



We are RISE!

The RISE institutes Innventia, SP, and Swedish ICT have merged in order to become a stronger research and innovation partner. Through our international collaboration programmes with academia, industry, and the public sector, we ensure the competitiveness of the Swedish business community on an international level and contribute to a sustainable society. Our 2,200 employees support and promote all manner of innovative processes, and our roughly 100 testbeds and demonstration facilities are instrumental in developing the future-proofing of products, technologies, and services. RISE Research Institutes of Sweden is fully owned by the Swedish state. www.ri.se

Beyond “Beyond”

The first edition of Beyond was published in 2004. At that time, the Swedish research institutes STFI and Packforsk had merged to become a stronger player. Soon afterwards Norway’s PFI also joined the group. The parent company changed its name to Innventia in 2009, but the magazine’s name Beyond lived on.

Now it is time to say goodbye to the name Innventia* and to get to know RISE and the Bioeconomy division. Since April 2016 when Innventia’s corporate owners transferred their shares to the Swedish state, the process of integrating the institute groups of Innventia, SP and Swedish ICT into the Swedish research institute RISE has been intense. Together we are a stronger research and innovation partner.

All of Innventia’s activities will continue in the RISE Bioeconomy division, together with parts of SP Technical Research Institute of Sweden. On the next page Birgitta Sundblad, who is head of the new division, offers her picture of how it can contribute to a competitive industry and a sustainable society. On the following pages we will get to know the units and the companies within the division.

This is the last edition of Beyond in its current format. What format the magazine will take in the future is not clear at present. At the time of writing, work to organise all the channels from RISE is ongoing in order to maintain the vital dialogue with customers and other stakeholders. It is quite clear that the communication on the possibilities of a bioeconomy will continue. Here at RISE we want to lead the transformation to a circular biobased economy and we hope that you, as a reader, will continue to follow us on this exciting journey in collaboration with business, academia and society.

If you would like to receive regular news from RISE Bioeconomy, please register for the newsletter RISE Bioeconomy News at www.innventia.com/Subscribe.

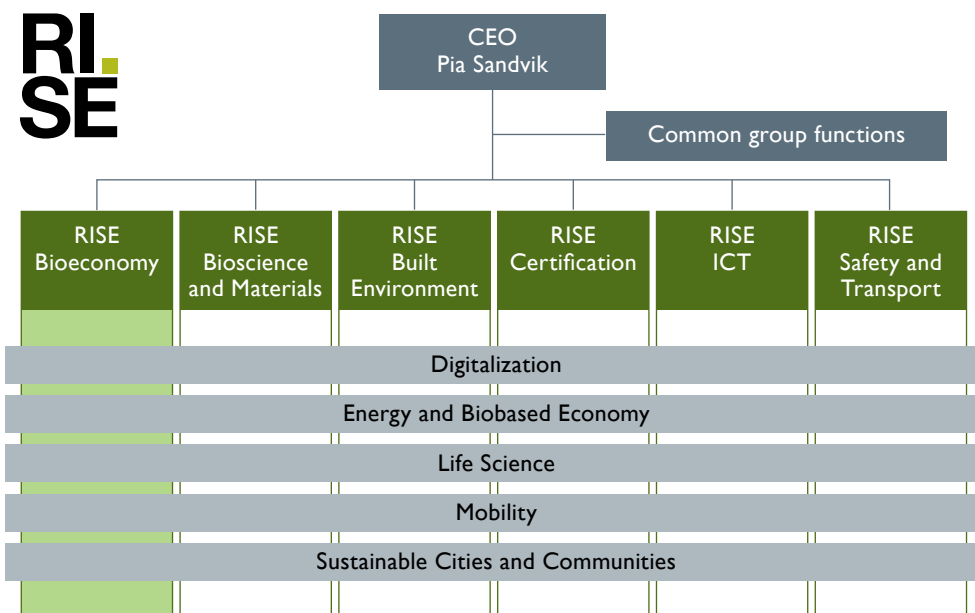
Marianne Lockner
Editor

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*) The process of changing business name is under way, but until the amendments are approved and registered by the Swedish Companies Registration Office, we will continue to write quotes, contracts, agreements and other legal documents using the current company name Innventia AB.



