



Overhaul of South American Economic Climate and Market Opportunities Emerging Acceptance of Eucalyptus Fibre – Tissue Maker's Perspective



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Edvins Ratneiks is a curious person who likes to share and gain experience in various fields of knowledge. Everything that may represent a challenge catches his attention. His main objective is to provide advanced group experiences to increase productivity. His professional life experience comprises 33 years of work in the Brazilian pulp and paper industries, namely Riocell, Klabin, Aracruz and CMPC Celulose Riograndense. His working areas have been Research & Development, Conceptual/Basic Engineering Studies and Technical Assistance/Papermaking Products Development. Edvins' current experience as Technology Manager with CMPC Celulose Riograndense is to integrate a group of persons into a superior level of technical assistance to the customers worldwide.



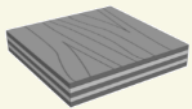
Emerging Acceptance of Eucalyptus Fiber Tissue Maker's Perspective

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Technology Manager

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CMPC at a glance

CMPC is a P&P company, established in 1920, that produces **solid wood products, pulp, paper, packaging products** and **tissue** in **Latin America**



CMPC's Figures

Sales: 4,831
 EBITDA: 974
 Net Debt: 3,494
 Assets: 14,861

Figures for the LTM as of March 2015 (US\$ million)

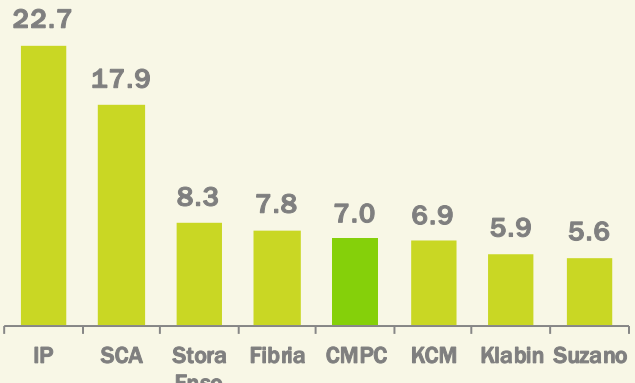
Market capitalization of **US\$7 billion** as of April 30th, 2015

Controlled by the **Matte Family**, one of Chile's leading economic groups

International rating
BBB+ (Fitch)
BBB- (S&P)
Baa3 (Moody's)

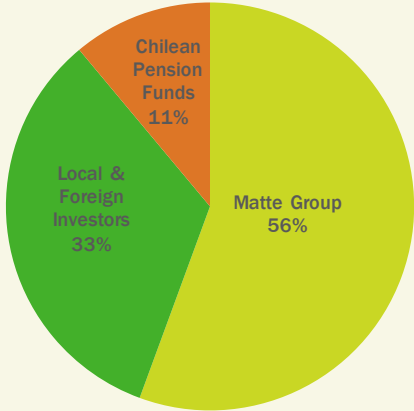
Local rating
AA (Fitch)
AA (ICR)

P&P main companies by market capitalization



*As of April 30th, 2015. Source: Bloomberg

Shareholders' Structure*



* As of March 31st, 2015. Source: CMPC

Operations in **8 countries**, selling to more than **45 countries**

~16,800 Employees worldwide



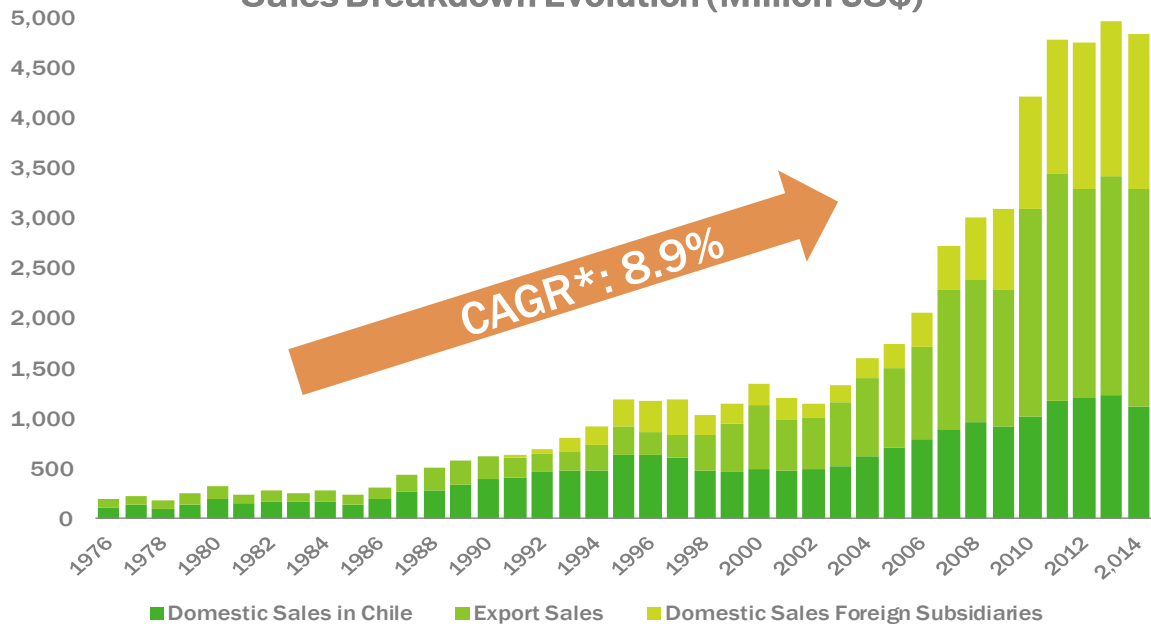
CMPC has evolved from a local company to a global player

- CMPC has **expanded significantly** through **Latin America** over the last two decades
- 11x asset growth** since 1990 (before CMPC's international expansion process)



- Forestry Operations
- Pulp Operations
- Paper and Packaging Operations
- Tissue Operations

Sales Breakdown Evolution (Million US\$)



*CAGR: Compound Average Growth Rate



Presentation outline

- Selected technical aspects of the eucalyptus fiber to set the ground for the tissue applications;
- Technological achievements that connect fibers and equipment to produce the papers with the desired quality and productivity;
- Products' requisites around the world and the impact on the machinery;
- The technological future for fibers and equipment.

