The New Era of Fiber Packaging

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AFRY MANAGEMENT CONSULTING

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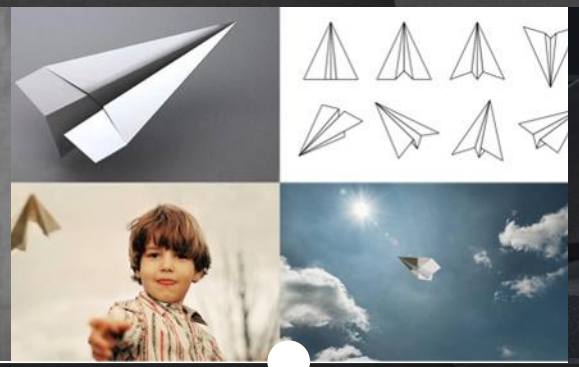
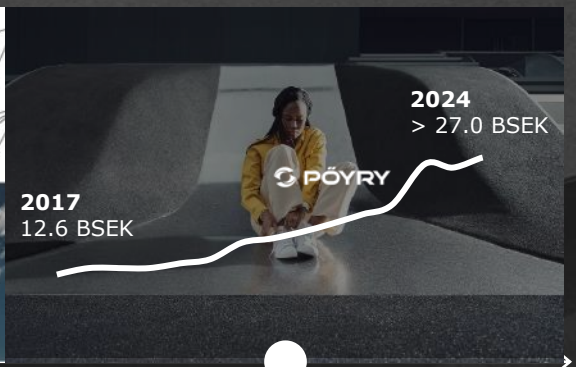
Agenda

1. AFRY introduction
2. The New Era of Fiber Packaging
3. Pressure to lower pulp costs
4. Changes in wood pulp markets
5. Wood vs non-wood pulp
6. Wrap-up

We are proud of our unique company history





1895

The steam boiler association is founded by owners of steam boilers and pressure vessels to prevent accidents

1958

Jaakko Pöyry starts his business with the roots in Finnish forest industries

2019

ÅF and Pöyry join forces, creating a leading company within engineering, design and advisory services

Today

Pioneers of technology and leading partner in the sustainability transition

AFRY is organized in five divisions, with more than 19,000 employees globally and net sales of 2.6bn USD in 2024

Infrastructure

Real estate, Rail & Road Architecture, Environment, Water

Industrial & Digital Solutions

Food & Life Science, Product and Software Design, Automation, Defense

Process Industries

Pulp & Paper, Mining & Metals, Steel Industry, Oil & Gas

Energy

Hydro, Renewables, Nuclear, Transmission & Distribution

Management Consulting

Bioindustry, Wood Products, Energy, Capital Industry

WE HAVE

19,000

Employees globally (as of 2024)

WE HAVE APPROX. NET SALES

2.6bn USD

in 2023

NUMBER OF COUNTRIES WITH OFFICES

>50

NUMBER OF COUNTRIES WITH PROJECTS

>100

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With its unrivalled knowledge of the molded fiber market, AFRY helps its clients assess growth opportunities and articulate their strategic vision

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AFRY Smart, AFRY's business intelligence platform now includes data on 300+ molded fiber plants in the world

WHAT DO YOU GET FOR YOUR BUSINESS INTELLIGENCE NEEDS?

- AFRY Smart is an **advanced online analysis platform** that provides high quality, up-to-date data of fiber-based packaging companies and markets – globally, regionally!
- AFRY Smart **data and models** have been developed and perfected every day for the last 40 years – in-house!
- AFRY Smart scope is **always tailored to fit your needs** and offers the features you use – we keep on adding more!

AFRY SMART FOR MOLDED FIBER BUSINESS INTELLIGENCE

- Global coverage of 300+ molded fiber plants by country
- Plant listings identifying:
  - Company, location, operating status (e.g. operating, decided, planned project), AFRY estimated plant capacities, technology type, raw material used
- Data analysis and visualization of e.g. top producers, technologies (Type 1, 2, 3), target end-uses (food service, consumer good, protective, food…) etc.
- Easy to use mapping tools
- Data download in Excel available

AFRY *Smart*

- Global molded fiber directory
- 300+ plants
  - Producers
  - Manufacturing platforms
  - End-use categories
- Online platform
- Quarterly updates

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World Fiber Outlook monitors global pulp markets, latest trends, and provides long-term demand forecasts

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The new era of fiber packaging: improving costs to unlock pent-up demand

Eco-friendly product demand and regulations continue to drive molded fiber's double-digit demand growth…

Lowering fiber costs is critical to improve molded fiber's value proposition vs its main competition: plastics

New pulp capacity in Latin America and changes in global trade could signal lower price trend for wood pulp

Despite the sustainability advantage, in some markets non-wood pulps might struggle to compete on price

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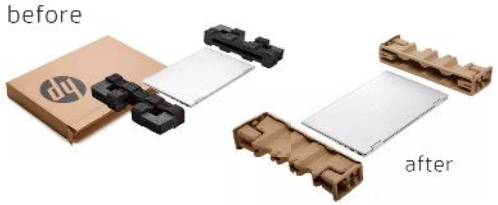
Molded fiber is at the crossroad of multiple macro trends

REDUCE CARBON FOOTPRINT

Most brand owners implementing carbon emission reduction targets. Some embracing Science Based Targets

RECYCLABLE AND RENEWABLE

Brand owners acting on their goals to source packaging from recycled or renewable materials or reusable packaging by 2030



ZERO WASTE

Large sporting venues and QSRs commit to reducing waste

PROMOTE HEALTHY LIFESTYLE

Molded fiber appeals to the "green customer" and supports messaging from healthy and sustainability-oriented brands

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MOMENTUM

Molded fiber is the “hottest” fiber-based packaging market in North America. Recent demand developments continue to support “fast growth” scenarios

