RESEARCH FRONTIERS IN PAPER DEVELOPMENT

Jesper Berthold, Mikael Lindström

Research Institutes of Sweden
Bioeconomy
Paper technology

The aim of this presentation is to tell you a little bit about some of the projects we are currently running at RISE on papermaking and aspekts thereof.
First we will talk about stretchable paper or highly deformable paper, then
We will explain some about various strenght additives followed by
Digital cellulose.

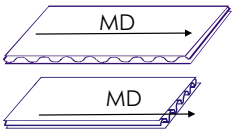
Stretchable or highly deformable paper

Pilot facility for Highly Deformable papers

RISE Bioeconomy is hosting technology patented and owned by Gruppo X di X gruppo with pilot scaled and implemented units for

- Increased strain at break
- Tailored anisotropy
- Structured surfaces
- And more...

RISE Bioeconomy is also hosting a technology patented and owned by Gruppo X di X gruppo for the production of a machine directional corrugated fluting



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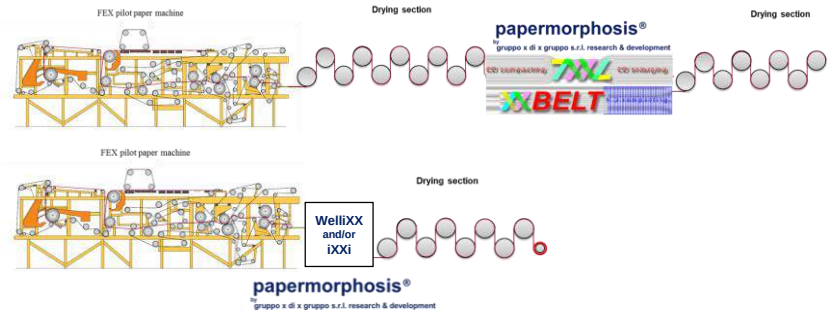
Platform at a pilot scale

- The papermorphosis® system tailors the extensibility of paper in both directions. These processes can now be tested towards YOUR specific application at a pilot scale. With your specifically designed trial, we can attempt to process your pulp, additives and paper machine settings with a chosen level of strain at break.



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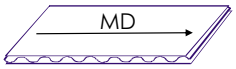
Subsequent micro-crepe in both directions allows for

- Tailored Anisotropy
- Highly engineered mechanical properties
- Completely new products
- Greatly improved existing products

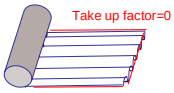
An array of benefits

- 80% of all corrugates produced globally are single walled.
  - Edge crush test is dependent on
    - Stiffness of the paper in loading direction (MD is the stiffest by the way)
- Combining the traditional and novel corrugation processes can create an isotropically stiff panel
- Panels are today corrugated with an immense decrease in paper length
  - In a preliminary test the novel technology produced a 1,3mm thick fluting at less than 1% width reduction
  - This leads to panel making at the same dimensions as the ingoing material

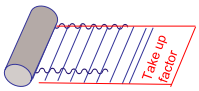


Traditional corrugate

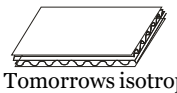
Novel MD corrugate



Flute of tomorrow +



Flute of today =



Tomorrows isotropic panel, possibility of better distribution on blanks on a homogeneous layer

One size fits all!

Wouldn’t it be nice to have a possibility to just pull the paper if the size is wrong?

TEXTILE-LIKE MATERIALS

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Research Institutes of Sweden
Bioeconomy
Paper and Packaging – Paper Technology

Textile-like materials from a paper machine

Materials of today that are perceived as textile-like typically have **two or more** of a certain set of properties.

Moreover they are typically permanent and not recycled

What about materials produced in a sustainable way, much faster and cheaper and with typically **one or more** of a certain set of properties?

Fibre and Additives for Optimizing for strength and softness

The ingoing raw material could be tailored to balance the softness to the strength needed for the application

A completely biobased, renewable and compostable multimaterial could achieve the set target in terms of both softness and strength even for relatively thin qualities

Process development

Full scale pilot production could be handled continuously as well as in batch-wise productions without risks of contamination of the subsequent product

Specially designed head box, on line measurements and foam forming technology was used to introduce 8mm long fibres into the paper making process and at good formation

One base material to rule them all

- The base material itself is
  - Twice as flushable as today's wipes
  - Renewable, compostable
  - Sealable, absorbent, warm to the touch
  - Softer than tissue paper but thrice as strong
- Various converting applications and functionalization chemistry are applicable to adapt the base material to textile-like material products.
  - Microcreping for stretch and drapability
  - Weldable for improved strength without loss of textile properties
  - Coating for added functionality
    - Hydrophobic
    - Flame retardant
  - Coloring and Printable
  - Curable for improvement of strength

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Demonstrating the potential

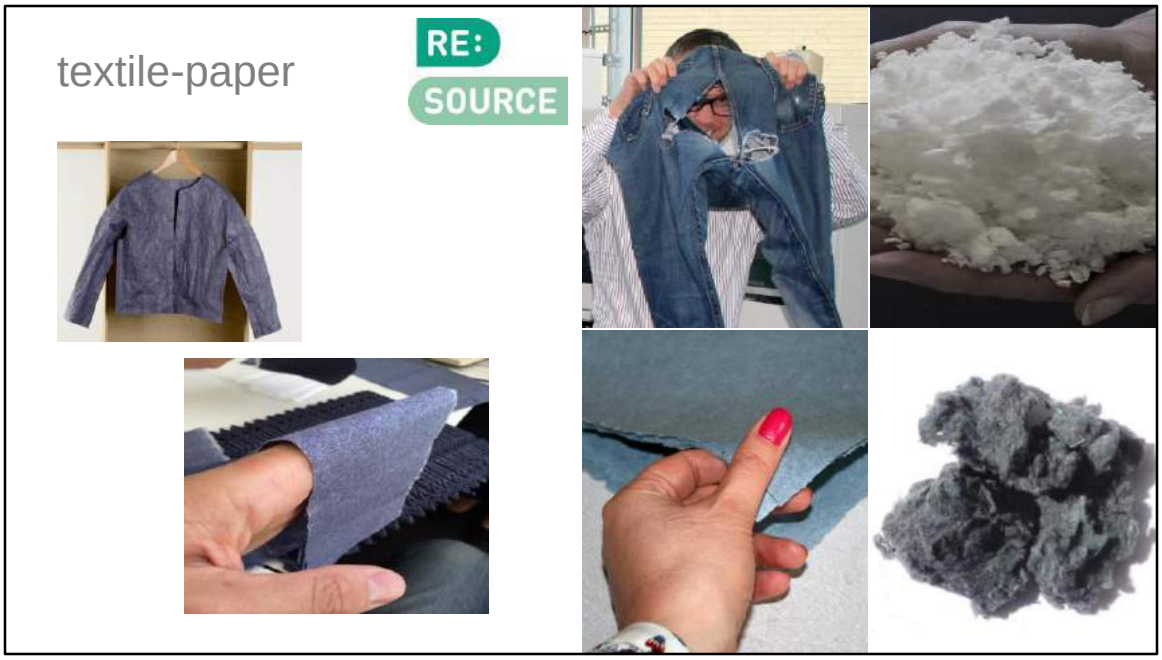
A number of different demonstrators were produced to show the various possibilities

A soft, printed curtain

A sealed, colored and unique patterned bag

An ultra fast fashion clothing

A sound absorbent for interior design



In this particular case we used old Jeanse together with part fresh virgin kraft pulp. This is just an example of what can be produced over a papermachine today when we talk about textile like materials

FIBRE BASED STRENGTH AGENTS

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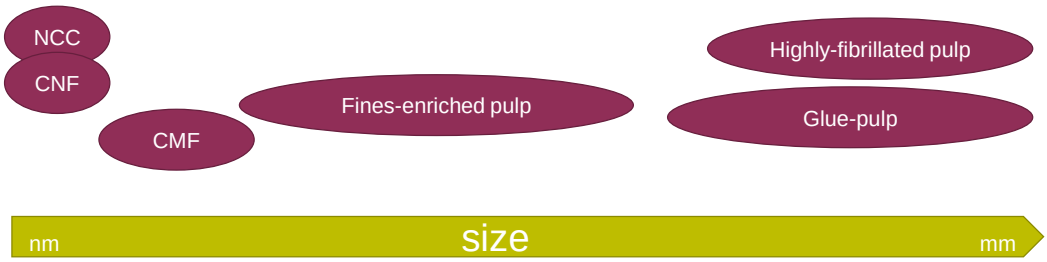
Bioeconomy
Papermaking & Packaging

There is a constant race going on towards lighter paperin order to save material at the same time as the new and lighter paper must maintain, or actually surpass the old one regarding strength.
This is one area where the use of various strength additives comes in to play.
Here we are talking about the use of the raw-material itself, the fibers and fractions of the fibers rather than starch and waious chemical schedules.

Examples of fibre-based dry strength additives



What is needed in each application?

- Strength enhancing effect?
- Specific surface?
- Retention?
- Dewatering?
- Production cost?

There are several problems arising when mixing in different kinds of post-treated pulp or fractions of pulp. Factors such as water retention and dewatering, product cost etc. How far do we need to refine the fibres in order to achieve the desired effect? Do we need to use CNF in order to get the increase in strength that we want or is it bette i.e cheaper to use for example FE-pulp (fines enriched pulp) or perhaps glue-pulp?

Examples of fibre-based dry strength additives

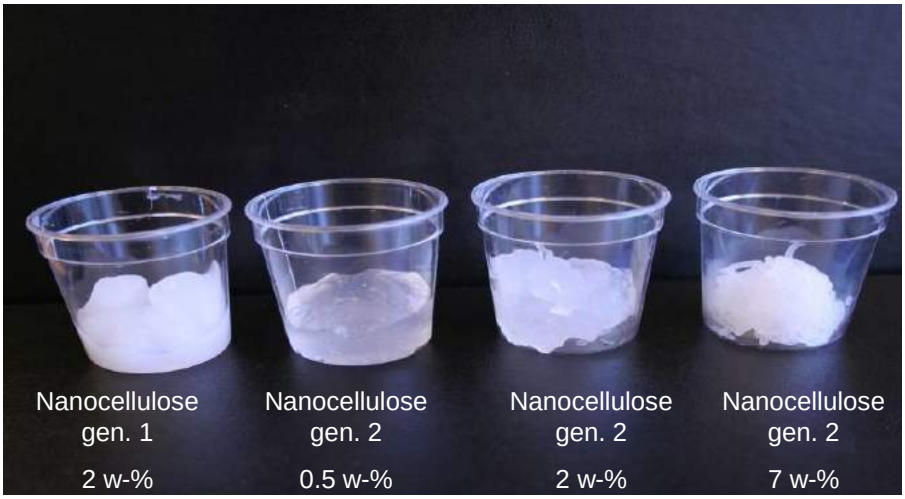
Type	Short description
Glue pulp, Birch slime	Chemical pulp treated with very high specific refining energies (SRE), standard refining process, recirculatory process layout, used for 50+ yrs
Enzyme-enhanced refining	Addition of enzymes makes desintegration/refining of the pulp fibres in refiner easier, same refining effect can be achieved with a lower SRE
Highly-fibrillated pulp (HF-pulp)	Extremely fibrillated pulp, produced in LC-refiner process, using very fine segments
Fines-enriched pulp (FE-pulp)	Combination of the glue pulp process with a size fractionation based on a microperforated screen, significantly reduced fibre length i.e. increased number of particles
FibreLean	Proposed by Imerys and Omya, Co-grinding of pulp and mineral particles results in a desintegration of the chemical pulp into much smaller pulp particles (MFC)
FibreFine	GL&V system, commercial scale cellulose nanofibril (CNF) system; recirculatory fibre treatment using LC-refiner (special plates), also proposed for the production of thin coatings
MFC, NFC, NCC	Very highly desintegrated pulps resulting in much smaller particles; produced using a combination of chemical, enzymatic and/or mechanical treatments; mechanical treatment processes are ”imported” form other process industries.

This slide gives you an example of what kind of different fibre based strengths additives there are and how they are defined by at least us at RISE Bioeconomy. Please have a look at the list later if you are interested.

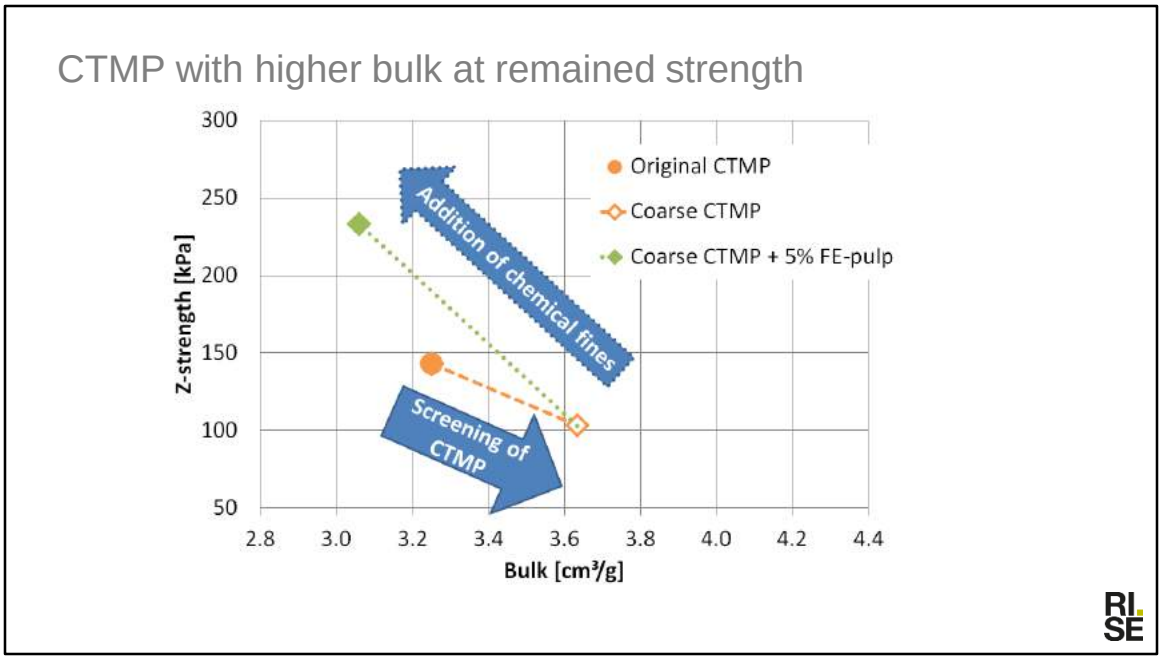
Aspects – fibre-based strength agents

- Strength
  - Maximum strength requires the right combination of treated, fibrillated fibres and smaller bonding particles (fines), see results from Lobben (1977)
- Dewatering
  - A higher fines content leads to a higher Schopper Riegler value and a slower dewatering in wire section sheet forming process
  - Dryness after pressing is significantly affected by the addition of fines
- Retention
  - The smaller the particle, the lower the mechanical retention during the forming process
  - The difference in retention for different components in the suspension (fibres, fines, fillers) leads to a Z-directional variation in sheet composition, e.g. the fines content at the wire side is lower
  - With decreasing retention, this Z-directional variation becomes more pronounced
- Morphology of fibre-based strength agents
  - The size and number of the strength agent particles has to be optimized in order to get the right balance between material efficiency (a high number of particles) and high retention (sufficient size of the particles)

Different types of nanocellulose



Two different forms shown here, generation 1 and 2. 5 different generations now exist.
Gen 2 slightly smaller diameter. Will say more about the differences in a few slides
NOTE: MFC is different from the so-called ‘Nano-crystalline cellulose’. MFC has a much smaller diameter is obtained from a high shear force homogenization.
NCC is obtained from sulfuric acid homogenization.



The graph shows you how the removal of fines (approximately 15% of the pulp) from CTMP through a screening process reduces the Z-strength and how a subsequent addition of 5% FE pulp increases the final Z-strength value for the pulp.

We are exploring the use of several different kinds of raw materials finding similar positiv indications in all cases. Softwood, hardwood, recycled paper etc..

BIOBASED ELECTRONICS

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October 2018

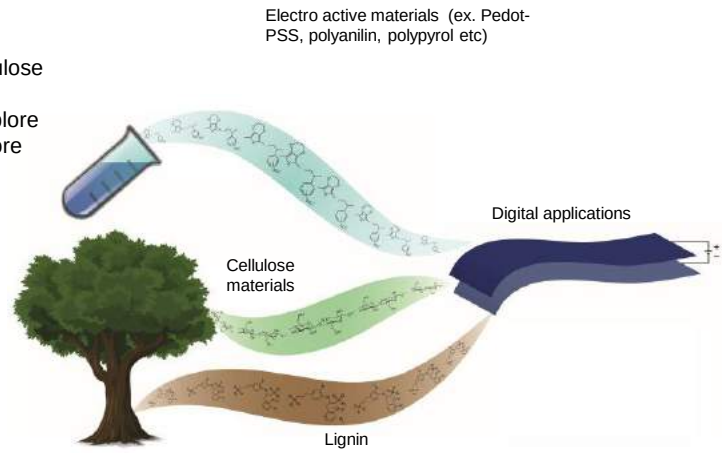
Research Institutes of Sweden
Bioeconomy

Biobased electronics

By combing different forms of cellulose materials from the forest with electroactive materials we can explore new digital functions in a much more sustainable way than ever before.

We are exploring low cost, simple functions to be used for ex in:

- Packaging
- Health care
- Batteries etc.