Selected technical aspects of the eucalyptus fiber

The theoretical design of tissue paper **softness** is based on **three main variables** with a positive correlation among them:

1. Number of Fibers Per Gram (NFPG)

- numerous small fibers sticking out of the surface

2. Wet Web Flexibility (WWF)

- adequate 3-D structure which produces the bulk softness and the pores for water absorption

3. Dry Bonding Strength (DBS)

- efficient inter-fiber bonding to “freeze” the aforementioned features after paper drying

NOTE: The concept of paper strength is developed separately, in a dedicated layer with fully refined long or short fibers. The main reason for that separation is given by the equation:

$$\text{Softness} = f(1/\text{Strength})$$

Selected technical aspects of the eucalyptus fiber

In this three-pronged design – **NFPG**, **WWF**, **DBS**, the **regular pulps in the market** would fulfill the needs of a conventional Tissue Machine e.g. Crescent Former and its improvements:

- Concerning **WWF** and **NFPG** :

- Eucalyptus wood density of 450 - 550 kg/m³

- WWF** = 0,5 – 1,0

- NFPG** = 15 - 30 Million

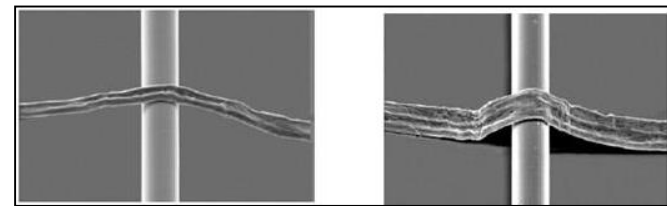
- Indonesian Acacia

- WWF** = 0,7

- NFPG** = 30 Million

- Concerning **DBS**:

- Unbeaten tensile strength should be enough for dry bonding
- Refined tensile strength preferably developed in a dedicated headbox
- refined pulp (BSKP - softwood or BEKP - eucalyptus)
- chemical/enzymatic treatments are valid treatments

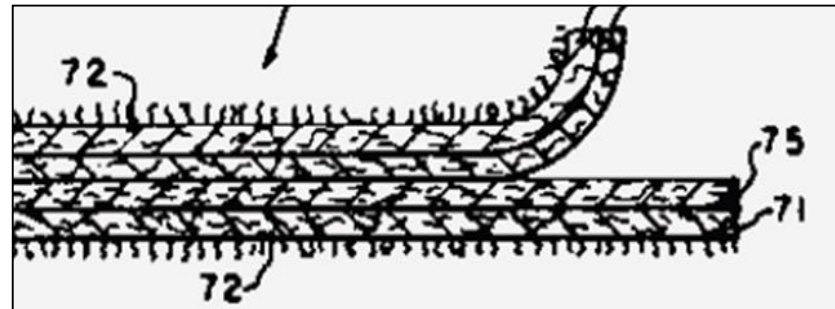


WWF= 1,0

WWF ~ 0,7

Layered-bath tissue

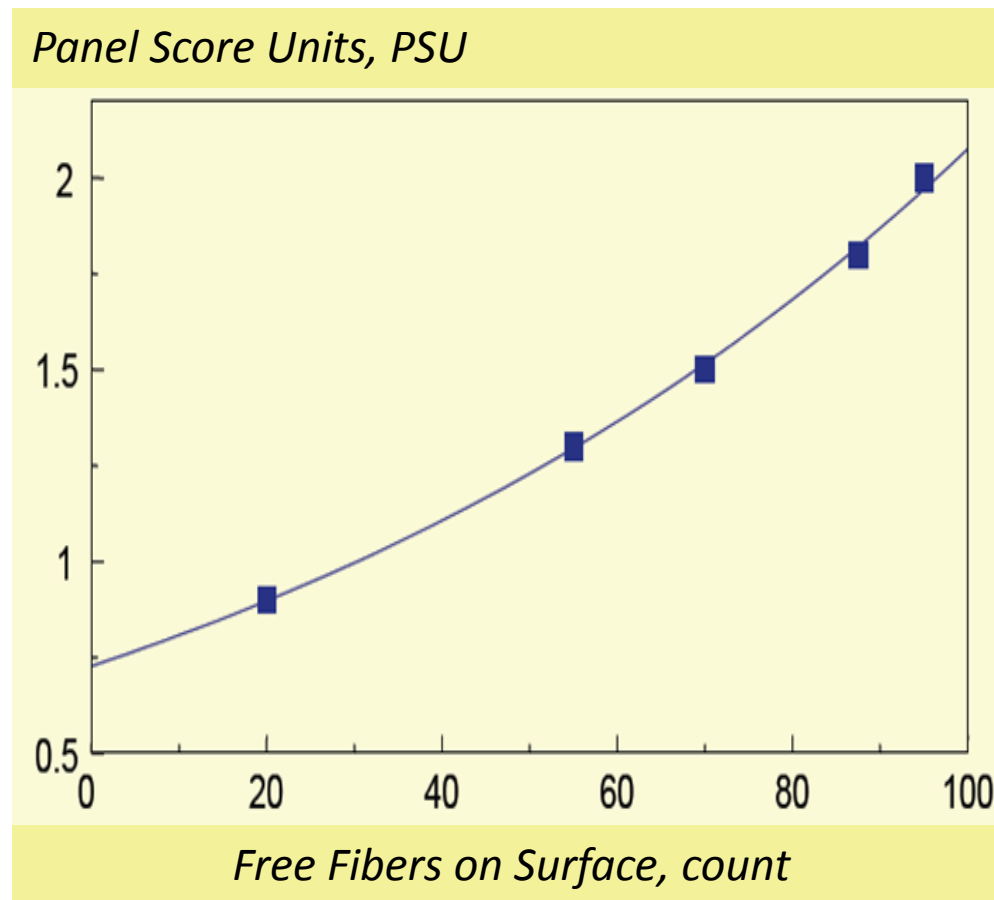
BEKP (eucalyptus) and BSKP (softwood)