North American Type III molded fiber demand recorded close to double digit growth in the past 5 years. AFRY's forecast scenarios point out to continued double-digit growth

Brand owners are expressing strong interest for molded fiber:
“We can’t make it fast enough” – domestic molded fiber supplier

Fiber-based packaging companies are making moves (Metsa developing Muoto; Stora Enso in Sweden; SmurfitKappa in Mexico) and might bring larger scale assets to the market

New investment and capacity development could also come from incumbent plastic thermo-formers such as Pactiv, Novolex (Eco-Products), Sabert and DART

The outsourcing model is quite prevalent (high market penetration of imports, especially from Asia). Tariffs might level the playing field and open new opportunities for domestic producers

CHALLENGE

Brand owners are asking for alternatives to plastic at cost parity

PRIMARY PURCHASING CRITERIA FOR BRAND OWNERS

– Product performance & efficacy

– Costs

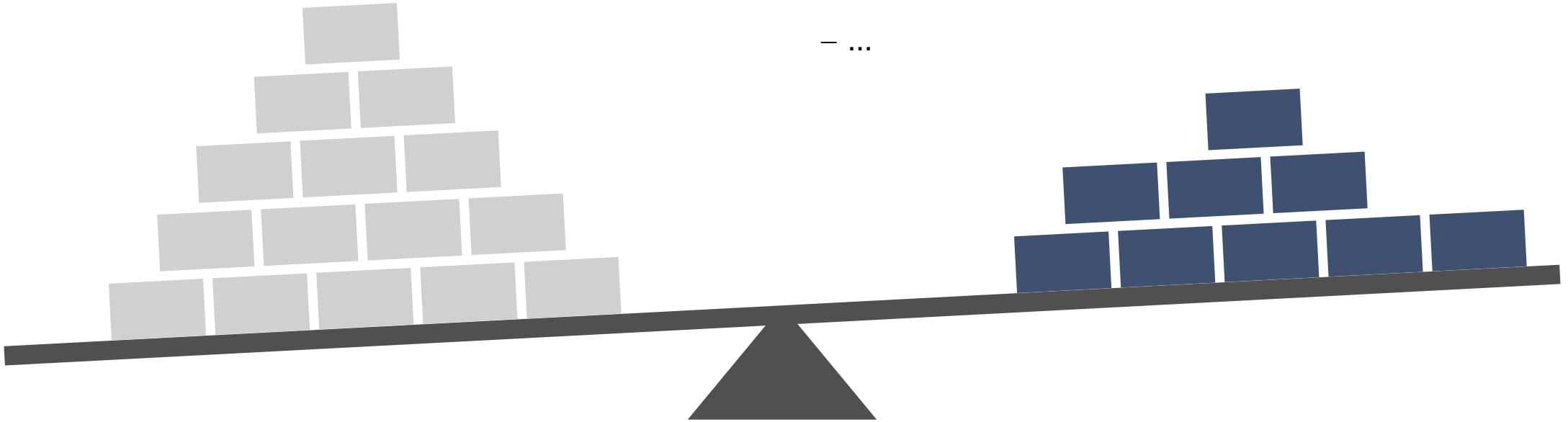
SECONDARY PURCHASING CRITERIA

– Sustainability claims

– Security of supply

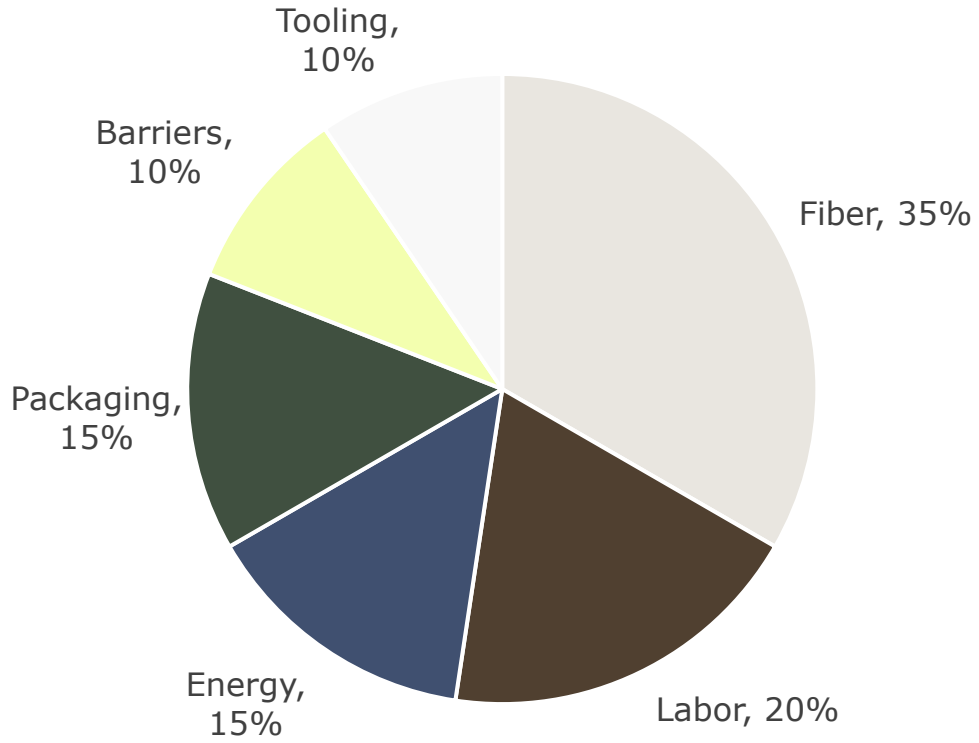
– Supplier relationship

– …



Understanding cost drivers:
Why fiber is one of the keys to reducing unit costs

VARIABLE COST OF PRODUCTION (TYPE III)