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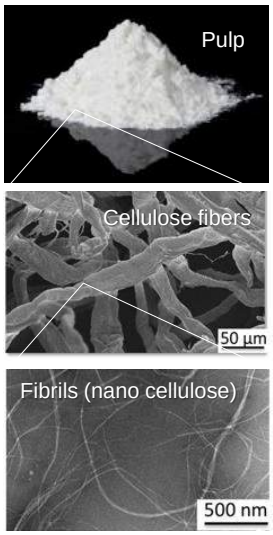
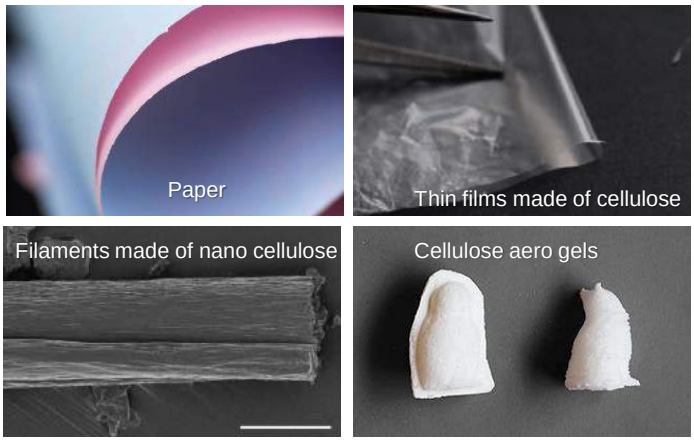
We are exploring what new functions are possible to achieve when we start to combine electroactive materials with biobased materials.



Examples of different cellulose structures suitable for biobased electronics



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By modification of pulp, fibers or nanofibrils, different electrical functions can be added to paper, films, filaments or 3D objects all depending on applications and general needs.

This is a short presentation of Arcwise. Arcwise® is a patented technology and a registered trademark of SCA Forest Products AB. Arcwise® is a unique packaging technology that for the first time entails curved shaped corrugated board packaging.

The Arcwise® packaging concept can be realized in conventional corrugated board machinery and subsequent printing and die-cutting equipment and does not involve significant investments. Arcwise® packaging can be shipped flat from corrugated packaging producers to brand owners (fillers) and attain a curved shape in the erecting/filling process. (www.arcwise.se)

ARCWISE®

SCA

Curved shapes are perceived as more attractive than objects with sharp angles

Stronger brand and product recognition

Evoking curiosity

Designs that stand out at Point-Of-Sale

Designs that stand out at Point-Of-Sale

The technology provides for example shelf ready packs and attraction in point of sale. In Point-Of-Sales, attractive curved shaped packaging designs are set to boost sales among brand owners

ARCWISE®

SCA

Extensive material saving potential through lightweighting

Sustainability: renewable, biodegradable and potential for extensively lower CO_2 footprint.

Possibilities for upscaling of packaging size (due to rigidity)

Performance

Performance

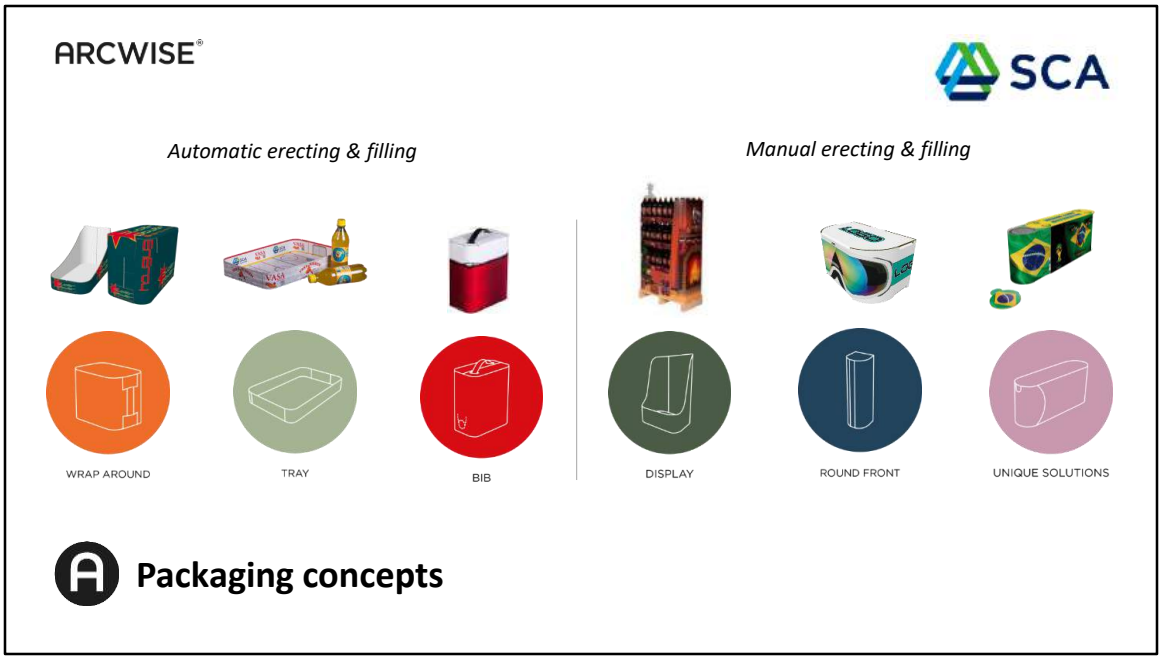
At the same time, Arcwise® has a significant lightweighting potential, which can substantially reduce carbon footprint. It is also possibilities for upscaling of packaging size (due to rigidity)

Curved shaped corrugated board packaging

Play

Short movie about curved shaped corrugated board packaging

This 2 minute-movie aims to further introduce you to Arcwise.



Packaging concepts
Here we see some examples of packaging concepts:
Automatic erecting & filling (wrap around, tray amd box).
Manual erecting & filling (display, round front and unique solutions).

ARCWISE®

SCA

Reference cases show that it is possible to use Arcwise without new investments.

01. DESIGN	02. MANUFACTURING	03. TRANSPORT	04. ERECTING/FILLING	05. RETAIL-POS
Arcwise® packaging are designed in conventional CAD-software	Arcwise® material is produced in existing corrugated board machines	Arcwise® material is shipped flat which assures efficient logistics	Arcwise packaging (e.g. tray, WA) can be erected and filled in existing machines	Arcwise® packaging stands out on the shelf at the retailer

Arcwise in the value chain

Arcwise in the value chain

1. Design: Arcwise® packaging are designed in conventional CAD-software
2. Manufacturing: Arcwise® material is produced in existing corrugated board machines
3. Transport: Arcwise® material is shipped flat which assures efficient logistics
4. Erecting/filling: Arcwise packaging (e.g. tray, WA) can be erected and filled in existing machines
5. Retail–POS: Arcwise® packaging stands out on the shelf at the retailer

Reference cases show that it is possible to use Arcwise without new investments.

ARCWISE®

ARCWISE®

SCA

ROUND SHAPED CORRUGATED BOARD PACKAGING

www.arcwise.se

MAY WE SUGGEST YOU CHANGE
THE PACKAGING INSTEAD

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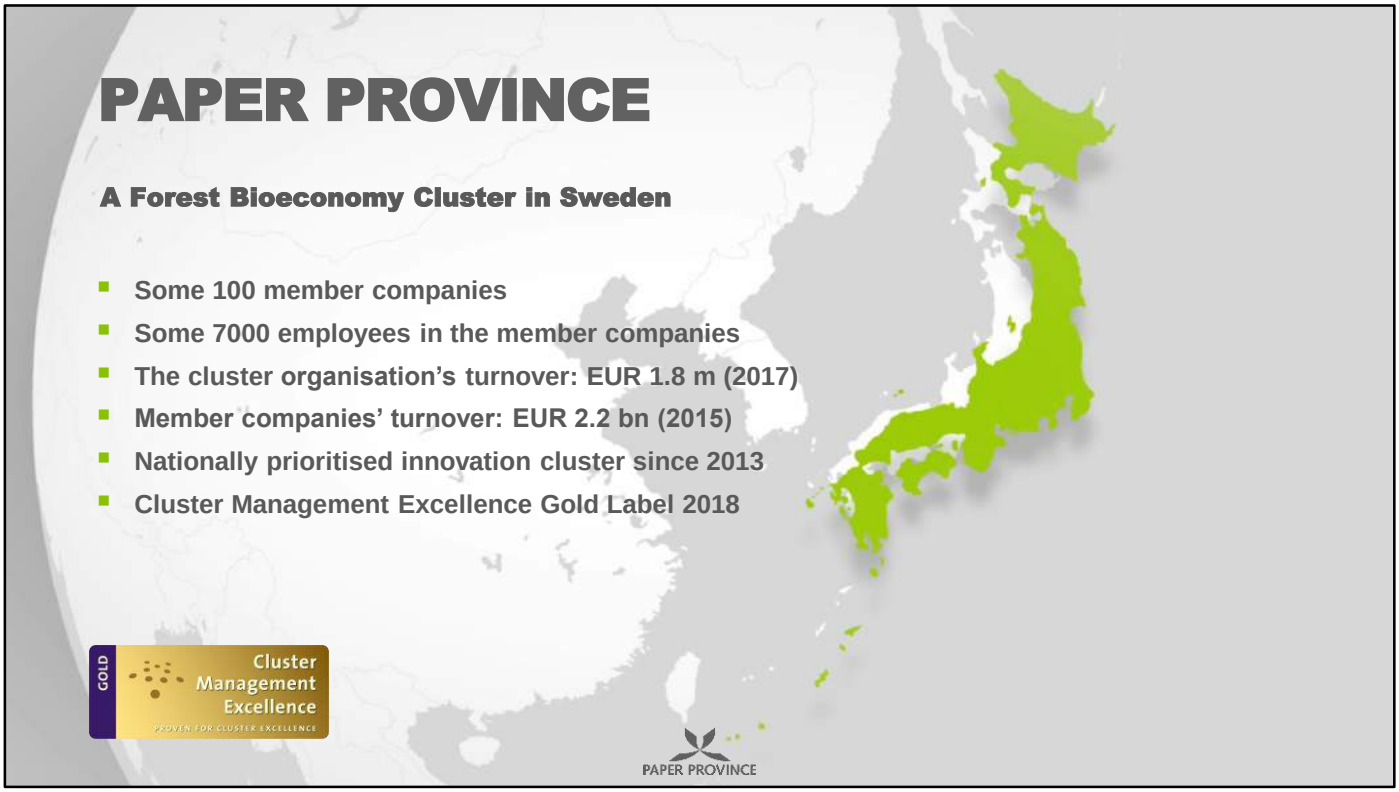


I am delighted to be here at Tokyo Pack

My name is Paul Nemes, I am Deputy CEO of Paper Province.

Paper Province is a cluster organisation in Sweden focussing on the forest-based bioeconomy. The cluster has around 100 member companies, from the packaging sector as well as from the pulp and paper, energy and wood processing sectors.

Since 2013, Paper Province is one of Sweden's innovation cluster, which means that we focus on innovation in relation to new, bio-based, products and services.

We are especially proud to this year have been awarded gold label status by the European Cluster Excellence Initiative. At the moment, we are the only gold label cluster in Sweden.

I could talk all day about what Paper Province is and what we do. However, as time is of the essence and to maximise the time that I kindly ask you to commit to my presentation, I will show you a short film which epitomises Paper Province, who we are and how we view the future of packaging.

Play

PAPER PROVINCE

What really makes Paper Province unique is the regional mobilisation for the transition to a forest-based bioeconomy that we have achieved.

What this means in practice is that all major stakeholders – from the private and public sectors and from academia – all pull in the same direction. This enables us to efficiently support innovation, with the support of all relevant organisations.

In short, we believe that this makes the Paper Province region *the* place to be for developing new sustainable solutions for the future bioeconomy. A very important part of this, of course, is sustainable packaging solutions.

We believe that this will enable us to realise our vision: a shift towards a more sustainable society, a bioeconomy.

With the transformation to a more sustainable society – with a forest-based raw material – we are building a better society, a better world.

A key part of this is demonstrating new biobased solutions.

If we do this, we can showcase how society can benefit from the bioeconomy, and from - for example - using more sustainable materials in packaging.

This is a milk carton, the way they look in Sweden. It is quite different from Japanese ones, right?

Today, one sixth of all liquid packaging board is produced in the Paper Province region.

As we speak, the world's largest and most modern carton board machine is being built in our region.

After the completion of the new machine, a quarter – 25 per cent – of all liquid packaging board – *globally* – will be produced in the Paper Province region. For a relatively small region in Sweden, an even smaller region from a European perspective and a tiny region from a global perspective, to have such a massive impact on the global market is, we believe, simply amazing.

Given that such a large part of the world already consumes products produced in our region, we have a fantastic opportunity to innovate and encourage the world to use packaging products that are even more sustainable and environmentally friendly.

THE ENVIRONMENT NEEDS MORE LIQUID PACKAGING BOARD

Compared to a monolayer PET bottle, a one-litre carton:

- **Generates 28 per cent less CO_2**
- **Uses 51 per cent less fossil resources**
- **Uses 24 per cent less primary energy**

Source: Study by IFEU (the German Institute for Energy and Environmental Research), commissioned by SIG Combibloc.

PAPER PROVINCE

At Paper Province, we believe that forest-based materials can replace less sustainable materials. For example, we are working with our member companies to find alternatives to plastic (PET) bottles and to make existing cartons event more sustainable and environmentally friendly.

In the future, we hope that all cartons will be ”eco-friendly”, and that we will not need to have it printed on only a select number of cartons.

Maybe you have heard of Tetra Pack? They were pioneers in producing cellulose based packaging, and we are building on that legacy.

On a final note, according to the Ellen Macarthur Foundation, there will be more plastic than fish in the world's oceans by 2050*. The extinction of a significant number of marine species would mean the collapse of the marine eco-systems.

In order to avoid this rather dystopian future, we need to improve the way we design, recycle and re-use plastics.

That is one option.

Another option is replacing plastics with other, more sustainable, materials. That is why we at Paper Province support innovation to find new areas of use for wood.

We are delighted to have had the opportunity to bring two of our member companies – OptiPack and UMW Coating Systems – to Tokyo.

They are continuously working to find practical solutions to the challenges that I have just mentioned.

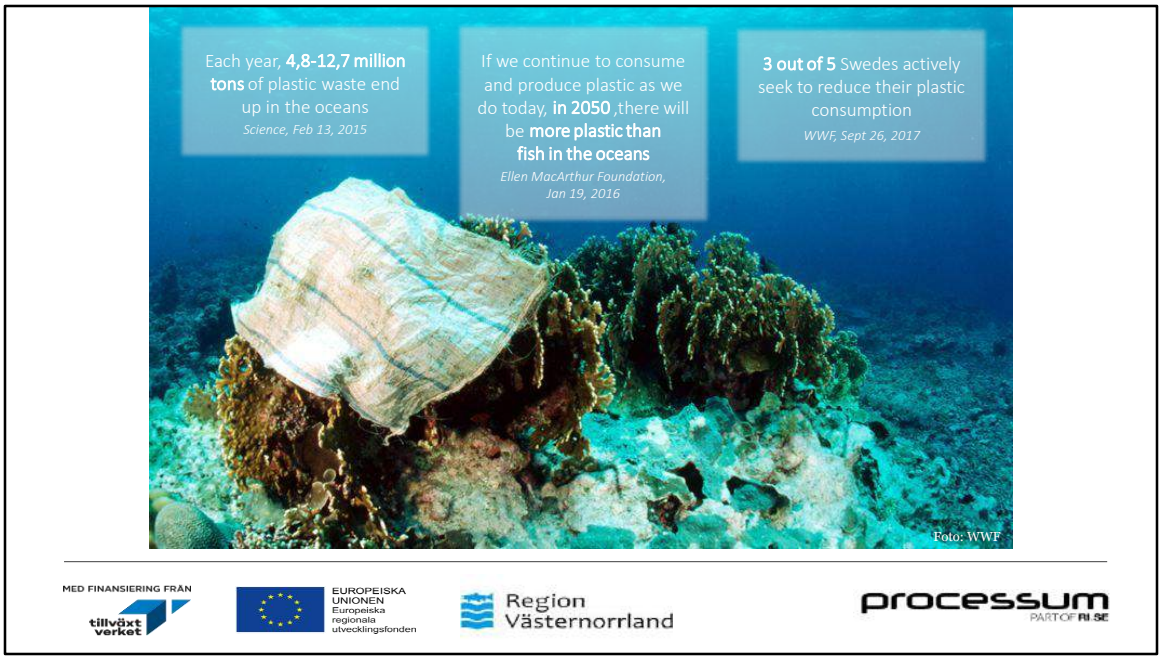
Thank you for your attention.

**Ellen Macarthur Foundation, report launched at the World Economic Forum in 2016.*

THANK YOU FOR YOUR ATTENTION!

PAPER PROVINCE

We are happy to present Paper to Replace Plastic – a research project developing packaging material and products at Mid Sweden University.



The background to this project, is that we live in a plastic world and we must reduce the amount of plastic that we use only once or a few times and then send to incineration. It does not make sense to produce packages out of materials that survives decades or centuries before it is degraded.

The problem is that a lot of it end up as garbage on land or in the oceans, where it creates problems for the environment and animals.

Each year, **4,8-12,7 million tons** of plastic waste end up in the oceans
Science, Feb 13, 2015)

If we continue to consume and produce plastic as we do today, **in 2050** ,there will be **more plastic than fish in the oceans.**

(Ellen MacArthur Foundation, Jan 19, 2016)

Also, 3 out of 5 Swedes actively
seek to reduce their plastic consumption.
(WWF, Sept 26, 2017)

WWF, Sept 26, 2017

Recycling is better than incineration but is often problematic because there is no simple technique to separate various plastics for recycling. Since the consumption of plastics is huge, a bio-based material available in large quantities is required to replace plastics. Also, cellulose from the forest is an abundant material and a possible resource for replacing plastics.

