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**The Increasing Need for High Quality
Fibers from Plantation Forests**

Celso Foelkel

Director of Technology and Environment
Riocell S.A., Brazil

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The Increasing Need for High Quality Fibers From Plantation Forests

**Celso Foelkel
Riocell S. A.
Brazil**

Summary

Consumers are becoming very demanding in terms of quality and price. In the competition game, those who could supply high quality and to have flexibility in offering the price, have the advantage to be winners. Paper products uniformity is one of the attributes of quality. This is very well related to pulp quality. Plantation forests are able to provide taylor made pulps based on low pulpwood costs. Eucalyptus planted forests are been improved in Brazil to provide top quality pulps for several paper end products, such as printing and writing, and tissue papers. Pine planted forests have also been upgraded for high quality packaging papers. At the same time, plantation forests are managed to guarantee minimum effects in the environment. High quality fiber production and sustainably managed forests are the main topics covered in this paper.

The Future to Come

Pulp and paper industry is facing, as many times in the past, a nervous moment of many worries. The depressed market for pulp brings emotion to overcome rationality. This is not different in relation to so many times in the past. Will future be a repetition of the past? Do these cycles may bring any substantial change in the market share in years to come? What driving forces will shape demand for quantities and qualities in the 21st century? How much end-use requirements will change? How much these changes are going to hurt or to favor some of the production regions around the world? What about globalization, how the free trade could promote the wood/pulp/paper business? All questions very difficult to give brief answers! One thing is true: no matter what happens, paper business is a healthy and growing business and consumers will show the overall behavior they are showing everywhere for any specific consumption product: higher and higher demand for quality and price. In the competition game, those who could supply quality and to have flexibility in offering the price, have the advantage to be winners. And believe me, next century will show us many more losers than winners. Do you plan to be in which category?

The Driving Forces

Many forces are acting and driving our business. Some are external, very dynamic, variable in intensity from time to time. Others are new and others are not playing yet!

The most significant driving forces affecting our today business are:

- a)- cost / cost / cost
- b)- price / price / price
- c)- production scale
- d)- competition
- e)- globalization
- f)- social trends
- g)- environmental trends
- h)- fiber supply
- i)- population growth
- j)- exchange rates
- k)- economic factors
- l)- Asian economical growth
- m)- technology / automation
- n)- recycling
- o)- treat of substitutes
- p)- emotionality

Others forces you do not see them now, but just because you do not see it does not mean that they do not exist.

Moreover, the forces do not act independently, they are completely connected and engaged.

Let's see fiber supply:

⇒there is no doubt that the growth of population (predicted 9 billion by year 2030, from today 6 billion) is a major component of paper consumption;

⇒new technologies and alternative products may change the arena in some extent;

⇒globalization favors the trade: which are mostly feasible to trade (wood, market pulp, paper, finished product?);

⇒how much recycling could grow? Do not forget, we can substantially raise recycling by speeding up collecting, transportation and the use of the fibers (one single fiber may be recycled more than once a year);

⇒cost: some countries as Brazil may have wood at a cost of 90 to 120 US\$/adt of finished market pulp;

⇒social and environmental issues are playing very strongly, no matter where you are. They are global trends and forestry and recycling are very sensitive to these issues.

The Awake Giant

Brazil is a huge country with a great people. Country's population reaches 160 million inhabitants, and it is yearly increasing around 2.8 million more. This means that Brazil grows a population almost like Uruguay or Costa Rica, or New Zealand, every year. This amazing consumerist people make the country very attractive as a great market to participate in. Now, with the creation of the economical block "Mercosul", a market of 250 million inhabitants has become available, comprising Brazil, Argentina, Chile, Uruguay and Paraguay. There is no doubt that a market with this size, in countries with rather stabilized economies, it is not to be neglected.

In the past two years, due to a finally well-succeeded economical plan, the Brazilians re-acquired the self-esteem and the "go-ahead" morale. This represents a great push to further economical and social growth and development.

