Differentiation in market pulp products: Is market pulp a commodity product?

Celso Foelkel

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When you look at your raw materials, products and customers ...
What do you see?
What do you see?
What do you see?
What do you see?
Is there a single and most correct way to see our mills, products and customers?
“Each paper-machine, each pulp mill, any pulp & paper process, any fibrous raw material although similar are specific and unique. They all have own key-factors to be controlled and optimized”
Thus:

- Why are some fibers different from others?
- Why are some fibers preferred by customers?
- Why some pulps, even when offered by lower prices, are not attractive to the papermakers?
Thus:

• What makes a market pulp more suitable or attractive than the competitor one?

• How to work our processes to give uniqueness to our product?

• Do I need to be unique on quality?

• Do I have more or less power when competing by volume and price?
What makes a pulp special?

“**Best fitness to the papermaker**”

- End product specifications?
- Paper-machine runnability?
- Easy-life to the papermaker?
- Overall cost reductions?

This means that we are not focusing only the pulp price, but the paper operational production cost.
What key factors shall be considered to give a distinct advantage to our customers?

- Are our fibers far distinct than the others?
- Are they oriented to specific products?
- Do they perform better at customer machines?
- Do they provide a special combination in terms of?
  - end-product quality?
  - paper-machine efficiency?
  - Ideal cost/benefit ratio?
Today:

- very competitive arena;
- lots of newcomers in the market;
- differences in paper-machines, and in paper manufacturing technologies;
- differences in fibrous raw materials;
- substantial differences in market pulp operational production costs.
In some countries and in some mills:

Cash costs are so low that may eventually allow some flexibility for quality improvements or differentiation in the final product...

Why?
Example 1:

**Improvements on pulp softness via tensile reduction due to more severe cooking conditions to extract more hemicelluloses**

This may lead to 2 situations:

1. Losses in daily production due to bottlenecks in pulpwood feeding to digesters, or in the recovery boiler area (**UNACCEPTABLE**, surely)

2. Higher consumption of wood, and increasing operational costs in the pulp mill (for each 1% of pulp yield reduction, it means 2% on more wood, in tonnage)
Example 1:

Improvements on pulp softness via tensile reduction due to more severe cooking conditions to extract more hemicelluloses

Decision surely depends on:

- Are there other valuable losses (transition pulp, operational disadvantages, etc)?
  - Is there available wood?
  - What is final cost increase?
  - Is there a premium price?
  - Is it sustainable?
Example 2:

Modifications in the fibrous raw material supply

- different wood species (sorting and blending);
- single pulpwood quality material (high density or low density; or just one species of Eucalyptus, example *E. globulus*)
Example 2:

Modifications in the fibrous raw material supply

Decision surely depends on:

- At what new production costs?
  - Does it pay?
- Is there a premium price?
  - Is it sustainable?
The world today:

• over 100 different brands of market pulps

• close to this numbers are the pulp quality categories

WHY?

• different raw materials;
  • pulpwood blends;
• different pulp-making processes.
The real world:

Lots of variability everywhere

- How to tame variability?
- How to cope with variability?
- How to live together with variability?
- How to use it in our favor?
Causes for pulp quality variability:

- wood differences
- chip quality management
- pulping processes
  - bleaching line
  - washing presses
- drying (flakt, drums, flash)
Some causes for pulp quality variability:

- pH
- fiber charges
- fiber population
- individual fiber strength
- water retention value
- fiber flexibility
- cell wall thickness
Because of these wide variations in different pulp qualities:

The papermaker develops a recipe or a secret potion and he is resistant to change (very understandable)

He has as objectives:

- costs savings
- fewer breaks
- less broke
- better runnability
- end product requirements
The truth is that:

The fiber cost is by far the most important cost for most of paper grades
The papermaker is always squeezed by:

- Commercial demands
- Cost reduction demands

He hates variability, but he is always obliged to look for better process conditions, and less expensive manufacturing (new fillers, new refiner discs, new retention aids, new brighteners agents, new quality demands from the customers, etc)
Wet Zero Span - Fiber Intrinsic Strength

Different Eucalyptus Market Pulps
Drainability - Freeness

PFI Revolutions

- Euca 1
- Euca 2
- Euca 3
- Euca 4
- Euca 5
- Euca 6
- Euca 7
- Euca 8

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The papermaker is always squeezed:

“Please, give me a stable quality pulp or one I may predict behavior”
What papermakers most dislike:

• breaks, breaks, breaks
• energy consumption
• chemical consumption
• drainage
• machine speed
• broke
• second class quality (below standards)

All representing HIGHER COSTS & PRESSURES
Papermakers want to have:

• a predictable pulp

• a “saving cost” pulp (I’m not making reference only to the market pulp price)

• a pulp recipe that allow them to reach the paper specifications 100% of the time
In case we provide these gifts to them, do they consider to pay a premium for?