P&G patents

Effect of Free Surface Fibers on Softness

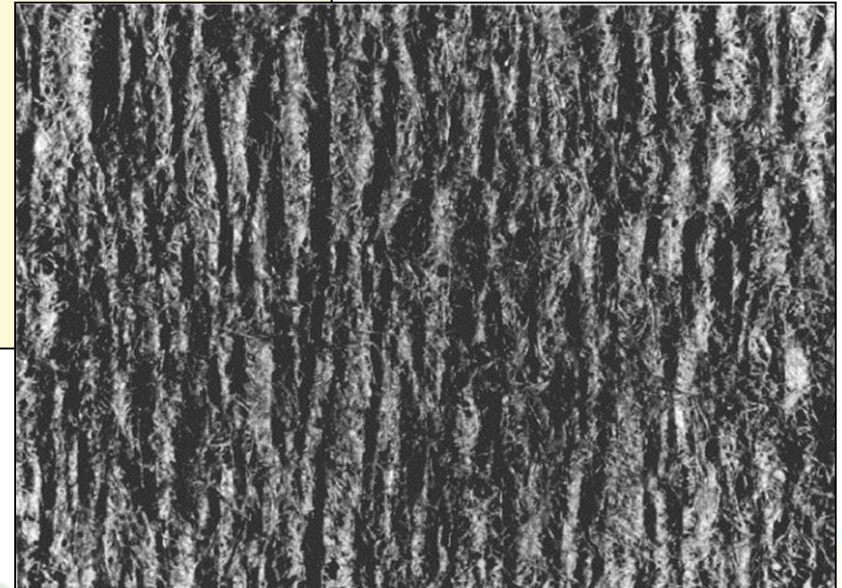
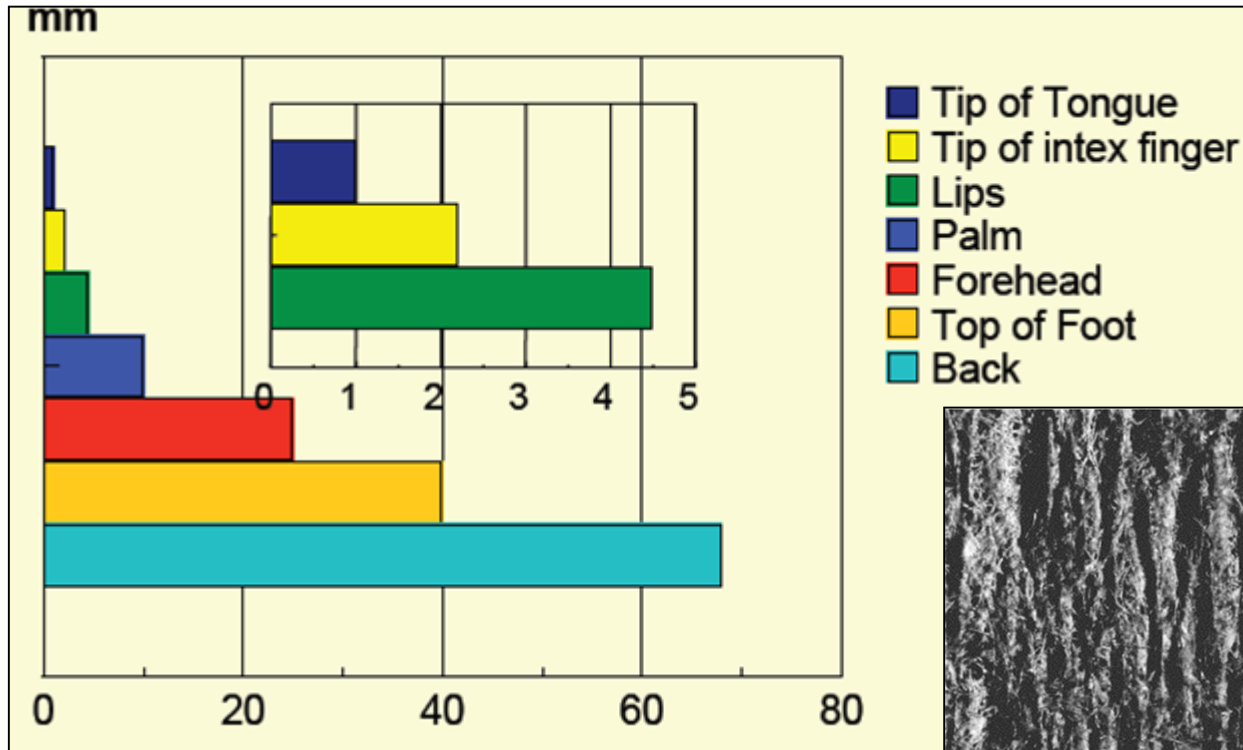
Free fibers account for up to 2/3 of perceived softness in a Panel Score test



