Agile Strategies for Packaging Development

The importance of an open-agile mindset in mastering the packaging transformation process from wasteful to recyclable solutions.

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The packaging Transformation

Most of us have recognized the urgency for changing our behaviours as consumers of energy, land, water, atmosphere, raw materials, goods and services.

Confederations have set the corner stones by establishing first regulatory frameworks which might appear radical to us and will cost a fortune. But can we take the pain and the costs for the next generations if we decide to stay dormant? So we'll move away from fossil fuels to regenerative energy sources, from exploitation to cultivation, from single-use to reusable and recyclable and from excessive to thoughtful consumption.

Agile is a new "how" of looking at problems and of interacting with the environment but only takes effect, if the "why" of the necessity for change is clearly defined beforehand. When it comes to a fundamental change of the status quo we are confronted with "VUCA" – a volatile, uncertain, complex and ambiguous environment. Our world has become unpredictable. Agile strategies provide a new mindset for those who are willing to challenge the state-of-the-art.

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"Change is never painful. Only the resistance to change is painful"
Buddha

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For the packaging transformation the "why" can be clearly defined. If we continue like we do today, **by 2050 our oceans could contain more plastic waste than fish by weight.** Single-use plastic packaging items contribute to almost 50% of this litter.

Therefore, we need to transform from a throw-away society towards a circular economy for packaging. Thus we need to design the rigid & flexible materials to be recyclable as many times as possible. And when it comes to end-of-life, a high renewable material content results in a smaller environmental footprint and less pollution. But recyclability only contributes to less waste in our environment if the material is truly recycled at the end. This is why we need to establish the proper collection, sorting and recycling infrastructure in parallel. The analogy to electro mobility and a charging infrastructure, to renewable energy production and a smart power grid is exemplifying this important correlation.

VUCA – volatile, uncertain, complex, ambiguous

Also, using less packaging is a precious target because we still need to ensure that food safety and shelf life can be guaranteed. Otherwise the effects of additional food waste is causing even worse damages to the environment. We need to design the packaging for convenience and need to consider functional requirements for e-commerce. This is the segment that is currently fuelling the 6-7% annual growth rate of the packaging market.

So clearly, the packaging industry is confronted with VUCA. And clearly, we need more agile practices in the packaging industry to navigate with the wind of change. The following sections give an overview on agile practices and transferring it to the example of designing sustainable, flexible packaging papers for food and non-food applications.
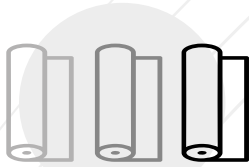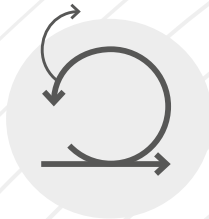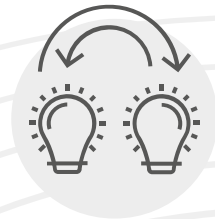
Rapid Prototyping   **Agile Collaboration**   **Design Thinking**   **Cross-Industry Innovation**
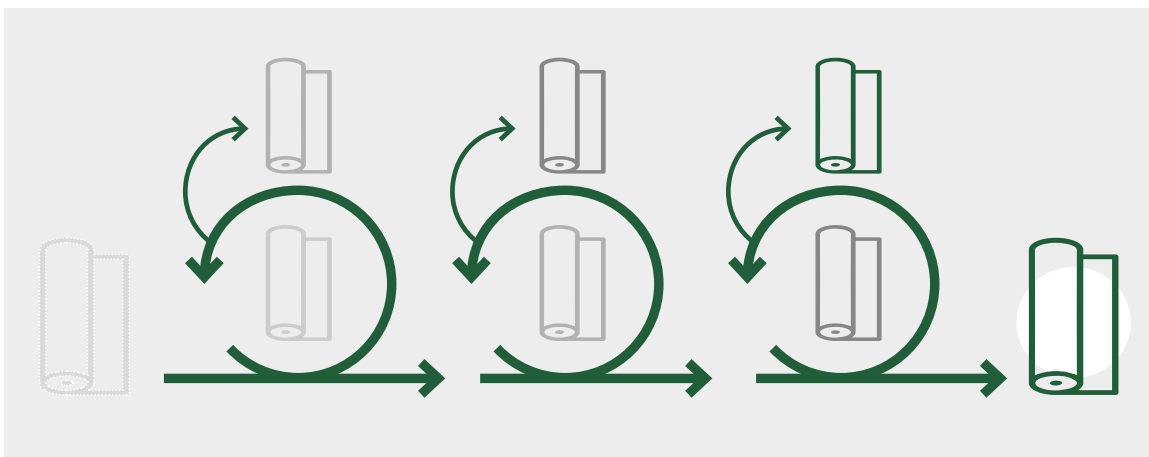
Rapid Prototyping

