
Forisk Strategy Note, Q3 2019

Technology in the Forest Industry: Observations from Pulp and Paper

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Summary Messages

- The ability to use and leverage technology can distinguish firms within and across sectors. For example, in the forest products industry, the pulp and paper sector stands out for its outsized (1) need for capital and (2) ability to create value from technology investments that improve facilities or lead to new products.
- This research highlights three observations from pulp and paper related to the role of technology on forest industry manufacturers.
 - 1) **Investments in manufacturing technology allow and often require scale.** Technologies that deliver efficiency, yield and productivity gains lower per unit costs and payback periods while relying on larger capital commitments. Data across North American pulp firms over the past ten years confirm a common strategy of scale and consolidation to focus and optimize these investments.
 - 2) **Current R&D projects point to massive growth potential from forest-derived products.** While innovations with solid wood products focus on getting more value from logs and boards, advances in pulp and related sectors move towards technological and product innovations that start at the cellular level. New pulp and cellulosic applications could literally reshape industries and change the world.
 - 3) **Forest industry technologies can help firms attract talent.** The advances occurring in the forest industry, and especially in the pulp sector, require folks who can communicate, lead and solve problems with teams. And this need creates opportunities for exciting and diverse careers.

Introduction

Technology is the application of science or knowledge for practical purposes, such as solving problems, developing tools, or conducting research. Examples of technology at work include hammers and hair dryers and the Hubble Space Telescope. In the forest products industry, investments in technology range from the use of advanced seedlings and continuous dry kilns (CDKs) to ArcGIS and engineered wood products.

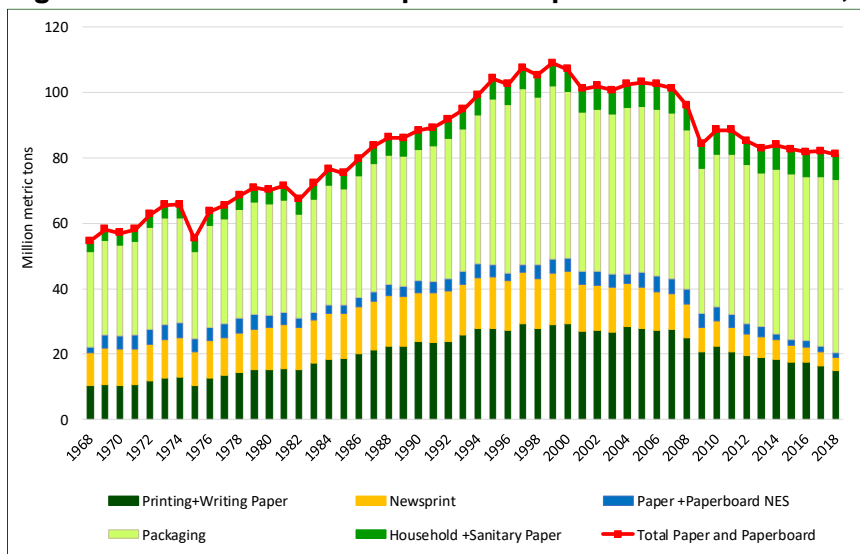
Within the forest products industry, the ability to leverage technology can distinguish firms within a sector, while clearly separating the ability to generate wealth across sectors. For example, the pulp and paper sector stands out for its outsized (1) need for capital and (2) ability to create value from technology investments that improve facilities or lead to new products. And as major users of wood, individual pulp mills serve as strategic factors for timberland investors screening timber markets and in the plans of sawmills looking to expand capacity in wood baskets where they can sell their manufacturing residuals (e.g. chips for pulp).

Our previous Forisk Strategy Note shared specific learnings related to the threats and opportunities associated with substitutes in the forest product industry based on research related to North America’s structural panels sector.¹ This Note reviews the pulp and paper sector to better understand the role and influence of technology in the forest industry, and the potential for both incremental and massive levels of innovation.

North American Pulp and Paper Sector

This is not your Grandma’s pulp mill. North America’s paper industry from 50 years ago has since updated, shifted and rationalized. While total production peaked in 1999 before dropping 25%, trends and advances diverge across individual segments (Figure 1). These shifts affect forest owners and chip buyers just as they respond to changes in end markets and consumer preferences.