The RISE institutes Innventia, SP and Swedish ICT have merged in order to become a stronger research and innovation partner.



- Divisions
- The Bioeconomy division consists of 3 units (Biobased Materials, Biorefining and Energy, Papermaking and Packaging) and 3 separate companies (ETC, PFI, Processum)
- Business and Innovation Areas



Birgitta Sundblad

PHOTO: BJÖRN TESCH

Cooperation is the key

In January, the Nordic Bioeconomy Panel, which is an activity under the auspices of the Nordic Council of Ministers, published its case catalogue “Nordic Bioeconomy – 25 cases for sustainable change”. The examples are intended to serve as inspiration and a basis for a future Nordic bioeconomy strategy. Four of these success stories have a link to RISE Bioeconomy, either activities that we ourselves carry out or projects in which we are involved, for example through our test beds.

Within RISE we are convinced that bioeconomy is important, and that not just the Nordic region but the world as a whole needs to shift from a linear fossil-based society to a circular bioeconomy. In May 2016 we released A Cellulose-Based Society, the third report in the series Innventia Global Outlooks. The reports are an interesting way of analysing where we and the industry are heading. A Cellulose-Based Society looks at the conditions for a transition to a bio-based circular society. It is

based on results from a comprehensive international consumer survey, trends affecting development in key areas, and future scenarios that describe various outcomes based on an analysis of crucial uncertainties. Among the most important insights from the report is that we are living in a world where the ability to demonstrate ideas and concepts is the

“we have a greater breadth of competence”

route to sustainable social transformation. We are convinced that the division’s test and demonstration plants can fulfil an important function in this regard.

Global Outlooks and systematic business intelligence help us and our customers to make the right decisions for future investments in research and development. As a direct result of A Cellulose-Based Society, three new projects started in the autumn, with the preliminary studies leading to, among other things, proposals for the next research programme, The Bioeconomy Research Programme 2018-2020. The three-year research programme has long been the core of our activities. We are

convinced that this cooperation model is a successful and cost-effective way of generating new knowledge as the basis for innovation. Thanks to the strong new Bioeconomy division, we will be able to offer a significantly stronger programme that is both broader and more focused.

Within RISE Bioeconomy we have a greater breadth of competence from raw material to finished material, to the extent that it is possible to say that energy is a material. We work around various value chains based on forest raw materials and a number of agricultural and bio-residues. The processes, together or individually, represent a biorefinery that can provide not just today’s traditional products but also a number of new basic materials that can meet various needs in the biobased society. That is why it is important that we cooperate across all organisational and industry boundaries.

In order to pursue cooperation between competence areas effectively and strategically, RISE has set up five business and innovation areas: Digitalisation, Mobility, Sustainable Cities and Societies, Life Science and Energy and Biobased Economy. These areas span all divisions and are designed to tackle long-term and major challenges, such as climate change and health.

The business and innovation areas drive the strategic development of interdisciplinary solutions within RISE, but the process also involves looking at and making use of opportunities together with others, such as universities, public players and, of course, companies in various constellations.

Cooperation is the key to making us a stronger research and innovation partner for business and society. As RISE we are stronger. Bioeconomy is important for society, and it is also the name of an important division within RISE. I am proud to have the task of leading it. ●