Paper to Replace Plastic

- Today, there are a wide variety of research projects world wide, with the purpose of finding new materials to replace plastic
- The main objective for the project **Paper to Replace Plastic** however, is to work with **existing types of paper** and coating made from environmentally friendly chemicals
- With the help of different types of treatments, the goal is to create products made out of paper that have the same characteristics as plastic – **moisture resistance, dirt repellent and wear resistance**

MED FINANSIERING FRÅN tillväxtverket

EUROPEISKA UNIONEN Europeiska regionala utvecklingsfonden

Region Västernorrland

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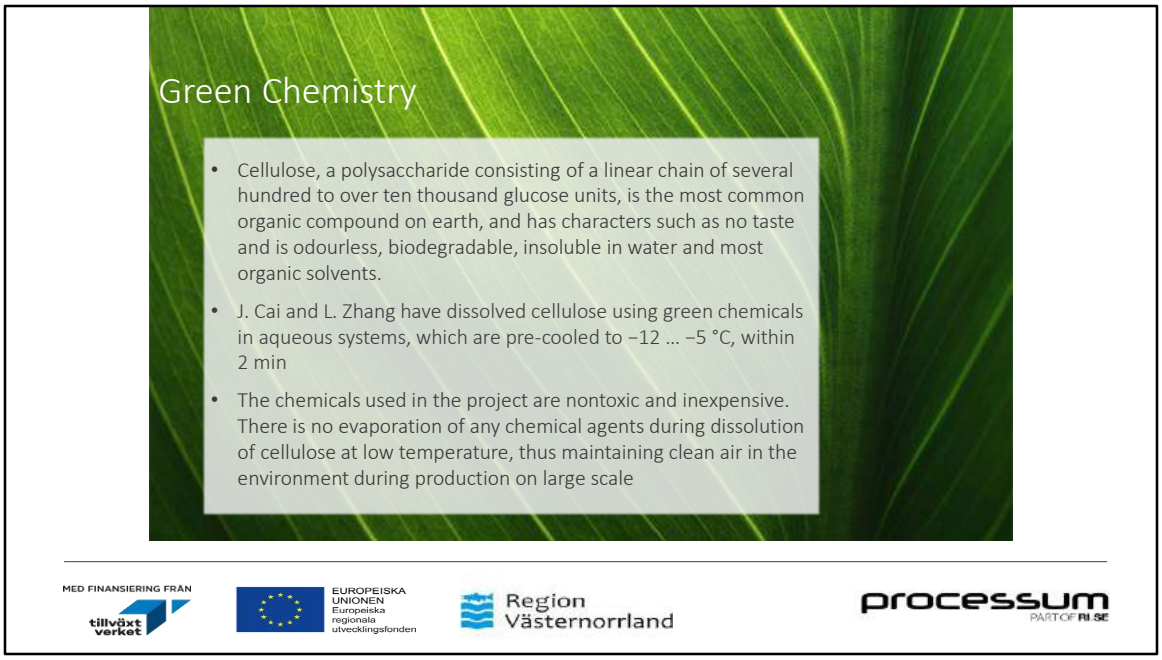
Research Background.

The research carried out at Mid Sweden University in Sundsvall, Sweden has its origins at Wuhan University in China, with professor Lina Zhang owning the current patents.



- Cellulose, a polysaccharide consisting of a linear chain of several hundred to over ten thousand glucose units, is the most common organic compound on earth, and has characters such as no taste and is odourless, biodegradable, insoluble in water and most organic solvents.
- J. Cai and L. Zhang have dissolved cellulose using green chemicals in aqueous systems, which are pre-cooled to −12 … −5 °C, within 2 min
- The chemicals used in the project are nontoxic and inexpensive. There is no evaporation of any chemical agents during dissolution of cellulose at low temperature, thus maintaining clean air in the environment during production on large scale.

Chemicals used: NaOH/urea, NaOH/thiourea and LiOH/urea

There are many possible applications for green chemicals to be used to treat paper, and also wood. The Paper to replace plastic project is thus divided into four different tracks: 3D Light Weight Objects, Surface Coating, Strong Paper Yarn and List Profiles.

3D Light Weight Objects

- With chemical treatment it is possible to form press paper and achieve similar characteristics as plastic
- We are currently trying different commercial paper and cardboard types to see where the limit goes for 3D-forming
- Construction of a heated press for 3D-forming of paper based materials is currently under its final stages
- The aim is to find solutions and products that can come into full-scale production

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3D Light Weight Objects

Numerous goods such as mugs, containers, packaging, etc. are manufactured today by molding metal or plastic foil. Often these disposable goods are difficult to recycle.

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Strong Paper Yarn

- Thin paper cut into narrow strips can be twisted and form paper yarn, for example Oji Fibre in Japan and Woodnotes in Finland
- Treatment with green chemicals has been tested in order to make the yarn less rigid and more suitable for textiles
- The treated yarn has good wet strength and could be used for replacing synthetic yarns in some applications
- Would greatly contribute to improving our marine environment and its ecosystem

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Strong Paper Yarn

Paper yarn is already used in e.g. furniture and decorative textiles. Its coarser character also inspires designers in several areas. From our recent setting, the yarn can go down to 40 micrometer in diameter.

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- Treatment with green chemicals has been tested in order to make the yarn less rigid and more suitable for textiles
- The treated yarn has good wet strength and could be used for replacing synthetic yarns in some applications
- Would greatly contribute to improving our marine environment and its ecosystem

Surface Coating

- With the help of green chemicals, trials are being carried out to coat wood and paper surfaces.
- Tests are also being carried out to investigate if hot pressing could create a smoother, more dirt repellent surface
- Surface coating can also enable lamination of plywood and other boards in form pressing, replacing polyvinyl alcohol or melamine formaldehyde (which is commonly used today)

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Region Västernorrland

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Surface Coating

By liquefaction or partial dissolution of cellulose, we use solvent to dissolve some part of the cellulose on the surface.

- With the help of green chemicals, trials are being carried out to coat wood and paper surfaces.
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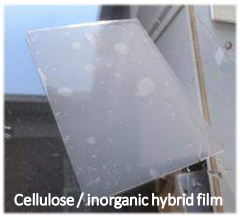
List Profiles

- Today, polyvinyl chloride (PVC) is commonly used in the manufacture of profiles for price tags in shop shelves, edge shields, stands etc.
- The project is working on developing prototypes that can replace today's PVC lists
- One of Sweden's leading manufacturers of PVC lists, HL-Display, is a partner in the project. They have customers in 50 countries and their products are being used in 265.000 stores world wide



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Possible applications

3D Light Weight Objects
By treatment with green chemicals and hot pressing, the strength and ductility of the paper increases which makes it possible to 3D-form and use as for example cups and lids for hot and cold beverages, and other disposable goods today made from plastics

Strong Paper Yarn
Could be an alternative to synthetic yarn, with possible use for textile clothing, curtains and carpets as well as technical yarns for fish nets

Surface Coating of Solid Wood
Could replace different types of other less environmentally friendly wood surface treatments, such as lacquer. Surface treatment can also enable lamination of plywood boards in form pressing

List profiles
Could replace today's PVC lists used in the manufacture of profiles for price tags in shop shelves, edge shields, stands etc.

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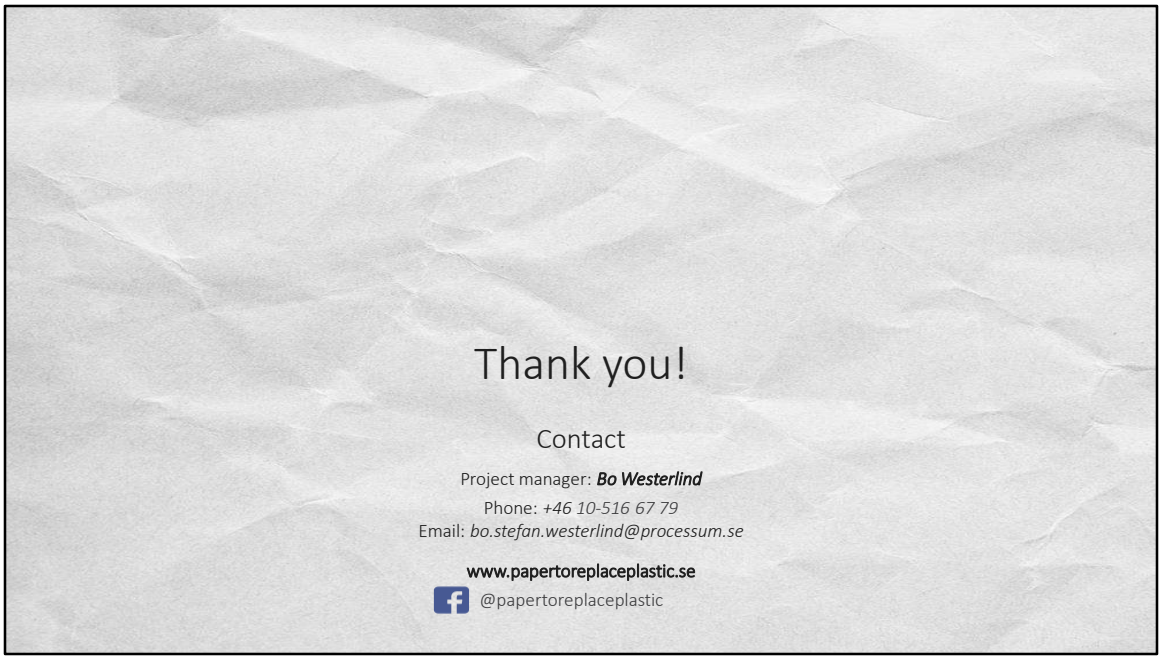

If you have further questions, please contact the Project Manager Bo Westerlind at Paper to Replace Plastic.

Thank you!

Contact information: Bo Westerlind, Project Manager, phone: +46 10-516 67 79, email: bo.stefan.westerlind@processum.se. www.papertoreplaceplastic.se

Project Financiers and Partners

MED FINANSIERING FRÅN tillväxtverket

EUROPEISKA UNIONEN Europeiska regionala utvecklingsfonden

Region Västernorrland

SCA Care of Life

AkzoNobel

processum PART OF RI.SE

FSCN PART OF MID SWEDEN UNIVERSITY

elby

HL

edvardssons

Njurunda Snickerifabrik

MED FINANSIERI tillväxtverket

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UMV Coating Systems started it´s operation 50 years ago in May 2016.

UMV Coating Systems AB

- Independent lead developer and global supplier of innovative
- Coating & Sizing Technology to the coated paper and board industry,
- for new installations and rebuilds.
- More than 50 years of experience and over than 600 installations

UMV Coating Systems is a company in the Mattsson group.
UMV Coating Systems has its premises in Säffle Sweden.

Säffle as such lays close to the big lake Vänern and this area is full of nature, one of the reasons why we today are focused on technology to create sustainability.

UMV Coating Systems is free to cooperate with any company, even the competition.
One example of this is that both Valmet and Voith buys our LAS decurler.
(A technology that OJI has experience with.)

Business Concept

UMV develops, designs and supplies customized sustainable coating solutions,

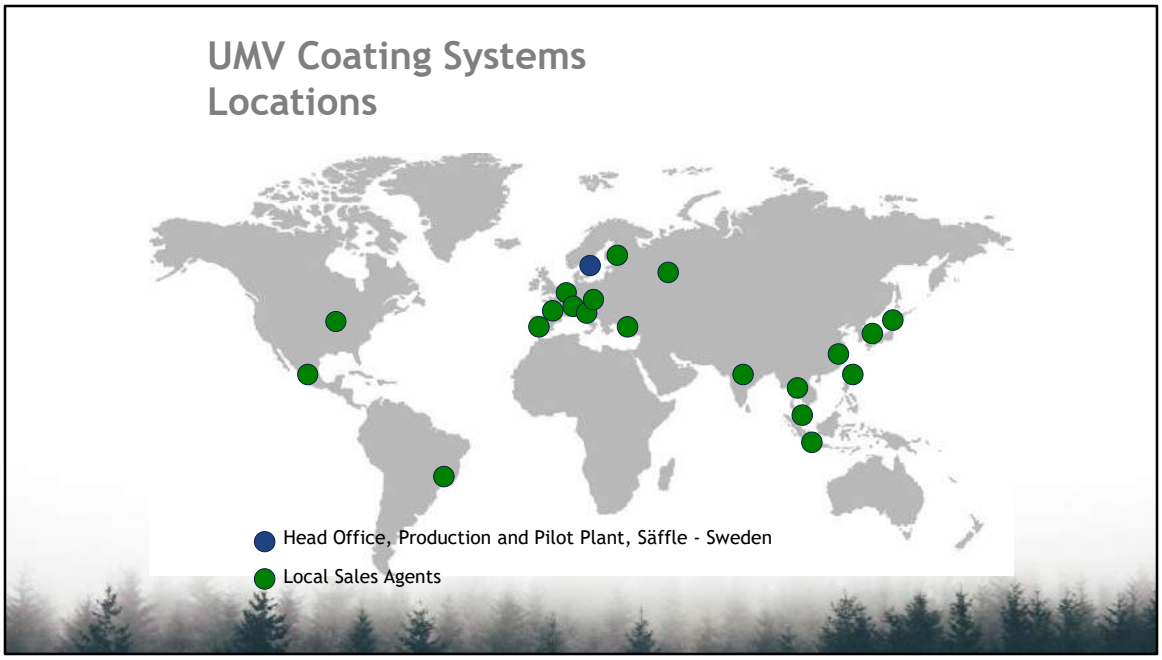
with attached service and know how,

to the global paper and board industry.

UMV Develops, designs and supplies customized sustainable coating solutions, with attached service and know how to the global paper and board industry.

UMV has all the tools to fullfill this business concept.

People with solid experience in the field.
Very efficient technology and a pilot plant.

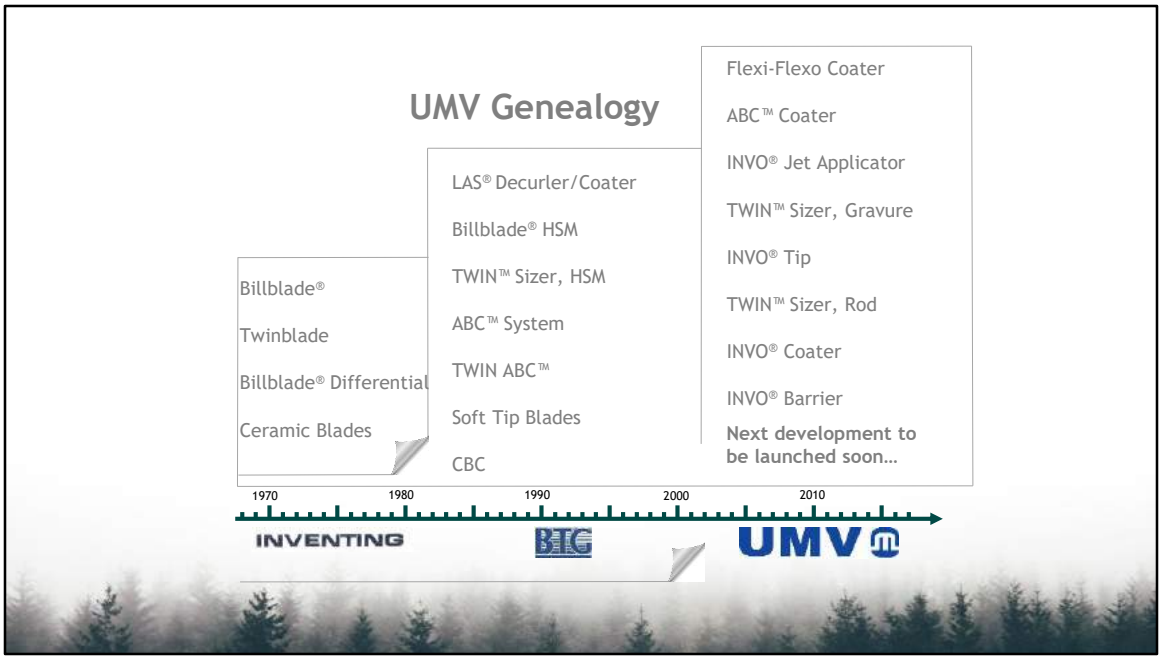


Very early UMV Coating Systems went International with their coating technology, with own sales companies all industrial countries. Japan was one of the most important.

Today we have chosen the structure with agents in the market where we ar active.

In Japan, our agent is.

Matsubo Corporation
Shinji Otsuka
Office: +81 03 5472 1747
E-mail: s_otsuka@matsubo.co.jp



This picture shows the products that were developed in the company until a couple of years ago.

The innovation drivers for this product portfolio:

Commercial
- Customer need of New & improved product
- Flexibility
- Higher efficiency and availability
- Less feedstock
- Less energy
- Less coating media

Political
- Sustainability
- Health protection
- Reduction of plastic utilization and salvation of the sea

During the 50 years of operation many different coating technologies have been developed.

WE started our R&D resources with the original Billblade coating technology, that made it possible for paper makers to take out 4 drying cylinders, which is a space enought for the installation and being able to produce coated grades up to 10 gsm per side.

The natural step in connection with this was to develop the ceramic tipped blade, Today owned by Duroblade in Switzerland.

Very ealy on we liked to develop coaters for thin paper and weak paper, line recycled new print. In connection with this aquired the LAS technology and developed the TWIN Sizer´s. These technologies involvs tranfer of film to the papers and therefore give a rliable runnability on weak papers.

Already 1991, our TWIN Sizer coated 40 gsm recycled base paper in Boourray France applying 12 gsm per side in one step.

The soul of our company is to find solutions to technical needs in the coating and sizing field.

Many times it is important to install a coating unit that is capapable of multi task situations, with simulataneous application on both sides.

