The responsibility of the pulp and paper sector with regard to sustainable development: how much is enough?

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Abstract Pulp and paper companies all over the world certify their environmental management systems assuming public commitments for the continuous improvement of their relationship with the environment. Once certified, they consider themselves having done their part. But is this enough? This work has been carried out with the clear intention of provoking the professionals who can give the much needed answers for the construction of environmental sustainability in the pulp and paper sector.

Keywords Clean production; sustainable consumption; sustainable development

Introduction

The classic definition of Sustainable Development, to satisfy the needs of the population of the planet without negatively affecting the availability of natural resources for future generations to satisfy their needs in turn, has become a commitment of both countries and companies. However, assuming this commitment without deeper consideration of the real challenges it entails is common. A lack of measurement mechanisms capable of defining objective responsibilities according to sector or productive activity, countries or regions, producers and consumers, makes us feel that that being committed to constant improvement of our environmental performance is all that is required to be an active part of the movement towards sustainable development.

Companies all over the world certify their environmental management systems assuming public commitments for the continuous improvement of their relationship with the environment. Once certified, they consider themselves having done their part. But is this enough?

In practice, assessment of the pros and cons of environmental measures taken or to be taken is often made according to the advantages or disadvantages they pose to the competitiveness of the company. The population tends to think that companies adopt inadequate practices to preserve the environment and companies in turn think that they do more than the legislation requires. When asked about the impact their products cause, they allege that they have to satisfy market demands. Countries adopt the dogma of constant economic growth without taking into consideration the fact that the planet has already started giving clear signs that its limits are being reached.

More recently, Pollution Prevention and Cleaner Production practices have been introduced with the aim of bringing together improvements in environmental and economic performance. Porter and vander Linde (1995a,b) illustrate with case studies the so-called Double-Dividend. Hawken et al. (1999) propose so-called Natural Capitalism, exalting the need to better understand natural processes and to adjust our economies to the nature
of the planet. Closure of material cycles and the rational use of energy are beginning to enter the rationale of production. Productive chains need to be organized and the relationship between production and market in the sense of looking for environmental sustainability needs consolidating. But is this enough? What is enough?

In fact, most commitments to environmental sustainability are no more than attempts to improve performance within the paradigm that Farley and Daly (2001) laid down in “Empty Planet”. However, what would happen if we behaved according to the rules of a “Full Planet”?

It is essential to envisage this way of life and production for both humanity in general and companies in particular. After all, using the signs of the future to help in medium and long term planning of companies constitutes a strategy of corporate survival.

The challenge of sustainability: factor 10

To illustrate the challenge of sustainability the Environmental Impact Master Equation or Ehrlich’s entity can be used (Graedel and Allenby, 1995, 1998).

Environmental Impact = (Population) × (Consumption per capita)

× (Environmental Impact per unit of Production)

Projecting population growth is a difficult task which rarely escapes the influence of ideologies which differ from person to person as well as from country to country. Using the growth rates predicted by the Department for Population at the United Nations (http://esa.un.org/unpp/), which estimates a population of more than 9 billion people on the planet in 2050, we can assume a growth rate of about 1.5 times over 50 years.

The forecast for the second factor, per capita consumption, is calculated using income per capita as an indicator. In this case we consider that commitment to Sustainable Development implies favouring a substantial improvement in the patterns of consumption of the lower segments of the world population. To match Brazil’s average income today in 50 years’ time, the populations of the countryside in China, India and a large proportion of Africa would need to increase their income 10 fold. If this goal is achieved and no substantial increase in the per capita income of richer countries can be reached, still the world’s per capita income will increase about 5 times.

The arguments presented here so far lead us to think that to repeat the environmental impact in 50 years’ time of what we are doing today, the impact of technological aspects, the third factor in the equation, per unit of production should evolve in such a way as to reduce the impact of unit of production more than 7 times. To think in terms of environmental sustainability is to think in terms of what the Wuppertal Institute call Factor 10 (http://www.factor10–institute.org/seitenges/literature.htm).

Factor 10 represents the rate of increase of the eco-efficiency of products and processes which would be necessary to stabilize the growth of environmental degradation over the next 50 years. Given the difficulty in reaching such levels at this scale purely through technological advances, international organizations such as the United Nations Program for the Environment (UNEP) and its sister program for Industrial Development (UNIDO) are working together on Cleaner Production and Sustainable Consumption.

Clean production and sustainable consumption

When asked to think about 10 times higher levels of eco-efficiency, it is difficult to find an environmental paradigm to meet this. The persistence of “End of Pipe” practices is worrying. These focus on the destruction of residues once generated. Large companies have been improving their environmental practices by giving preference to control at
source or cleaner production within their production processes. Rare are the cases where more sustainable processes and products, even the so-called Design for Environment, and others, have been introduced in the productive chain.

