



Circularity concepts in the pulp and paper industry

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Study series on circularity

THANK YOU

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The UNECE/FAO Team of Specialists on Sustainable Forest Products

FAO Advisory Committee on Sustainable Forest-Based Industries (ACSFI)

The Joint UNECE/FAO Working Party on Forests Management, Economics and Statistics during their sessions in 2022 and 2023.

The series includes the following studies:

- **Sustainable and circular bioeconomy in forest-based industries. How to get there.**
- Circularity concepts in the wood construction sector, as an example of a long-lived products value chain.
- **Circularity concepts in the pulp and paper industry, as an example of a group of commodities with a short life span.**

Overview

- CHAPTER 1 Setting the stage for circularity in pulp and paper industry
- CHAPTER 2 Pulp and paper manufacturing process, products, and their characteristics
- CHAPTER 3 Pulp and paper industry context
- CHAPTER 4: Recycling – the most prominent circularity feature in the pulp and paper sector
- Examples of Good Practice
- CHAPTER 5 Conclusions and recommendations

CHAPTER 1 Setting the stage for circularity in pulp and paper industry

- **Understanding circularity and sustainability**
 - For the need of the study the concept of circular economy is based on EMA as described in UNECE/FAO 2022
 - Circularity and sustainability approaches are understood by the application of the 9R approach at different stages of the pulp and paper value chain
- **Circularity and sustainability in the pulp and paper industry**
 - Three core principles: reducing waste by design, retaining materials in circulation, and restoring the systems from which resources are extracted.
 - Circularity of paper products broadens the availability of renewable raw material for all forest-based products to allow for a growing bioeconomy substituting fossil material and energy



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CHAPTER 1 Setting the stage for circularity in pulp and paper industry

- **Background and objectives of the study, scope and limitations**
 - Provide a comprehensive overview of how circularity concepts and sustainability practices can be applied in the pulp and paper industry
 - Less focus on forestry but points out the use of recovered materials as priority feedstock for pulp and paper mills
 - Focus on material flow, energy and water cycles duly mentioned
 - Particular focus on circular design and its interlinkages with the high level of paper recycling



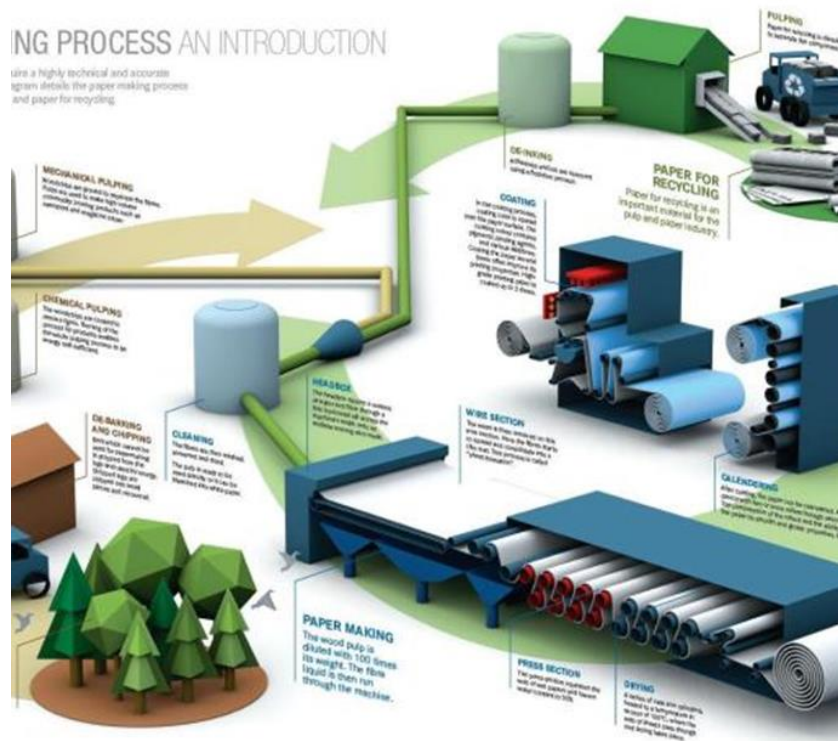
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CHAPTER 2 Pulp and paper manufacturing process, products, and their characteristics