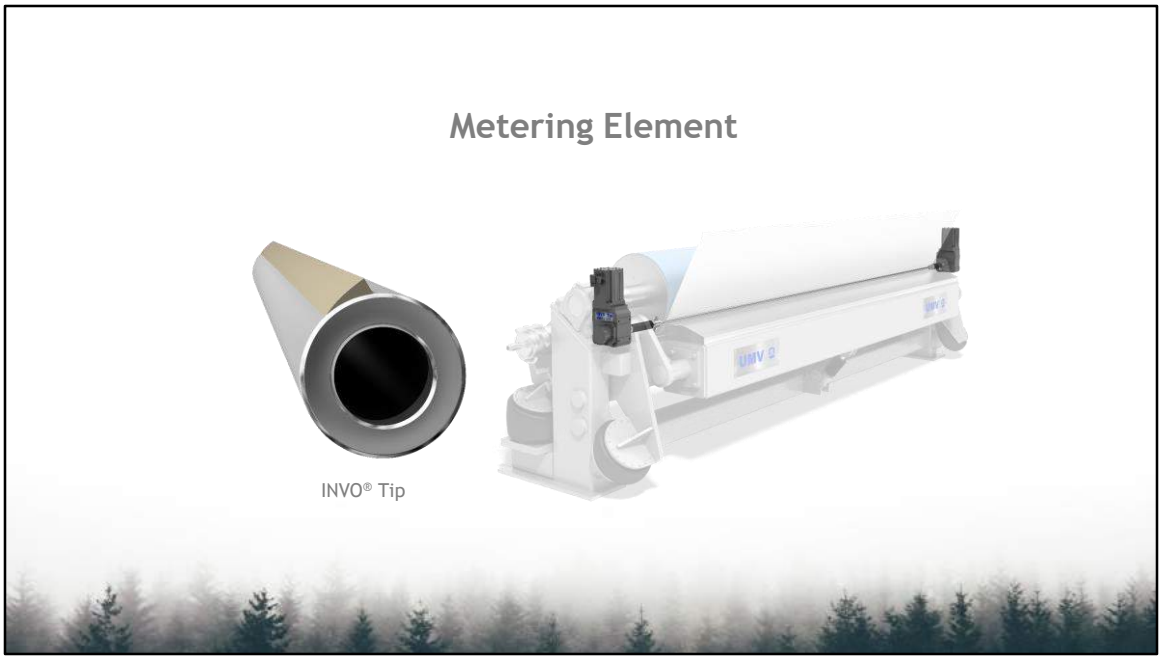
We therefor have a concept ”Combination machines”, that allows for uniqe machines however build on known components.

The INVO Coater unit/coater, can be utilized in a premetering position or in a direct coating opertion.

During the later 6 years we have developed a new coating technology.
Its charater is to apply the media on the top of the paper for best coverage at low amounts.

The main aim with this is to be able to apply expensive specialty chemicals, which for instance is important for applying barriers.

The surface located treatment is achieved with a extremenly short time between application of the media and the metering – theso called Zero Dwell.

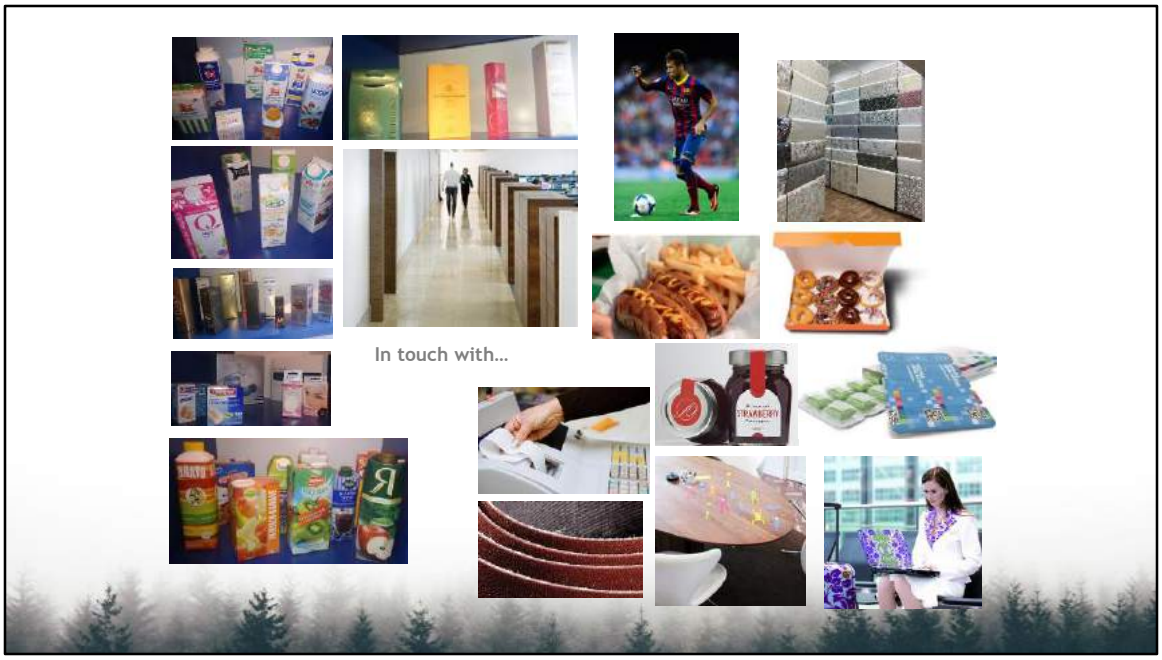


The metering process is important for the achieved surface quality.

By intensive R&D work UMV found that a soft metering tip is the best for achieving a good coverage. This since the tip follows the substrate and therefor the distibution becomes more efficient.

The soft tip as such is sensitive for the heat that is developed by dry friction.
This situation was solved by the INVO Tip concept, where the steelphase is brougt to the paper when it is dry and after the media is coming the soft tip is brought to the metering point.

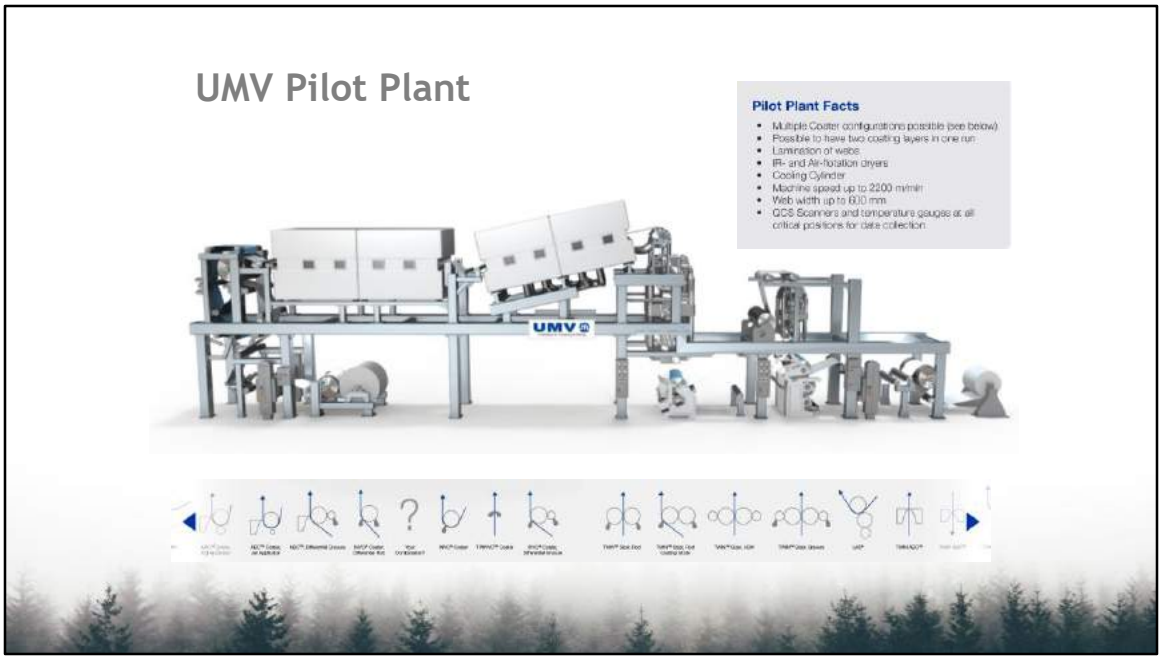
The soft metering tip gives excellent coverage in connection with application of barriers to paper & board.



Our coating machines are utilized in a broad field.

It is utilzied for conventional coated board to specialty papers like abrasive papers and tranfer print paper. In-line or off-line.

I just like to show you a short movie that describes in what typical field/end products our coaters operate.



It is very important for a company like UMV, allocating high amount for R%D, to have access to a pilot line.

Today our pilot line is one of the four most advanced in Europé.

The pilot line was installed 1986 and it has beeen rebuilt and enhanced many times since then.

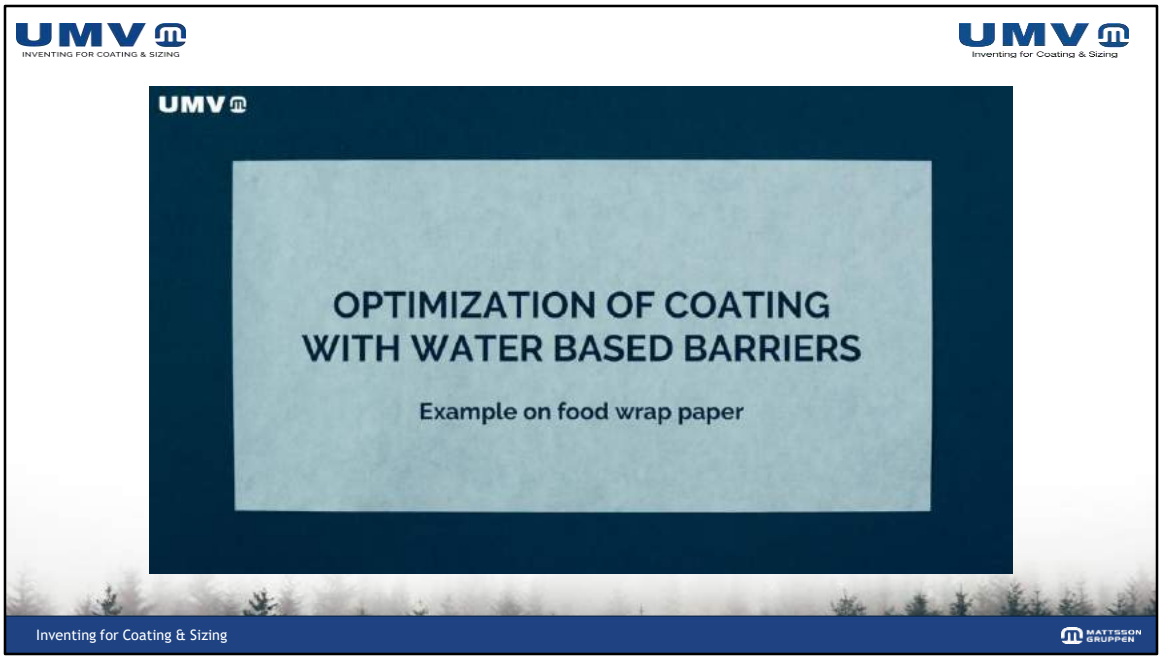
We have during the last 8 years focused on application of barriers to paper & board.

Primarily to protect the food from migration of cancerogene substrates and lately to develop barriers for grease resistance and air & water vapor permeability resistance.

Barrier application depends of course of the media itself. However the application method and the drying techniques are equally important.

In order to develop knowledge in the field we have added a cooling roll after the dryer, to avoid blocking on the pope. Temparture sensors along the webrun for precise control of the dryers and made it possible to apply 2 layers in one go through

the machine.

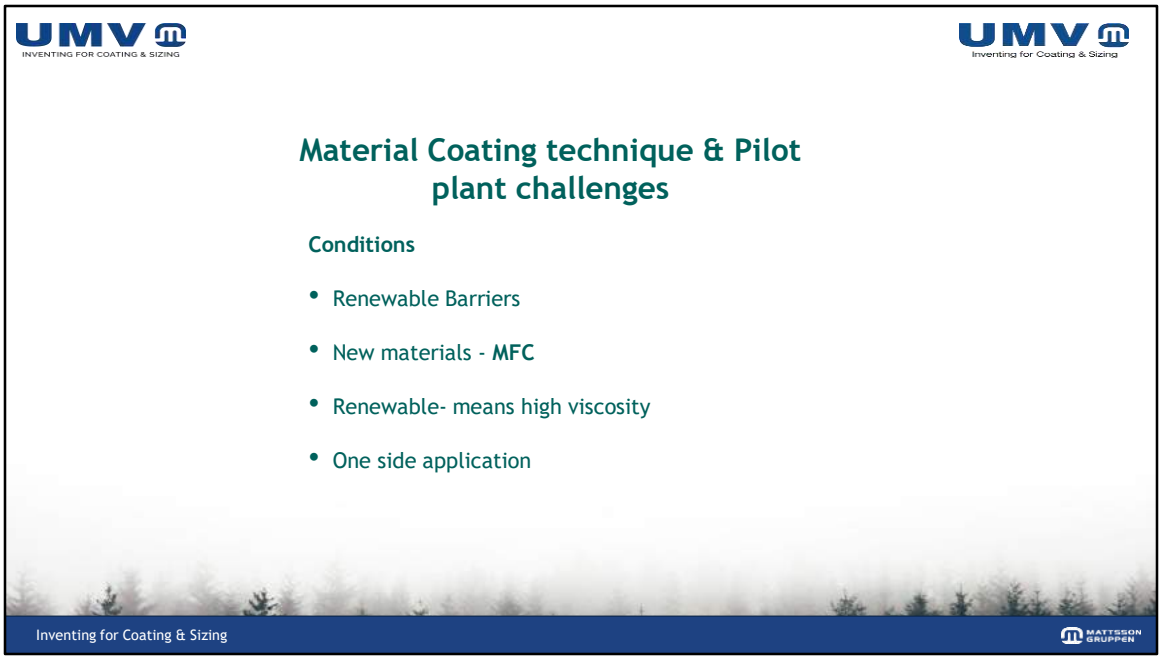


This movie shows the essence of the findings that we have learned:

Multipel thin barrier layers applied with INVO Coater (zero-dwell) and INVO Tip meterin), is a concept that ensures good barrier performance.

In the film we show the difference between zero dwell versus long dwell.
We can also see the difference between conventional metering and INVO Tip metering.
The impact on one or two layers is also demonstrated.

The actual product shown is a wrapping paper for Hamburgers.



Sustainability is an important goal for the society.
In order to reach this, renewable and biodegradable barrier chemcials need to be utilized.

The common factor for the most well knows biobased barrier chemicals is that the viscosity becomes very high when applied att high solids.

Commining from a field coating regular board and graphical papers, with moderate viscosity levels, this is a new challenge.

MFC for instance has extremely good barrier against airpermeability and grease.
The reological behavoir is on the other hand very different.

We have in cooperation with PaperProvince and the Interreg project committed us to make barrier application at extreme high viscosity accessible for the market at the end of this year.

I like to comment, that the well known curtain coater will not be an adequeat solution for application of media with this demanding reological behavior.

UMV INVENTING FOR COATING & SIZING

UMV Inventing for Coating & Sizing

Material, Coating technique & Pilot plant challenges

To meet the new challenges, new coating solutions need to be developed.

- **Extreme high viscosity**

Inventing for Coating & Sizing

MATTSSON GRUPPEN

In order to meet the conditions by application of biobased barriers, new coating technique needs to be developed.

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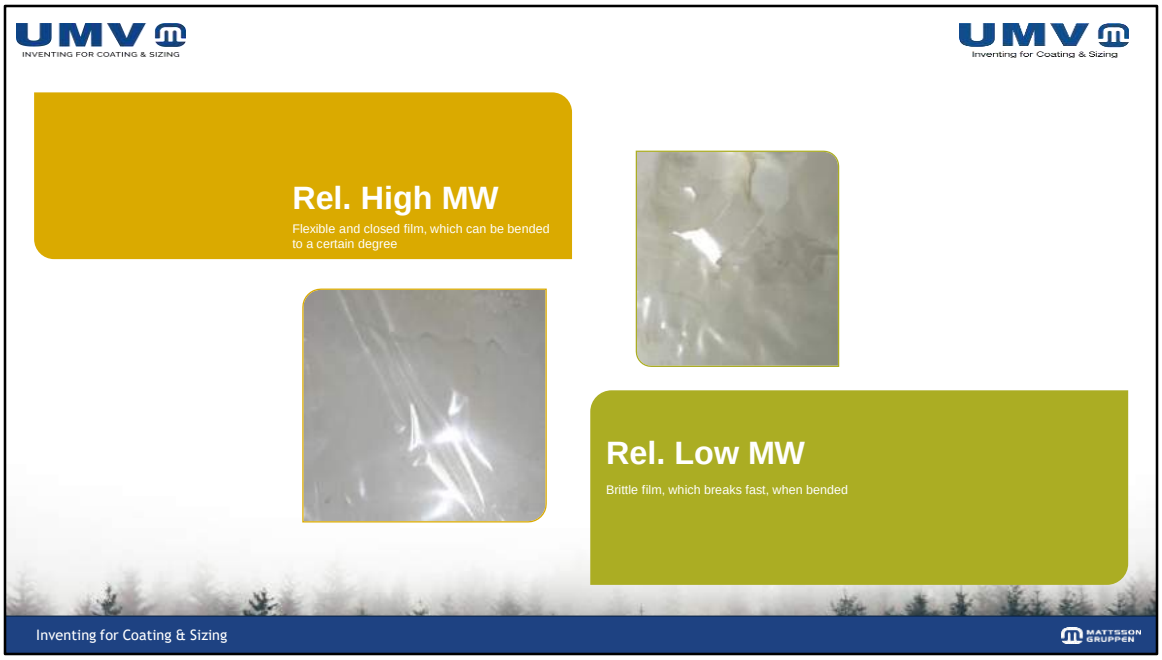


Higher viscosity is casued by long molecule chains in the media.

Long molecule chains as such gives a better flexibility in the barrier layer.

