

Sustainability as a Driver in US and EU in Paper and Nonwoven Sectors

Miika Nikinmaa,^{a,*} Lokendra Pal,^b and Martin A. Hubbe^b

The US and the EU have adopted contrasting pathways in their pursuit of increased sustainability. This editorial highlights such contrasts with respect to paper and nonwovens products. The American way, at least at the federal level, depends on consumer input, which can have an impact on corporate decisions and practices. Progress with respect to sustainability in the European Union has a higher reliance upon regulations. Each approach has merits as well as deficiencies. A regulation-dependent approach sometimes just moves problems to other parts of the world. A consumer-driven approach does not have a good way to deal with a need for systematic change, such as systems to recycle textile and nonwoven materials. It follows that a combined approach, involving both consumer demand and regulations, can be recommended as a most effective path forward. In addition, applications of artificial intelligence have potential to reconcile societal needs with future industrial practices.

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Contact information: a: VTT Research Institute, P.O. Box 1000, 02044 VTT, Finland; b: Department of Forest Biomaterials, NC State University, Campus Box 8005, Raleigh, NC 27695-8005, USA;

* Corresponding author: miika.nikinmaa@vtt.fi

A Global World, But Fragmented Approaches to Sustainability

Sustainability criteria and approaches are still globally very fragmented, despite efforts for implementing global sustainability criteria. Greenhouse gas (GHG) emissions are dominating as a key sustainability indicator globally, and this emphasis has become larger due to the Paris agreement. However, there are large differences in implementation and ambition levels between the countries. Other factors, such as waste management, recycling, circular economy *etc.*, don't have such broad support from the international community and are implemented in various ways between the sectors. In this paper we will highlight some differences between the EU and USA.

In both the EU and in the US, CO₂ trading mechanisms have been implemented. Within the EU, the regulatory body has played a very active role in reducing the negative environmental impacts and promoting industrial transformation. The recent policies under the European Green Deal initiative, relevant for paper and nonwoven sectors, include the Single Use Plastic directive (SUP) [Directive (EU) 2019/904], Waste Framework directive [Directive 2008/98/EC], ecodesign regulation [Regulation (EU) 2024/1781], and the Packaging and Packaging Waste directive [Directive 94/62/EC]. The general aim of these directives is to reduce emissions, pollution, and waste, as well as to promote circular economy. In the US there hasn't been federal legislation, but individual states have addressed plastic issues or textile waste individually. Thus, the burden of selecting more sustainable solutions remains more on the consumer's shoulder.

The American Way

The lack of wide-reaching federal regulation, but pressure from consumers, non-governmental organizations, and individual states, is driving companies to reduce waste and emissions. The decrease in waste and emissions is happening through careful consideration of economics. For example, older and less performing assets are being closed due to commercial reasons. These assets are often also less efficient, highly reliant on fossil fuels, and energy-inefficient; hence, the CO₂ footprint per ton of product is reduced. The product mix is also shifting towards paper from single-use plastics due to consumer preferences and environmental concerns such as microplastics generation (Tyagi *et al.* 2022). In the case of cardboard, the circularity system is working well, and lately there has been a significant amount of capacity added for containerboard production from recycled old corrugated container (OCC) material. This shift towards circularity is driven by increased demand for recyclable packaging due to e-commerce and excess capacity available from declining writing and printing segment of paper production. Further, the nonwovens industry continues to look for alternative and sustainable polymers and fibers sources such as poly(lactic acid) (PLAs), polyhydroxyalkanoates (PHAs), and industrial hemp-based bast fibers (Pal and Lucia 2019).

Where the “American way” gets in trouble involves aspects where a system change would be needed. For example, textile recycling does not have any existing infrastructure. In some areas there is no capacity for sorting and recycling mixed recyclable consumer wastes. Costs for building such systems *versus* the cost of landfilling the waste and simply buying new resin or fiber do not create a favorable picture. Hence, unless federal or state level regulation is implemented in the US, there will likely be waste and pollution that won't be addressed, simply because it won't be profitable for anyone to do so. The waste and expenses associated with it will be passively allocated and often cause harm to the environment or to people at lower social standing, *i.e.* communities located next to a landfill (Salem *et al.* 2023).

The European Way

The EU has been actively driving towards a significant system change to achieve climate goals by 2050 as well as to promote circular economy. The upside of such a regulatory-driven approach is that the industries are forced to renew their operations. New opportunities are opened in the market for the alternative products that before had no ability to compete with less sustainable, and often cheaper, products. Moreover, through regulations, lawmakers can allocate negative effects to the products where typical pricing tools would fail to do so (such as tobacco taxes), leading to overall increases in quality of life. The downside of regulatory-driven approaches is that the resources are not necessarily allocated efficiently. Regulations also can build artificial boundaries between products where one is seen as good and another as bad based on classification rather than environmental impacts. A case in point is the choice between PLA / PHA *vs.* viscose in the SUP directive. Furthermore, regulations don't implement the solution; the initiative is left to industrial actors to ensure that the value chains are ready to deliver the impact that the regulation is aiming to deliver. At worst, the section of value chain that is impacted can be driven completely out of the area of jurisdiction, and the waste / negative impacts are simply outsourced to another location. Moreover, there is also a risk of reducing the standard of living, as the replacement product doesn't fulfill the consumer's need, or it does so, but at a much higher cost. The Renewcell bankruptcy in 2024 is an example of the

challenges associated with the regulatory push. Renewcell had developed a technology for upcycling textile waste to a dissolving pulp, but the value chain wasn't ready or capable of absorbing the increased cost and needs for processing of the fiber. Free trade can also cause challenges for local producers, who face additional costs from complying with strict regulation and struggling to compete with imported goods produced in a less regulated area.

Conclusion

It is clear that sustainability needs to be addressed in global forums to ensure the wellbeing of humans and the environment. The comparison between the European and American way of addressing sustainability highlights some challenges associated with both systems. Addressing the efficiency through market forces seems to be critical, but regulation is necessary for allocating the full expenses associated with emissions and waste associated to the product throughout its life cycle. Further, it is essential to harness the power of artificial intelligence (AI). Such advances make it possible to understand diverse societal needs and create impactful solutions for climate change, including sustainable waste management and GHG emissions reduction, encompassing a multi-stakeholder approach through public-private partnerships.

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