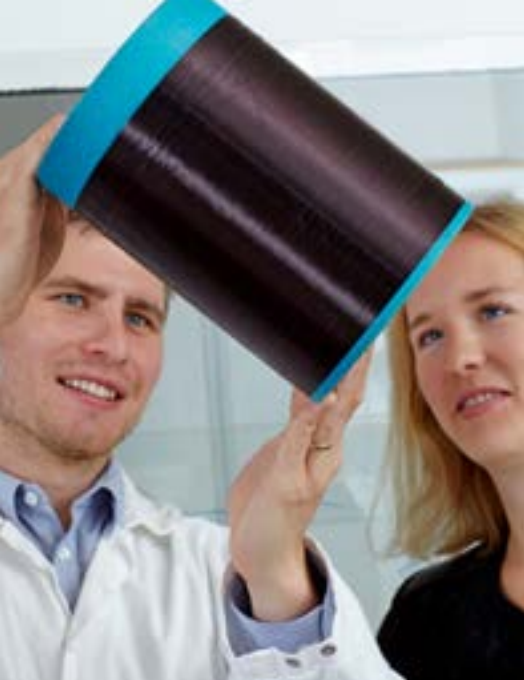
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I RISE Bioekonomi har vi fått

en större kompetensbredd från råvara till färdigt material. Vi jobbar kring olika värdekedjor utgående från skogsråvara och en del jordbruks- och biorester. Processerna utgör tillsammans eller enskilt i sig ett bioraffinaderi som kan leverera inte bara dagens traditionella produkter utan en mängd nya utgångsmaterial som kan fylla olika behov i det biobaserade samhället. För att effektivt och strategiskt driva samverkan mellan kompetensområden har RISE inrättat fem affärs- och innovationsområden som spänner över alla divisioner.

Som RISE är vi starkare. Bioekonomi är viktigt för samhället, och samtidigt namnet på en viktig division inom RISE. Jag är stolt över uppdraget att leda den.



This is RISE Bioeconomy

Biorefinery and energy – separate for highest value

The forest – our green gold – already accounts for huge values, but it can generate significantly more in the bioeconomy. The main process for dealing with the components of the forest – cellulose, lignin and hemicellulose – is the biorefinery. There is a special unit for this within the Bioeconomy division. Director Catharina Ottestam explains:

“Our mission is to be able to separate out these elements for the applications for which a high value can be obtained. And we don’t just need to look at how the components are extracted, but also at how they are structured. For instance, what does the cellulose need to be like to be suitable for nanocellulose in order for

“we now have a mobile demo plant”

it to be implanted in a human body or to become a textile? It could also involve extracting a lignin that can be transformed into carbon fibre composites for lightweight products. Hemicellulose can be used as a raw material to create excellent barriers. The challenge here is to develop processes that make it financially viable. We also work on process simulation and system studies in order to see how we can achieve the best overall sustainability, which obviously also includes financial aspects.”

“The merger of Innventia’s and SP’s competences in this new division means that a stronger offer will be clearly signalled in the Biorefinery and Energy unit.

We will gain an overview of cellulose and a diversification within what, in the future, may be a bioenergy platform. Bioeconomy is not just material and products. In some situations, you need to create energy and fuel, for example from residual streams.”

“We will also be stronger on the test and demo side. We shortly hope to have our new X-ray equipment, a SAXS and WAXS, in place, which will enable us to take high-resolution measurements of nanostructures. That paves the way for more advanced studies at Max IV in Lund. On the lignin side, we will now take the next step towards a continuous line to produce carbon fibres. And in terms of nanocellulose, we now have a mobile demo factory ready to travel around the country in order to evaluate concepts at various mills.” ●

Biobased materials – challenging fossil-based materials in many areas

The Biobased Materials unit brings together a broad spectrum of competences and research areas. There is one overarching challenge – to replace traditional fossil-based materials with new bio-based materials.

“In general, I’d say that it’s in part about cellulose-based composites, in part wood-based products,” explains Director Hans Holmberg. “We have many core areas linked around these main flows. One example is measuring techniques and process control within the wood mechanical industry. Another is how the new biobased materials we develop are perceived by consumers. Product safety involves ensuring that materials intended



Catharina Ottestam



Hans Holmberg

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for contact with food meet the relevant regulations. When it comes to wood-based products, long term performance is an important issue, which is one of several areas that we are pursuing within the EcoBuild arena in collaboration with industrial companies.”