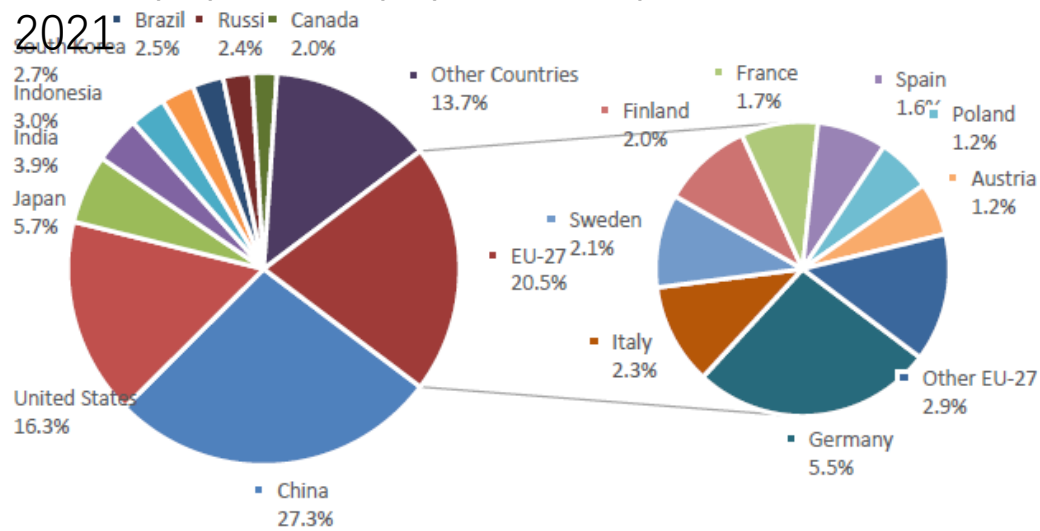


Source: Cepi

- Pulp and paper manufacturing
- The value chain and related products
- The raw materials for pulp and papermaking
- Auxiliary products and side streams
- The role of water and energy
- Innovative Products based on the biorefinery concept

CHAPTER 3 Pulp and paper industry context

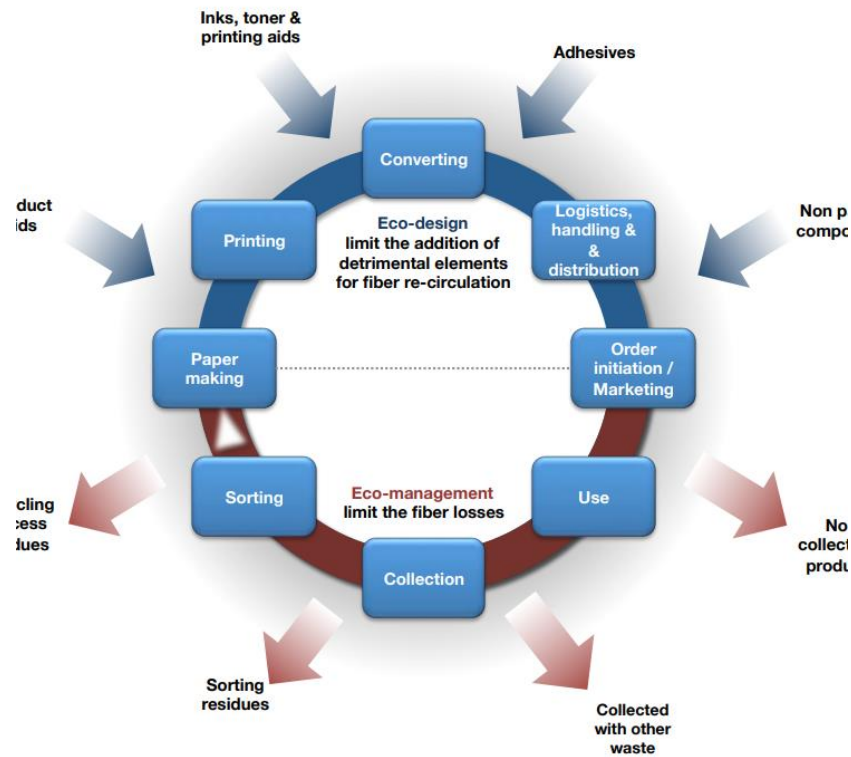
World paper and paperboard production in