FIBER HAS THE LARGEST IMPACT ON PRODUCTION COSTS

- Fiber costs (30-35%) represent the largest input, highlighting the importance of managing fiber procurement and utilization efficiently
- Labor (15-20%) is the second-largest contributor, reflecting the operational intensity of the process. (Influenced by machine speed and automation)
- Energy and Packaging each contribute about 15%; high costs tied to production and distribution
- Barriers and Tooling each account for approx. 10%, associated with product customization
  - Barrier costs are highly dependent on product application and may be significantly higher

Note: These percentages represent typical values for Type III molded fiber products. The total may not equal exactly 100% due to rounding

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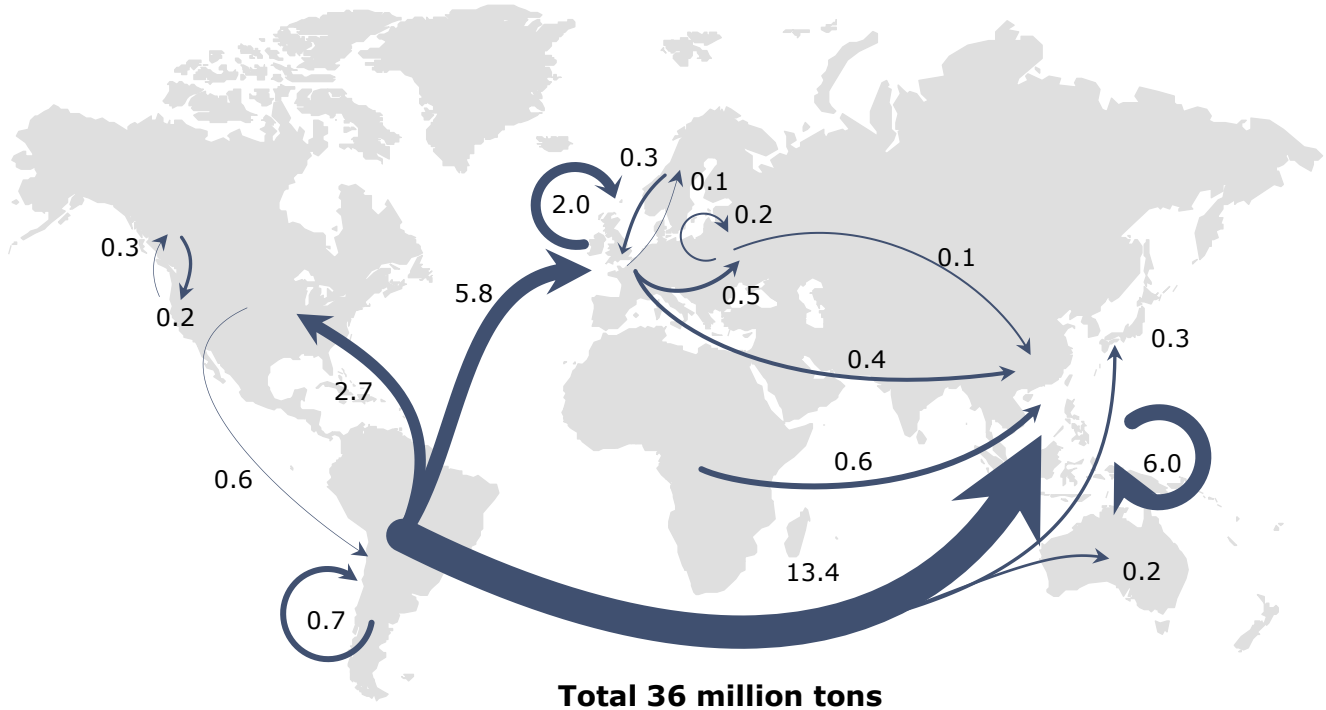
GLOBAL BHKP TRADE

BHKP is the largest pulp commodity. Latin America producers dominate the global trade and are increasing capacities