P&G patents

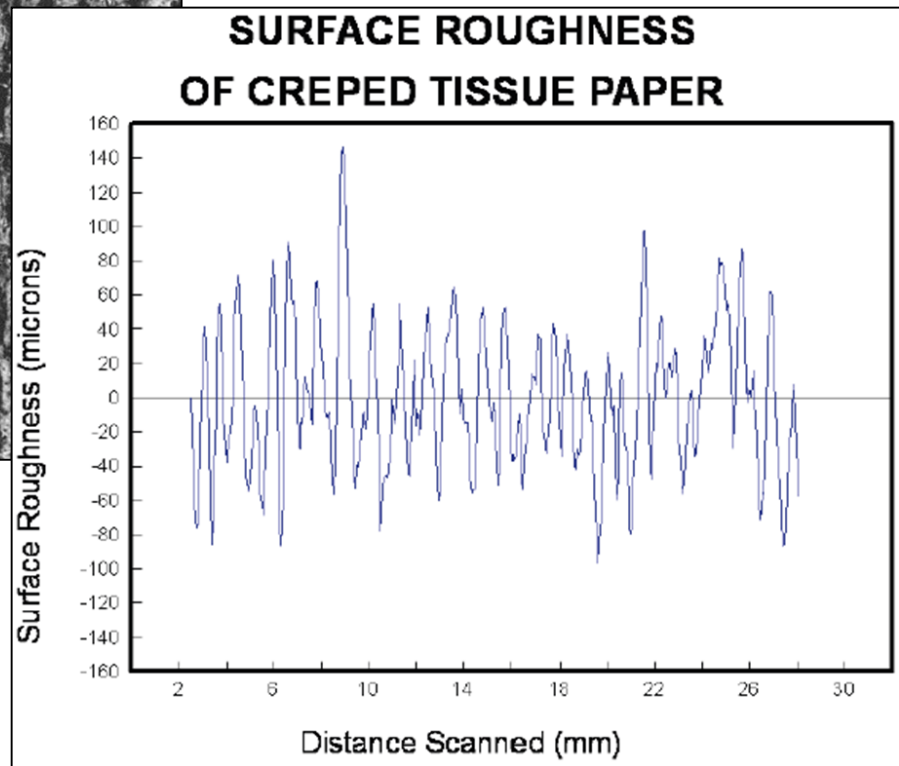
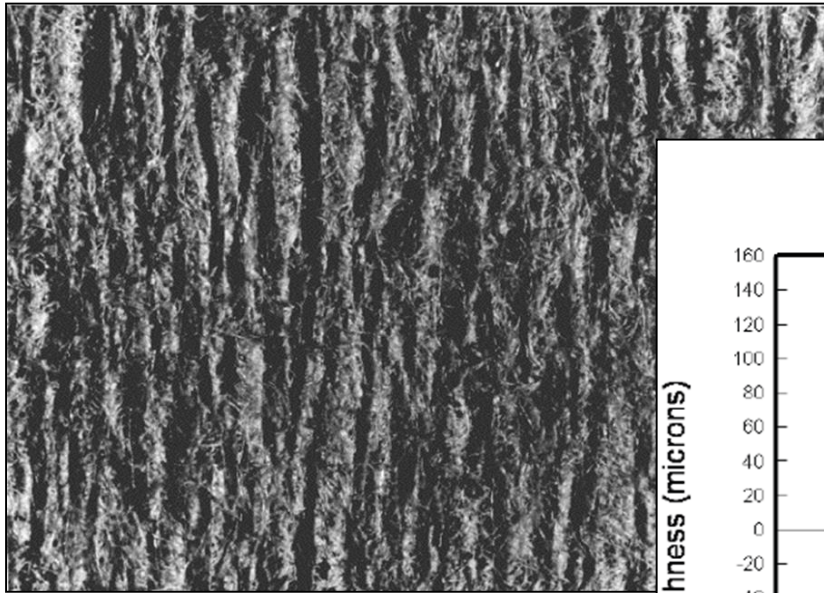
Technological achievements connect fibers and equipment