Source: Fastmarkets RISI

- Production and consumption trends: e.g. digitization, Covid-19, e-commerce
- Resource efficiency trends: raw materials, energy, water, CO₂
- Outlook: an industry in a deep transformation
- The role of policies and regulations e.g.,
 - public procurement,
 - plastic substitution,
 - reusable packaging

CHAPTER 4: Recycling – the most prominent circularity feature in the pulp and paper sector

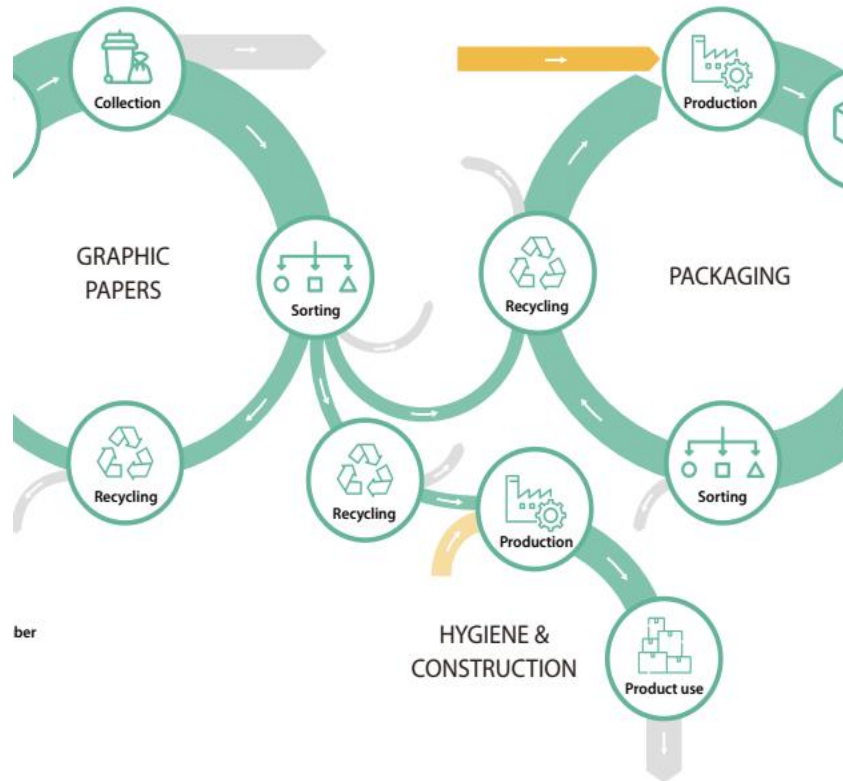


Design for recycling:

- the high recycling rate of paper products at the end of their lives is largely facilitated by the design
- paper products as an example of short-lived commodities extend the lifespan of cellulose fibers through a repeated recycling and reuse with the industry
- Standardized and widely applied recycling processes facilitate designing products “for recycling”

Source: World Economic Forum

CHAPTER 4: Recycling – the most prominent circularity feature in the pulp and paper sector



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adapted from WEF (2016).

Source: UNECE/FAO

Commitment and collaboration

- Design guidelines and recyclability evaluation scorecards exist at global, regional and national level
- Multi-stakeholder processes facilitate commitment to paper products designed for recycling
- Standardization of recyclability testing a prerequisite

CHAPTER 4: Recycling – the most prominent circularity feature in the pulp and paper sector



