Innovation and Adaptation in the Planted Forests Sector

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The world needs 4 billion $m^3$ of wood every year

WORLD ROUNDWOOD HARVEST 2020

- Sawlogs: 1.14
- Fuelwood: 1.93
- Other Ind wood: 0.16
- Pulpwood: 0.71

3.9 billion $m^3$

WORLD INDUSTRIAL WOOD USAGE

- Sawnwood: 472 million $m^3$
- Wood Panels: 389 million $m^3$
- Wood Pulp: 178 million $t$

Source - AFRY AB
Global Trends in Wood Removal – 1961 - 2018

FAO – Forest Resources Assessment 2020
Forest - Additional Annual Area to Sustainable Growth @3% aa – 120 MM m³
A story of contínuos transformation
KLABIN
A Brazilian Company
with 123 years of History
Direct and Indirect Collaborators in 23 industrial Sites

+25 K Direct and Indirect Collaborators in 23 industrial Sites
Forestry
Pulp
Papers
Packaging

Klabin
Integrated From Forests to Paper Packaging
BUSINESS AREAS

Forestry Base

671,000 ha
42%
total land
Preserved native forests

287k ha of cultivated
Eucalyptus and Pine

Bleached Pulp
Hardwood, Softwood & Fluff

Paper for Packaging
Kraftliner & Coated Board

Packaging
Corrugated Boxes &
Industrial Bags
OUR FORESTS

42% of its total area PRESERVED

PLANTED
287 thousand hectares

PRESERVED
280 thousand hectares

forests areas located in the Southern part of Brazil
Forest Management as a MOSAIC
forms Ecological corridors.

Preserves river springs.

Protects fauna and flora.

Klabin's forest management helps protects natural resources, enhances production and collaborates with the preservation of biodiversity.
Integrated Biodiversity

Puma, pygmy brocket and howler monkey are some of the endangered species, protected in areas owned by Klabin.
Sustainability and Innovations

Responsible solutions with renewable, recyclable and biodegradable Forest-based products, towards the construction of a sustainable economy
PULP AND PAPER MARKETS
Focus on representative and consistent growing markets

Long-term demand growth 2019-2030

- Tissue
- Containerboard +1.7%p.y.
- Coated Boards
- Sack Kraft† +4.2%p.y.
- Other papers

Growth of containerboard demand by region 2020-2030

- Latin America +2.2%p.y.
- Asia +2.1%p.y.
- Rest of the world +1.8%p.y.
- Europe +1.3%p.y.
- North America +0.7%p.y.

†- Considering substitution of solutions in other materials
Source: AFRY
INNOVATION INITIATIVES
5 Development Routes

- Wood
- Pulp
- Packaging Paper
- New Technologies on Wood Based Products
- Environmental and Sustainability
Tree Breeding
Increasing productivity potential of Pine and Eucalyptus

Biotechnology
New tools applied to genetic materials

Cloning
Transferring genetic gains to the operation

Environment

Genetics

Management

Target

Soils and Silviculture
Application of best silviculture practices

Plant Health
Minimizing damage to productivity

Ecophysiology
Optimization of soil-plant-environment interactions
No warranty of success

Silvicultural practices

Environment

Target

Genetics

No warranty of success

No warranty of success

No warranty of success
Klabin - Good rainfall and mild air temperatures
Soil characteristics and challenges

- Deep soils
- Transition soils
- Shallow / rocky soils

Distinct
- Textures (clay, sand)
- Natural fertility

Increase in challenge
Increase in limitations for productivity
Target: Improving productivity

Production environments for each species

Site quality = Soil + Climate + Indicators

Target: Improving productivity
FORESTRY COMPETITIVENESS
High Productivity in Fibers

PINE
Mean Annual Increment (MAI) - Klabin

EUCALYPTUS
Mean Annual Increment (MAI) - Klabin
Potential Opportunities:
• Forest Sensoring / Digitalization
• Data analytics on Forest Management
• “Speeding up” Genetic Material Selection
• Biotechnology Tools
• Best Silvicultural Practices
• Plantations Protection
• Environmental Interactions
Sensoring
Experiments Monitoring
CRISPR - Exploring Gene Edition
FOREST-BASED OPPORTUNITIES FOR GREENER FUTURE
Trees,
hundreds of years of evolution resulted in super materials
WHAT CAN COME FROM A TREE?

Energy
- Heat
- Electricity
- Pellets
- Biocoal
- Biooil
- Ethanol
- Methanol
- Biogasoline
- Biodiesel

Chemicals/materials
- Lignin
- Biocoal
- Biooil
- Ethanol
- Methanol

Pulp fibers and cellulose

Source: RISE
New Technologies

Developments in biorefinery including: lignin, sugars, phytosterols and fine chemicals.

Cellulose nanocrystals and microfibrillated cellulose applications.

Renewable chemicals as fossil based alternatives.
BARRIERS

- Water
- Insects
- Oil & Grease
- Odors & Fragrances
- Light & Temperature
- Gases
  - Water Vapor
  - $O_2$
Fiber-based Biomaterials

Fibers

Micro (MFC)

Nano (CNC)
Paperboard bottom surface without barrier application

Paperboard bottom surface with barrier application
Kraft Lignin

100% renewable macromolecule extracted during wood kraft cooking and isolated in precipitation processes.
PUMA PULP & PAPER MILL

Integrated new opportunities

- Sulphuric Acid from Non-Condensable Gases;
- Biomass Gasification – Syn Gas;
- Sulphate of Potassium – SOP;
- Sludge Drying Plant.
Sulphuric Acid Plant

Gasification Plant

Sulphate of Potassium
THANK YOU!!
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