For example the pictures shows two films developed by the same type of starch at two different viscosity levels: Rel. High MW and Rel.Low MW. (MW = molecular weight).
The high viscous starch to the left with high viscosity is more flexible and will withstand the folds in the packaging to a higher degree.

UMV Coating Systems supplies coating machines for the paper- & board industry as well as conveters.

Equally important is the capacity to help customers to develop processknowledge and products.

An important field for UMV coating Systems is the sustainability.

The INVO Coater technology, the INVO Tip and technology are contributions to the industry for their ambitions to create sustainable products.

I like to thank you for listening!

Are there any questions?

OptiPack

From multinational group to dynamic packaging provider

Flexo printing developments

Ulrik Fauhlér - OptiPack

OptiPack

Megatrends

OUR FUTURE WILL BE DETERMINED BY SIX FACTORS:

01	02	03	04	05	06
Population growth	Globalisation	Energy shortage	Healthcare revolution	Technological change	Climate change

Convenience	Sustainability	Finishes	Cost Efficiency

Packaging today

OptiPack

The many roles of packaging

- to contain the product
- to protect the product, especially during transit
- to preserve the product
- to provide information to the consumer regarding the product
- to market the product

OptiPack

Product variations

From 1 product and 1 design to print

Product variations explode

Many products and many designs to print

Design for no humans!

- COMPANIES ARE ADAPTING TO AND GAINING FROM NEW TYPE OF SUPPLY CHAINS
- DOES THE PRINTED DESIGN MAKE ANY SENCE THAN?

Companies need to rethink how to:

- Adapt to new delivery models
- FAST!

OptiPack

Sustainability - plastic

Plastic trash pollution on beach of Lobinas Bajo (Flores Island). Photograph: Getty Images

Is this the world that we want?

Link to https://www.youtube.com/watch?v=ju_2NuK5O-E

What is plastic?

”Syntetic organic materials that soften upon heating and harden upon cooling and softening/cooling cycle can be repeated many times”

- Not ONE material
- Plastic undependend of raw material (Bio or fossil)
- Materials whose degradation time varies from 0 to more than 100 year

Classification of polymers

Fossil Based Polymers
- LDPE
- HDPE
- PP
- ETC

Plant Based Polymers
- Sugar Cane
- Forest based
- Slaughtery residue based
- Post consumer based

Biogradeble Polymers
- PBS
- PBAT

Biogradeable Polymers
- Bio PBS
- PLA

- Most major players now implement a global plastic strategy for all its markets
  - More plastic should be recycled
  - Total plastic use should decrease
- The strategy includes products, stores, suppliers and stocks.
- Non-recycled plastics is one of our biggest environmental threats and drastic measures are necessary

Ways to go!

Renewable

- BIO-based, plastic made from from plants or forest
- Compostable

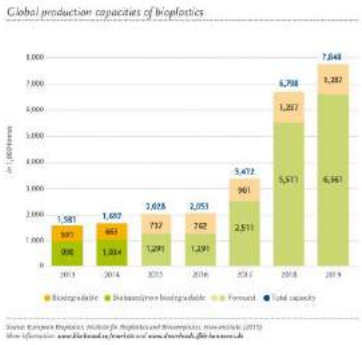
Recyclable material

- Regranulation, Different types of granules
- Reuse of internal production waste in order to obtain a good quality regranulate

Material optimization

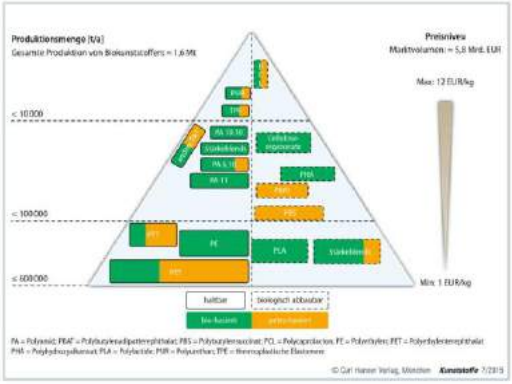
- Reduce the material weight gr / m2 - reduce the size of the packages
- From hard plastic to flexible packaging (rinsing liquid, detergent, liquid soap)
- Paper to replace plastics in many applications

Biofilms – Capacities



- 300 million tonnes of plastic are used
- 0.9 million tonnes are biodegradable
- 2.5 million tonnes are bio-based

Biofilms – Volumes & Costs



- Everyone wants BIO plastic
- Few are ready to pay for it

OptiPack

Investing in latest technology

Co-operation creates future

- Project Team of leading companies in the printing industry
- Promoting a new manufacturing method
- To create Digital Flexo by "digitizing" the Flexo process.

New age - New Softwares

QUALITY & PERFORMANCE

- Screening and calibration technologies adapted to Flexo are integrated

PRINT BRAND COLORS ACCURATELY WITH A FIXED SET OF INKS

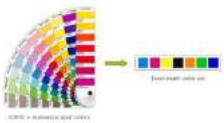
- Accuracy of brand colors is highly important in packaging.

COLOR CERT for Printer

- Better manage the complexities of CMYK, Expanded Gamut, and Spot Color workflows,

COLOR CERT for Brand Owners

- For brand owners, ensuring accurate, consistent color and print. Enables digital communication of exact color and print requirements



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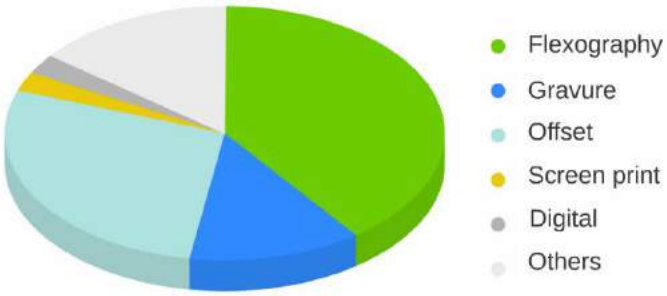
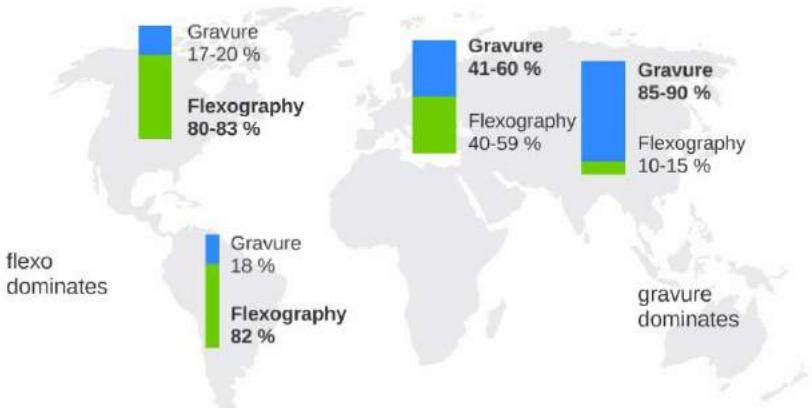
3D visualized shop

Market share flexible market



Source: Smithers Pira

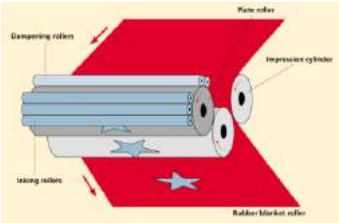
The world wide market



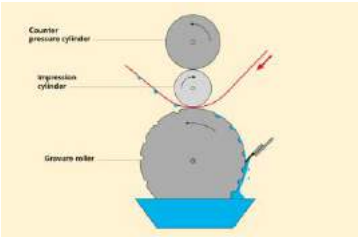
Source: DuPont, Siegwerk

What printing method to choose?

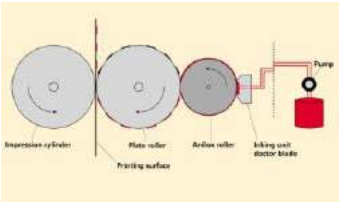
Offset



Gravure



Flexo

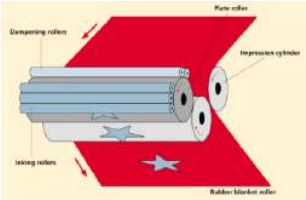


Digital

Offset Print

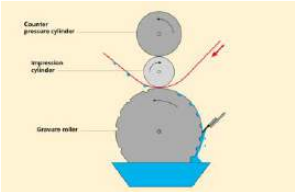
- ☺ Cost- advantage printing forms
- ☺ Very good quality of printed designs
- ☺ Standardisate process

- ☹ Very high investment cost in printing machine
- ☹ The most complex technology, high quality is a must and necessary
- ☹ Limited ink transfer for solids and depths
- ☹ Color deviations caused by color/water balance
- ☹ Quite high material waste during job settings



Gravure Print

- ☺ The simpliest design of printing press
- ☺ Any print repeat lenght
- ☺ Very good quality on smoth surface
- ☺ High ink transfer
- ☺ Minimal color deviations
- ☺ Ideal for long runs



- ☹ Complex production of printing cylinder
- ☹ Expensive print form production (problematic for jobs getting shorter and shorter + faster design changes
- ☹ Insuffiecent flexibility due to long lead time
- ☹ No option to change part of design
- ☹ Limited sharpness of small design parts
- ☹ Small letters high problematic
- ☹ Only possible with smoth surface material
- ☹ High investment in printing press
- ☹ Enviroment : High energy consumption in print process

Digital Print

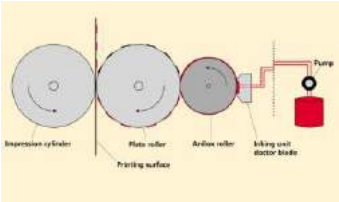
- ☺ No need for printing form
- ☺ High flexibility and initial cost advantage
- ☺ Variable, personalized designs
- ☺ Proof, job settings and production print on tha same press
- ☺ Extremly perfect for short runs and quick delivery
- ☺ Good print quality

- ☹ Extremly high investment costs in printing press
- ☹ Very high ink costs
- ☹ Printing inks do not meet all requirements for food packaging
- ☹ Low production speed
- ☹ Limited range of substrates to print on
- ☹ Limited sizes of printing machines

Flexo Print

- ☺ High quality up to 70 l/cm
- ☺ Simple printing technology (no color zones)
- ☺ Widest range of substrates: rough or coated paper, film, foil, nonwoven and different kind of laminates
- ☺ Great flexibility with formats
- ☺ Wide range of widths and repeat lengths
- ☺ High speeds for long runs and fast changes
- ☺ High ink transfer
- ☺ Minimal color deviations based on simple ink transfer
- ☺ Low material waste for job
- ☺ Low investment for printing press
- ☺ Flexibility and short lead time
- ☺ Good sharpness of printed bar codes and letters
- ☺ The best register thanks to CI drum

- ☹ Worse print quality in some cases (Highlights)
- ☹ Quite expensive printing form production & mounting when jobs getting shorter and shorter



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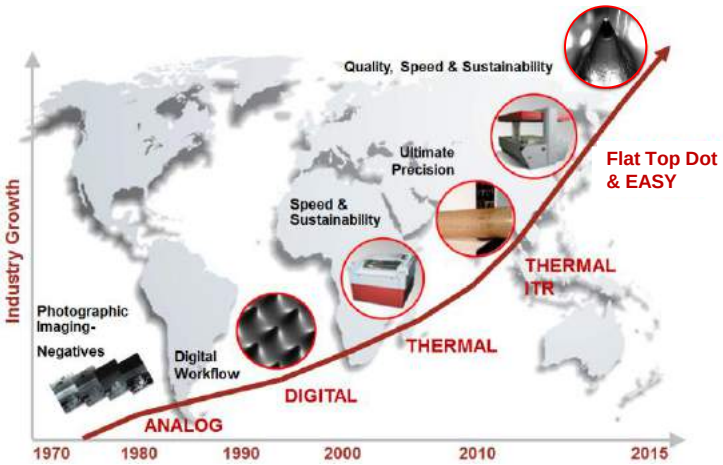
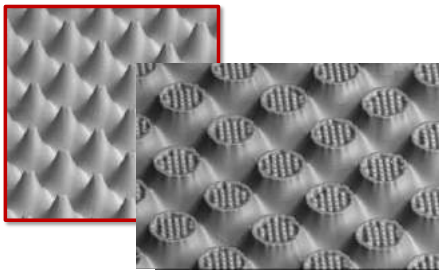
Milestones in Photopolymer Technology

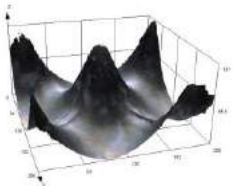


Flat Top Dot

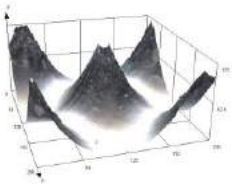
- 1st FTD plate to market with In-the-Plate technology (2014)
- Solvent or Thermal processing
- Clean Print Technology
- 2016 FTA Technical Innovation Award winner



min dot

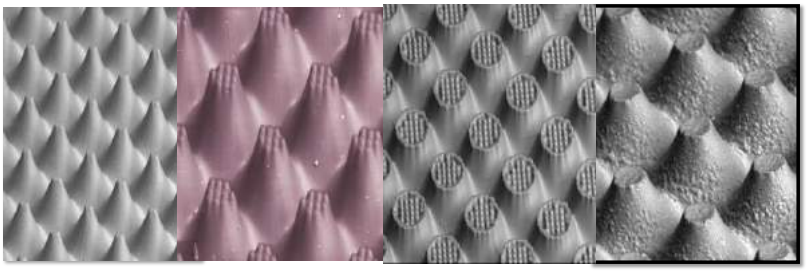


digital dot



digital flat top dot

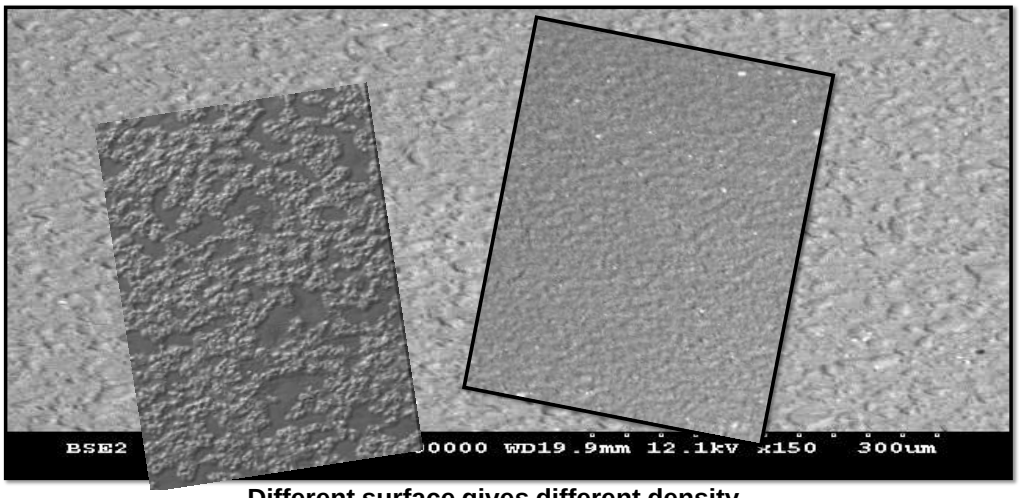
Flat Top Dot Development



- Flat Top Dot plates provide higher consistency
- Improved Highlight and Midtone performance
- Capped plate surface
- Clean print technology
- Good ink transfer, Good ink surface
- Full HD quality

OptiPack

Surface Consistency: Which do you prefer?



Different surface gives different density

OptiPack

New Investment – Printing press

- For SHORT run and superb HIGH QUALITY print
- ZERO print defects with ADVANCE BOUNCE CONTROL
- Attractive ECONOMICS with ZERO set-up waste system
- EASY TO OPERATE – easy access and clever operation
- DESIGNED FOR SUPERB STABILITY AND CONSISTENCY TO PRINT HIGH QUALITY
- REDUCE RUNNING COSTS AND TO SAVE MONEY

OptiPack

New Investment - Mounter

FULLY AUTOMATED + OPTION

ZERO Set-Up Waste

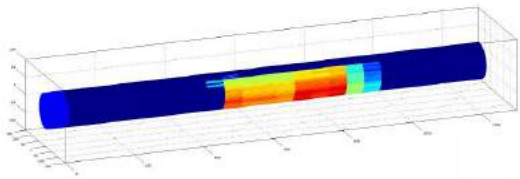
Minutes in the press for 10 color job

RFID chip in all sleeves

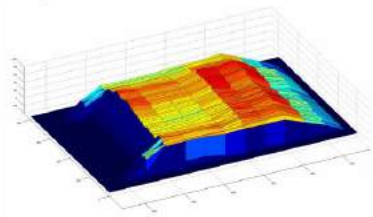
- AUTOMATIC Impression & Register setting
- OFFLINE Setting on mounting machine
- DATA AUTOMATICALLY transferred to FLEXO PRESS
- REDUCE RUNNING COSTS AND TO SAVE MONEY

Measure Topography

A-RUN + OPTION



Topographic map of printing plate on sleeve



- EASY TO OPERATE – Easy SET-UP access and clever operation
- ZERO set-up waste system
- SAVE Time

OptiPack

ZERO Waste

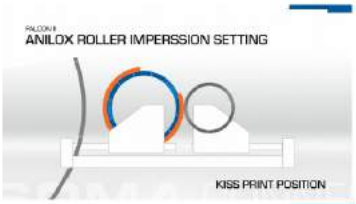
FULL AUTOMATIC + OPTION

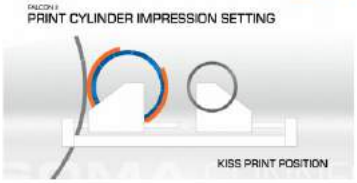
- FALCON II automatic impression setting based on torque resistance
- Significant time saving and reduced material & ink waste
- Impression setting without print

IMPRESSION SETTING	PRINT REPEAT	STANDARD SETTING	MAXIMAL SETTING
Both sides	800	0 m	0 m
Individual sides	800	0 m	0 m
Both sides	360	0 m	0 m
Individual sides	360	0 m	0 m

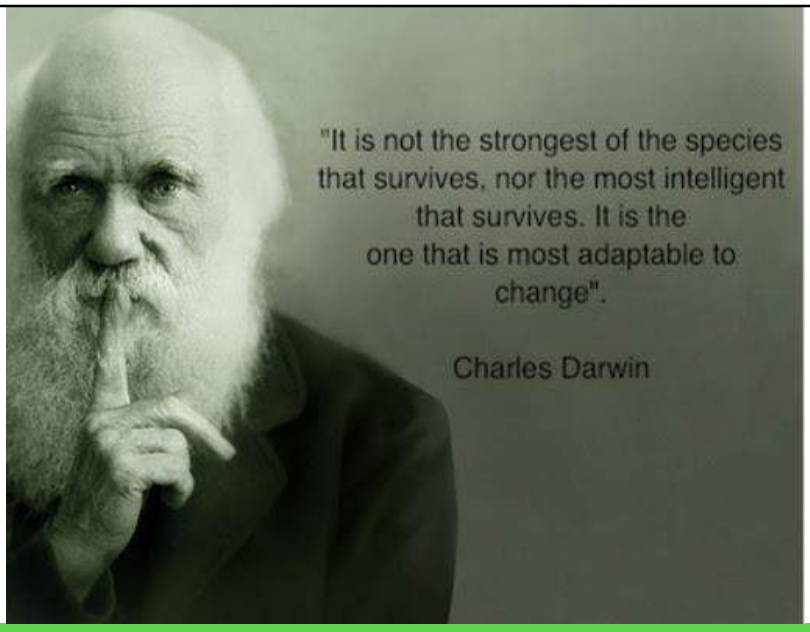
Web speed during impression setting 20 m/min

Impression setting without print = waste-less impression setting





OptiPack


"It is not the strongest of the species
that survives, nor the most intelligent
that survives. It is the
one that is most adaptable to
change".
Charles Darwin

OptiPack

My name is Doctor Jesper Berthold and I am the director of **packaging development and product testing** at RISE in Sweden and I'm here today to talk to you about the packaging science and Development Centers that we have within RISE then focusing on RISE Bioeconomi.