MAIN TRADE FLOWS 2023

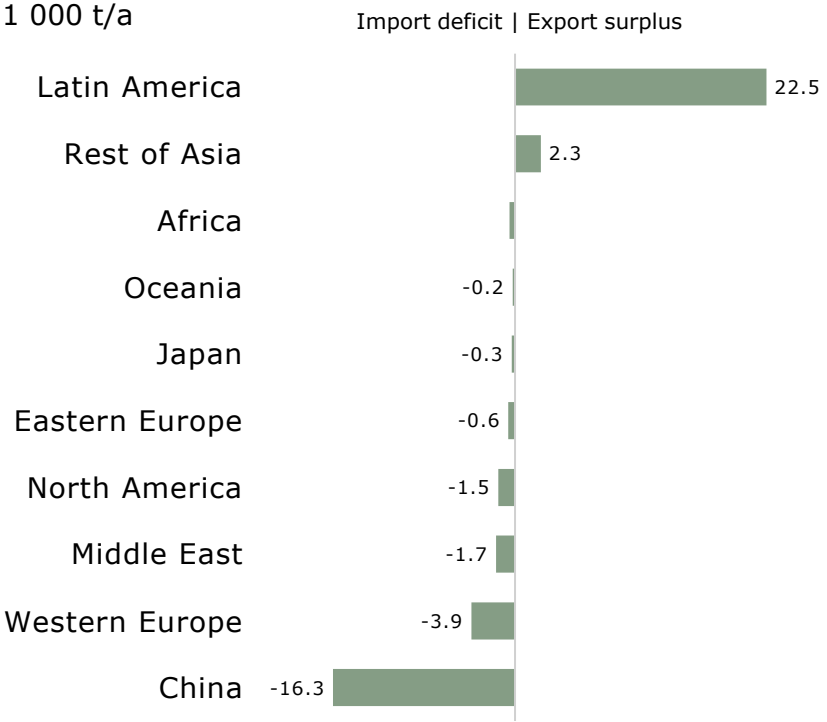
M t/a



Total 36 million tons

NET TRADE BALANCE 2023

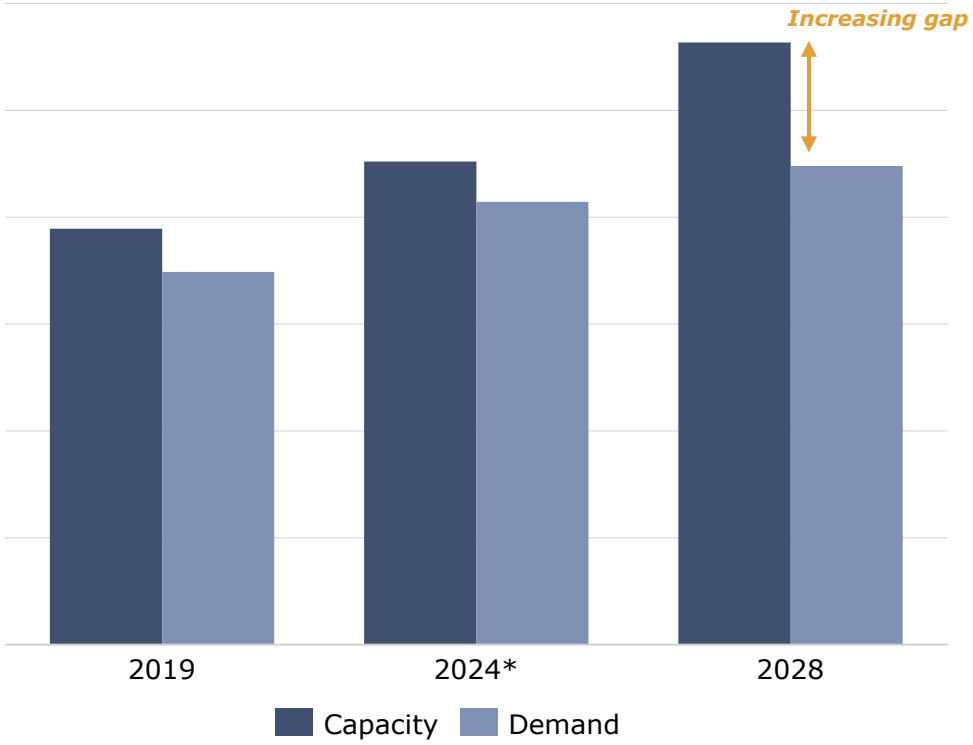
1 000 t/a



Latin American BHKP producers are bringing a new generation of large scale and cost-efficient mills to the market, which might upset the S/D balance

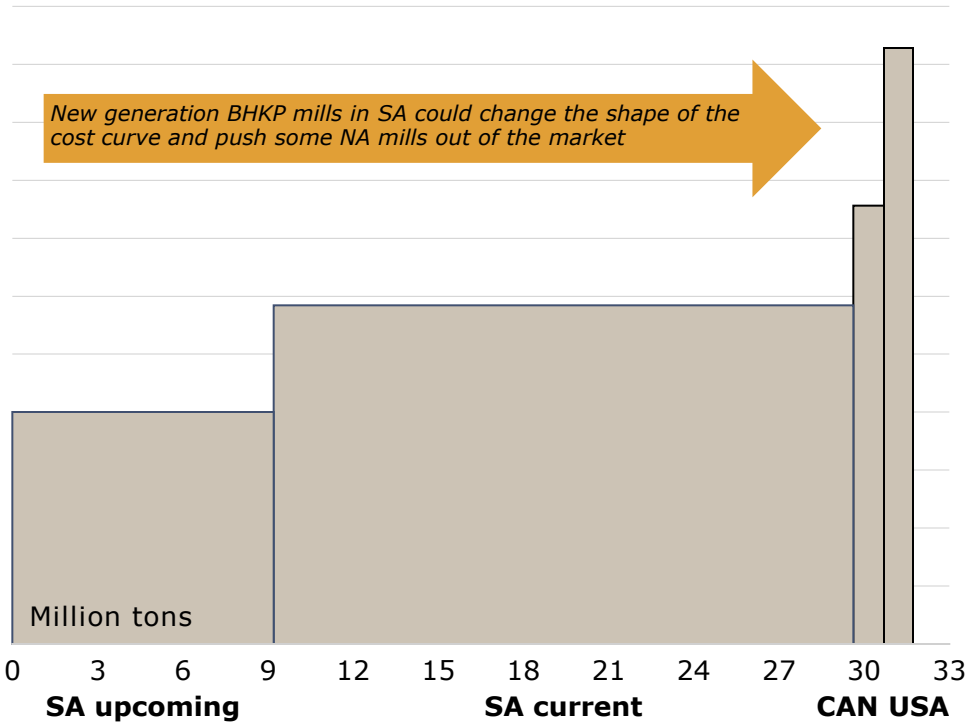
MARKET BHKP GLOBAL SUPPLY/DEMAND FORECAST

