Nestlé | Research and Development

OPPORTUNITIES AND CHALLENGES FOR FIBER-BASED PACKAGING

AFVP Conference
Divonne
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Nestlé Research Lausanne

Contents & Objective

- Nestlé and Nestlé Research in a nutshell
- Nestlé's 2025 packaging vision
- New opportunities for fiber-based packaging?
- And what about challenges?
- Summary

Objective: Give you an outlook on the potential of the novel fiber-based packaging concepts for the long shelf-life applications in food sector

Nestlé in a nutshell

Good Food
Good Life

- 10,000 different products
- Over 1 billion products sold every day
- A product for every moment of every day, from morning to night and from birth to old age

Nestlé Research & Development structure

Discover

- Nestlé Research
- Nestlé System Technology Centre

Develop

- Nestlé Product Technology Centres
- Nestlé R&D Centres
- Nestlé Development Centres
- Nestlé System Technology Centre

Deploy

> **300 Application Groups** in factories in over 80 countries

Nestlé Research

Nestlé Institute of Health Sciences

- Brain Health
- Nutrition & Dietary Recommendations
- Gastrointestinal Health
- Metabolic Health
- Musculo-Skeletal Health
- Cell-Biology
- Multi-Omics & Profiling

Nestlé Institute of Food Safety & Analytical Sciences

- Analytical Science
- Data Science & Issue Management
- Food Safety Research
- Food Contact Materials

Nestlé Institute of Material Sciences

- Biology
- Chemistry
- Technology

Nestlé Institute of Packaging Sciences

- Under construction (announced December 2018)
- Enhancing research capabilities to develop alternative packaging materials

Clinical Development

Nutrition, Health & Wellness

Petcare Research

Plant Science Research

Singapore Research Hub

NESTLÉ'S 2025 PACKAGING VISION

Our vision

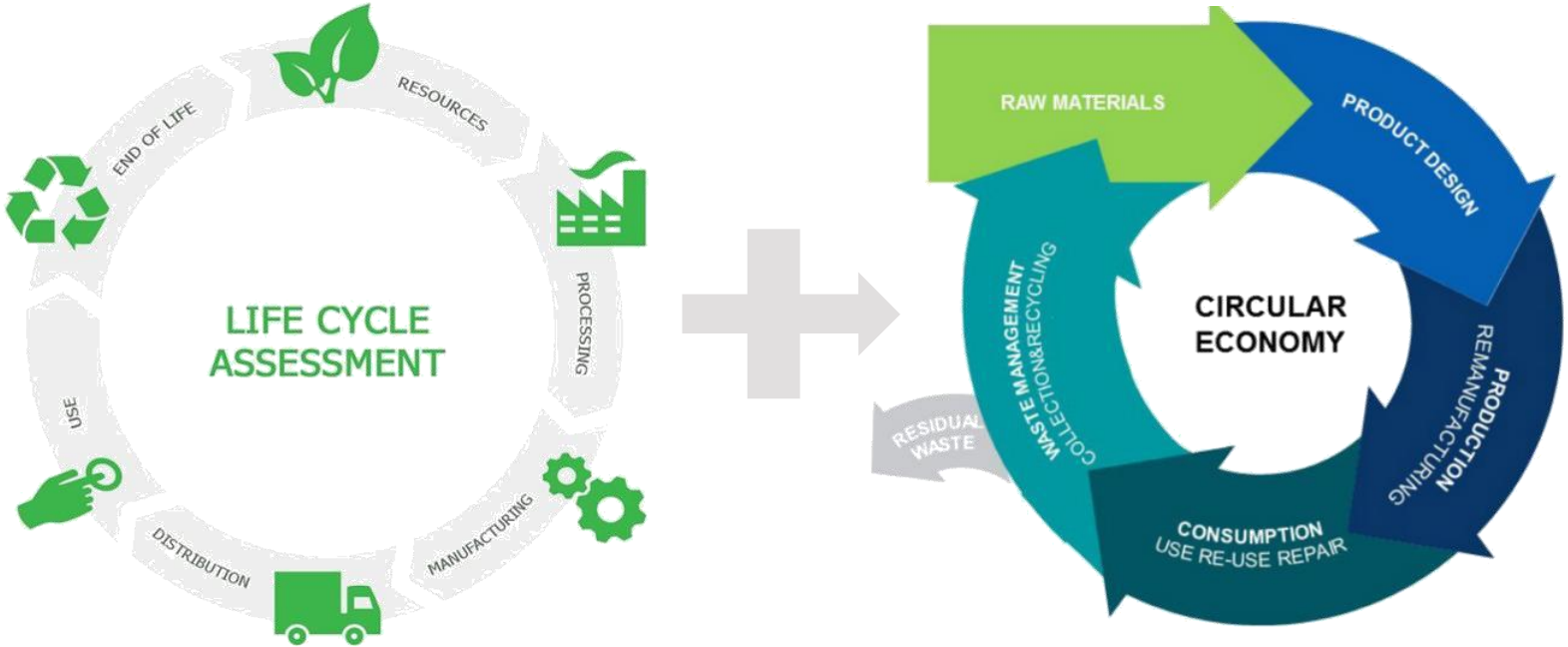
None of our packaging (including plastics) ends up in landfill or as litter