Looking at the paper industry one can assess that production processes can be very efficient but also tremendously inflexible.

Very simplified the inflexibility is due to the physics of the high-speed formation of a stable and consistent paper web out of a liquid fibre stock. The profitability of paper mills is tightly linked to the degree of capacity utilization and output of each paper machine. Long set-up times result in costly product changes and production tests of new development papers may lead to unscheduled downtimes.

This makes product and process development of new paper packaging grades quiet challenging. On the other hand, paper printing and converting processes, which are subsequent manufacturing steps in the packaging value chain, are much more flexible. This is due to a less complex process control, smaller reel widths and more modular and less investment intensive converting equipment.

When considering product & process development of paper-based packaging by means of rapid prototyping it is advantageous to separate the base paper formation from the surface functionalizing necessary for packaging applications. The paper substrate has to provide the appropriate mechanical properties and defined surface conditions for subsequent coating and printing layers.

At the end, the functionalized paper need to have all attributes of a mono-material.

By the means of rapid prototyping coating equipment with similar reel widths and diameters compared to converting lines as well as an appropriate set of analysing devices paper manufacturing companies can tailor their substrates with the necessary surface properties for packaging applications.

Among others, the surface has to provide barriers against Water, Oil and Oxygen, need sealing properties to hermetically close the package, has to ensure the runnability on high-speed printing and converting lines and last but not least, need to **fulfill all requirements for recyclability.** At the end, the functionalized paper need to have all attributes of a mono-material.

"Less is more", "functional layering" and "early testing" are the main design guidelines in the rapid development of paper-based packaging prototypes.
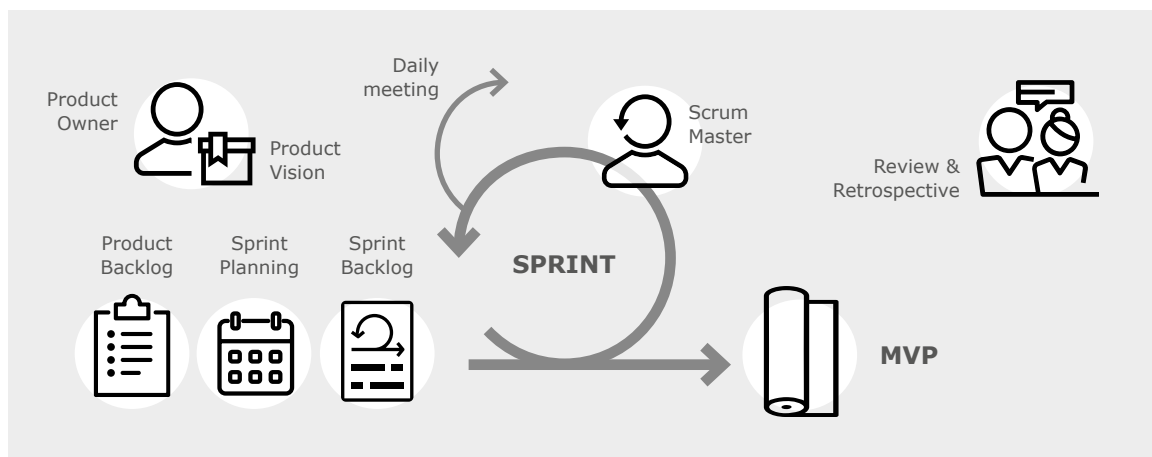
Agile Collaboration

Agile collaboration can help to make cross-functional teams more efficient.