“We are also running a test bed on durability to help companies gain increased understanding of how materials and products perform within the environments in which they are used. Within the area of material design, the work involving demonstrators has proven to be a successful way of illustrating new concepts. On several occasions we have cooperated with designers, and the results have led to both industrial interest and fine design prizes.”

“During 2017 we will initiate a new area of strength with a focus on upscaling components and cellulose-based material concepts. We are also hoping for a similar initiative in the wood mechanical industry within the area of digitalisation. In addition to wood products and cellulose materials, we can see how our method development within chemical analysis is assisting in the development of lignin products. We very recently released four public methods for lignin analysis. Harmonised analysis methods are required to facilitate the trade in lignin. We believe that we can play a leading role in that.” ●

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Papermaking and packaging – for the circular economy

The Papermaking and Packaging unit features an unbroken chain from fibre-based processes to the functionality of the finished packaging. An increasingly important task is to loop the chain into new circular flows and to create platforms for materials in the circular economy.

“Within papermaking, we are working as much on optimising traditional production processes as on the development of new products that draw on the infrastructure, competence and know-how of the paper mill,” says Director Marco Lucisano. “A new focus for the papermaking teams is to implement the new framework for the circular economy of the future in commercial production processes. In this respect, “circular fibre flows” is the key concept.”

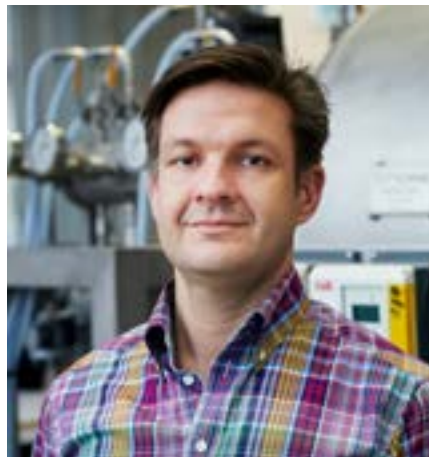
“Our FEX pilot facility is the best tool for bringing research projects and new ideas as close to implementation as possible. And the infrastructure is being renewed all the time. The latest news is

that we are playing host to the Italian company Gruppo X di X Gruppo, which has installed equipment at FEX. Their technology makes it possible to develop new concepts for highly elastic 3D-like paper. This is a new, exciting form of cooperation for accelerating innovation.”

“Another exciting opportunity is the area of packaging, where RISE allows us to understand and work on a much broader spectrum of material solutions. Our goal is to create a “Packaging excellence centre” for sustainable packaging in the circular economy. Sustainability is becoming increasingly important. This involves both optimising the use of resources and designing new materials and functions. What about printing strength locally, only where it is needed, but also a transparent window, only where it is needed?”

Another exciting area is materials for bio-based electronics, in close cooperation with RISE ICT. This includes cellulose-based materials for energy storage, but also functionalities that can be designed into the material, such as sensors or options for interaction with the user. ●

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Marco Lucisano

 **Den huvudsakliga** processen för att ta hand om skogens beståndsdelar är bioraffinaderiet. Fokus för enheten Bioraffinaderi och energi är separationsprocesser för att utvinna cellulosa, lignin och hemicellulosa för de tillämpningar där man kan få högt värde samt hur komponenterna ska vara strukturerade.

Enheten Biobaserade material spänner över flera områden som biokompositer, trämekaniska produkter, mätteknik/processstyrning, materialupplevelse och produktssäkerhet.

I enheten Papperstillverkning och förpackningar finns en obruten kedja från process till den färdiga förpackningens funktionalitet. Här finns också den unika pilotanläggningen FEX. En allt viktigare uppgift är att skapa plattformar för nya material i den cirkulära ekonomin.