Million metric tons



PRESSURE ON PRICES AND NA BHKP MILLS

Average ex-mill manufacturing costs in the Americas – USD/mt



*Present-day capacity

Source: AFRY Management Consulting analysis BHKP = Bleached Hardwood Kraft Pulp

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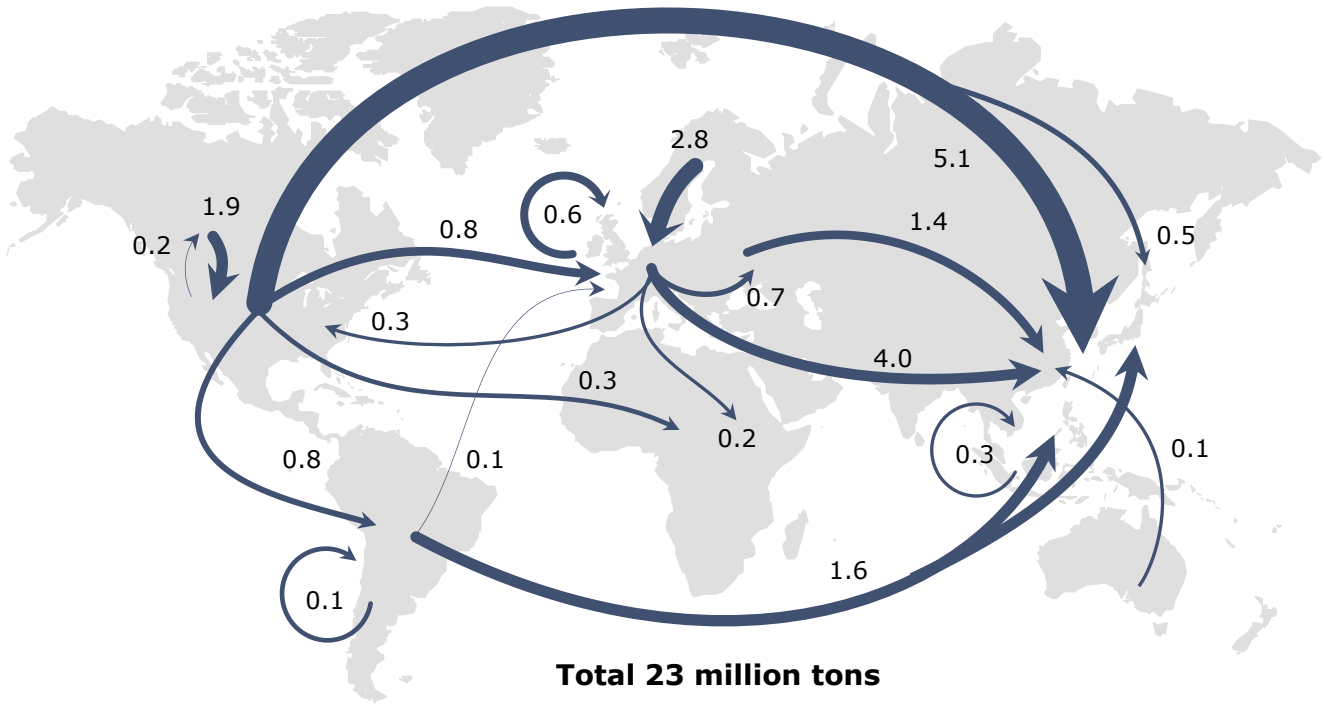
GLOBAL BSKP TRADE