The focus on execution, encouraging experimentation and the completion of MVPs (minimum viable prototypes) helps to navigate through complex jobs to be done. Working agile means working in short iterations within precisely defined time boxes called sprints. Sprints shall be designed in planning meetings, individual tasks will be prioritized and its complexity will be estimated, the tasks will be pulled one after another from a task list ("backlog") and subsequently executed with the goal of finalizing a testable MVP until the end of the sprint. **From the first MVP to the final products its like moving from the inner skins to the full**

classical product development, where you design things by adding different functional components to each other. Additionally the team is coordinating in short meetings on a daily base and is evaluating and improving its performance in a review and retrospective meeting after each individual sprint.

The iterative nature and the process framework of Scrum can be leveraged for cooperation & development in a complex R&D environment for packaging. Especially the different functional properties of coating chemicals, the many different layer combinations, the multitude of coat-

onion which means that prototypes and products have already similar functionalities just on a different level of granularity. This is one of the biggest difference when it comes to

ing technologies and the vast number of different suppliers in the market call for an agility driven innovation process that is supported by state-of-the-art statistical test planning.

While a "Product Owner" is responsible for the product vision and the main product features (typically a Sales or Product Manager), the job of a "Scrum Master" is to supervise and improve the process itself and getting all hurdles to the Product Developers out of the way.

Packaging development teams in paper manufacturing companies especially have to deal with many external partners to create product-market fit; chemical and additive suppliers, coating and packaging equipment suppliers, converting and printing companies, R&D institutes for barrier property characterization and recyclability assessment and many more.

By splitting the product creation (the "why" and "what") from the management of cooperation (the "how") in the team and selecting partners that are ready to mirror such kind of team organization, striking and agile partnerships can be established. In our team we have looked for a mix of open-minded experts from different disciplines – paper technologists, polymer and material scientists, coating specialists and R&D process managers. Additionally we have looked for T-shaped persons with excellent skills in specific areas and a fondness for the holistic packaging context as well.

We manage most of our development projects for specific paper grades with an agile framework and seek to

Splitting the product creation (the "why" and "what") from the management of cooperation (the "how")

test our prototypes as early as possible. We use digital SCRUM & KANBAN Boards (e.g. over Atlassian's JIRA Platform) to visualize the working progress of projects and sprints.

We run packing and shelf life tests, which we call "real life tests", with the targeted products for packaging at a very early stage to predict properties already before going into the determination of physical properties. We are striving for quick wins with MVPs by tightly synchronizing our R&D activities with Sales and collaborating with lead customers who are willing to test our prototypes on their packaging lines.

We collaborate with downstream partners also by means of iterative development cycles from paper sheet level to paper reel level and coordinate our activities in regular status meetings. And we seek to regularly evaluate and improve our collaboration quality and efficiency also with external development teams. This sometimes also result in the respectful termination of an external collaboration at an early stage especially when the mindset of the partners is too afar from each other. Failing quickly helps saving money!

Finally, when embracing also your customer and product users into this agile cooperation concept, we'll end up with Design Thinking.

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Design Thinking

Design Thinking does not just refer to a modern way of problem solving but also to a mindset of connecting & empathizing with the users of your products.

Developers usually know what their customers want, thus creating a fit between the customer problem and the product or service solution is a crystal clear job, at least that's the common believe. But the fine line between a bubble and a trend lies in the understanding of what users actually need, this is when developers and marketers have created a product-market-fit and suddenly, your new packaging solution is going through the roof.