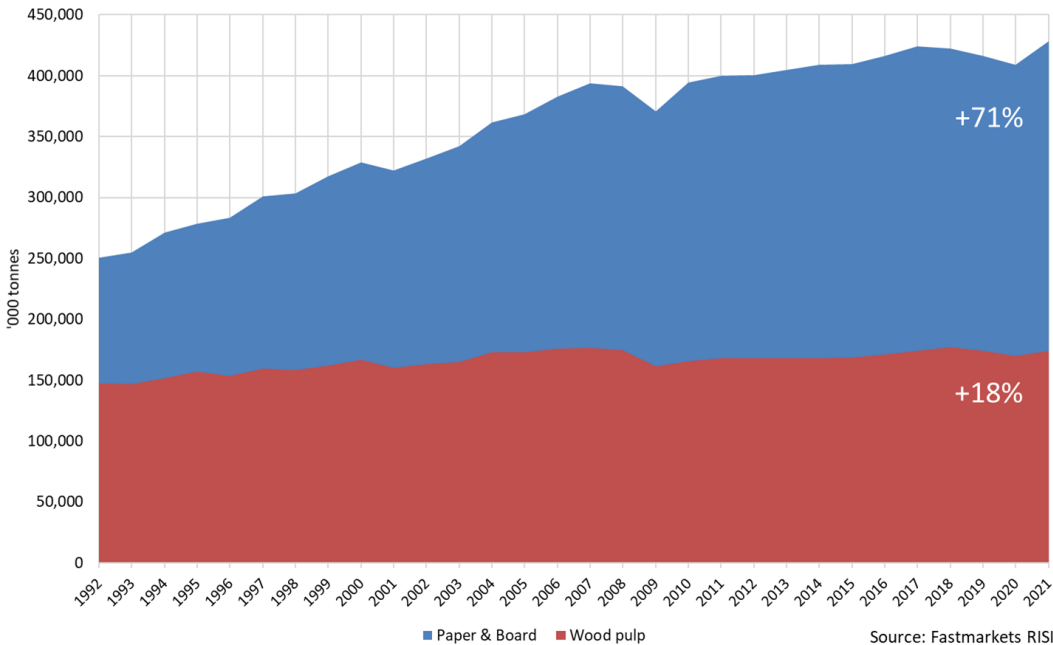
Source: ImpactPaperRec

End-of-life management

- Separate paper collection
- The importance of citizens' buy-in
- The existence of sorting infrastructure
- Standardized grades of paper for recycling
- Paper for recycling a locally, regionally and globally sought-after commodity
- The existence of a market pull facilitates more collection and circularity

CHAPTER 4: Recycling – the most prominent circularity feature in the pulp and paper sector

Global pulp and paper & board consumption



Environmental benefits and trade-offs

- Increasing paper recycling reduces the amounts of paper incinerated or landfilled
- it reduces the need for fresh wood fibers in papermaking, which diminishes the pressure on forests
- Use of LCAs can help weighing trade-offs in other environmental parameters (e.g. energy, water)
- Paper recycling and use of virgin fibers contribute to one system and broaden the raw material base of the circular bioeconomy

CHAPTER 4: Recycling – the most prominent circularity feature in the pulp and paper sector



The role of policy

- Policies and regulation to prevent landfill have gained ground
- Recycling targets set in some regions and sectors (e.g. packaging)
- Still more potential in improving ways of collection and sorting, harmonisation of environmental footprint methodologies
- This will allow for better comparison of products and more informed choices by consumers

Examples of Good Practice

Research, policy and sectoral initiatives:

- 1) **American Forest and Paper Association** Design Guidance for Recyclability of Paper-based Packaging
- 2) **Austria's policies** in the pulp and paper industry
- 3) **4evergreen initiative**: A cross-industry alliance for circularity in fibre-based packaging
- 4) **University of Helsinki analysis** on added value from wood-product industries' by-products
- 5) **Georgia-Pacific recycling technology**
- 6) **Ibema paperboard from recovered fibres**
- 7) **Klabin– circular by-products management**
- 8) **University of St. Petersburg ecopaper** from unbleached hardwood pulp and aspen
- 9) **Suzano nurseries paper pots** become fertilizer for surrounding communities
- 10) **WestRock innovative paper packaging**

CHAPTER 5 Conclusions and recommendations

- The pulp and paper industry is a complex industry with many different processes and a growing trend to refine bio-based feedstock into more value-added products
- The changing industry context impacts the structure of the sector
- Further growth in packaging papers will depend on the uptake of reusable packaging
- Paper recycling rates will keep increasing, however a continuous inflow of virgin fibers will be needed
- Pulp mills implement circularity approaches also through development of innovative products in biorefineries

CHAPTER 5 Conclusions and recommendations

- Circular design is key for both high recycling rates and high quality of products made from Paper for Recycling
- Standardization is a compelling enabler for the circularity of paper and paperboard
- Paper recycling is a business case
- Environmental performance of paper and paperboard made from virgin fibers and from Paper for Recycling can be compared only case-by-case
- Recycling paper and paperboard extends the raw material base substituting fossil-based products
- Policy has a key role in creating an enabling environment for circularity in the pulp and paper industry