Our ambition

100% of our packaging is recyclable or reusable by 2025

LCA as an approach to asses environmental impacts of packaging

LCA is to be adapted for circular economy



… combining lifecycle thinking with circular economy

2025 Nestlé ambition means that all of our packaging must be recyclable

Meeting the 4 criteria described in ISO 14021,
available for a reasonable proportion of consumers (50% or more)

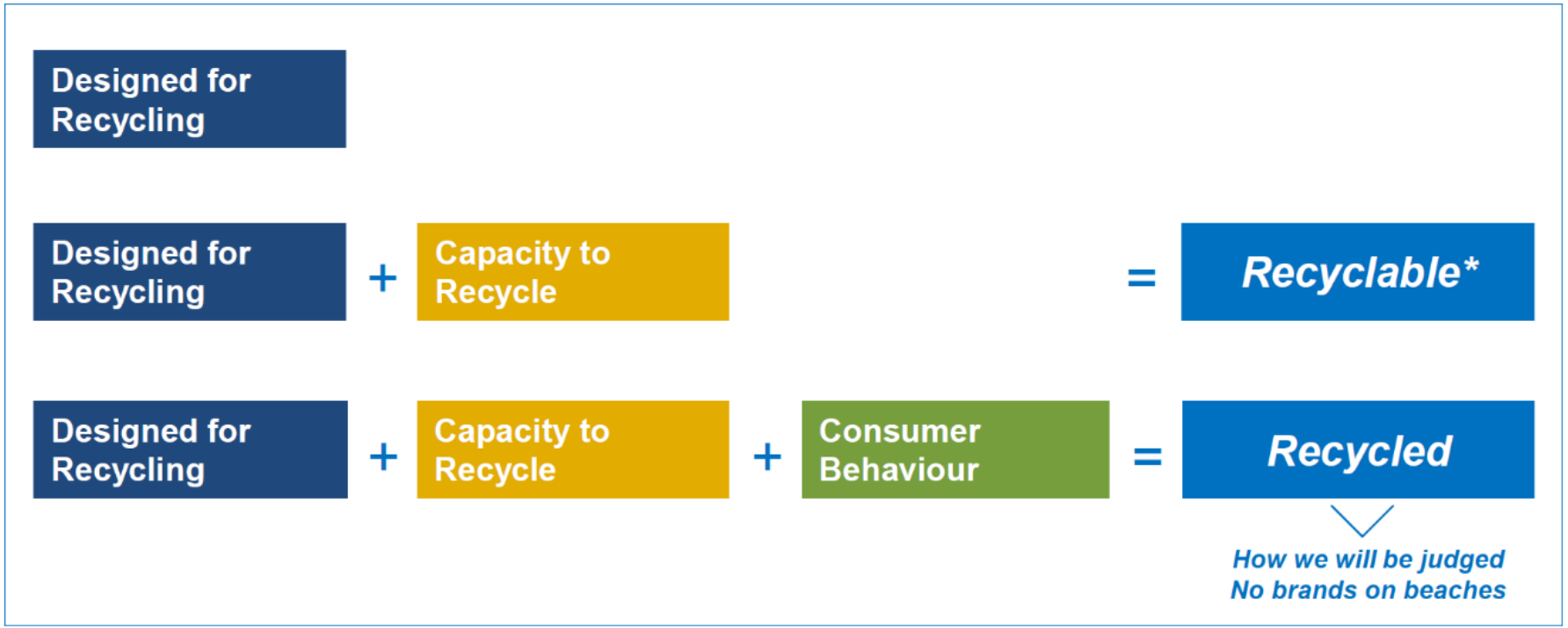
Designing packaging for easy recovery

Collection, sorting & delivery systems are available

Re-processing facilities exist to handle the collected product packaging

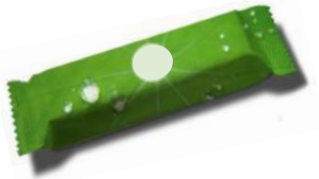
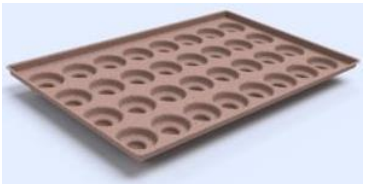
The packaging is being collected and recovered