PHOTO: PAX ENGSTRÖM

The winner of the Ekman medal is driven by new questions

During the Ekman Days event in January 2017 Tomas Larsson was awarded an Ekman medal for his research. The Ekman Medal is awarded by SPCI and has been awarded to 45 individuals since its introduction 1929. Tomas' research has resulted in new knowledge and insights within the field of cellulose structure.

“New knowledge is not just new knowledge for me personally; it is new knowledge not yet known to anyone,” says Tomas.

Part of the reason why Tomas was awarded the medal is that his research provided new knowledge and insights. During his work he has met many other researchers, given presentations, published articles and rapidly identified his research area. All the contacts and meetings are part of the quality control process for research, and, according to Tomas, were an important reason for him receiving this reward.

“I am really delighted and honoured. The award was not a foregone conclusion in any way, so it was fantastic news.”

Tomas has developed new understanding of the internal structure of cellulose that was not previously available. SPCI's board believes that the new cellulose fibre knowledge is essential to be able to replace other raw materials and to adapt cellulose materials for future uses. ●

Read the whole interview on www.innventia.com

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Within the Bioeconomy division, there are three separate companies in addition to the three units described on the previous pages. These fully or partly owned subsidiaries of RISE are Energy Technology Center (ETC) in Piteå, Paper and Fiber Research Institute (PFI) in Trondheim and Processum in Örnsköldsvik.

ETC – accelerating innovation in sustainable energy solutions

Piteå in northern Sweden is the location of a unique test bed environment for research and development within the focus area of thermochemical conversion processes of biomass and waste materials. Energy Technology Center (ETC) offers services that contribute to converting industry to production of renewable fuels, transportation fuels and chemicals. “Above all, it is a question of combustion, gasification, pyrolysis, upgrading and biomaterials,” explains CEO Magnus Marklund.

“Our operations have always been very technology-related, regardless of whether we are working on major public research projects or direct customer assignments. Among the areas of excel-



Magnus Marklund

lence, I would like to point out catalytic processes, process characterisation, multiphase fluid dynamics and non-intrusive diagnostics. Based on the process, we can customise experiments on scientific basis and under industrially relevant conditions. You could say that we are the bridge between basic research and industrial application within our focus area.”

“The conversion to sustainable energy is vital for the whole of society. There are many interesting technical tracks to develop further together with industry. One example is the partnership with Preem involving upgrading of bio-based raw materials for conventional transportation fuels. Another is the project with Smurfit Kappa within the strategic research programme Re:Source. Here we are studying co-pyrolysis of recycled plastic and biomass. There is a huge need to make use of this residual product.”

“ETC has a good strategic location next to Smurfit Kappa Kraftliner’s paper mill and within the Piteå Science Park. This spring we will be inaugurating a

new unique pilot plant for upgrading based on the slurry hydrocracking principle. This is a process found at a number of oil refineries today and which we now intend to use on pumpable liquified biomass. We have actually already started a verification project for upgrading kraft lignin from pulp mills in this case,” concludes Magnus. ●

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PFI contributes to Norwegian and international bioeconomy targets

Since 1923, PFI has been the Norwegian research institute within wood-based biorefining. With offices at the NTNU University Campus in Trondheim, Norway, PFI is strategically positioned in the heart of the main technology and innovation hub in Norway.

“Our focus areas are biorefining and bioenergy, fibre and paper, nanocellulose and carbohydrate polymers and biocomposites,” says Philip A. Réme, Managing Director of PFI. Continuously advancing the research front, PFI works within such various applications as paper and packaging, food and feed ingredients, biomedical applications, composites, oil-field applications, wood fibre insulation, membranes, biofuels and biochemicals.