CHAPTER 5 Conclusions and recommendations

Recommendations

- Support for sustainable forest management should continue. While recycling rates can be further increased, a steady inflow of virgin fiber will be needed, and it must be sourced from sustainably managed forests.
- Better communication on sustainable forest management is needed. The general public should be able to distinguish harvesting trees in the framework of SFM from deforestation
- The use of recycled fibers should be promoted to widen the raw material base for renewable products substituting fossil ones. Promotion campaigns on paper recycling should avoid associating the use of virgin fibers to misleading information on deforestation, which is driven by factors outside the forest sector, including agricultural expansion and poverty.
- Waste streams including valuable raw materials such as paper and paperboard should be as much as possible diverted from landfills and other disposal options to keep materials circulating and creating added value in the economy.

CHAPTER 5 Conclusions and recommendations

Recommendations cont.

- Paper and paperboard should be collected separately from residual waste and from other recyclables. There should be consistent waste collection programs at least at national level, but ideally in wider economic areas to enable the value of secondary raw materials to be maintained.
- Sorting instructions for the end-consumer of pulp and paper products should be included on the products, next to information on the origin required by law.
- Science-based environmental footprint information needs to be publicly available to make sure that claims on products are reliable and comparable for the consumer.
- Waste management policies, including collection and sorting, should be linked to the product design and production policies to allow for closed material loops in which products are designed in full knowledge of the recycling processes that keep them in use.

CHAPTER 5 Conclusions and recommendations

Recommendations cont.

- Product support policies (e.g., green procurement) should be further developed to take into account the recyclability of products and the renewability of their raw materials to favor nature-based material over fossil fuel-based ones.
- Innovation and access to research and development funding should be encouraged to facilitate product and energy efficiency innovations. This would support the continued development towards biorefineries, which can produce more value-added products from side-streams and other waste.
- Paper mills should be encouraged to use their potential for becoming more energy self-sufficient by producing renewable energy onsite using e.g., waste and residues for bioenergy in line with the cascading use of biomass. For the remaining energy needs, access to affordable clean energy is crucial to increase the synergy between increasing circularity and efforts to mitigate climate change.
- Cooperation among different actors across value chains and the establishment of industrial ecosystems should be promoted to facilitate exchange along supply chains and make them more circular i.e., turn the supply chains into supply circles.
- Various value chains should be analyzed by industrial associations and policy makers to identify the potential for increased circularity while keeping in mind all other environmental impacts and sustainability aspects.

CHAPTER 5 Conclusions and recommendations (summary)

Conclusions:

- a complex industry with many different processes and currently in a phase of transformation: Paper recycling rates will keep increasing, however a continuous inflow of virgin fibers will be needed
- Especially pulp mills implement circularity approaches through refinement of bio-based feedstock into innovative, more value-added products in biorefineries
- Circular design is key for both high recycling rates and high quality of products made from Paper for Recycling, recycling is a business case, standardization is a compelling enabler
- Environmental performance of paper and paperboard made from virgin fibers and from Paper for Recycling can be compared only case-by-case
- Recycling paper and paperboard extends the raw material base substituting fossil-based products
- Policy has a key role in creating an enabling environment for circularity in the pulp and paper industry



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CHAPTER 5 Conclusions and recommendations (summary cont.)

Recommendations

- Support and better communication on SFM should continue. While recycling rates can be further increased, a steady inflow of virgin fiber will be needed.
- The use of recycled fibers should be promoted: not to save trees, but to widen the raw material base for renewable products substituting fossil ones.
- Valuable waste/raw material streams should be as much as possible diverted from landfills and other disposal options. Paper should be collected separately including from other recyclables
- Products designed for recycling must include sorting instructions for the end-consumer
- Science-based environmental footprint information needs to be publicly available to make sure that claims on products are reliable and comparable for the consumer.
- Paper mills should become more energy self-sufficient by producing renewable energy onsite using e.g., waste and residues for bioenergy in line with the cascading use of biomass.
- For the remaining energy needs, access to affordable clean energy is crucial to increase the synergy between increasing circularity and efforts to mitigate climate change.



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