Spatial Threshold for Stimuli



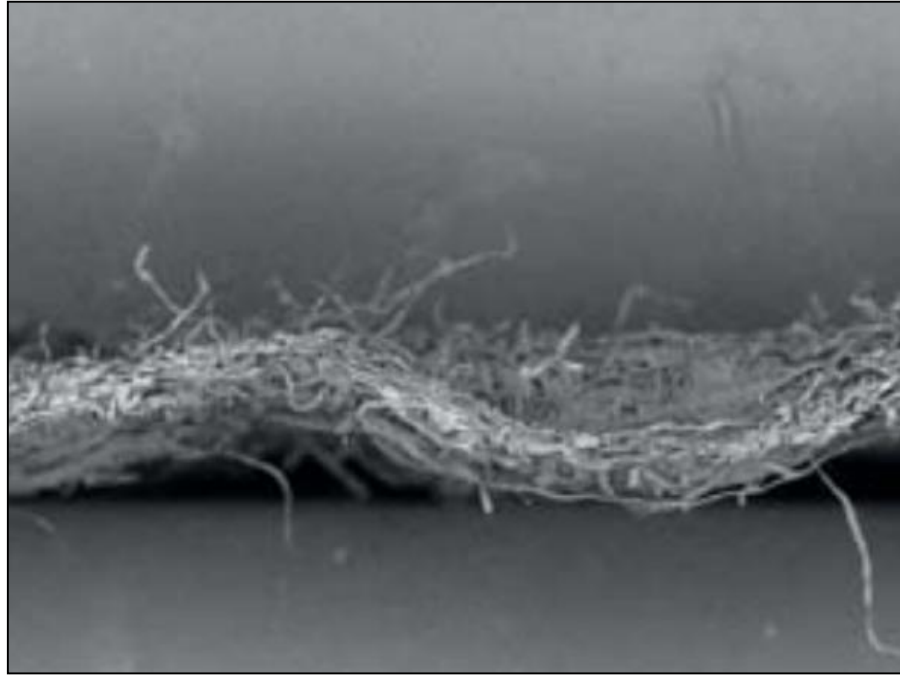
Technological achievements connect fibers and equipment

Spatial Threshold for Stimuli



Technological achievements connect fibers and equipment

Spatial Threshold for Stimuli



- “Textured tissue produced by the Advantage NTT has a 3D-build up like through-air dried (TAD) tissue.” (Technology owner statement)
- Besides the micro-texture effect, the wet pocket formation stresses and strains the tissue structure, releasing loose fibers out of the surface of the paper (again, ubiquitous loose fibers!)

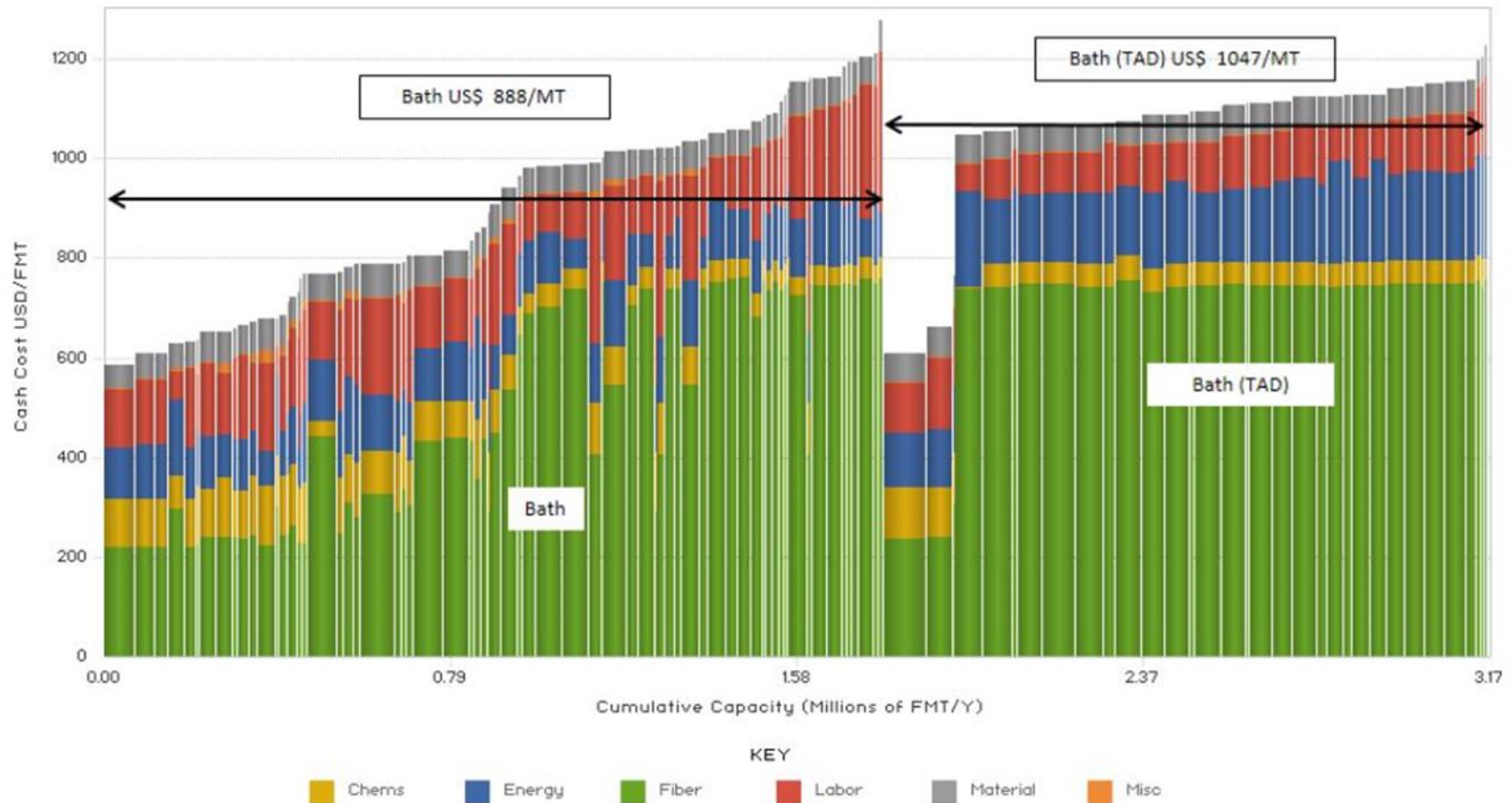
Technological achievements connect fibers and equipment

Structured tissue papers

- TAD and Structured tissue variations produce a **bulkier, more absorbent, and softer** tissue product. A structured or molded pattern is created on special fabrics or belts and then maintained with subsequent hot air drying and pressing with significantly less nip loadings than conventional tissue machines.
- North American consumers purchase premium and ultra-premium tissue and towel products, and pay more for it.
- More energy efficient variations of the technology recently have been commercialized and are implemented mainly in North America.

