defined compositions of the concentrates. Finally, energy is saved by replacing the energy intensive process of evaporation.

Third pillar: improvements in the handling of dairy wastes. Foreseen are recycling of water from Clean-In-Place(CIP) processes and a recovery of chemicals from CIP processes. The organic load fraction of waste water can be used to produce biogas. Another use for bioethanol or lactic acid production are investigated.

### Research process is underway with tech-installations and testing

SUSMILK is working with 21 partners from technology institutes and the dairy industry to reach a more resource - efficient food production in Europe through eco-friendly dairy technologies. This includes the development of the technical components, their installation and testing at partner dairies of all sizes in different countries.

Also part of the research is a life cycle assessment (LCA) of the concept/components and transfer of the findings into an on-line-tool for dairies.



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The online-tool allows dairies to check their individual potential for energy/ water savings. The not-one-size-fits-all-approach as well as the modularity is the key. The modular method will benefit not only to big milk factories but also smaller family-owned businesses which will select single elements first.

#### SUSMILK technology validation at four dairies in real environments

Demonstrators: Green technology tests are currently tested within demonstration dairies. Two dairies in Spain and two German dairies at different unit sizes ranging from processing 100,000 to 600,000 liters per day are participating as real environment demonstrator plants. A new high temperature and gas driven heat pump, an absorption chiller and combined solar energy and biomass boiler are tested here as well as the new milk concentration process.

Tech- developments and concepts: The project has selected bio-tools to increase the efficiency of dairy waste treatment for energy (biogas and bioethanol), CIP-water and chemicals recycling or lactic acid production from by-products (whey, permeate) and wastewater are currently available on lab-scale.

Online Tool: A process simulation and assessment of the „green dairy“ with an online tool as well as cost/energy calculator are carried out and partly implemented. The tool allows a modelling of different dairy types to calculate potential savings in the enterprises of different size. The developed simulation will help even small family-owned dairies to optimize their process chains. The online tool can be used for efficiency assessments.

Publicly available are also web-based guidelines for improved waste-water treatment in the sector.

#### Future clients: milk processing industries and small dairies - open innovation

Future customers are dairies of all sizes, food equipment manufacturers and small/medium process engineering companies. SUSMILK developed an open-innovation tool called the “Green-DairyNet”: [www.greendairy.net](http://www.greendairy.net). This is an open innovation platform for experts and professionals interested in sustainable development and resource efficient processing technologies in the dairy sector. The tool is accessible after web- registration. It benefits from the participation of its members and their ideas and proposals

In September 2016 SUSMILK holds its Final Workshop to the theme „Solutions for Sustainable Milk Processing“ in the Spanish Santiago de Compostella. The workshop is open to the public. All study results will be presented and discussed here. Expected audiences come from the EU dairy industry, including farmers and cooperatives, associations, platforms and clusters, technology providers, researchers, policy makers, media. A cooperation with the International Dairy Federation has been established. Agenda and keynote

speakers and more information at [www.susmilk.com](http://www.susmilk.com) or per mail: [susmilkconference@feuga.es](mailto:susmilkconference@feuga.es)

“I think that for each dairy something is in the SUSMILK project. No matter what size, each milk processor will find positive elements in our green technologies, be it water or energy savings, be it cost reduction or access to new networks in the dairy industry. Greening can make the dairy business more competitive.”

**Christoph Glasner,** *General Project Manager SUSMILK*

INFO: [www.susmilk.com](http://www.susmilk.com)



# GIVE PEAS A CHANCE!

## NEW VEGGIE-PROTEIN SOURCES THROUGH REVAMPED LEGUMES

Beans, lentils and peas, the so-called legumes, will play an important role to cover the ever growing protein hunger of the world. With new protein-rich crops agriculture can drive the change of our diet to veggie proteins and help to save greenhouse gases. But a legume-based agriculture has to be built up in Europe first: the project EUROLEGUME facilitates the take-off.

### Beas, peas & Co : Protein-rich veggies to the European market

High in fiber, calcium, and iron, beans and legumes are also a great source of protein. Combined with high protein whole grains like buckwheat, brown rice, millet, quinoa, and teff, beans and legumes not only make a delicious meal, but often provide the full compliment of essential amino acids needed by humans. However, the EU only dedicates small areas to legume crops. And this has even decreased in the last decades. The self-sufficiency of legumes in Europe is under 20 %. All others legume - shares consumed in the EU rely on imports to Europe! EUROLEGUME's is to increase the production and consumption of legumes in European countries. Legume-based new foods and improved seed varieties will be brought to the market. The improved resistance to abiotic stress is an objective which EUROLEGUME expects to overcome with new cultures of positive microbes which are inoculated to the roots of the plants.