Due to former economical policies, the country developed a dynamic industry and it is almost self-sufficient in agriculture products. Only crops that require special climate conditions, such as olives, wheat, for example, demand for imports. The industry is strong in many segments: chemical and petrochemical, steel, car manufacturing, food processing, shoes, pulp and paper, etc.

The country is dependent on oil: only 70% comes from own sources. This dependence activated creativeness and Brazil has most of electricity coming from hydraulic sources, and has also more than 10% of vehicles running by alcohol moved engines.

Pulpwood Fibers are Vital Components to Brazilian Economy.

Pulp and paper industry is considered to be a goldmine to the economy and it has an enormous social importance due to job and strong currency generation. Brazilian pulp and paper industry reaches \$8 billion total sales per year, being 2.0 to 3.0 billion as exports. This corresponds to about 5% of country's exports and the size of the industry is responsible for 1.2% of the GDP. The estimated number of jobs generated is 100,000, but this is surely an under-estimated figure. There are no doubts that more than 1 million people are directly or indirectly linked to the pulp and paper industry.

Due to the fact of having more than 75% of the population living in large cities, paper recycling is a growing business because the simplicity of collecting. This is becoming an important social and economical activity, even considering the low per capita consumption of the average Brazilian (34 kg/inhab/year). From the 6 million tons of manufactured paper, 35% comes from wastepaper. The informal economy, comprising hundreds of wastepaper pickers, also generates a good number of jobs, what is fundamental in a developing country.

Paper is a product of growing consumption in the country: yearly consumption grows at a 4.2% rate, more than the double of population growth. This is mainly due to the average income growth of the Brazilians. A part of the population is being given access to many paper products they were not used to. Papers like tissue, printing and writing, newsprint and packaging, are growing at an average rate of 6% in the past 5 years. At these rates, total paper requirements by the year 2005 it will be 9 million tons, 50% more than today's production. As I have said before, in Brazil the numbers are enlarged by two main factors: size of the market and growth rates.

Government is aware about this and is starting programs to promote forest plantations and new capacities in P & P. This growth for the industry means to supply domestic consumption and to generate surplus for market pulp and paper exports, essentials to the balance of trade health. A new growing season in the P & P industry is expected to happen soon, due to these opportunities.

Brazilian Government and the Brazilian Paper and Pulp Manufacturers' Association are developing strategies to a new production boom to happen along the next 20 years.

An optimistic investment plan of US\$ 13 billion dollars to happen till 2005 is on way. Substantial growths are expected in pulp (70%) and paper (45%) production.

From the total investments, 2 billion dollars will be placed on forestry (plantations, genetic upgrading, mechanization, environment improvements).

Brazil and P & P Industry in Figures

<i>Population:</i>	<i>160 million</i>
<i>GDP:</i>	<i>650 US\$ billion</i>
<i>GDP/inhabitant</i>	<i>4000 US\$</i>
<i>Total exports:</i>	<i>50 US\$ billion/y</i>
<i>Total imports:</i>	<i>50 US\$ billion/y</i>
<i>World total paper and board capacity:</i>	<i>310 million tons</i>
<i>Brazilian paper production:</i>	<i>5.8 million tons</i>
<i>Brazilian pulp production:</i>	<i>5.8 million tons</i>
<i>Market pulp:</i> -World capacity:	<i>38 million tons</i>
- Eucalyptus (total);	<i>5.4 million tons</i>
- Brazilian eucalyptus:	<i>2.4 million (46%)</i>
<i>Brazilian market pulp exports:</i>	<i>2 million tons</i>
<i>Brazilian paper exports:</i>	<i>1.2 million tons</i>
<i>Brazilian paper imports:</i>	<i>0.8 million tons</i>
<i>Eucalyptus plantations growth rates:</i>	<i>8 - 10 admt/ha.year</i>
<i>Pine plantations growth rates:</i>	<i>2 - 4 admt / ha.year</i>

Fiber Supplied by Planted Forests

Brazilian pulp and paper industry is based on plantations. Fast-growing trees provide the competitive advantage to the industry. Wood cost per admt of pulp is below 120 dollars for eucalyptus kraft. This corresponds to 25 - 30% of direct cost and 20-25% of total cost.