The BSKP supply landscape is more stable but tariffs could disrupt trade

MAIN TRADE FLOWS 2023

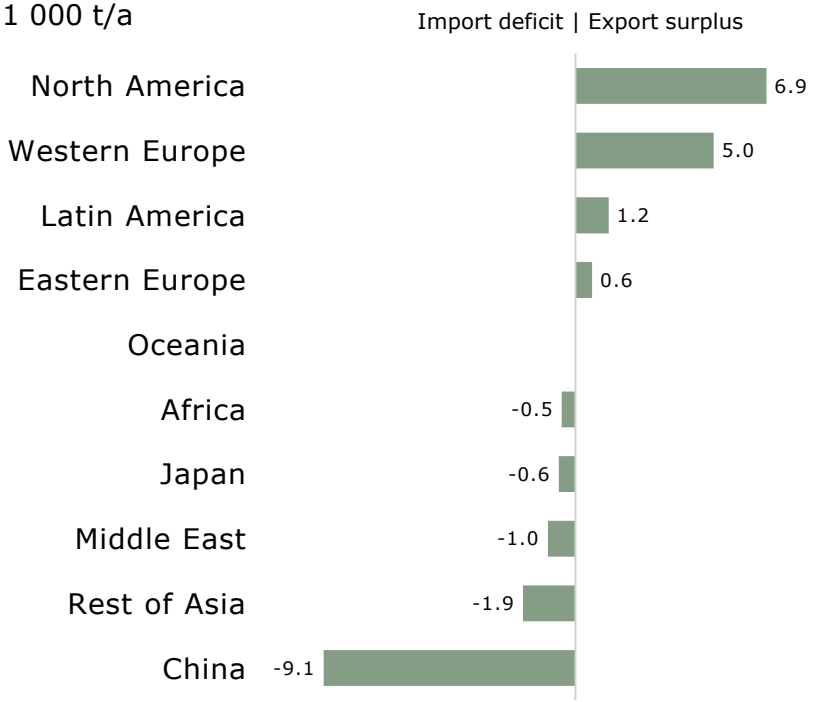
M t/a



Total 23 million tons

NET TRADE BALANCE 2023

1 000 t/a

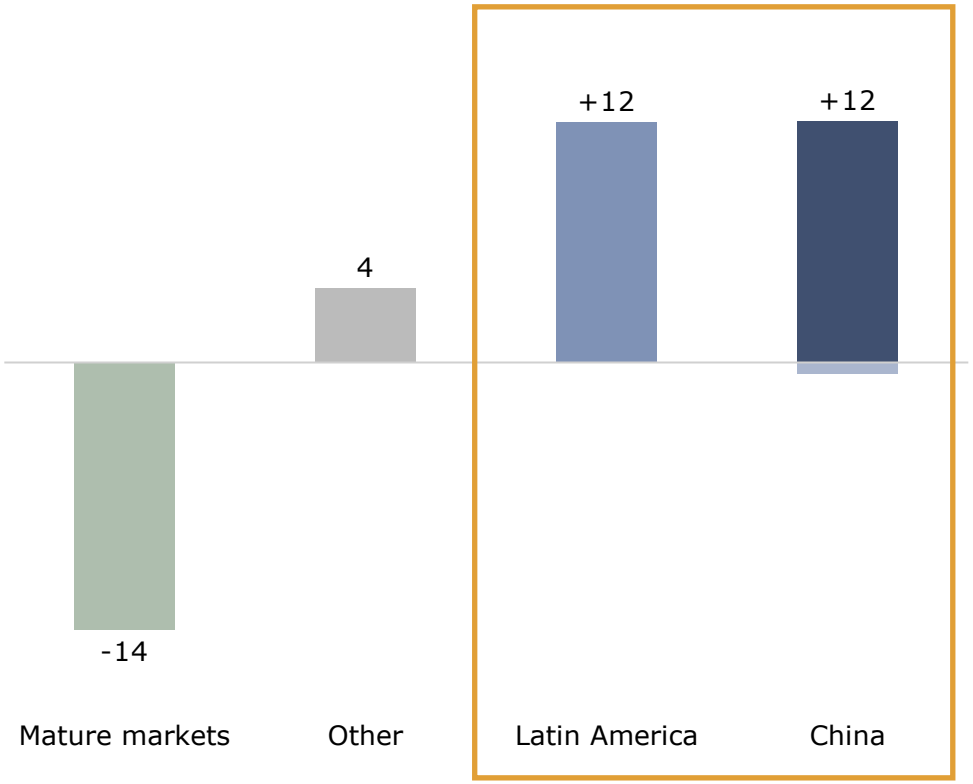


PULP INTEGRATION IN CHINA

China has been developing its own eucalyptus pulp production capacity, which could also upend the global trade dynamics

PRODUCTION NET CHANGE 2012-2022

Million tonnes



COMMENTS

- Integrated pulp production in China has grown as fast as market pulp production in Latin America
- Virtually all that expansion in China has been integrated to paper, tissue and board production
- New eucalyptus plantations allow Chinese pulp and paper producers to shift from importing pulp to being integrated
- Higher pulp integration in China might reduce the need to import pulp from Latin America (esp., Brazil and Chile)
- Softwood pulp imports could also be impacted as increasing price difference between BSKP and BHKP prompts paper producers to optimize their furnish mix

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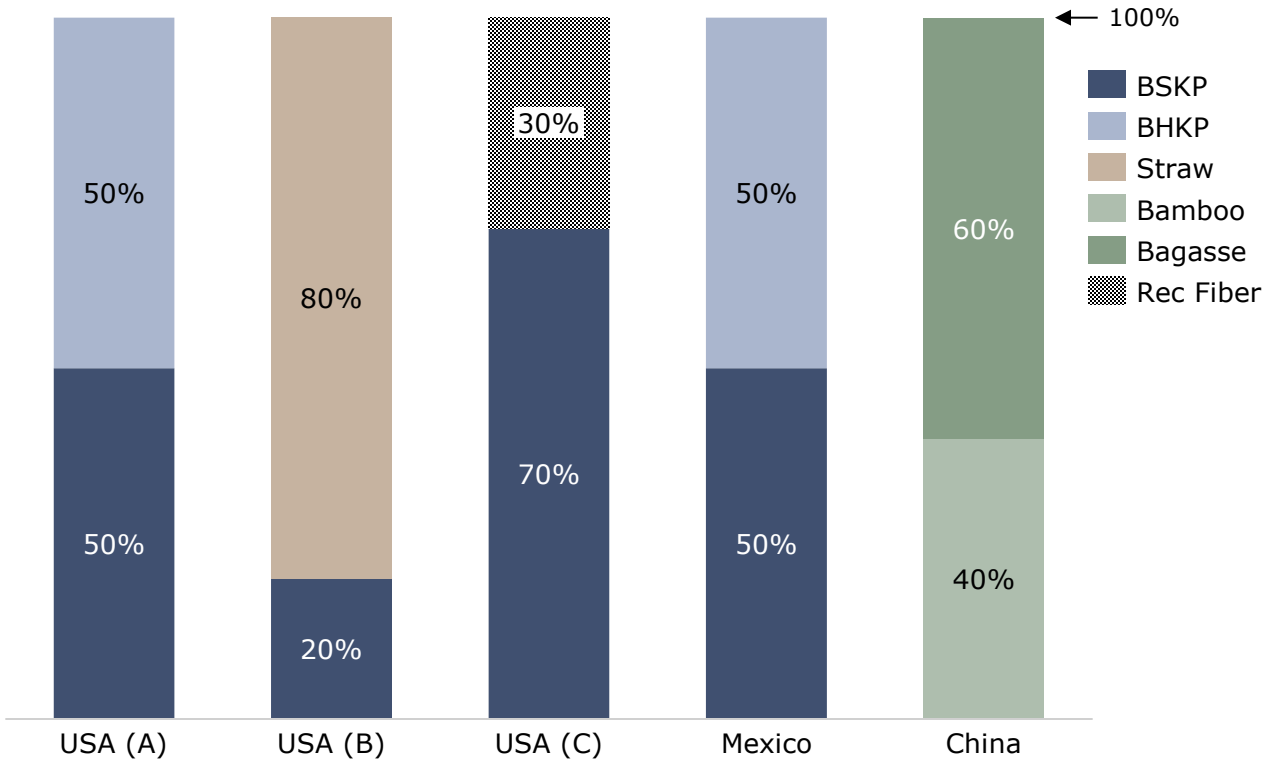
TYPICAL FURNISH MIX FOR MOLDED FIBER

Non-wood pulp (bagasse and bamboo) is commonly used to produce molded fiber in Asia. In North America, wood pulp remains prevalent