Technological achievements connect fibers and equipment

North American Bath Tissue Effect of fiber and energy cost on the premium grade cost



Products requisites and the impact on the machinery

- Emergence of a small luxury sector in **China** could be serviced by the newer structured technologies.
- **China** and **Latin America** are set to grow. It opens up the opportunities for new generation machines to come on-stream and more quality segmentation to happen.
- **Latin American** market is largely conventional, no big opportunities for structured tissue. Small producers possibly could succeed. Swing machines can make a range of products. **South America** has the cheapest and abundant eucalyptus pulp. It is producing the world's highest quality conventional tissue. Several mills are making Crescent Former quality bath tissue with 100% eucalyptus.
- **Europe** is basically frugal. It is hard to change the toilet tissue values of Europeans. No one sees the premium tissue really taking off there. Probably some structured tissue to make higher quality paper towels.

Niche markets have been explored around the world

- APP is **re-launching its premium brand** in Australia
- Premium **Jumbo-roll market** is small, however it makes profits
- **Structured towel quality** is common in NA and Europe. Some LA countries already have such operations for **local supply and exports**
- Colombia and Mexico produce **high quality bath tissue based on bulk softness** both in conventional and structured/texturized machines
- South Korea and Taiwan push hard to differentiate products mainly based on **surface smoothness in conventional layered machines**

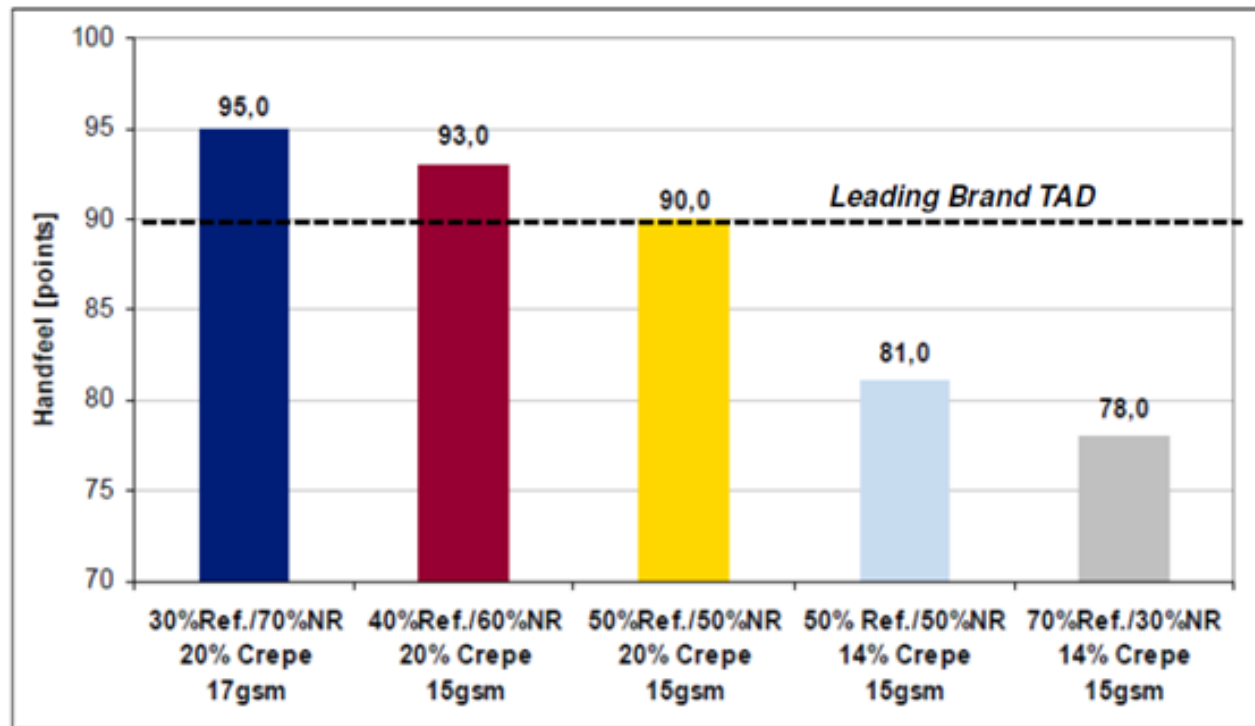
Products requisites and the impact on the machinery

- The **conventional machines operating in Latin America** with eucalyptus as the main fiber have in general one-layer headbox. To develop strength, the whole pulp is refined to some extent.
- Such tissue papers are of **good quality**. The “Scott handfeel” grade ranges from 80-85 points for those papers (100 represent the benchmark).
- The **latest machines orders are energy-efficient, layered headboxes Crescent Former TMs, with gentle pressing, etc.** They can arguably produce 100% eucalyptus separate layers for softness (un-refined) and for strength (fully refined).