Although most of the capacity is based on eucalyptus; pines (loblolly and caribbean pines) also have a good growth and they are low cost woods. Long fiber domestic consumption could be easily supplied with no major problems. It is only a question of not placing all eggs in the same basket.

Due to the scarcity of wood for furniture and other high-value uses in south Brazil, eucalyptus and pines are being considered as source of wood not only to the P & P industry, but in an integrated way for multiple uses to the P & P, furniture, lumber, fuelwood, etc. This new philosophy opens new markets to these woods and it

will reduce the pressure on the use of native hardwoods by the lumber and charcoal based industries.

All Brazilian pulp and paper industry depends on plantations. Only wood coming from planted forests are raw materials to manufacture pulp and paper. However, those who believe that Brazil is covered by "green deserts" due to plantations, they should know that total eucalyptus plantations correspond to 2.9 million ha and pine plantations about 1.7 million ha. For pulp and paper manufacture, the forest area corresponds to 1.4 million ha.

4.6 million ha of planted forests are equivalent to 46000 km², or 0.54% of Brazil's total country area (8.5 million km²), being 0.16 % for pulp and paper purposes.

46000 km² is about 120% of Netherland's area, just to have a reference. The plantations in Brazil are not concentrated, but spread evenly from North to South, becoming source of wood for many different purposes (lumber, hardwood, veneer, charcoal, plywood, particleboard, furniture, pulp and paper, etc).

Just for fun: let's suppose that the world production of primary chemical pulp (about 130 million tons) could be made in Brazil using high quality fast-growing eucalyptus plantations. The total required area of forests would be 17 million ha, or 2.0% of the country's area. It is still far below the world average area of pastures (25% of the available lands according to the 1992 World Environment Report of the World Bank).

Forestry Sustainability as Major Target

Eucalyptus is a magic tree. It also provides a magic fiber to the pulp and paper industry. This masterpiece of Nature was born in Australia, but moved to Brazil to grow together with the country and to develop social welfare. It is essential to make justice to this tree. It deserves our appreciation, our recognition and our most sincere thanks.

Pines are also magic trees. They are not "best sellers" as the eucalyptus because they are very much known in the Northern Hemisphere. Several pines found Brazil as a very good environment to grow. In the Southern states, the American Southern pines (slash and loblolly pines) are the dominant pine planted species. In the tropical Brazil, Caribbean pines are just perfect. In average, pines grow 15-25 m³/ha.year that corresponds to 2.5 to 4.0 admt/ha.year of manufactured pulp.

What we shall understand is that wood is a man's necessity and forests are man's and Nature's requirements. It is good to know that we need production forests and preserved forests. This understanding is not to be restricted to the forest area, but enlarged to the agricultural, social and forest network. We shall avoid extremism "in favor of environment", many times with clear damages to man and to Nature. We shall not place in opposition things that are fully compatible, as preserved forests and production forests or plantations and natural forests.

It is fundamental to plant trees in the planet. We cannot fight against this need. It is also a way to avoid that the remaining natural forests be harvested for human consumption. How and where to do it? Once more, it is something to be faced case by case. There is no generic rule, but planting of new forests could be destined to already degraded areas, that had forests in the past. It is also important to evaluate the social benefits to the local population, not only the benefits to the fauna and flora.

Production forests demand sustainable environment for their growth and recognition by people. Part of the definition of sustainability is to provide goods to society. Thus, it is fundamental to use the forests. Each one will require the own model. We have highly productive forests (plantations), natural forests managed for production, preserved forests to guarantee biodiversity and protection forests (for environmental reasons, as example, to regulate water flow in a watershed).