FURNISH MIX EXAMPLES FOR TYPE III MOLDED FIBER PRODUCERS



COMMENTS

- Choice of pulp type is driven by fiber properties, cost and availability
- Non-wood pulp is more prevalent in Asia than in North America, although some U.S. molded fiber producers use straw and bagasse, respectively
- In order to achieve required product efficacy, molded fiber producers blend different pulps

Rec Fiber = Recovered Fiber (pre-consumer)

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NON-WOOD PULP PERFORMANCE

Non-wood pulp performs well for molded fiber applications, but its limited scalability compared to wood pulp puts it at a cost disadvantage

	ADVANTAGES	DISADVANTAGES
CULTIVATION & HARVESTING	– Fast growing crops and plants – Multiple harvest per year is some areas – Some species have relatively high yields per ha	– Seasonality requires to adjust logistics – Production far consumption hubs – High volume, low density increase handling costs
PROCESSING (PULPING)	– Simple pulping process (low lignin content) – Less refining required and easy bleaching process	– Variability in fiber quality – More pulping liquid required in the process – Removal of silica; economic feasibility of desilication
QUALITY	– Non-wood fiber can match wood fiber's quality	– Ash content significantly higher than wood pulp's – Fiber properties limit the range of paper qualities that can be produced

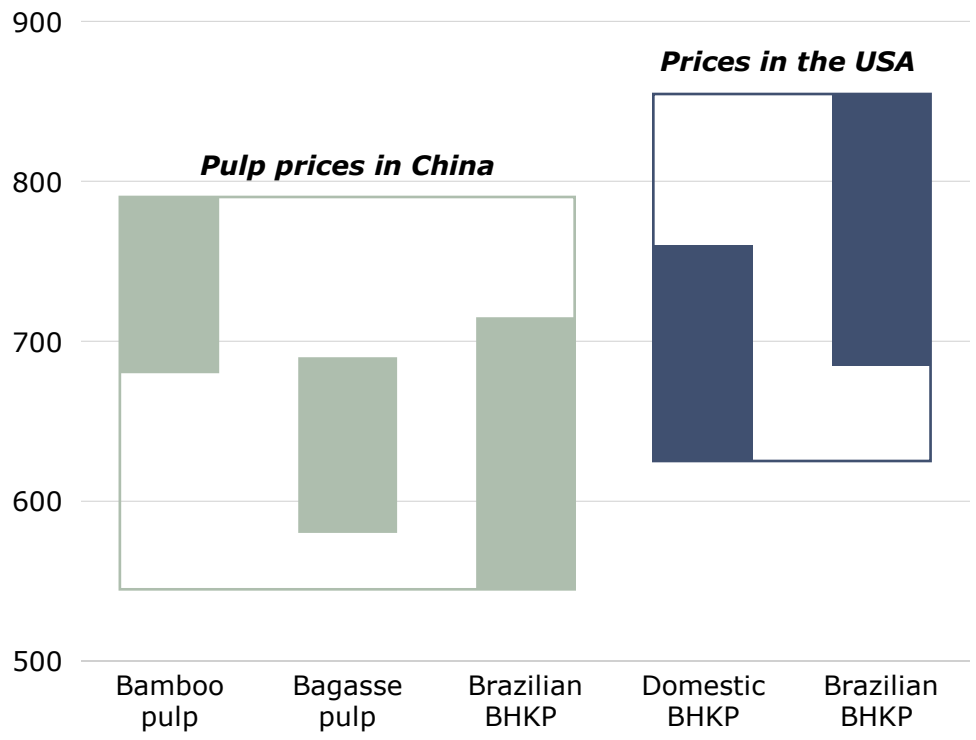
Source: AFRY

PRESSURE ON PRICE

In some markets such as North America, non-wood pulps might struggle to compete on price with wood pulp

NON WOOD PULP VS WOOD PULP PRICES

USD/ton



COMMENTS

- Most non-wood pulps compete with hardwood pulp. In China, pulp imports from Brazil are the price benchmark
- As a result, non-wood pulp prices in China match the price of BHKP imports from Brazil as evidenced in the chart
- Domestic non-wood pulp is not as common in the USA. Domestic and imported BHKP are the price references
- It might be challenging for non-wood pulps to align with USD 800/ton price level in the US market
  - Non-wood pulp mills are usually small scale assets
  - Non-wood pulp producers might claim a price premium for sustainability but it might not be sufficient to offset the cost disadvantage vs larger scale wood pulp

Source: rolling 12 month prices from RISI/Fastmarkets. Brazilian BHKP prices in the USA estimated with 45% discount on list prices