Recyclable vs. Recycled



** Definition not yet agreed across industry & stakeholders, therefore no consensus on "recyclable"*

Where does technical R&D comes in?

Use of recycled material	Simplify material structures	Substitute material structures
 	  	 

R&D, Procurement, Manufacturing, Marketing

Negative list:
Eliminating ‘hard to recycle’ materials

Material	Application examples
Polyvinyl Chloride (PVC)	sleeves, labels, films, trays, printing inks, sealing layers
Polyvinyliden Chloride (PVDC)	PVDC coated bi-oriented Polypropylene (PP) films
Polystyrene (PS)	trays, yoghurt pots, lids for ice cream cones and coffee cups
Expanded Polystyrene (ePS)	trays, pots, tubs, transport protections and sleeves
Regenerated Cellulose	twist wraps, pack windows
Non-recyclable plastics/paper combinations	paper/plastic laminates, laminated paper cups

Where is Nestlé Starting From?

Nestlé figures for all packaging - 2018

4.7Mn
Tonnes of packaging

1Bn
Products / day

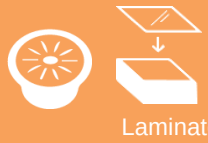
98%
Single use

1.7 Mn
Tonnes of plastic

24%
Recycled content

1.8%
Recycled Plastics

33%
Renewable based



PVC
ePS
PS

Laminates

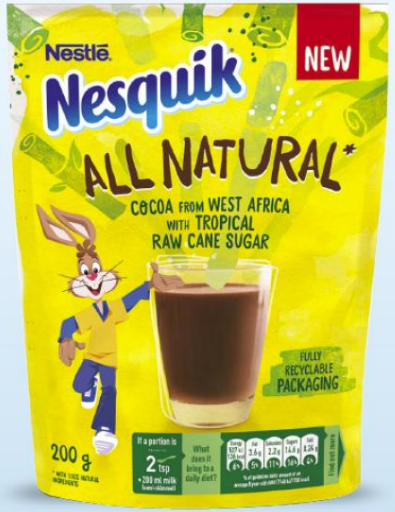
23%
Hard to recycle

18%
Limited recyclability

59%
Easily recyclable

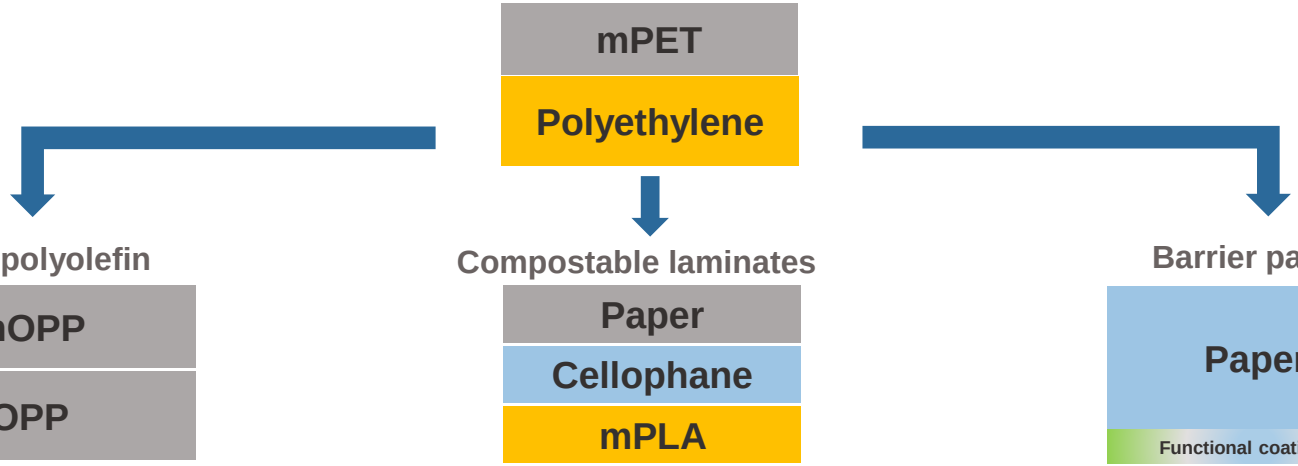
NEW OPPORTUNITIES
FOR FIBER-BASED PACKAGING?