“Close cooperation with industry is a key success factor. One example is the new demonstration plant for production



PHOTO: ETC

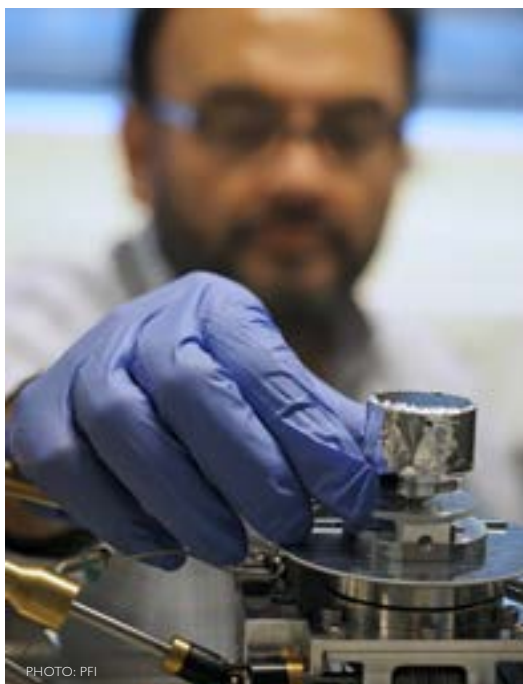


PHOTO: PFI



PHOTO: PROCESSUM

of microfibrillated cellulose at Norske Skog Saugbrugs, where long-term research cooperation with PFI within nanocellulose technology has made important contributions. Another example is Hunton Fiber's planned production of wood fibre insulation in Norway, where a joint innovation project between Hunton Fiber and PFI has provided important input."

"We are now starting 2017 with a highly interesting portfolio of research and innovation projects, making important contributions to Norwegian and international bioeconomy targets." ●

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Philip A. Reme

Processum – collaboration on biorefinery development

Processum is a partly owned subsidiary of the RISE group. The company was founded in 2003 and is located in Örnsköldsvik. Activities focus on supporting and initiating research and development within biorefinery. Together with other biorefinery initiatives, the cluster of partners from industry and academia represent an important hub for the development of new products, processes and energy solutions from wood raw materials and the side streams of process industry.

"Together with industry, universities and research institutes, we run a large number of projects, all aimed, in various ways, at helping to create a more sustainable, greener society," says Magnus Hallberg, CEO of Processum. "Biorefinery is one area that requires broad cooperation and access to specialist expertise within several areas. Our core areas within biorefinery are Biotechnology and Organic Chemistry,



Magnus Hallberg

and half of Processum's employees have defended theses within these areas. Residual materials is another area where we are also active."

"We want to bring good ideas and successful laboratory results closer to commercialisation. That's why we have established a pilot park with equipment for pretreatment of biomass, fermentation, enzymatic reactions and chemical syntheses, as well as purification and separation. That allows us to carry out extensive experiments on pilot scale and in some cases also demonstration scale. This is a requirement for being able to produce new products based on renewable raw materials.

"We are currently participating in around fifty development projects of various sizes. Some examples are further development of proteins for feed purposes, green chemicals based on industrial side streams and covering mining waste with green liquor sludge. Extensive collaboration within RISE, and with companies, institutes and universities both in Sweden and abroad, ensures our activities help to create a more sustainable society," Magnus concludes. ●

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I divisionen ingår tre separata bolag, helt eller delvis ägda av RISE.

ETC har en unik testbäddsmiljö för FoU inom termokemiska omvandlingsprocesser av biomassa. Det handlar framför allt om förbränning, förgasning, pyrolys, uppgradering och biomaterial.

PFI:s verksamhet riktar sig mot många olika tillämpningar såsom papper och förpackningar, livsmedels-/fodringredienser, biomedicinska tillämpningar, kompositer, oljefältapplikationer, träfiberisolering, membran, biobränslen och biokemikalier.

Processum's kluster med partners från industri och akademi utgör, tillsammans med andra bioraffinaderiinitiativ, ett viktigt nav för utveckling av nya produkter, processer och energilösningar från skogsråvara och processindustrins sidoströmmar.