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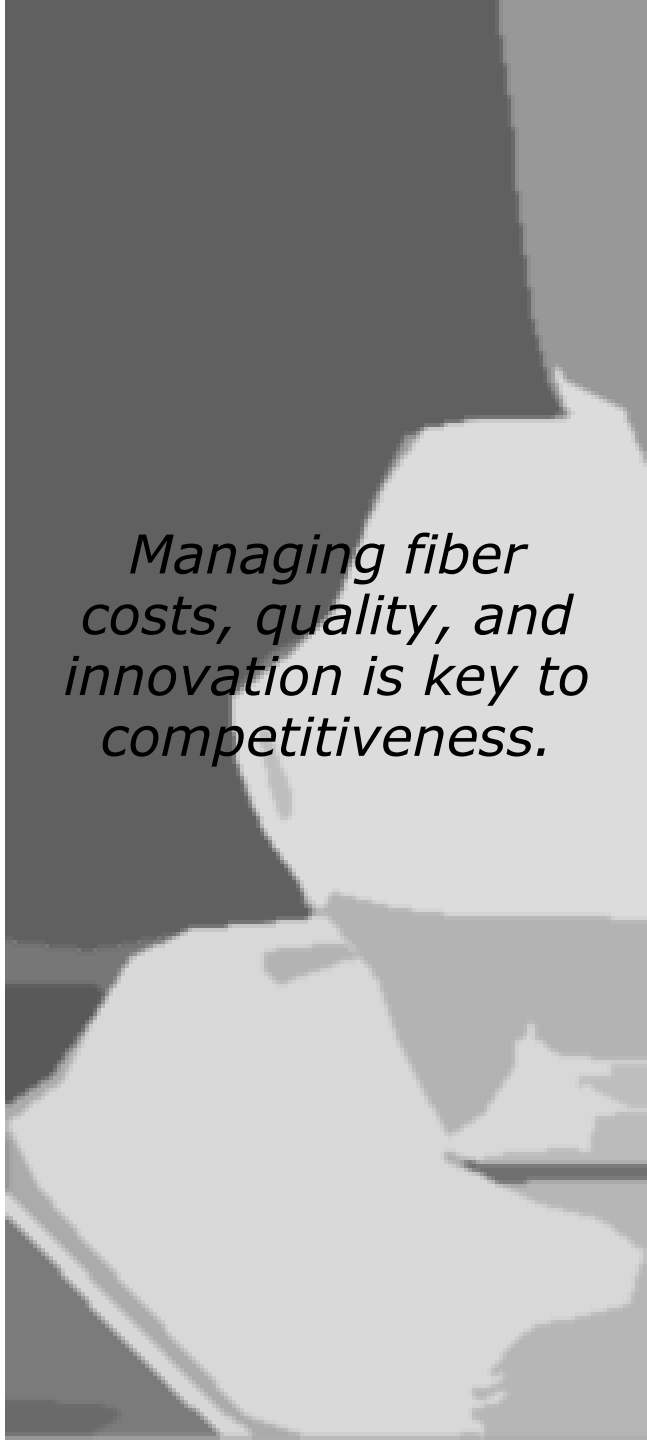
Eco-friendly product demand and regulations continue to drive molded fiber growth …

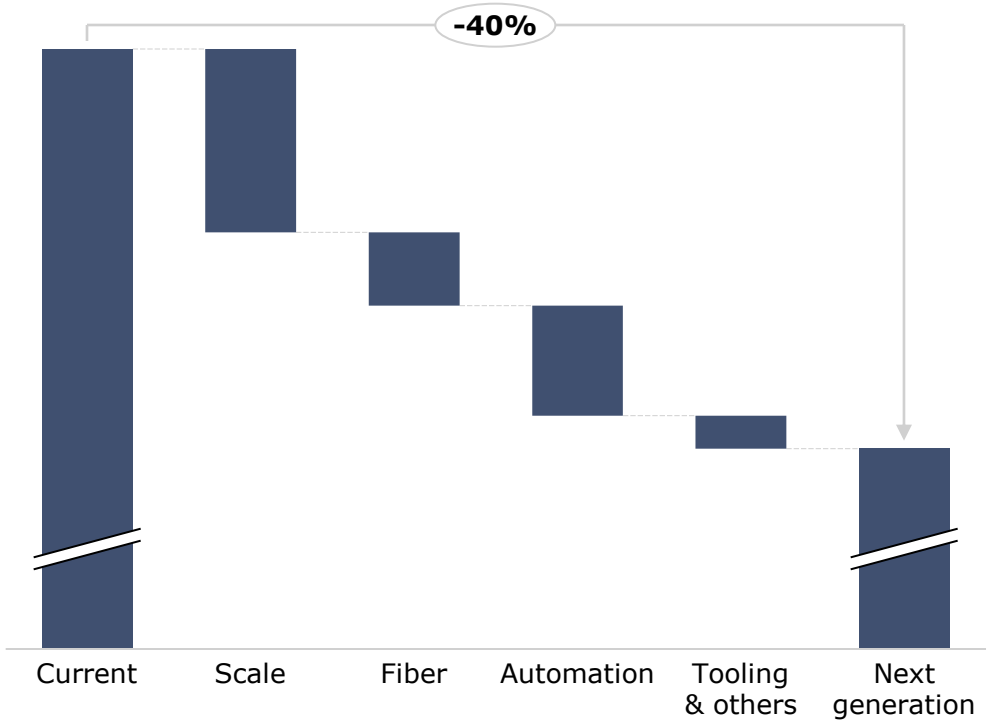
- Consumer demand for eco-friendly packaging solutions and regulatory influences (e.g., EPS) represent bullish drivers for MF packaging, especially in the foodservice and retail sectors. Demand growth is driven by the replacement of plastic containers that, in most cases, are less expensive to produce. This is a strong incentive to reduce manufacturing costs.
- Fiber procurement remains the largest cost component in MFP production, accounting for approximately 30-35% of total costs, followed by labor, energy, and packaging.
- New large scale and low-cost pulp capacities in Latin America and potential changes in global trade dynamics could signal lower price environment for wood pulp.
- Despite having higher ash content and variability in fiber quality, which can affect the strength and durability of the final product, non-wood pulp is adequate to produce molded fiber. But while non-wood fibers are advantageous in terms of sustainability, in some markets non-wood pulps might struggle to compete on price with wood pulp.



Fiber is not the only lever to optimize molded fiber manufacturing costs

NEXT GENERATION MOLDED FIBER PLANT: COST PERFORMANCE

Indicative manufacturing costs for a MF clamshell



COMMENTS

- Currently, the average US molded fiber plant is relatively small, procures fiber from the market and automation is limited
- In addition to fiber, there are other avenues for molded fiber producers to optimize their costs
- Next generation plants could significantly improve their value proposition vs plastic through:
  - Up-stream integration
  - Achieving higher scale
  - Optimizing fiber costs or integrating into fiber
  - Investing in automation
  - Innovating in tooling design
  - Developing dry process for relevant products
  - Barrier technology innovation

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