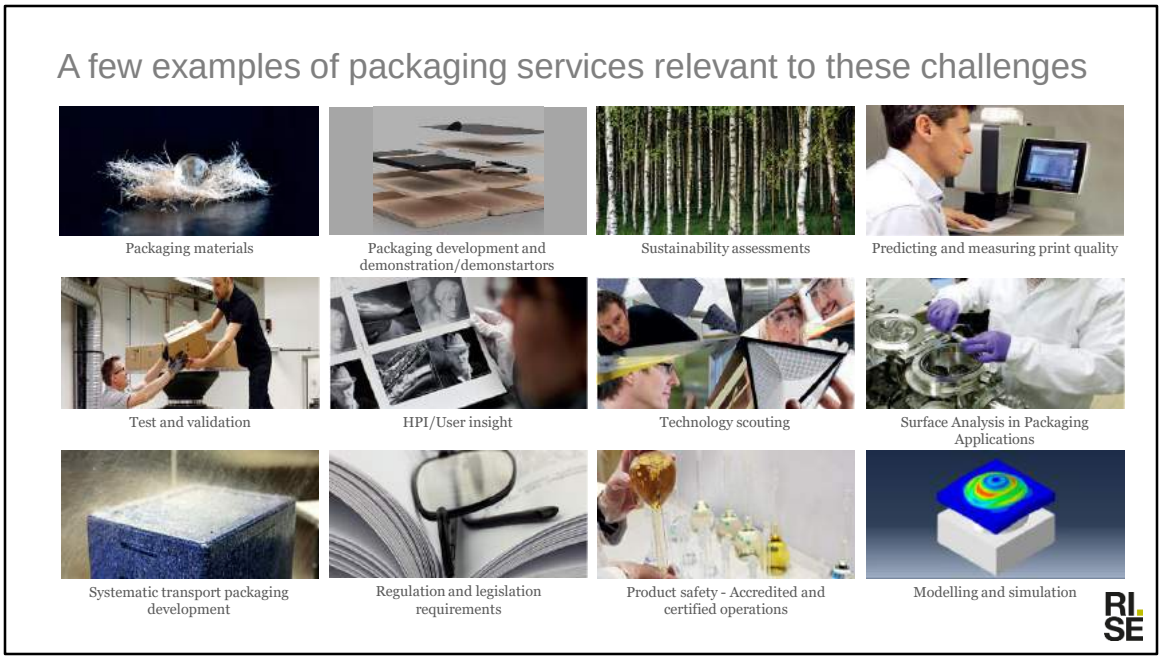
Aim with this presentation

- To explain **why** we are working with packaging
- **How** we work
- **Where** we work with this and
- to give You some examples of **what** we are focusing on

99

The aim of this presentation is to try to explain to You why we are working with packaging, how we work, and also where we work. And finally try to give you some examples of what we are focusing on when we say that we working on packaging within RISe Bio economy.

The whole global society is facing a lot of different challenges and changes in the years to come. It is important to identify what they mean for us and how they shall be addressed if at all. In the coming years RISE as a whole has identified and chosen to focus on the following Challenges.
Environmental impact and resource extraction, climate change, urbanization, risk and security, globalization, digitalization, changing demographics and coming challenges for private and public sectors.
This has given us working with packaging a general direction in which to focus and try to address as many of these challenges in a sensible relevant way as possible.



We have a unique toolbox, skilled personel and hold over 100 test and demo environments within different areas. This allows us to support our customers in their entire packaging development process, no matter the packaging related area

This slide gives you a few examples of packaging Services we think are relevant to these challenges.
Packaging material: we work a lot trying to come up with new materials that can go into different kinds of packaging solutions focusing on sustainability. Mainly fiber-based materials.

Packaging development and demonstration/demonstrators: where we can help customers to visualize what a potential solution, using the new materials, could look like.

Sustainability assessments: we help customers Better understand how their products are interacting with the environment and how the load from their packaging material is affecting the environment.

Predicting and measureing printing quality.

Testing & validation is of course very important

HPI (human product interaction)

Technology scouting is an area where we help customers who are not able to themselves to participate at conferences or perhaps extract relevant information from the background noise of information existing, so we can offer them reports on a regular basis focusing on just that.

Surface analysis and packaging applications where we have expertise in understanding how a surface reacts to its environment, how the surface could be altered etc.

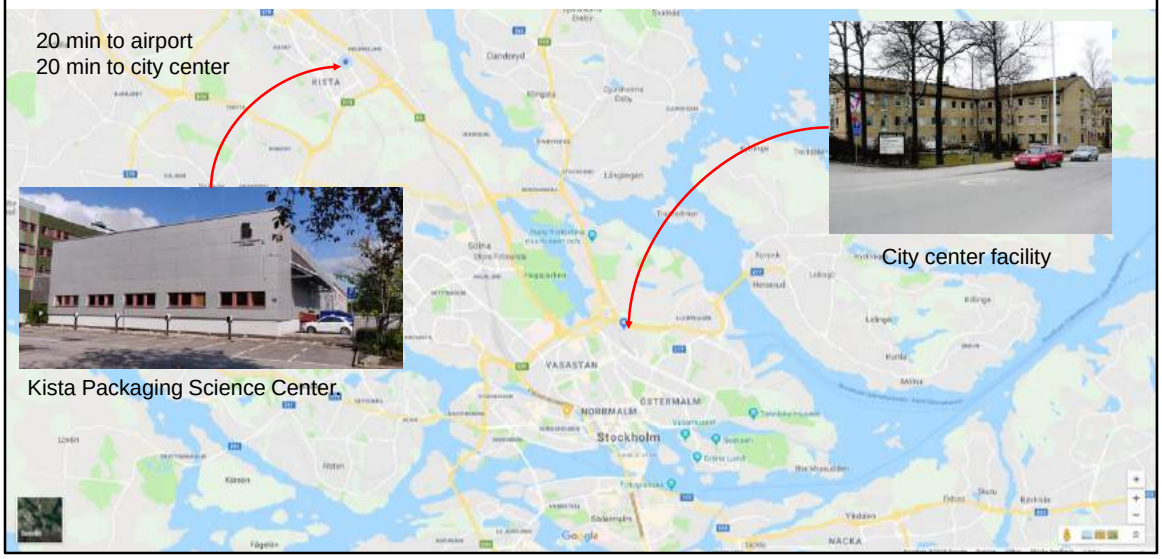
Systematic transport packaging development where we help customers develop package materials and packaging solutions that protect their product.

Regulation and legislation requirements We help customers stay updated on what the rules and regulations are important for them at any given time.

Product safety Accredited and certified operations. This accredited and certified lab helps customers understand if their product is going to work together with a chosen packaging material among other things.

Modeling and simulations He wants to be able to predict the performance of a books by programming our systems with parametres from the components such as paper making up the box thus shortening the time to markets and also lowering the cost.

RISE Bioeconomy Packaging Science Centers.



Rice bioeconomy has chosen to allocate its packaging science centers in two different locations, both working with and focusing on, solving packaging and material problems. One of them Is located in Kista which is only approximately 20 minutes car-ride from the city center also approximately 20 minutes from the airport. The other one is located very close to the city center.

103

Some slides where I'm showing you a very brief overview of the laboratories in the Kista facility. You can see one of the vibration tables we have…... in the second picture you see a little bit more of the part of the laboratory where we perform an impact test among other things. This is one of the vibration tables that we have and here we study problems on a smaller scale using MTS-equipments for which we develop our own tooling. A customer setting up his equipment in our Laboratory. An embossing equipment that we just have installed etc etc.

Testing services

Transport test

- Vibration
- Compression
- Shock
- Climate
- Impacts

Packaging test

- Pallets
- Climate
- Compression

Environmental test

- Vibration
- Climate
- Salt mist
- Dust
- Rain

Kista Packaging Science Center

104

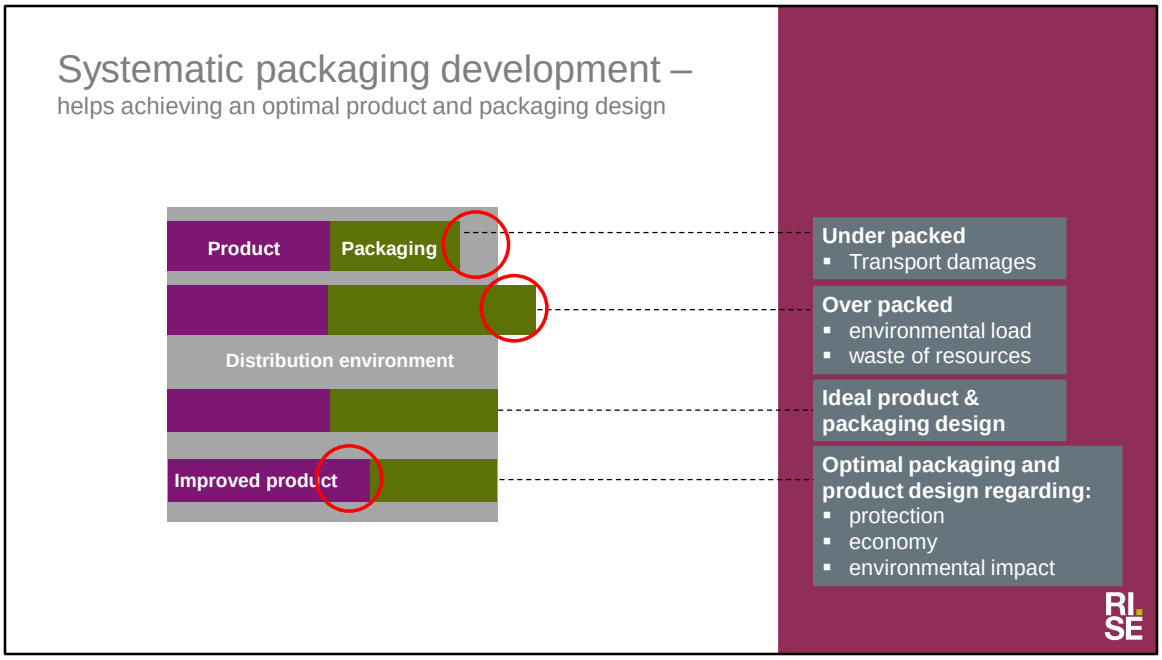
The testing services that we perform or quite standard. We have the transport testing part where we go through vibration, compression, shock, climate, and impacts. And the packaging testing where we testing involves working with pallets, various climates and compressions. We also have what we call environmental tests where we also test for vibration, various climates, salt mist, rain and so forth. The laboratory is accredited and certified to perform various tests.

Systematic packaging development

1. Determine transport and handling environment
2. Determine product strength
3. Suggest product improvements
4. Select and dimension packaging material
5. Design and manufacture test packaging
6. Test of new packaging solution

105

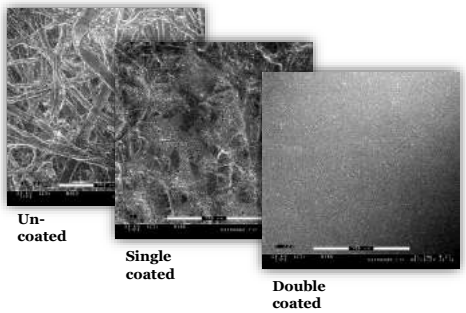
One of the main tasks we have is that is to help customer with what we called *systematic packaging development*. in doing so we follow a six-step process. First we help the customer to determine and map transport and handling environment that the product is exposed to. Once we know that we continue to determine the product strength or the product Integrity so that we can help customers understand where there might be room for improvement on the product itself. Finally we help customers select and dimension the packaging material, looking at design and Manufacturing test of the packaging, and at the end of course we have to test the new packaging solution checking that it meets the criteria set by the customer.

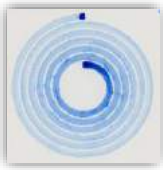


The systematic packaging development work helps achieving an optimal product and packaging design. It is not uncommon that packaging solutions are inferior causing lots of transportation damage. It is also quite common (second example) that the solution is over-packed with environmental load and waste of resources as a consequence. With an optimal packaging- and product design-solution, we have a balance between protection, economy and environmental impact.

Printing solutions

- Our mission is to conduct research, development and quality assurance around surfaces to create competitive advantages and new business opportunities together with our customers





RI.
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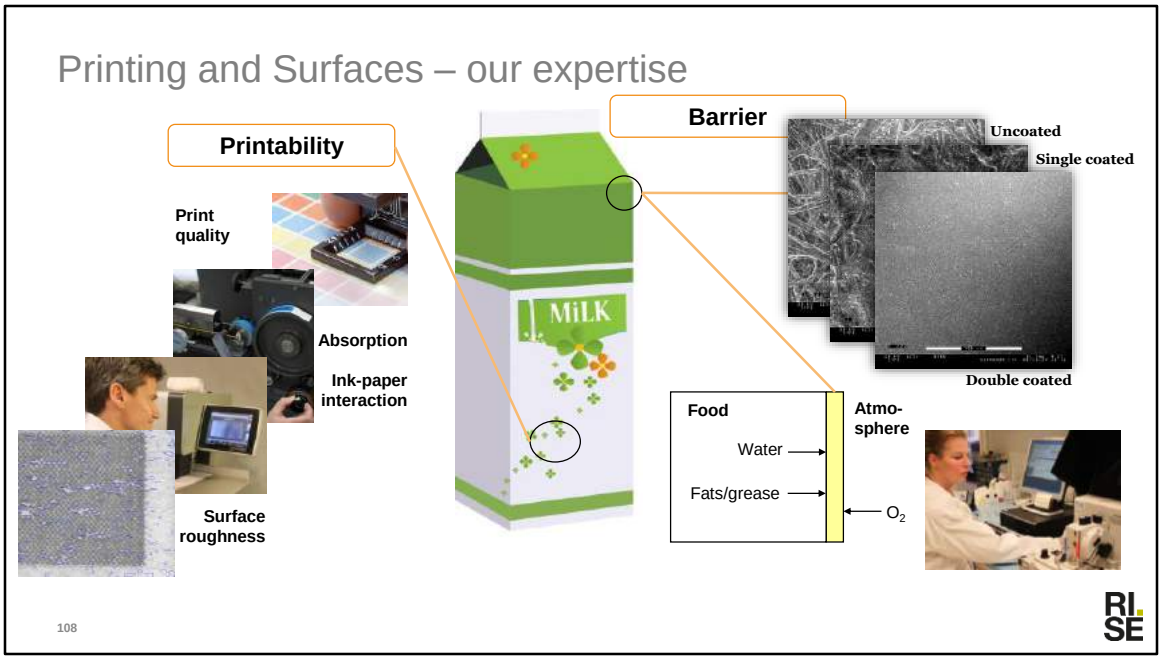
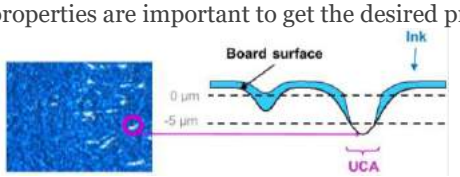
Our mission is to conduct research, development and quality assurance around surfaces to create competitive advantages and new business opportunities together with our customers



In the area of printing and surfaces our expertise lay within 1) printability and 2) barriers.
On the printability side we focus on surface roughness and how to measure that, ink/paper interactions, absorption and general print-quality. On the barrier side we are working with various ways of finding new solutions for classical barrier problems with water, fats & grease and oxygen that needs to be either kept in or kept out.

Predict and Measure Print Quality

- **Vision:** Create **high performing print material** together with our customers
- Do you need methods to predict printability?
- Which surface properties are important to get the desired print quality?