- better machine performance
- higher productivity
- lower energy, chemicals, etc
- better quality
- fewer broke generation
- no complaints
- better sleep at night
- no problems with the wife (or spouse) due to machine running problems at night
Are we able to find such “enjoyable pulps” in the market?

• Are all market pulps stable in quality?

• Are they really a commodity in quality?
In pulp making, when things are going wrong:

The cause is....... The WOOD

In paper making, when things are going wrong:

The cause is....... The PULP
and, when we have a blend of pulps?

The “convict” is exactly the one added to provide the quality is not being reached.

or the weaker pulp, if the problem is wet web strength;

or the short fibered pulp if the problem is wet end drainage.
Most important quality properties to papermakers

**Fiber properties:**
- fiber population
- coarseness
- curl index
- wet zero-span breaking length
- hemicellulose content
- fiber charges
- fiber flexibility
- fiber rigidity
- fine content, etc.

**Paper-machine properties:**
- drainage speed
- refining ability
- WRV
- swelling ability
- formation
- wet web strength
- pH
- dry handsheet properties:
  - bulk;
  - porosity;
  - opacity;
  - stiffness;
  - tensile; etc.

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Are there ways to build differentiation?

- Fiber fractioning
- Fiber raw materials selection
- Modifications in our production processes

Unique pulp at the market
Differentiation is not that simple, and it has to be sustainable to the papermaker.

- Avoid big changes
- Offer possibilities to better machine performance
- Offer cost savings, not only in the pulp price, but in runnability and reductions on broke & second class paper generations, etc.

Unique pulp at the market
Differentiation is not that simple and it has to be built at the pulp mill.

- Avoid big changes in the mill processes
- Understand the causes for variability
- Tame the raw materials and the production process
  - Be simple and effective

Unique pulp made to the market
Most important quality properties to pulpmakers

**Wood quality:**
- wood density
- wood cost
- wood availability
- lignin content
- extractives content
- wood deterioration
- wood cleanliness,
  - etc.

**Process parameters:**
- wood specific consumption
- pulp yield
- alkali charge
- total solids to recovery boiler
- pulp viscosity
- bleaching ability
- pitch content
- pulp cleanliness
  - “one week pulp beating evaluation”
Today’s attractions in the hardwood pulp business

Acacia mangium

Eucalyptus globulus

Eucalyptus urograndis
**Morphological Differences: are they important?**

<table>
<thead>
<tr>
<th>Species</th>
<th>Coarseness</th>
<th>Population</th>
<th>Fiber Length</th>
<th>Pentosan Content</th>
<th>Fines DPCJ</th>
<th>WRV</th>
<th>Cell Wall Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. urograndis</em></td>
<td>6 - 8</td>
<td>20 - 23</td>
<td>0.70 – 0.75</td>
<td>15 - 18</td>
<td>8 - 9</td>
<td>120 - 130</td>
<td>3.5 - 4.2</td>
</tr>
<tr>
<td><em>E. globulus</em></td>
<td>8 - 9,5</td>
<td>17 - 22</td>
<td>0.7 – 0.8</td>
<td>19 - 22</td>
<td>7 - 8</td>
<td>110 - 115</td>
<td>4.0 - 5.0</td>
</tr>
<tr>
<td><em>E. nitens</em></td>
<td>5.5 - 6.5</td>
<td>23 - 24</td>
<td>0.65 – 0.75</td>
<td>15 - 17</td>
<td>8.0 – 9.5</td>
<td>125 - 130</td>
<td>3.0 - 3.5</td>
</tr>
<tr>
<td><em>Acacia mangium</em></td>
<td>6.5 - 8</td>
<td>26 - 28</td>
<td>0.6 – 0.65</td>
<td>14 - 16</td>
<td>9 - 10</td>
<td>125 - 135</td>
<td>3.4 - 3.6</td>
</tr>
<tr>
<td><em>A. mearnsii</em></td>
<td>8.5 - 10</td>
<td>16 – 19</td>
<td>0.65 – 0.75</td>
<td>19 - 22</td>
<td>7 - 8</td>
<td>100 - 105</td>
<td>4.5 - 5.5</td>
</tr>
</tbody>
</table>
Suggestions for Low Corseness Fibers (Light Fibers)