Sustainability implies in a three leg concept: economical, environmental and social. Each situation may require the legs with somewhat different sizes and weights.

Forestry Issues for Reflection

With the purpose of bringing people to reflect about forestry, some of the most questionable issues on this activity are being presented. It is important to face these questions in a constructive way, even so, because the most enthusiastic questioners wish to continue to use forest products in their ordinary like. Thus, a common ground has to be achieved.

Issue 1: Loss of biodiversity

This is not applicable when new forests are established in degraded areas, old and eroded pastures, etc.

Issue 2: Plantations / monocultures

There are restrictions to homogeneous plantations when they are huge and with no care about blending plantations with other forests and/or agricultural activities. We shall consider the whole network to identify its environmental health. Ecological and well-balanced landscaping is the most sustainable way to grow plantations.

Issue 3: Concentration due to economy of scale

Again, the network is fundamental. It is also possible to compensate by the multiple use of the forest and of the tree, blending forestry and agroforestry systems to enrich them.

Issue 4: Exotics

It is difficult to speak about geographical frontiers now-a-days. Since exotics are well studied and adapted to the places they are growing, like eucalyptus and pines in Brazil, why to be afraid of them?

Eucalyptus and pines are becoming global species: they are no longer exotics, you will find them everywhere, growing as trees or incorporated in products.

Issue 5 - Cloning

Cloning is a technique that enables the user to have homogeneous raw material. As a consequence, quality is better and costs lower. It is one technological alternative that gives to the final user a better product at a lower cost. The fundamental environmental issue is that the forester must be aware of the risk of concentrating a single genoma in an area. Good planning is required to avoid potential damages, such as detrimental effects to soil fertility and potential attacks by pests or diseases.

One suggested alternative is to blend cloned forests with other agriculture uses. Thus, agroforestry and multiple use of the forest products are interesting options to those involved with cloned forestry. A well-planned mosaic of clones, natural forests and agricultural uses is a very healthy and adequate solution.

Issue 6: Clear cuts

It is a controversial issue, but in the way to be clarified through good science. Through a good harvesting planning, the problems of clear cutting may be minimized. Also, multiple uses cooperate to remove wood gradually from the forest.

Issue 7: Preservation of natural forests

This is an everybody's commitment and a legal obligation. Harvesting of natural forest must require special permits. Also, planted forests require legal permit to be harvested.

Issue 8: Minimum environmental impact practices

The forester must evaluate the environmental impact of his activities and look for minimum effect techniques. This procedure is enhanced as part of the ISO 14001 requirements.

Issue 9: Use of agrochemicals

Toxic compounds are still required in the combat of pests, diseases, insects. However, through research and creativeness, this practice may be minimized.

Issue 10: Social impacts

Although some improvements in this subject, there is still a lot to be done. It is important to consider the impact of mechanization on the local job generation. This measure, when required, shall be well planned to avoid social impacts.

Issue 11: Social forestry

Social forestry is associated with the production of wood by small farm owners, in small scale, as part of their agricultural products. Few years ago, social forestry was poorly valued by the large scale wood producers. However, it is being now considered as one the best alternatives for next century.

Issue 12: Agroforestry

Farmers and forest-based companies have already discovered the agroforestry potential. Thus, agroforestry is a natural trend.

Issue 13: Multiple uses of forests

There is a growing interest in having more than a single product coming from the forest. Essential oils, fuelwood, bark, wood chips, honey, fruits, and many more: this is the new menu from the forests.

Issue 14: Forest certification

A trend to give reliability to the forest industry: EMAS, ISO 14000, FSC, CERFLOR, BS 7750 and so one, they are key points now. In Brazil, some forest based

organizations have already obtained ISO 14001 and FSC certifications. Many others are working to have one or another very soon.

Issue 15: Forest legislation

Legal restrictions are necessary but cannot be stricter than required. Forest-based industry must follow the process in a continuous dialogue and good willingness.