- What is the needed absorption capacity of the paper in inkjet printing?
  - total absorption
  - absorption uniformity
  - time dependence

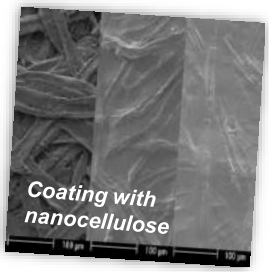
109

- Come to us if you need help analysing key properties such as
  - **topography**
  - **absorption**
  - **paper optics**
  - **contact angle**
  - **compressibility**
  - **cracking**
  - **surface strength**
- Test printability
  - **lab printing presses**
  - **plan full scale printing trials**
- Measure print quality
  - **mottling**
  - **missing dots**
  - **print sharpness/blurriness**
  - **uncovered areas (UCA)**
  - **gloss variation**

Predictability and measurability of print quality is very important since haveing the knowledge of how to do that in an efficient way will save a lot of money. It will also increase the efficiency in production thus reducing waste.
If you have any specific interest please have a look at this slide and the next where we list some of the areas we are currently focusing on.

Do you want to develop biobased barriers?

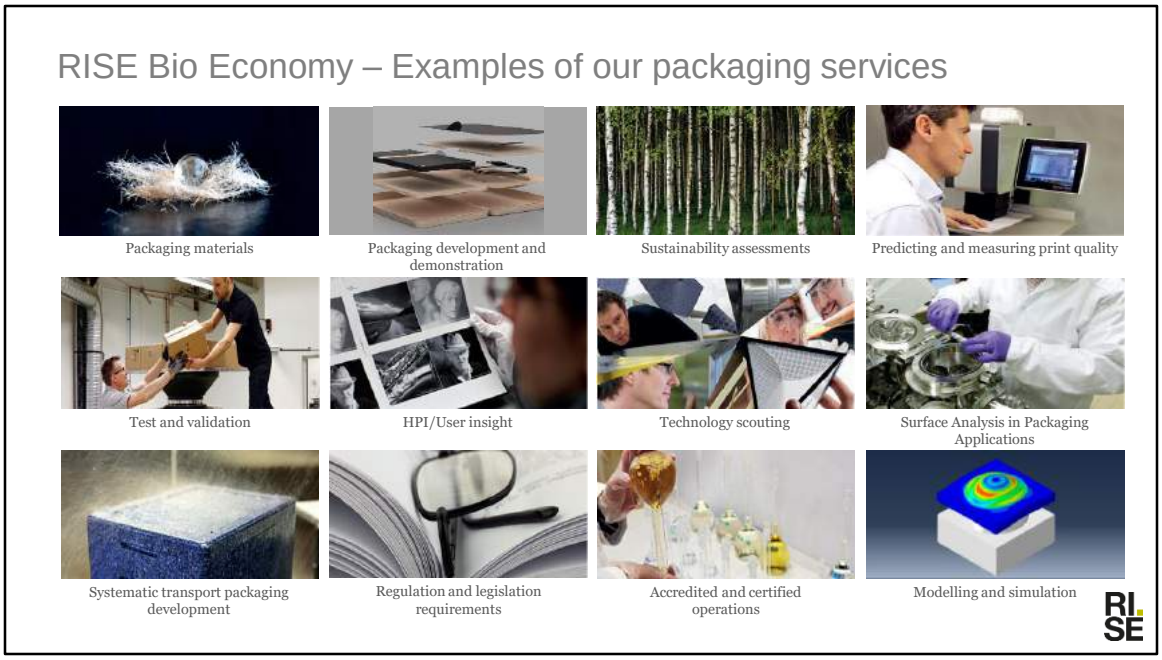
- **Vision: multibarrier – replace aluminium**
- use renewable sources as the raw materials to protect the content of your package
- move from the lab to pilot scale



- Testbed and demonstration
  - development of formulations
  - surface treatment
  - measurements on film or package
    - Oxygen transmission - ASTM D3985-05(2010)
    - Water vapour transmission - ASTM F1249-06(2011)
  - migration tests
  - adhesion, sealing
  - surface analysis (pin-holes, cracks, defects)

HPI Human Product Interaction

- The technological development has come a long way in developing biobased materials and products, today one of the main obstacles to achieving sustainable bioeconomy is rather social and psychological than technical. Consumers' acceptance of new materials and processes is necessary in the transition to a more sustainable society. A product will not survive for a long time on the market unless it appeals to or is accepted by the consumer, regardless of its amazing and innovative features.
- How people experience, feel, think about and accept new bio-based materials and products can be tested, for example, with psychophysical methods in different experiments, surveys, interviews, panels, etc. This gives an opportunity to understand how the consumer thinks, feels and likes a product before it possibly comes out on the market.



This slide and our rater unique toolbox, skilled personel, over 100 test and demobeds allows us to support our customers in their entire packaging development process, no matter the packaging related area.

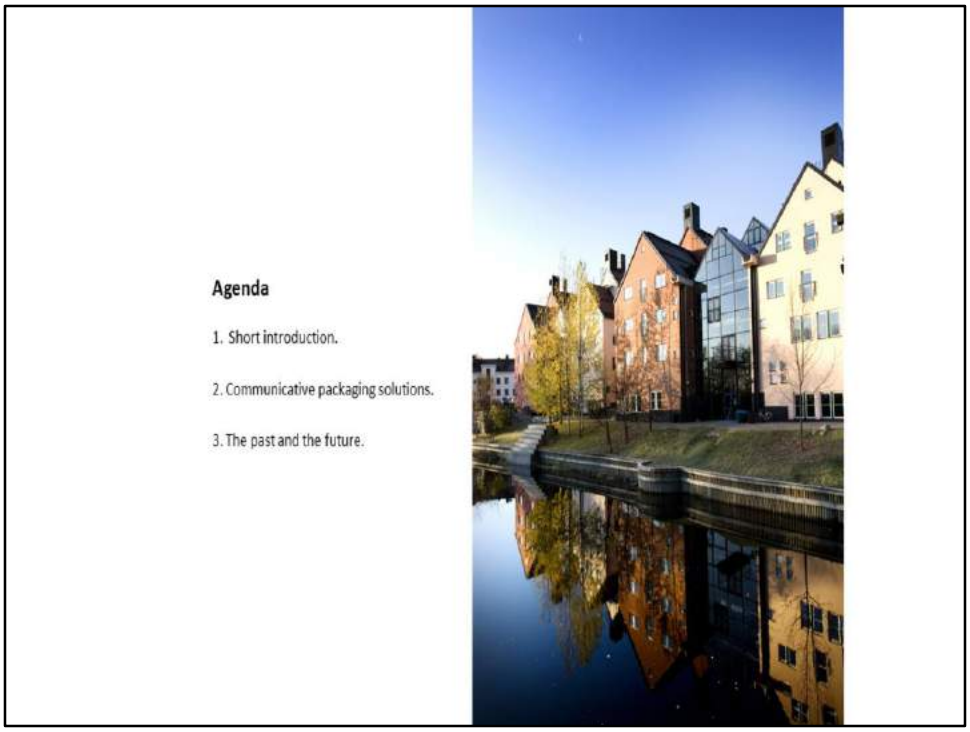
I hope that I have been able to clarify to you all why we are working with packaging a little bit, how we work, where we work and on what we work with regards to packaging.
Thank you very much!

Communicative Packaging Solutions in Different Business Conditions.
Tokyo Pack 2018, October 2–5. Sweden Packaging Seminar.

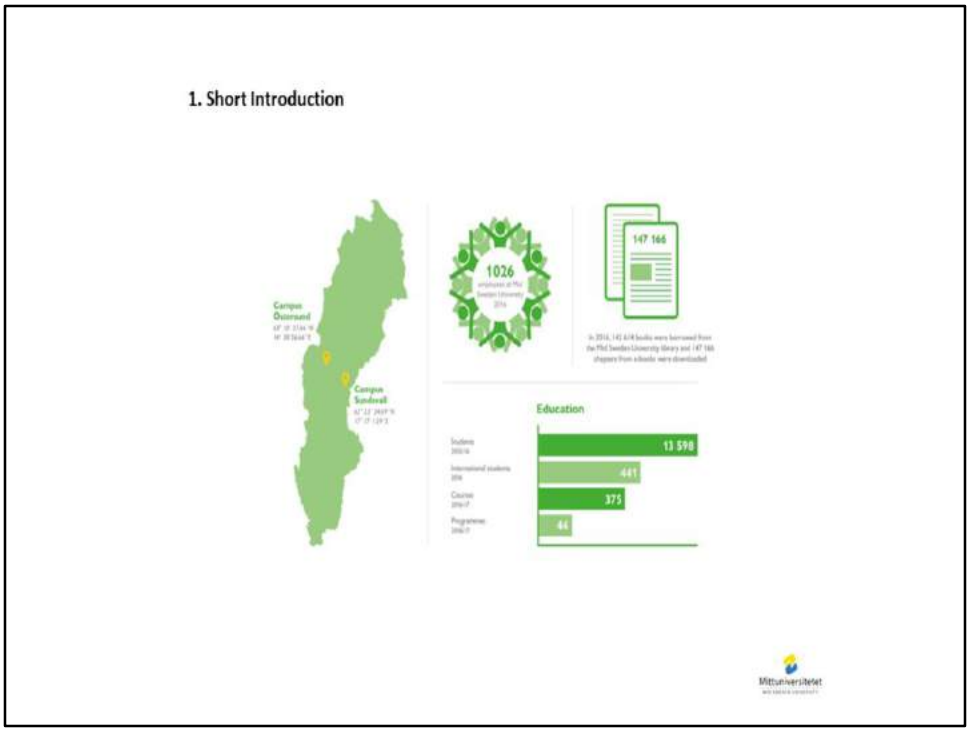
KRISTINA BRINK
Associate Professor and Head of Department of Design,
Mid Sweden University

ANNA-SARA FAGERHOLM
Associate Professor and Director of Graphic Design,
Mid Sweden University

- First of all, we would like to say that we are happy to be here in Japan. We are **KRISTINA BRINK,** Associate Professor and Head of Department of Design at Mid Sweden University and **ANNA-SARA FAGERHOLM,** Associate Professor and Director of Graphic Design at Mid Sweden University.



This is the agenda. We will start this presentation with a short introduction, then we will talk about Communicative packaging solutions, and we will end this presentation reflecting upon the past and the future.



At Mid Sweden University we have two campuses, one nearby the coast – Sundsvall, and one nearby the mountains – Östersund. We have around 14 000 students and 1000 employees. Now we will introduce you to how Mid Sweden University and the Department of Design work with Communicative Packaging Design.

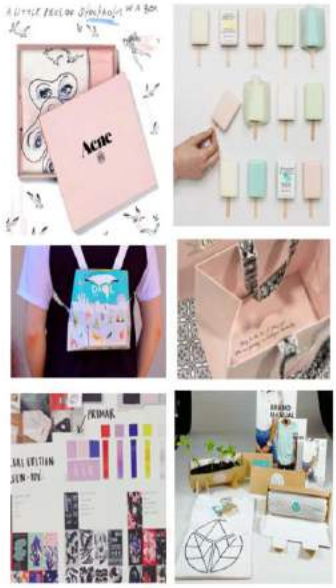
At The Design Department we work for Communicative packaging solutions in different business conditions in close co-operation with the surrounding community and international partners.

Together with the industry our students and researchers develop commercial packaging concepts that contributes to a sustainable development. In every packaging project the forest is resource.

2. Communicative packaging

Packaging communicates via multiple structural and visual elements, including brand logo, colors, fonts, pictorials, text, materials and shapes.

The package communicate symbolic meaning. Also, communicative packaging is important for the ecommerce business.

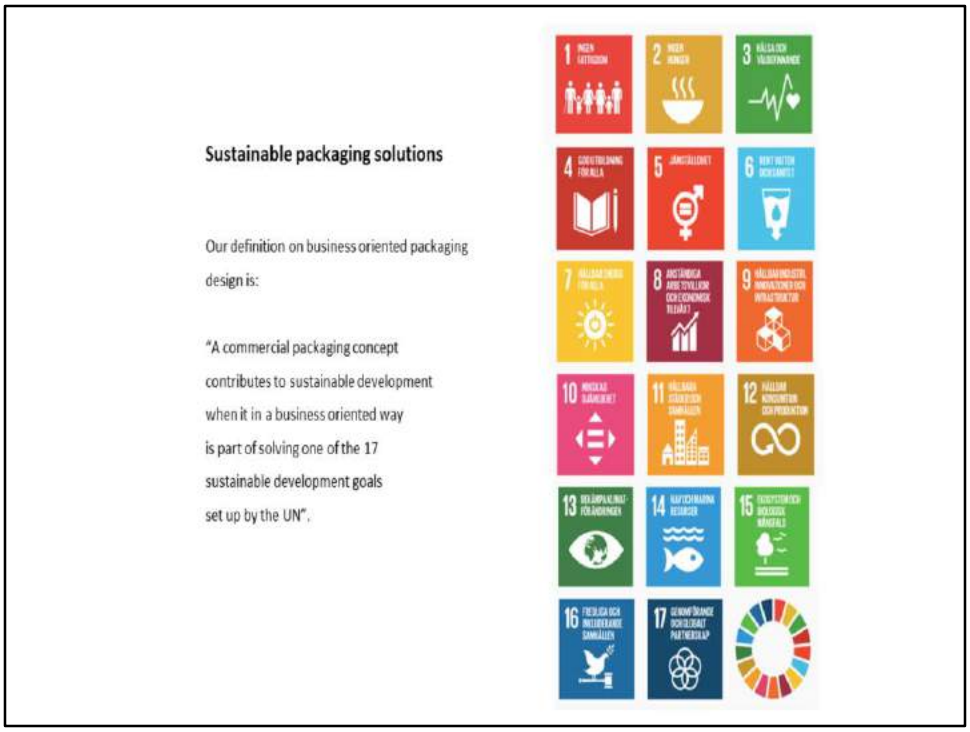


We see the package as a communication medium.

Today, people buy products not only for the functional utility they provide, but also the symbolic meaning they possess. Here, the package is the communicator of the meaning. Packaging communicates via multiple structural and visual elements, including a combination of brand logo, colors, fonts, pictorials, text, materials and shapes.

Symbolism communicated by the package may include environmental consciousness, health consciousness, national or regional authenticity, among others.

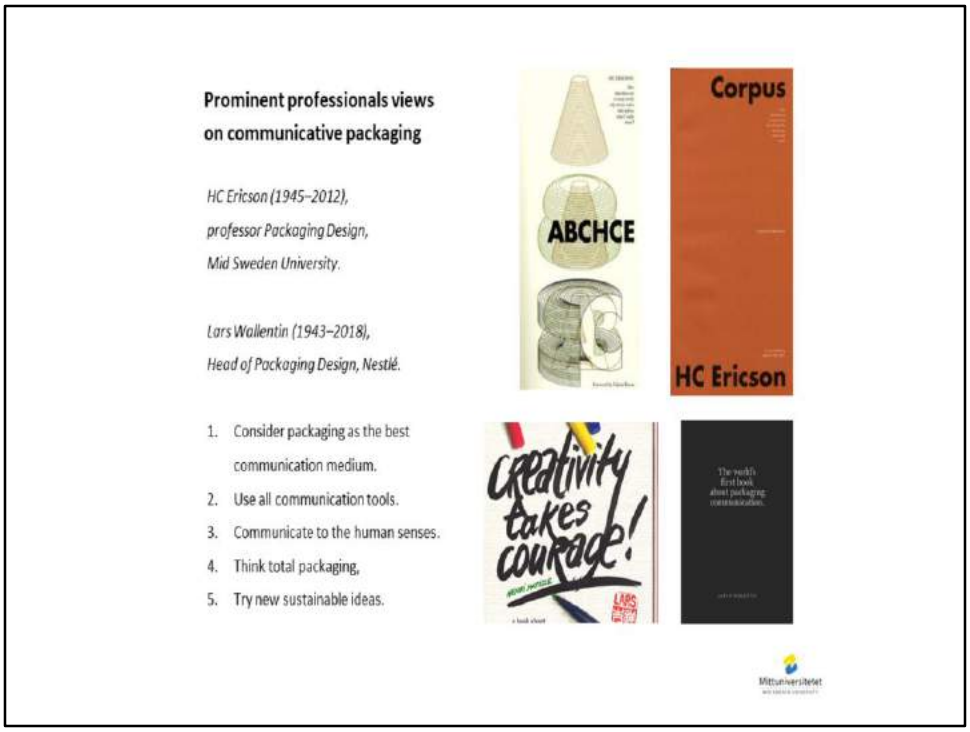
Also, communicative packaging is important for the ecommerce business. About 60% of all respondents in a recent Dotcom Distribution report (2016) reveal that they would share the product image on social media if it looked nice, and this is an example of how ecommerce delivery packaging can shape brand perception by communicative design. Here are Swedish brands such as Odd Molly, Acne and Other Stories, good examples of how communication solutions are seen and reposted in social media.



- From a marketing perspective, packaging is an important tool. More traditionally, the packaging should attract the consumer, describe the product and encourage sales (Kotler, 2008). Today, packaging also is a tool for communicating corporate social responsibility. So, when we are designing communicative packaging for different business conditions, we argue that we must take into account the 17 global goals for sustainable development, set up by the United Nation.

Global sustainability challenges require joint efforts from industry and government. Thus, the Packaging Industry must also contribute to achieving the global sustainability goals.

So, our definition on business oriented packaging design is: "A commercial packaging concept contributes to sustainable development when it in a business oriented way is part of solving one of the 17 sustainable development goals set up by the UN".



In Sweden, two prominent professionals in communicative packaging are professor HC Ericson and chief designer Lars Wallentin. We are grateful that we had the privilege to learn about communicative packaging from these two great designers. In this presentation we want to highlight their valuable knowledge on communicative packaging, collected from litterature, lectures and interesting discussions.