The diagram shown in Figure 1 illustrates the desirable sequence of the development of environmental practices.

The end-of-pipe procedures are on the lower steps of the figure. At this level, we assume that the residue is inevitable and the task is to reduce the impact of their discharge into the environment. This requires energy and other materials. On the intermediate steps are the measures to modify the productive process itself within the factory or productive chain. Here, losses and inefficiencies once identified, and which result in an environmental impact, are corrected at source, i.e., the process from which it came is corrected. This focus aims to prevent the generation of residues while also making more efficient use of raw material and energy. As well as reducing the impact at the discharge point, it reduces the impact caused at the point of extraction of raw materials. If the aim is, however, to reach levels of eco-efficiency of the order of 10 in 50 years' time (Factor 10), focusing on improvements in the internal processes of production or its immediate chain will not be enough.

The highest steps include measures for which greater cooperation with the consumer market and other productive sectors are required. At this level the aim is to optimize all the economic-social aspects of life so as to respect the ecological and thermodynamic limits of the planet (Kiperstok et al., 2002; Kiperstok and Marinho, 2001a,b). To foster the search for more environmentally appropriate relationships along the supply chain, new tools are being developed.

Material Flow Accounting (MFA) uses the concept of mass balance in very large social and economic environments. This was introduced by Robert Ayres in 1989 to support the concept of Industrial Metabolism (Garner and Keoleian, 1995) and has become widely used in large productive systems. Mass balance calculation allows us to measure the efficiency of the use of natural resources and identify the points where waste is generated as well as identify opportunities to integrate flows of material between varying links of the product–consumption chain. This information allows the incorporation of concerns about natural resources at initial stages of creation and the design of a project or process within the so-called Design for Environment.

According to Suren Erkman (1997) industrial ecology has the additional aim of studying the means to better integrate and compatibilize industrial systems with natural

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**Figure 1** The development of environmental practices (Source: Kiperstok and Marinho, 2001a, b)
ecosystems. Industrial ecology attempts to learn from the basic principles of nature’s ways to optimize manmade processes while at the same time looking for more appropriate insertion of them into natural cycles. Productive processes generally take place in open or linear cycles whereas natural processes take place in closed cycles, in which the notion of waste is absent (Graedel and Allenby, 1995 and 1998; Marinho and Kiperstok, 2000; Garner and Keoleian, 1995). Other authors present similar ideas of so-called Natural Capitalism (Lovins et al., 1999; Hawken et al., 1999). In this case, the idea is that productive processes develop from their present open cycles to closed cycles.

With an abundance of natural resources and without pressure from concerns regarding the efficiency of use, unlimited materials are used and unlimited waste is generated. The more insignificant the transformation process is on the surrounding ecosystem, the less perceptible the generated impact is. When the growth in pressure from consumption and production begins to be felt on the ecosystems, be they local, regional or planetary, the limits of the environment become apparent. Restrictions on unlimited use of natural resources appear and resources have to be used with greater efficiency. This leads to a reduction in residue per unit of product.

Additional growth in consumption has led to a need to find ways to achieve more closed systems (Marinho and Kiperstok, 2000). The concept Factor 10 is just such an example. Thomas Graedel (in Socolow et al., 1994) mentions the need to set up interaction within each productive process, among them and with consumption so that the efficiency of raw material use is maximized. To achieve the proposed eco-efficiency, Industrial Ecology indicates the following additional lines of action: dematerialisation; decarbonisation; economic functionality; biomimetism; openness of information.

Dematerialisation refers to the development and production of products and services which improve on their previous generation, but using fewer raw materials, such as in the manufacture of computers and stereo systems. Civil construction has hardly developed in this sense. Decarbonisation concerns reduction in the use of fossil fuel per unit of production or services offered and is directly related to reducing the greenhouse effect. Economic functionality is connected to the substitution of the prevailing sales model which is based on the satisfaction of certain demands through the purchase of goods. In this model, instead of selling the goods or services, the manufacturer offers the service desired. The product is used in such a way that it remains the property of the manufacturer. Lovins et al. (1999) and Hawken et al. (1999) present various examples illustrating this. Biomimetism is related to the knowledge of natural cycles whose model of functioning needs to be considered when designing man-made systems. A clear understanding is needed of the relationship between the ecosystem’s flow of materials and energy and that required by man-made productive processes.