It’s becoming reality!



Alternative flexible packaging *(e.g.)*

Current multilayer laminates (*e.g.*)



+Technically recyclable
+High barrier performance possible
+Low cost

-Lack of recycling infrastructure
-Mechanical recycling lack markets
-Limited runnability

+High biobased content

-Not recyclable
-Poor availability of composting facilities
-High environmental impacts
-Limited barrier performance
-Limited runnability

+High biobased content
+Recycling infrastructure available

-Limited barrier performance
-Limited runnability

Fiber-based packaging is an attractive alternative to certain plastics

Environment:

- Lower environmental impacts when compared at weight basis
- Renewable origin
- Sustainably sourced/Not in competition with food

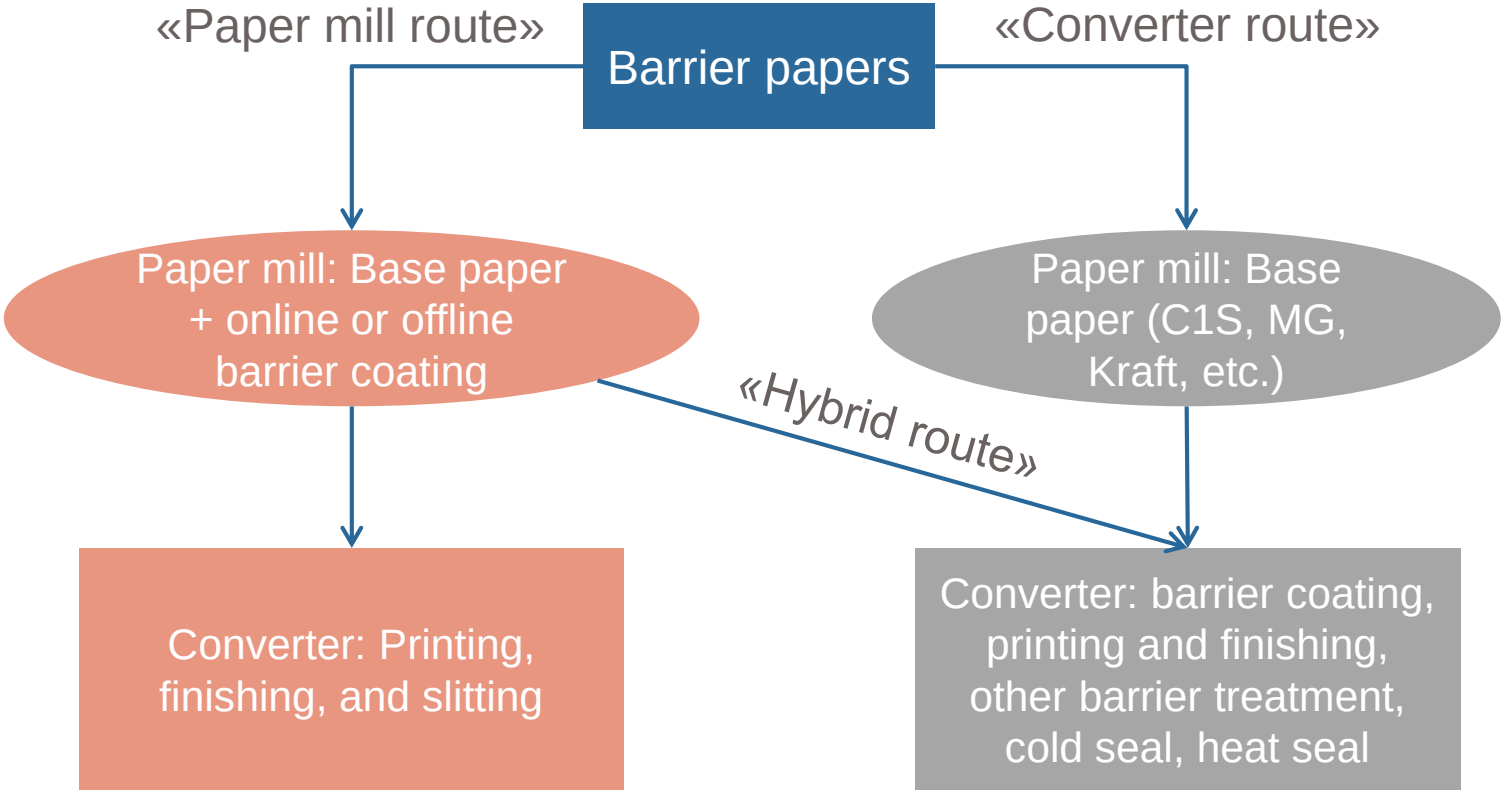
End-of-life:

- Well-established formal and informal collection of waste paper globally
- Established recycling infrastructure worldwide and high demand for recovered paper
- Lower EPR payments in comparison plastics

Packaging:

- Consumer preference in certain regions
- Cost per ton is favorable in comparison to common resins
- Can be efficiently converted by any of existing printing methods
- Large converting and customization capabilities (embossing, metallization, surface finish, *etc.*)

How functional papers can be produced?



AND WHAT ABOUT CHALLENGES?

Challenges in machinability and use phase

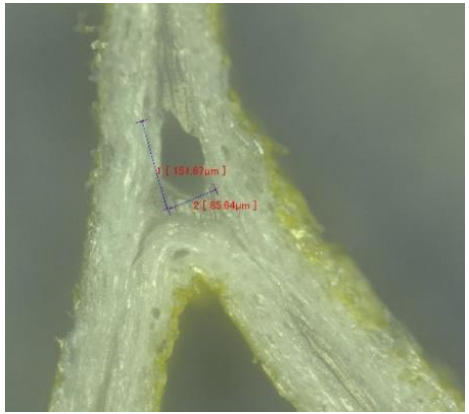
Forming shoulders are tricky

Heat sealability

- Low thickness of heat-sealable layer,
- Low heat transfer coefficient (0.1 vs. 0.4 W/m*K),
- No thermal softening behavior for fibers and fillers
- Poor compressibility

Mechanical and physical properties

- Anisotropy and curl
- Low tear strength
- Property variation in accordance with moisture content
- High compression resistance
- High bending stiffness
- Low puncture resistance
- High coefficient of friction of coated papers



Triple-seal point of pouch before sealing adjustments

Challenges in machinability and use phase

Barrier protection:

- Poor moisture barrier
- Poor oxygen and aroma barrier
- Mineral oil barrier
- Tightness and wear resistance of sealing

On-Shelf and transportation performance:

- Ink rub resistance
- Abrasion and folding damage
- Transportation and storage in damp conditions

Product requirements

Water vapor barrier:

- Protects from moisture uptake or loss
- Low barrier <10 g/m2/d, Medium 10-1 g/m2/d, High <1 g/m2/d, Ultrahigh <0.1 g/m2/d (38 °C, 90% RH)

Oxygen barrier:

- Protects from oxidation, requirements depend on the application

Grease barrier:

- Prevents grease staining, requirements depend on the application

Mineral oil barrier:

- “Must” for a long shelf life product in secondary packaging from corrugated board

Heat sealability:

- “Must” for all applications except flow wrap and fold wrap, tight and strong sealing (5N/15mm or more)

Mechanical properties:

- Depend on format and machine type

Challenge in recyclability and collection

Source: http://www.thepaperstory.co.za/about-pamsa/prasa/

What is paper?

Test liner

98% of recycled pulp
«100% paper and 100% recyclable»

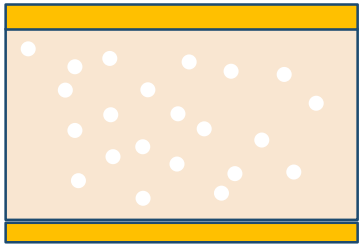
C2S paper

60-70% of chemical and mechanical pulp
30-40% fillers, latex binders, starch
«100% paper and 100% recyclable»?

«Barrier» paper»

80-90% chemical pulp
10-20% mineral and barrier polymer coating
Composite, Paper, Laminate?
Recyclable?

Office paper



70-80% of virgin pulp
30-20% fillers and starch
«100% paper and 100% recyclable?»

Glassine paper

100% virgin pulp
«100% paper»
Not recyclable?

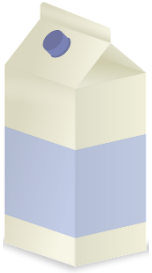
What is collected as paper?