HC Ericson (1945–2012), was a professor in Packaging Design at Mid Sweden University. Lars Wallentin (1943–2018), was Head of Packaging Design at Nestlé.

HC Ericson and Lars Wallentin generously shared their experience of communicative packaging in books, talks and blogs. Their views on communicative packaging, is summarized as five advices:

1. Consider packaging as the best communication medium.
2. Use all communication tools: clear signs, good typography, materials, shapes, illustrations, texts.
3. Communicate to the human senses, and don't forget the tactile role of packaging.
4. Think total packaging, i.e. retail package plus display and shipper.
5. Try new packaging ideas that are sustainable. What was best yesterday may not be good enough today.

- Now, we would like to further discuss these advices by presenting examples of communicative packaging solutions in different business conditions. (*Source: http://www.packagingsense.com/category/trends/; https://www.svt.se/nyheter/lokalt/vasternorrland/kand-formgivare-till-sundsvall)*

Communicating Sustainability

This example illustrates how the Swedish dairy brand Arla communicate Earth Hour by printing all their packages black.

Also there is a there is a on / off button on the package communicating that we must turn of the lights for the sake of the environment.

Communicating Recycling

Another example, is the Swedish company Orkla's goal for 2020 is to develop more environmentally friendly packaging and products with

reduced environmental impact.

This work supports the UN's global sustainability goals 12, 13 and 17.

Their juice packages, that are the most sold juice in Sweden, communicate that every time you recycle the packaging you will get money back.

Communicating Playfulness

This is another examle of communicative packaging. In Sweden we drink a lot of milk, actually, Sweden is one of ten countries where we drink the most milk in the world.

Yet, this campaign has been successful since Oatly has made the Swedish people drink oat milk instead of cow milk by using a different communicative expression.

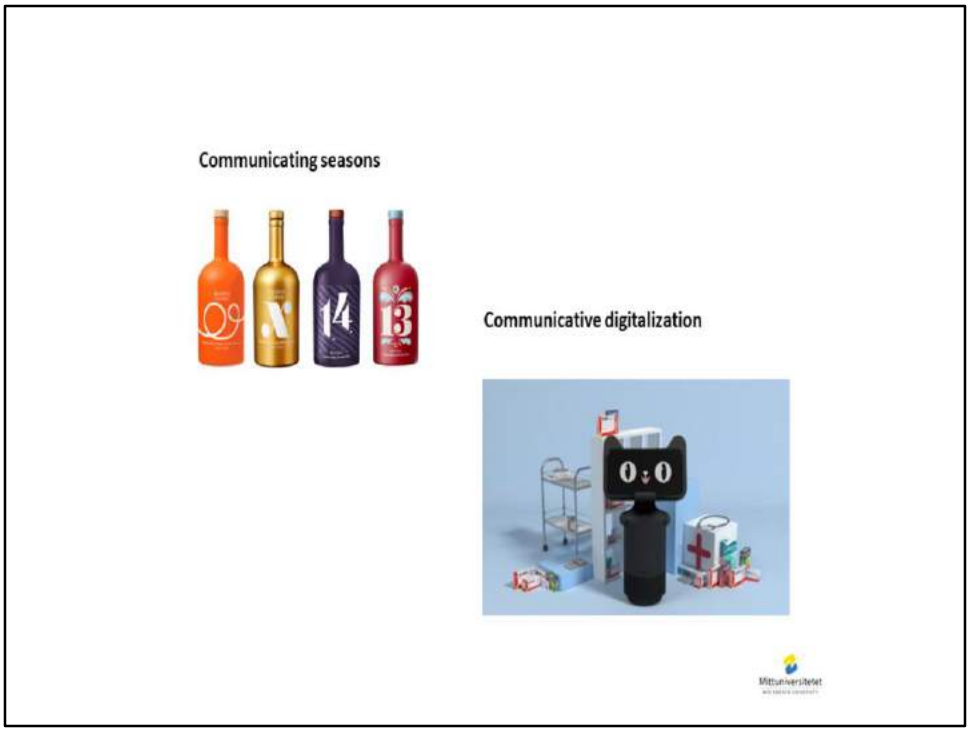
The packaging reflects health and sustainability by maintaining a straight-forward approach. It is playful and catches the attention of the consumers. Also, it is smart to budget advertising by getting the most out of packaging, by using the package as an advertise.

Design by Forsman & Bodenfors.

- **Communicating Stories**

A great way to reach the audience with a message on the packaging is to create a story. Storytelling is created through a series of related stories in logical and chronological order. Instead of telling customers how good the company's products are, the packaging tells a story that shows how good the products are – so that customers understand it without having to say it.

Here are two examples of beer packages communicating stories of Rembrandt and stories of the Vikings.



Communicating seasons.

Seasonal editions is a big category of communicative packaging. Here is a personal favorite of ours, the Swedish mulled Wine ”Glögg”, by Blossa.

Every season there is a new packaging edition, and a new bottle to collect.

Communicative digitalization.

This is an example of when communicative packages meet digital solutions. This new functionality of the The Tmall Genie is to help older people to read messages on medicine packages.

The user can, via his cell phone, read QR codes to let the smart speaker tell the contents of the packaging.

This example is developed by the company Alibaba Group, using the service AliGenie.

- *The Tmall Genie, 2018.*

Communicating Shape

Communicating through a shape is a very visible and powerful way of communicative packaging in a business context. This is Kleenex tissues.

Communicating the original

Communicating that the product is the original is a common way of communicating prestige on packages.

The company Kellogg's is often repeating that they have the original (and best) cornflakes.

This example confidently communicate cornflakes as "The Original since 1906".

The Biomimicry Trend

Finally, we would like to present the growing trend called Biomimicry. This trend is about integrating nature's shapes, patterns and features in the design process in a sustainable way.

Here, we can see an example of a package made of agricultural byproducts that come from renewable sources. This packaging is compostable and biodegradeable.

- An example of the Biomimicry Trend, is The company Ecovative Design that turned waste into a resource. Also, the lifetime of the package matches the lifetime of its use.

The inventors were fascinated by mushrooms growing on wood chips, and this inspired them to think of new ways of using mycelium as a resin.

Here is another example of Biomimicry. The designer Karoline Esbjörnsson has turned waste into a resource and createded packages out of horse manure. These packages contain horse riding products, manufactured in Sweden.

This is Symbio, by Elvira Jacobi. To the left, we can see one package of mango juice. After drinking the juice it is possible to throw the package into the nature since it will be naturally composted. Also, to the right, we can see two edible packages. The material is: dried algae, soaked algae, flower seeds, edible paper. About the project: https://vimeo.com/166976980

The last example of the Biomimicry trend, is a project by Kajsa Jonsson. The products are shrimps and fish, and the packages are made of ice.

Now we would like to end this presentation by reflecting upon history from a Swedish perspective. Communicating on packages is not a new phenomena. More than five thousand years ago, humans developed a written communication system. This communication sytem initially consisted of pictographs that enabled humans to identify stored products in packages.

Even during the Viking era, the period between 800 and 1050, packaging were designed with communicative messages.

And, as people made their way around the world, goods were transported containging perfumes, spices, wine, metals, textiles, and later, coffee and tea. This created the need for packaging to contain, protect – and to communicate.

In 2018 the movement of banning plastic straws is in full swing around the world: For example, in Seattle there is a prohibition of plastic straws and utensils. Starbucks, American Airlines and Alaska Airlines stops using plastic straws in 2020. Vancouver has already banned straws, and Scotland plans to next year. In France plastc bags are not allowed. Taiwan is banning single-use plastic items by 2030. In the U.K. Queen Elizabeth II banned plastic straws and bottles from all royal estates, cafes, and gift shops. So has McDonalds, Waitrose, London Airport, Ryanair, Marriott and Costa Coffee.

The bans are meant to be a step in easing the burden that plastic waste has on our environment. But it can also make life more complicated for

disabled people. This will affect *how* we design packages and *what* we communicate on the packages.

A growing number of consumers say they're willing to pay more for products with a sustainability message on the package.

But when something sounds better for the environment than it actually is, it is called greenwashing (Kahle & Gurel-Atay, 2014).

Greenwashing can be achieved with the help of communication on the packages. In summary, we have to be aware of "fake news" in a communicative packaging context.

Celebrating 150th Anniversary of Japan & Sweden

Future work and collaboration projects

Tokyo students, Kanda university & Chiba Institute of Technology 2018

Mittuniversitetet

- When it comes to future work and collaboration projects, we have ideas on what Japanese organizations and companies could do in the packaging area with Mid Sweden University or other actors in our region. Here are some examples:
- Application of cutting edge technology, augmented reality (AR), to packages (research at Mid Sweden University)
- Packaging projects aiming to reduce the use of plastic materials in water bottles (prototypes used at for example the Olympic games 2020 in Japan)
- Projects on design and branding within e-commerce
- Packaging projects on how to develop packages that are part of solving the microplastics problem

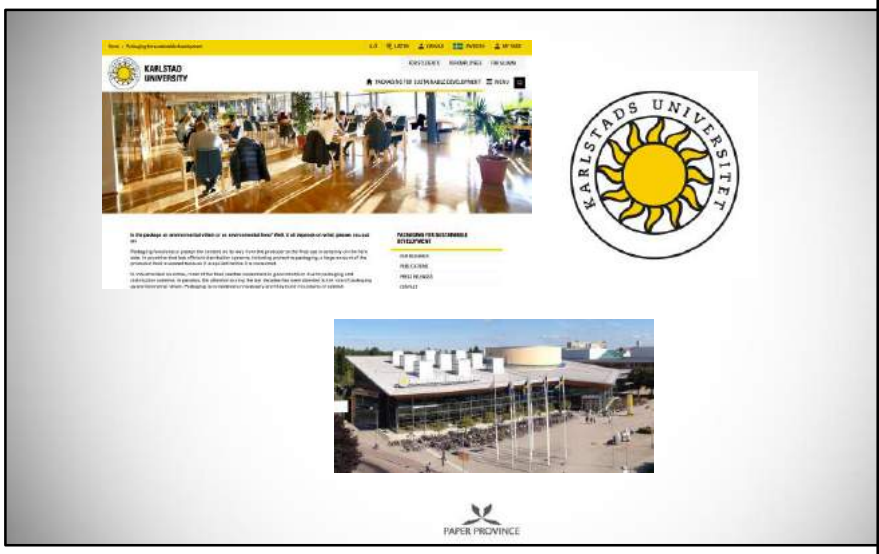
- We would like to see these packaging projects focus on contributing to the UN's global sustainability goals.
- If you are interested in future work and collaboration projects, please contact us.

Im very glad to see you all here. My name is Peter Edberg and I work as a Project Manager at the cluster organisation Paper Province.

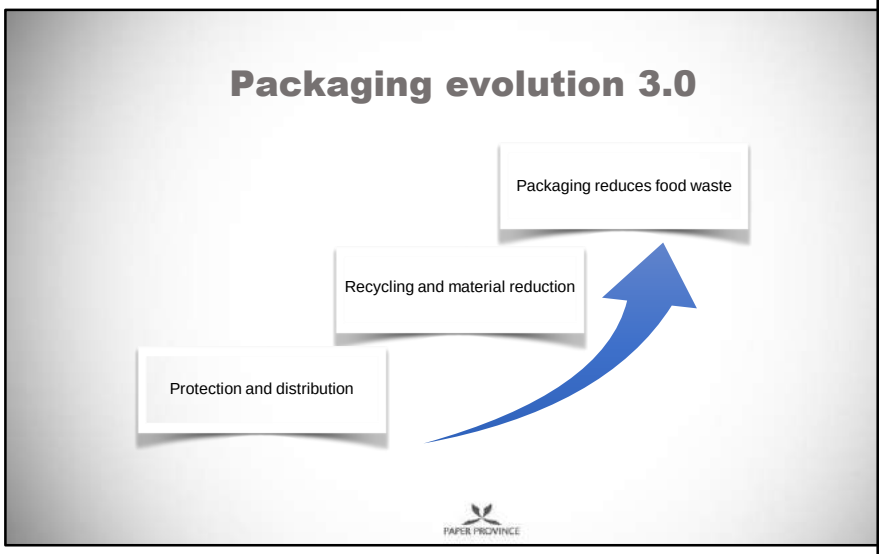
Im going to tell you about exciting research that a University in Sweden are doing.

The food production in the world has the same carbon foot print as all transports in the world.

The world. We. Need to decrease food waste.



At Karlstad university in Sweden there are a group of researchers that deals with packaging for sustainable development. Their contributions have been about the service of packaging. What packaging is doing in protection and increasing convenience. And more specifically reducing food waste.



They have summarised their work. It is time for a Packaging evolution 3.0.
When the first packaging was developed during the 30s and later exploded in numbers in the 50s they increased product safety and enhanced distribution.

In the 80s a higher concern for the environment made packaging come into the spotlight because of all the packaging in the houses trash cans.
Which in the 90s was handled by regulating the area with less amount of material in packaging and recycling of packaging material.

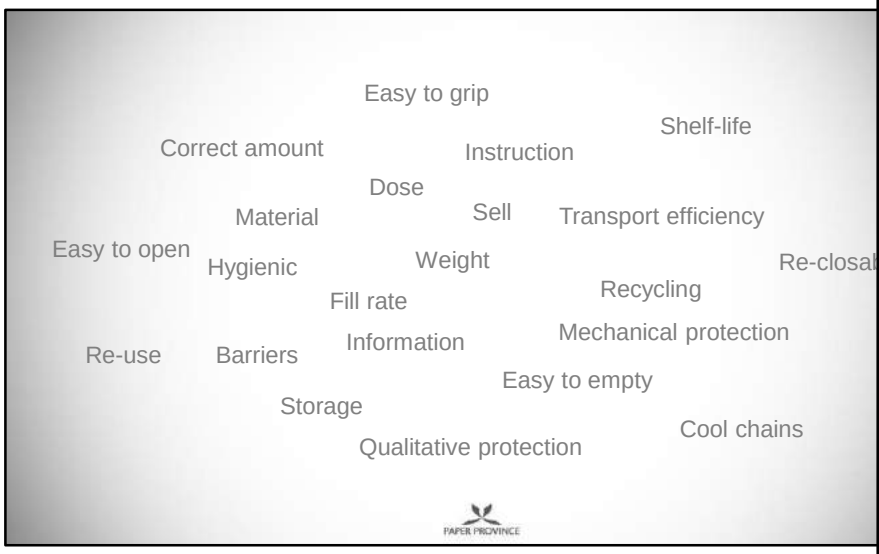
This have been very important and we must continue to

develop when we take the next step to reduce food waste. Increased recycling is very important in the circular economy strategy and the large amount of plastics found in the oceans are unacceptable.

The governments around the world wants to see a development of packaging that reduces food waste in the supply chain and at the users. This means that different stakeholders need to cooperate to a higher extent to find solutions. In the second step it was mainly a questions for the engineers to solve. In this third step people and behaviour is more central.

The researchers at Karlstad University have in many studies shown that using more packaging will benefit the environment if food waste can be reduced.

For example I can mention the plastic surrounding a cucumber. The plastic increase the life length of the cucumber with around 2 weeks. The carbon footprint of producing the cucumber is larger then the plastic wrapping. So in that case, plastic wrapping is good!



Historically and from an environmental point of view businesses have focused on three different packaging attributes: The **material** chosen, its **weight** and how to **recycle** the material.

PUSH

What the research have shown is that there are many more attributes that influence the environmental impact.
Since consumers waste food the environmental impact of a packaging depend a lot of human behaviour.

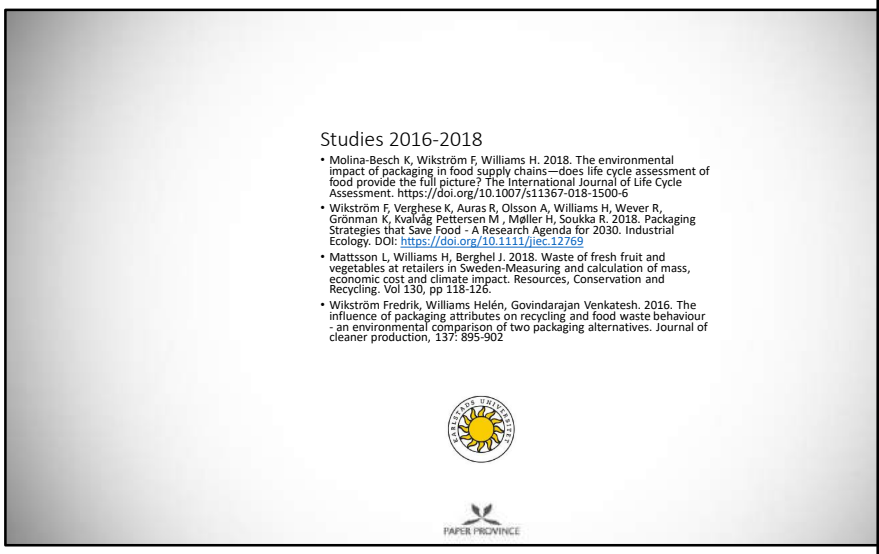
The most important task of packaging is to make sure that the produced food can be safely distributed and be consumed by a human.
We need to understand how the consumers think and act in order to develop the packaging attributes that will contribute to less food waste.

- Packaging should be easy to empty
- Re-closable
- Easy to open.
- Easy to dose

- Information about how long time the food is fresh after opening
- Best-before date

We do need to communicate in a better way that the food is good after the best before date have been passed and consumer should smell and dare to try the food. For food products with high environmental impact the different initiatives for smart-labels that indicate the freshness of food may be very useful.

And least but not last and perhaps the most important attributes of them all and that is **that the packaging should offer the correct amount of food**. How much food should there be in a package? We need to a higher extent offer at least two different sizes? We cannot find one size fits all, from single households to large families.



If you want to learn more here are the studies published since 2016 by this research group. The global group of researcher in **Packaging Saves Food Research** Group published a research agenda in April this year.

150

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