### Proteins and plants for the future bring new food and agri-boosters

Food, feed, fiber and even fuel are all products that come from legumes – plants that grow with low nitrogen inputs and in harsh environmental conditions. The initiative is focused on pea, faba, and cowpea cultivars grown in northern and southern Europe. Expected results will enable legume grain imports to be reduced by 20 % and improve yield of homegrown plants and enhance soil productivity as well as the sustainability of the farming system.

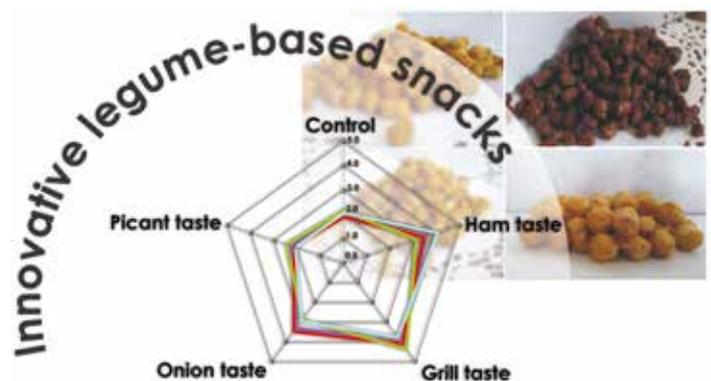
Consumers are expected to go for a higher consumption of plant protein based on evidences of a less carbon foot print, a contribution to a more sustainable environment and high quality diet protein. Protein-rich snacks from legume crops such as pea spreads, salty or sweet pea crackers and cookies or bean fudges will come out soon. Also Frozen novel products for normal meals

will enter markets.

New seed, new soil -improvers : Rare grains from Latin America ( cowpeas, faba beans) will be introduced to farmers. Tradeable cultures of Rhizobium and mycorrhiza – two microbial root funghi with positive characteristics - will improve the plant-resistance. Innovative Feed-stuff and fertilizers to better store nitrate will be developed with the legume-waste and can be used as soil-enhancer in agriculture.

### The EUROLEGUME Research- Process: Academia and SME together

EUROLEGUME partners summarized in two handbooks the protocols for harmonising the scheduled procedures. Researchers gathered a large number of cultivars, selecting them according to biomass, leaf morphology, Huber value, root architecture and yield characteristics under diverse agro-climatic conditions.





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Unlike most plant types, legumes fix nitrogen in soils by synergic relationships with Rhizobia and mycorrhizal fungi. They help reduce the need for fertilisers and avoid economic inputs and environmental impacts. EUROLEGUME assessed the effects of inoculants isolated from 139 samples on legumes adaptability and yield, and on soil properties. The work produced fingerprint analysis for 65 Rhizobial isolates. New commercial Rhizobia and AMF products will be developed; valorisation of the residual biomass and nitrogen fixation is foreseen .

### Greening the agriculture

Crop rotation experiments highlighted the positive effect of organic matter from legumes on soil properties, on significant savings of nitrogen applied to legume following crops and on yield in diverse cropping systems. The team also optimized the methodology for the study of in vitro digestibility and evaluated the effects of legume-based feed supplements for livestock.

Peas, faba beans, and cowpea were assessed as ingredients for the development of innovative foods with regard to physicochemical properties and nutritional composition. This enabled the best combinations to be chosen for the planned products. 50 varieties of legume plants were genetically screened and their nutritional content was assessed (calories, glycaemic index, protein content, etc.), most promising varieties selected. Alternative processing technologies are also being considered to improve the commercial viability of these foods.

Breeding: European genetic diversity of legume crops is accessed and new elite genotypes for production and/or breeding will be selected. NIR calibrations will be created for use in the fast and efficient evaluation of breeding material;

Root treatment : germplasm cultures have been assessed and selected for inoculation;

The EUROLEGUME project involves 18 partners with a long-term experience in specific research areas. This expertise is balanced across different countries and regions of the 10 European countries. The partners involved come from Research

Institutions and SMEs. The participating actors form a consortium that has a broad reach across agronomy, biology, genetics and environmental science.

### EUROLEGUME Development stage: Up-Scaling of pilot products

Novel frozen legume-based food products and protein snacks can be produced on several hundred-kilogram levels. All these new food products are being tasted for food production. Introduction of legume-based ready-to-eat-meals to consumer markets.

Microorganisms for nitrate fixation enhancing soil quality are currently tested in the field, the cultures then are proposed to farmers.

Novel grains, pulses, will be transferred to farmer markets, including legume-based feeding and fertilizers including the introduction of resistant inoculation cultures to breeders.

“ We are enthusiastic to offer with the EUROLEGUME project improved varieties of pulses, legume plants and new pea-based food products soon.”

**Eduardo Rosa,**  
*EUROLEGUME*

*Project Coordinator*

INFO: [www.eurolegume.eu](http://www.eurolegume.eu)



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