- **Germany:** 95% «paper» 5% «anything»; other to «yellow bin»
- **France:** 51% «paper» 49% «anything», currently undergoing change
- **Nordics:** «paper» stream and «carton» stream
- **Many countries:** vague regulation or no post-consumer collection
- **Informal sector:** whatever sustains my living is recyclable?

CONFUSION

No clear legislation and absence of the standard recyclability testing protocol for paper creates difficulties in design for recycling!

What is recyclable?



- **Corrugated board, solid board and graphic papers:** Recycled worldwide
- **Paper and board laminates, liquid packaging board:** Require a separate collection stream
- **Barrier coated paper & board:** Recyclability on the level of «pure» but legislation, collection and sorting is unclear

Whatever has been traditionally recognized as «paper» or whatever has a value is recycled as post-consumer paper waste

Paper recyclability: Rules of thumb

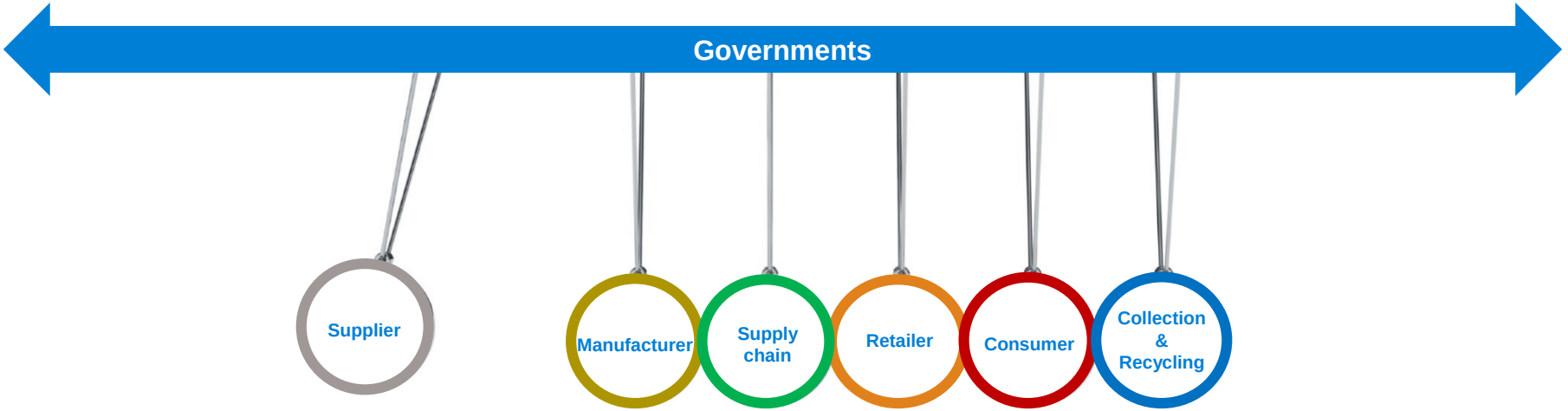
- **No food contamination**
  Macrosized food and non-paper objects shall be removed from packaging (small staining is OK)
- **The higher the fiber content the better**
  this determines financial feasibility of recycling (e.g. Corrugated board ~98% vs. UBC-60-75% Fiber)
- **Easy repulbability**
  suitable for low consistency continuous and batch pulpers with short residence time (less than 5-7 min)
- **Stock preparation**
  Fibers can be easily cleaned from debris (fillers, hotmelts, adhesives, coatings, etc.) without impairing the operations in stock preparation
- **Stickies**
  Non-Fiber elements of packaging do not harm papermaking process and paper machine environment
- **Quality of paper**
  Fibers are strong enough for designed purpose

SUMMARY

Challenges for R&D

- How to ensure sufficient product protection?
- How to ensure run-ability on existing packing lines?
- How to reduce potential losses in supply chain?
- How to ensure that packaging is actually recycled?

Collaboration is the cornerstone of success



Transforming the value chain for single-use packaging requires joint technical, regulatory & legislative mechanisms across the value chain, to establish sustainable market-based waste management systems and drive circularity

Summary

- Environmental drivers in the packaging development are the ever strongest
- Barrier paper packaging has certain advantages over compostable and mono polyolefin concepts due to well-established recycling infrastructure
- Nestlé is actively involved in the development of novel fiber-based packaging
- A lot of unresolved challenges which can be addressed only through collaboration across the whole packaging value chain


Thank you!
Good To Know
Good To Talk
Nestlé
Grade 3