- Base paper for coating
  - Label papers
  - Release papers
  - Glassine papers
  - Thermal papers
- Highly bonded papers
  - Some P&W

However, this is very much dependent on the customers limitations (Machine speed, porosity and bulk specs, etc.)
Suggestions for High Corseness Fibers (Heavy Fibers)

- Decor papers
- Filter papers
- Tissue papers
- Cigarette papers
Fibre property interrelationships

Width

Thickness

Wall area
Collapsible and collapse resistant fibers
Thick-walled relative to perimeter
↓
Collapse resistance
↓
Less bonding Bulk
Bulk softness

Thin-walled
↓
Collapse susceptibility
↓
More bonding Adhesion to dryer
Surface softness
Chemical Pulp Fibers
Eucalypt Fibres
It is more than obvious the importance of the Wood Density on Fiber Quality

<table>
<thead>
<tr>
<th>Wood Density g/cm³</th>
<th>Fiber Coarseness mg/100m</th>
<th>Fiber Population Nº/g</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.43</td>
<td>5.8</td>
<td>25.4</td>
</tr>
<tr>
<td>0.46</td>
<td>6.4</td>
<td>21.6</td>
</tr>
<tr>
<td>0.51</td>
<td>7.4</td>
<td>19.7</td>
</tr>
<tr>
<td>0.54</td>
<td>9.3</td>
<td>17.5</td>
</tr>
<tr>
<td>0.60</td>
<td>11.8</td>
<td>13.0</td>
</tr>
</tbody>
</table>
Half coarseness = Double number

\[ \iff \text{MD} \]
Pulp Blends

Eucalypt fibre component
  • Bulk
  • Bulk softness

Softwood fibre component
  • Strength and runnability
Pulp Blends

Softwood : Eucalypt mixture

100 : 0  ← MD  ⇒  50 : 50
Pulp Blends

Softwood : Eucalypt (20 : 80)
PAPERMAKING PERFORMANCE OF *Eucalyptus*

Refining  
Bulk  
Strengths  
Opacity

grandis  globulus  urophylla  camaldulensis

High  Moderate  Low

High  Moderate  Low

High  Moderate  Low

High  Moderate  Low
Fiber life is not simple

S_0
S_1
S_2
S_3
S_4

Curl
Kinks
Fiber Length Variations

Frequency, %

Fiber Length, [mm]
Form Factor of a Fiber = $100 \times \frac{\ell}{\mathcal{L}}$
Fiber new attributes

How to add these attributes to a pulp?
Development of Curl

Mechanical efforts applied to fibers

Curl (%)  
0  5  10  15  20  25  30  35  40

SW  HW

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Does this really may happen in a foreseen future?

Input:
- Fiber length
- Fiber width
- Fiber population
- Coarseness
- Fiber Strength
- Fiber Deformations

Predicted:
- Beatability
- Pulp "Strength"
- Paper characteristics
  + Brighness, cleanliness etc.
Fiber population correlates significantly and negatively with wood density.
Fiber coarseness correlates significantly and positively with wood density.
Active Alkali demand correlates positively with wood density.
Specific wood consumption correlates negatively with wood density.
Fiber wall thickness

Wall thickness

AGE - years
Forest Age and Wood Specific Consumption

![Graph showing wood consumption over age](image-url)
Tensile Index vs. Wood Basic Density

![Graph showing the relationship between Tensile Index and Basic Density.](image-url)
• **Today’s world**

  . lots of opportunities to creative work

  . pulp suppliers are in most cases “old fashioned” commodity manufacturers

    focus on tonnage's
    focus on production costs
    focus on distribution
    focus in single product
• **Today’s world**

Market pulp suppliers would like to be able to sell their products to any paper segment, the same product with “universal utilization”

Which one of the paper segments is your pulp more suitable for? Does anybody have any idea?
Today’s world

What can we do to bring a unique reference to our pulp products in the competitive market?
Coarseness & Fiber population
Curl
Pulpwood recipes
Brightness & cleanliness
Individual fiber strength
Paper-machine drainage & speed
Strengths

“and associated paper properties”
Well, this is all friends.
Thank you very much.
Good luck with the goal to bring differentiation to your fibers.