COMING EVENTS

MARCH

- 14-15 "Bioekonomiriksdagen" (Bioeconomy Parliament)
- 16-17 The Lignin Center of Sweden - 1st Workshop
- 28-30 7th Nordic Wood Biorefinery Conference 2017

APRIL

- 2-6 ACS National Meeting & Exposition
- 23-26 PaperCon Conference
- 26 P3G (Packaging & Product Protection Group)
- 27 "Livsmedelsförpackningar i Fokus" (Food packaging conference)

MAY

- 9-12 28th IAPRI Symposium on Packaging 2017
- 24-26 International Chemical Recovery Conference 2017

For further information on coming events, see our websites ri.se, innventia.com, sp.se, pfi.no and processum.se.

We have changed our e-mail addresses*: name.surname@ri.se

* previous Innventia and SP addresses



Unique opportunity to see our new mobile demo plant

On Monday 27 March the new MFC demo plant will be showcased during an "Open House" for NWBC 2017 conference delegates.

For information about NWBC, see www.innventia.com/nwbc2017.

For information about the demo plant, contact eva.alander@ri.se.

Have you changed address?

Let us know by sending an e-mail to info.innventia@ri.se

B



New research programme balances present and future

The Bioeconomy Research Programme 2018-2020 is both broader and more focused than the current research programme. Thanks to RISE, more areas will be added, with the unique cooperation model remaining in place.



Anders Pettersson and Fredrik Aldaeus

With almost ten months to the start, the next three-year programme is starting to take shape. The ideas have been gone over repeatedly in internal workshops and in consultation with the industry. It is quite clear that the it will have a clearer sustainability focus, with the circular bio-based economy at its heart.

“The programme will also include more areas and we will have a better offer within many areas. For example, we can now see how we can muster our strengths within areas such as biofuels and textiles,” explains Fredrik Aldaeus, who is leading the planning work for The Bioeconomy Research Programme 2018–2020.

The ideas now being discussed are based on both the current research programme and the needs identified by the participating companies. This involves both improving existing processes and developing new ones, balancing the traditional with the innovative. For brand new areas, input from internal business intelligence will play a key role, as will the studies carried out for the Global Outlook reports.

“One thing that we will work more on during the next programme is demonstrators. We have noted the impact you can have by demonstrating something in

concrete terms. It is also one of the main conclusions of the “A cellulose-based society” project. That’s why we, along with our customers, want to consider upscaling and industrial implementation right from the off. “Here we have an advantage in the access to advanced equipment,” Fredrik comments.

The programme will consist of two parts: the “Precompetitive Research” (PCR), where the results will be published, and the “Application Oriented Research” (AOR), which is focusing on various applications.

“The model was new when it was launched in 2015 and our assessment is that the companies in particular are positive about determining in advance what will be open and published and what will be reserved for the participating companies,” says Anders Pettersson, Chief Technology Officer at RISE Bioeconomy.

“An innovation with PCR that we also believe will be well received is business intelligence. We have already included this in one area in the current programme, and it was greatly appreciated. During the next programme, it will feature in all the areas,” reveals Anders.

The next stage of the process is to evaluate the project concepts together

with the companies, so that a final programme can be presented in the autumn.

“Then the programme will go public. Until then we will regularly be presenting some of the most interesting research areas we are involved in within RISE Bioeconomy on the website,” explains Fredrik.

“And naturally we welcome any interested companies to contact us now for individual discussions,” adds Anders. ●

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Tradition och nytänk i balans

karaktäriserar The Bioeconomy Research Programme 2018–2020. Det handlar både om att förbättra befintliga processer och utveckla nya. Det nya programmet får ett än tydligare hållbarhetsfokus med den cirkulära biobaserade ekonomin i centrum. Klart är också att det kommer att bli både bredare och vassare tack vare samgåendet i RISE. Det blir också mer fokus på demonstration, att redan från början tänka in uppskalning och industriell implementering. Detta är en av insikterna från Innventia Global Outlook A Cellulose-Based Society. En nyhet är att omvärldsbevakning nu kommer att ingå i alla programområden.

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