Through user research and the derivation of personas, through the investigation of the whole customer journey from getting aware of your product until disposal of your packaging
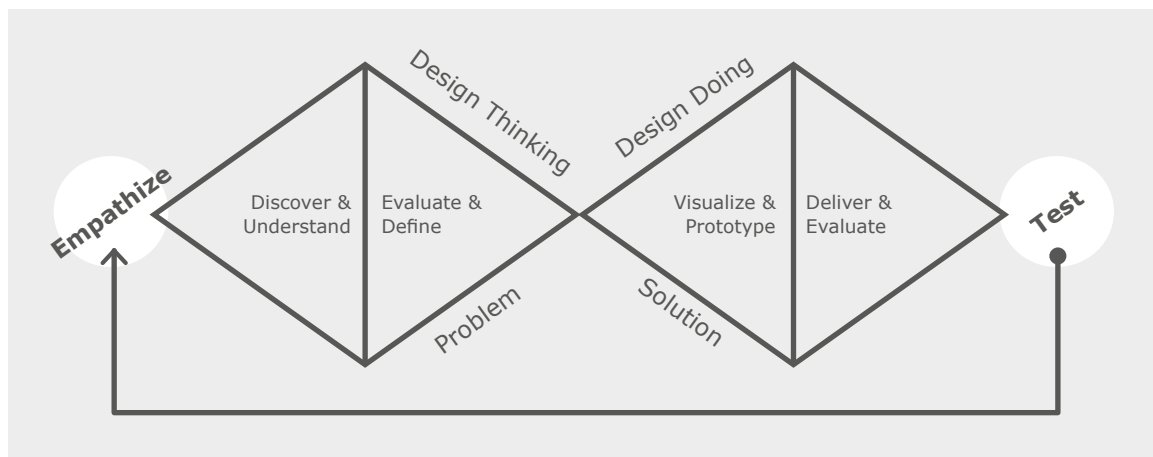
"**The time it takes to make a decision increases with the number and complexity of choices**"
Hick's law (1952)

and through prototyping & testing you can learn to visualize the product through the eyes of the user.

The ultimate goal of design thinking is the creation of the maximum usability and customer experience with the minimum possible complexity of a product!

When the functional attributes of your product are well defined, the design of the right packaging solution implies running customer surveys and observing the end user while

utilizing it, putting a lot of emphasize in the usability and look & feel of your product and finally making sure that your material finds the proper way back after end of life to ensure circularity. This involves a lot of prototyping & testing and selecting the right user groups that are open to share knowledge and experience. **Ideally you can seamlessly align yourself and your partners along a value chain not only for production but also for prototyping and piloting.** The experience we have made is that such chain of prototyping companies have not yet allied in the packaging paper value chain. We are also striving to initiate this and bring interested partners together.

Take part in our customer survey:
www.delsci.com/surveys

Please get your passwort via contact@delsci.com.

Cross-Industry Innovation

Most innovations have been created by combining existing know-how in a different way, this is well known even to those ones who are still suffering from the "not invented here" syndrome.

A cross-industry innovation process could be characterized by observation & abstraction of the problem, identifying analogies of the problem in different industry segments, analysing the existing cross-industry solution, trying to recombine the solution's building blocks and finally adaption and implementation of the approach to the problem in your industry segment.
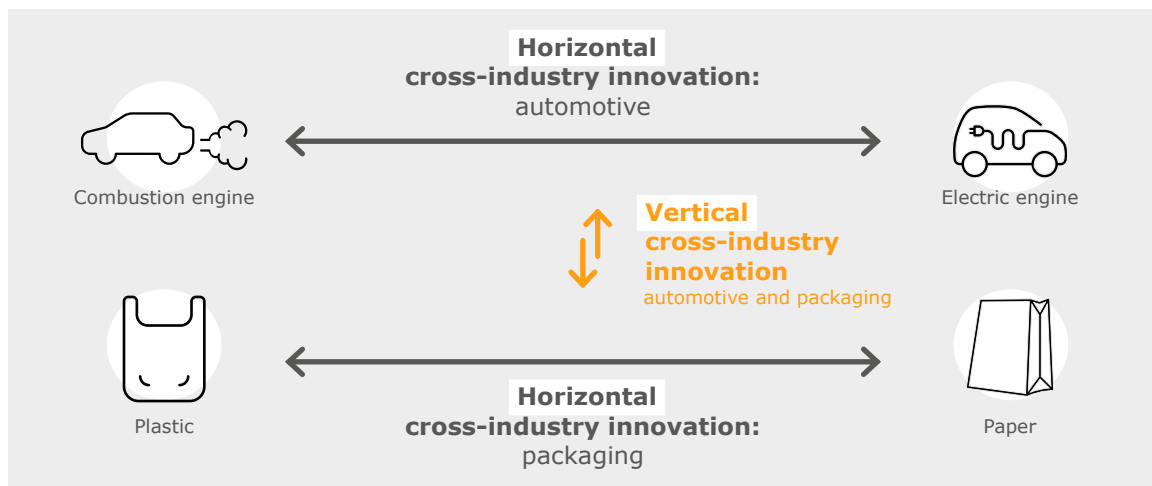
Basically there is ==vertical and horizontal cross-industry innovation==, which shall be visualized and simplified for the packaging and the automotive industry subsequently.