Modern Crescent Former with a 2-layer headbox

100% Eucalyptus Bath Tissue

Handfeel Softness x Ratio Refined:Unrefined








Ref = Refined
NR = Not Refined (Yankee Side)

Judson Fidler; Manoel Faez
Tissue World Americas, 2014

Products requisites and the impact on the machinery

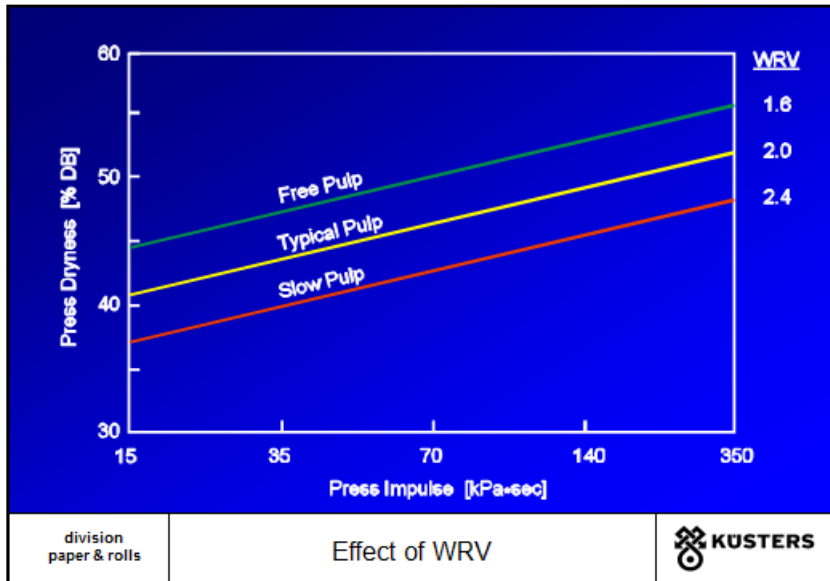
Technological achievements Conventional tissue machine

Bulk improvement (in % over base) in a Conventional PM rebuild

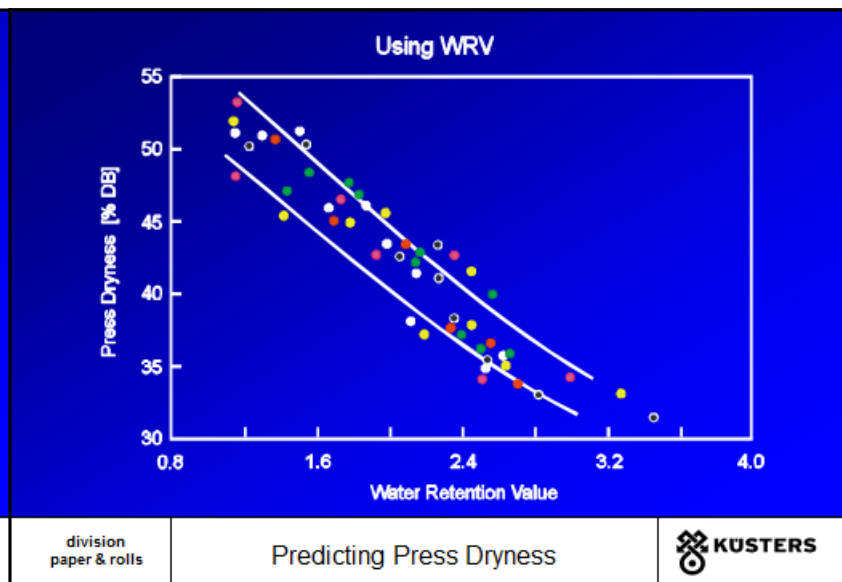
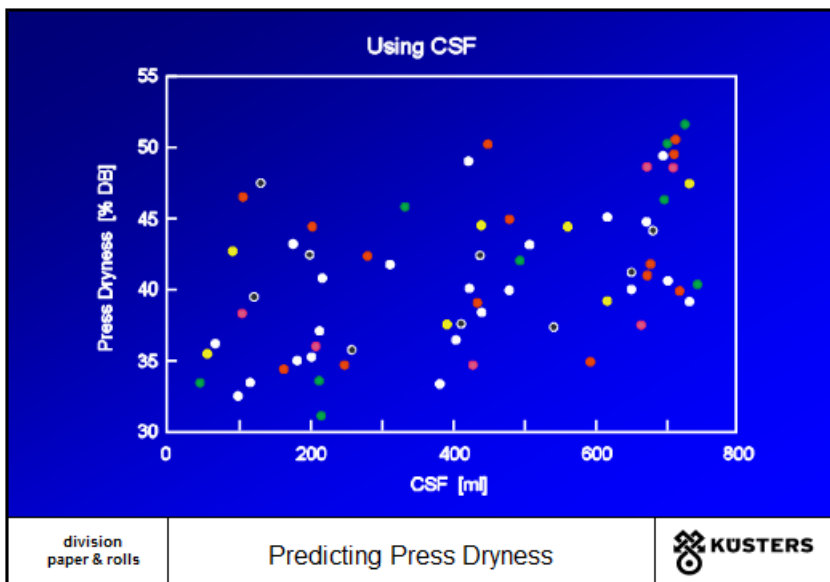
Stratified Headbox vs. Single Headbox	+ 3%	
Improved Yankee Hood	+ 3-6%	
Crescent Former vs. Double Wire Former	+ 6%	
Shoe Press vs. Suction Roll	+15-20%	
Nip Reel of 0.1 kN/m vs. 0.8 kN/m	+ 5-8 %	
TOTAL	+ 35 %	

Source: Voith Tissue Super Soft Machine
Set/2004

Products requisites and the impact on the machinery



- Efficient pressing of eucalyptus pulp is key to achieve high solids content before the Yankee while maintaining bulk.
- Pulps can differ according to origin.
- Conventional drainability methods like CSF and °SR are misleading to control efficient pressing.
- Water Retention Value (WRV) is the method to predict press dryness.