A fundamental aspect for the evolution of society’s environmental performance, as emphasized by industrial ecology, is the openness of information regarding the environmental risks of processes and products. In this sense, some aspects of European and American practice (particularly in the State of Massachusetts) are worth highlighting. They require that the fine qualitative and quantitative details of the toxic substances used by companies be published on the Internet.

**Discussion on the sustainability of the pulp and paper sector**

In light of the discussion above, certain specific aspects should be taken into consideration when dealing with eco-efficiency in the pulp and paper sector. As it is an intensively industrial segment in terms of use of natural resources, productive practices within the process have developed noticeably. Increased efficiency in the use of water has led to constant reduction in water consumption per metric ton of product, e.g. from water...
consumption over 200 m$^3$ per ton of pulp in the sixties, new mills today are designed to use no more than 25 m$^3$ per ton of pulp.

The forestry sector has developed to such an extent in recent decades that productivity rates for wood from eucalyptus are 3 to 10 times higher per hectare than before, particularly in tropical regions. However, the impacts in terms of loss of biodiversity have grown with the shift of production to such regions.

It is interesting to bring the challenges of Factor 10 into the sector’s environmental discussion. Using this perspective, certain environmental aspects of the sector can be discussed.

**Pulp bleaching**

This entails high water consumption and an increase in the toxicity of the effluents associated with bleaching. While acknowledging the great advances that have taken place in the search for greater eco-efficiency, it remains necessary to question the need for this stage in the process altogether.

Why run these risks and impacts if the gains to society from bleaching paper are negligible? When posing this question to representatives of the productive sector, the reply is often that the market demands these types of products. When the same question is posed to the public, the university in particular, the answer is the opposite.

Are we trapped because of a lack of more advanced mechanisms for dialogue between producers and consumers? It is true that some attempts to launch non-bleached paper products onto the market have been economic failures, either due to resistance to the appearance of the product or its higher cost. The latter would seem easier to overcome as production of non-bleached products on a larger scale would bring down the price. However, the first touches on certain taboos.

On the one hand, it is a fact that society confuses the notion of cleanliness with whiteness, and this is reinforced by the media on a daily basis. In fact, the concept of cleanliness is associated with smells which have nothing to do with cleanliness, but rather the emission of chemical compounds into the environment. Cleanliness has neither smell nor color. Stimulating the senses, however, has led to the use of products that contribute to a loss of environmental quality and increased health risks. On the other hand, it is not entirely correct to accept, in this case, the argument that consumers oblige companies to bleach paper. Companies have the collective responsibility to clarify their environmental responsibility as regards this stage in the process to the market.

This is unlikely to occur given the high business risks associated. We are therefore faced with a situation which highlights the absence of mechanisms of dialogue and action which serve the more advanced stages of environmental development in society, those illustrated on the higher steps in Figure 1. The mechanisms of industrial ecology require the joint efforts of various companies, NGOs and governments to accelerate solutions for the “full planet”.

To help reflect on paradigms that should prevail on a full planet, it is useful to take into consideration that in a study carried out by the Indira Gandhi Institute of Development Research for UNCED (Parikh et al., 1994) the per capita consumption of paper in developed countries was found to be 14 times higher than that of developing countries. When comparing the US with India it was 115 times higher.

**The impact of monocultures on biodiversity**

At the moment, with the prevailing “empty planet” vision of the world, it is impossible to think of the large scale production of pulp or any other industrial product based on agriculture or forestry without the practice of monoculture. The impact of this practice
when applied to regions of temperate climate is quite different to that of tropical regions. Evidence of this impact has led companies in Brazil to make use of land which has been already used by man (and severely impoverished from an environmental point of view) for activities such as cattle raising. But can this healthy practice guarantee the land expansion needed to satisfy the growth in demand for paper in the next decades? We obviously have to question the sustainability of the growth in demand for paper but we also should think about the development of forestry production which has radically less impact on biodiversity. To provide an economic base for these developments we could count on the great superiority, in terms of forestry productivity verified in the regions that have the greatest biodiversity. Once again we are dealing with a problem that requires mechanisms which are not available in the empty planet vision.

Conclusion
To reach higher levels of eco-efficiency, of the order of a factor of 10 in the next 50 years, the productive sectors have to start thinking of new paradigms for production and new intra and inter-sectoral relations. A new dialogue with the consumer market needs to be initiated. This work has been carried out with the clear intention of provoking the professionals who can give the much needed answers for the construction of environmental sustainability in the pulp and paper sector.

References

Factor 10 Institute. The Factor 10 Institute has been created to provide practical support for achieving significant advances in resource productivity in the production and consumption sectors. [http://www.factor10-institute.org/setienges/literature.htm](http://www.factor10-institute.org/setienges/literature.htm).