tive, ==copy with pride and adapt what supports a sustainable paper-based packaging approach.== A lot of analogies can be derived from the automotive industry in what today's electro mobility approaches have adopted from the continuous improvement efforts of diesel cars, e.g. platform and series production technologies.

But also today electric car producers have copied and recombined many solutions from segments outside the automotive industry, e.g. battery technology and software & connectivity solutions. By the way, like paper

Horizontal
cross-industry innovation:
automotive

Combustion engine — Electric engine

**Vertical
cross-industry
innovation**
automotive and packaging

Plastic — Paper

Horizontal
cross-industry innovation:
packaging

For paper-based packaging innovations it sure make sense looking into the history of plastic multi-layer film development for high barrier packages on a horizontal perspec-

was used for packaging already before the rise of the plastics industry, also the electromotor was in use before the development of combustion engines.
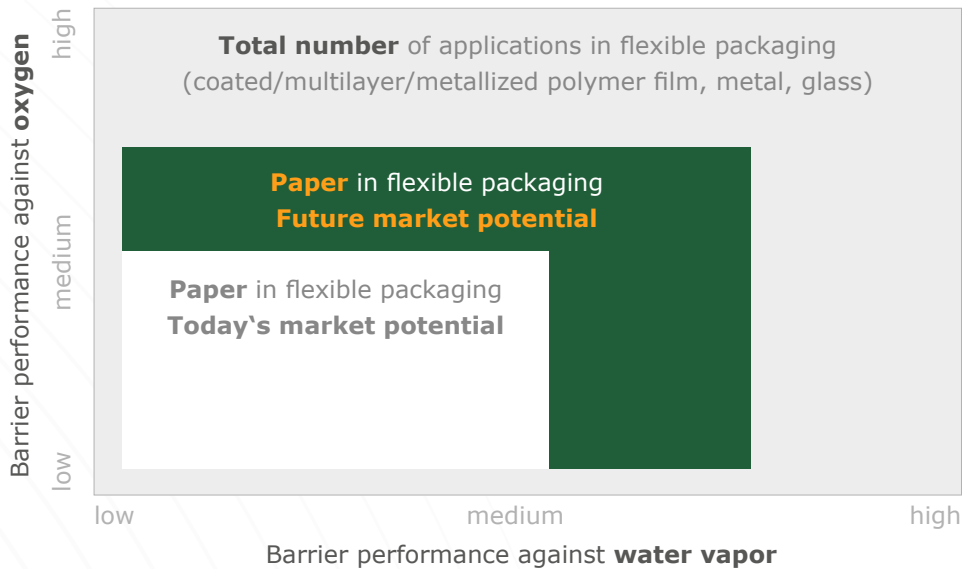
"Design for packaging" and "design for circularity".

So for packaging innovations, paper companies should look beyond their industry borders and cross-link with other segments that have already functionalized substrate surfaces successfully (e.g. paint, textile, display industry). And on a horizontal level it makes a lot of sense trying to "coopete" (cooperate + compete) with players from the plastic industry.

Because we are certain that paper-based packaging will replace its plastic coopetition for certain applications only where it's advantages in sustainability (e.g. recycling) will be a benefit to our environment and where the usability and convenience will be accepted by the end user. **We call for the right packaging material to be used for the right packaging type,** this is true "design for packaging" and "design for circularity".

Barrier performance against **oxygen**
high / medium / low

Total number of applications in flexible packaging
(coated/multilayer/metallized polymer film, metal, glass)

Paper in flexible packaging
Future market potential

Paper in flexible packaging
Today's market potential

low   medium   high

Barrier performance against **water vapor**

On the long run, we also won't be able to provide enough electrical power to run every car with lithium ion batteries. It will be a co-existence of several energy and storage technologies depending on the type of mobility application.