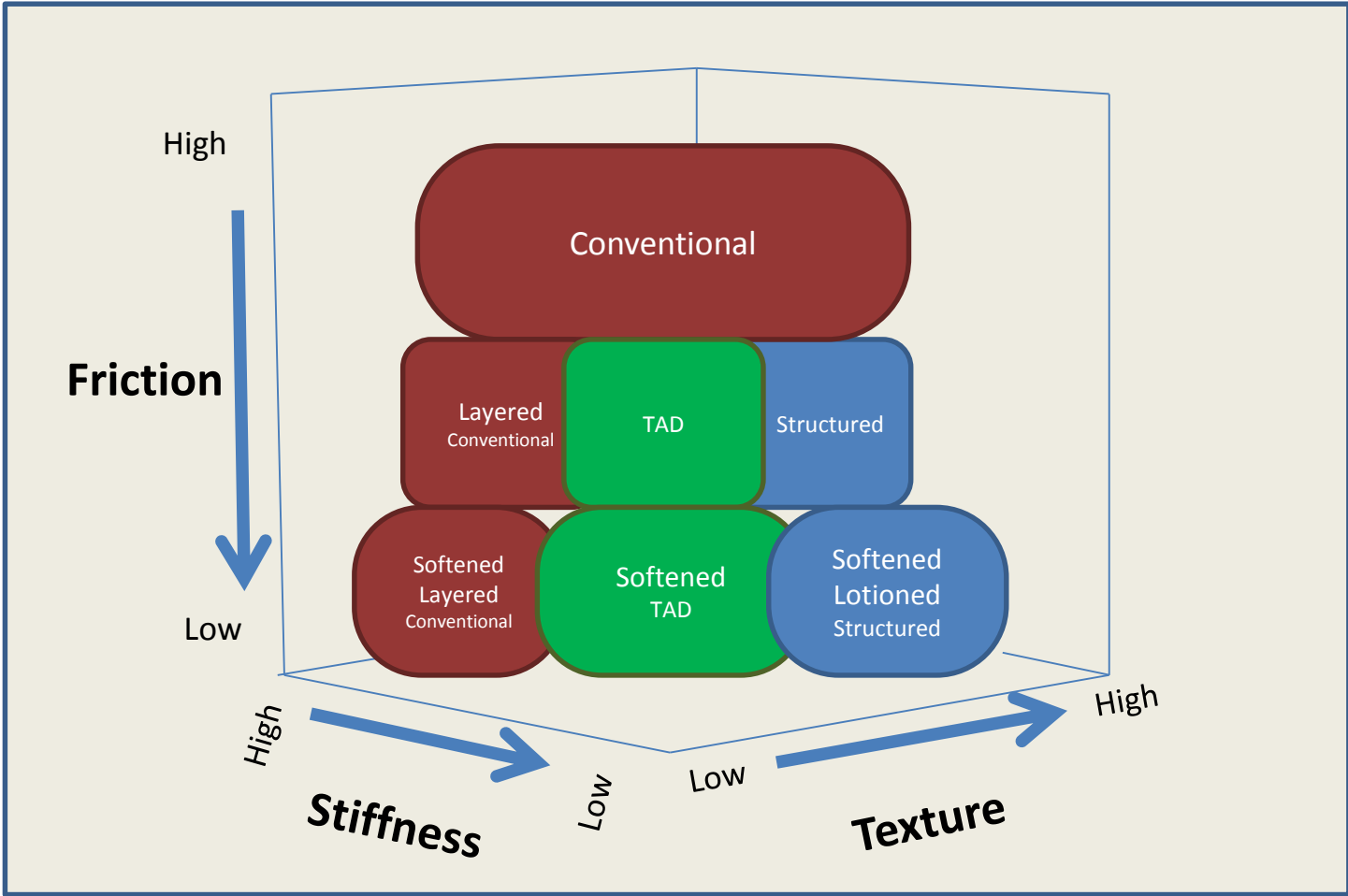


The technological future for fibers and equipment

- **Bulk property** measures include;
 - **compression, tensile stiffness**, elongation, bending stiffness, and sonic modulus.
- **Surface property** measures include
 - texture and **friction**.
- **Instruments** have been developed to make combined measurements simultaneously, like **bending and friction**.
- To date no single instrument or physical method used alone has been found to adequately classify a broad range of samples in the same fashion as the human hand and brain. **The use of multiple measures and physical tests is required.**
- **Developmental trends** in the field of remote sensing and surgery may lead to new insights and instrumentation that could eventually tell us **how the human hand senses touch.**

Hollmark and Ampulski, 2004

Tissue structure technology evolution



Update based on Ampulski, 1991

The technological future for fibers and equipment

- For the forerunners, **it is the right time for a breakthrough**. The model based on friction, stiffness and structure of a tissue is going to an end.
- **Fibers selection, paper machine technologies and surface friction reducing chemicals** have played important roles in the last 40-45 years.
- Several **fiber suppliers have set their tree breeding programs** to include the variables that play a role in tissue papermaking.
- The **paper machines are evolving** towards energy efficiency, productivity and quality.
- The **chemistry, the belts and wires** of the structured papers have been a **good field for development**.
- The **accumulated knowledge is becoming common** to several interested papermakers with affordable investments and production costs.
- The **ultimate goal** is to provide a tissue product that could be considered as good as a piece of the **finest fabric**.