Issue 16: Forest research and the role of universities

It is already time of the academic world to perform the role of extension and to be more linked to the public, helping community to better understand technical, environmental and social issues of forestry. Research must provide knowledge to decision-making processes. The next R & D generation will not be regarded only with the technological issues of forestry. Instead of focusing on specific subjects, the research will be more holistic, more interdisciplinary, more cooperative, and covering broader matters. Research will be directed to problem-solving, aiming results and helping to understand questions marks. R & D is no longer a process just destined to add knowledge without demands. Our prediction is that the preference for researching will be fields as: natural resources conservation, environmental education, sustainable management, agroforestry, social and community forestry, environmental impacts and minimization, etc.

Taylor-made Pulps from Eucalyptus

We have no doubts that eucalyptus fibers rank in a podium position worldwide. In its young age, eucalyptus was considered a filler pulp, a low strength fiber that could be bought for a cheaper price. However, very soon its distinct and typical fiber properties were discovered. The success came because the unique features they bring to the paper quality, no matter a printing and writing or a tissue paper. Today, eucalyptus fibers are vital to the papermaker: it is part of his life to work with these pulps. Softness, smoothness, tactile properties, porosity, bulk and absorption are advantages imparted by eucalyptus to tissue papers. For printing and writing, we may say that papermakers look for opacity, bulk, smoothness and formation.

These are some species growing very well in soils that are not able to other agricultural purposes (sandy, wet, rocky, high slope soils). Today, the most frequent species being planted in Brazil are Eucalyptus grandis, E. saligna, E. urophylla, E. robusta, E. tereticornis, E. camaldulensis, E. globulus, E. dunnii and the hybrid E. urograndis. Many other species are being evaluated for tree breeding. Since eucalyptus are easily crossed generating hybrids of superior quality, the forest upgrading is a never ending story. More than 600 eucalyptus species are available for the forest engineer's dreams.

There are two main procedures to develop the forest: by cloning (vegetative propagation) or by seeds (sexual multiplication). Planting seed originated forests has the aim to enlarge the genetic basis, giving to the forester the chance to find new "plus trees" to continue the breeding. Cloning is a faster improvement technique and it has the advantage to generate a very uniform forest based on a single or few genomas.

After finding a superior tree confirmed to give superior progenies by cloning, this tree is multiplied by this procedure. These "plus trees" may be or not a hybrid. By

hybridation is possible to incorporate advantageous qualities in the hybrid. Examples of superior quality: lower lignin content; higher wood density; higher growth rate; higher resistance to insects, pests, diseases; better pulping characteristics; better use of minerals in the nutrition; better opacity in the paper; better bulk, porosity; etc.

The perfect knowledge of the relationship among wood characteristics, pulp/paper properties and heritability is a key issue to develop tailor-made pulps to specific uses. Cloning of the selected genomas in similar sites, for sure, gives to the pulp manufacturer unique pulp properties according to the paper end-use requirements.

For example, some species give fibers more easily refined and bonded, promoting better strength to the paper sheet (*E. grandis*, *E. globulus*, *E. saligna*). Others because of stiffer fibers, lead to bulky, porous and absorbent paper sheets (*E. urophylla*, *E. tereticornis*, *E. dunnii*). The age of the forest stand also has influence on these properties. The older the tree, the denser the wood and stiffer the fibers.

Another opportunity to the market pulp manufacturer is to work his pulping process to diversify his pulp quality: kraft cooking, oxygen delignification, bleaching, drying. Cooking to a lower hemicellulose content changes the fiber ability to bond. Drying in a flash unit provides pulp very good to filter and laminating papers. Unbleached eucalyptus pulp finds niche market because the amazing porosity and bulk.

The right combination of process manufacturing and fiber supply provides to the market pulp manufacturer the ability to supply unique features to the consumers. However, a very close partnership is required to the success of the option. This is not different than any guru on quality management is suggesting: work close to your customer, no matter where he is. And thanks to this, enjoy the business of papermaking.