Figure 1. North American Paper and Paperboard Production, 1967-2018

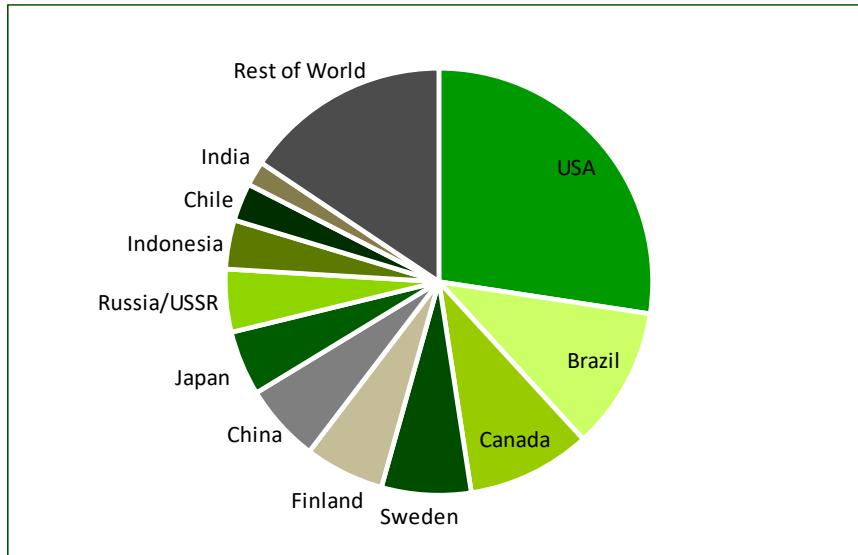


Sources: UN FAO; “Wood-Consuming Pulp Mills”, Chapter 4 from Forisk’s 2019 North American Forest Market & Industry Rankings.

Figure 1 summarizes five decades of key product categories. Packaging, which accounts for 65% of total paper and paperboard production, and household and sanitary products are up, while printing and writing paper and newsprint contracted. Despite declining production, **North America (37% of global production) among continents and the U.S. (27%) across countries remain the top wood pulp producers in the world** (Figure 2).

¹ “Substitution in the Forest Industry: Lessons from Plywood and OSB,” *Forisk Strategy Note*, Q2 2019. Available at: <http://forisk.com/resources/white-papers-and-articles/#forisk-strategy>

Figure 2. Top Wood Pulp Producing Countries



Sources: UN FAO; Q3 2019 Forisk Research Quarterly (FRQ)

The U.S. and Canada also import and export significant volumes of wood pulp, though most of those flows occur within North America. On the margin, the U.S. shifted from a net exporter through the 1990's to a net importer between 1999 and 2006, then back to a net exporter since 2006. Since 2010, the U.S. production of paper and paperboard exceeded consumption by an average of 2.8%. Exports in 2018 made up 16% of U.S. production. When the U.S. imports pulp, Canada is the major source.

Three Observations from Pulp and Paper on Technology

Paper and paper products serve us daily. As Gary Smook wrote two decades ago, paper and packaging have distinct and unique roles for capturing and sharing information, for packaging goods, and for basic sanitation.² And producers of these products, to survive and profit, travel a road of constant innovation. What do we observe from the use of technology in the pulp sector?

One: Investments in Technology Allow and Require Scale and Consolidation

The economics of pulp and paper differ materially from the rest of the forest industry. The superior margins and ability-to-pay relative to lumber, panels and pellets create a pecking order, reinforced by the fact that wood raw materials account for a smaller portion of pulp mill total manufacturing cost. At times, certain pulp mills could pay over \$100 per green ton of delivered log to make its product and still have room on a cash breakeven basis.³

However, owning facilities in the pulp and paper industry requires capital and technology. Between 2009 and 2019, the number of pulp mills in North America decreased by 16% while average pulp mill capacity increased 6% (from 493 to 520 thousand tons per plant).⁴ Pulp firms seek to lower their per unit manufacturing costs by scaling up facilities with better technology and faster, more efficient machines, and this requires capital.

² *Handbook for Pulp and Paper Technologists, 3rd Edition* by G.A. Smook. 2002. Angus Wilde Publications. 425 pages.

³ Clarity in gross margins and the ability-to-pay for wood frames strategic analysis. See Part II on "Pallets and the Forest Industry," Forisk Blog posted December 6, 2018. Available at:

<http://forisk.com/blog/2018/12/06/reinvention-competition-wood-pallets-forest-industry-part-ii/>

⁴ *North American Forest Market & Industry Rankings*, 2019 Forisk Multi-Client Study.

In a world of budget constraints, deploying capital necessitates choices. In the pulp and paper industry, choices manifest themselves through efforts to focus on and consolidate product lines. In North America, only four of the ten largest pulp producers in 2009 remain on the list in 2019, as companies merged and restructured (Figure 3). The top ten producers increased from 60 million tons of capacity in 2009 (60% of North America’s total) to around 65 million tons in 2019 (72%). Currently, the top three firms alone represent 46% of total North American capacity. All firms on the current list invested in machines and technology over the past decade.

Figure 3. Top Ten North American Pulp Producers, 2009-2019

2009		2019	
Company	Capacity (M Tons)	Company	Capacity (M Tons)
International Paper	16,334	International Paper	18,613
Georgia-Pacific	9,616	WestRock	13,149
Smurfit-Stone Container	7,962	Georgia-Pacific	9,750
AbitibiBowater	7,173	Packaging Corporation of	5,100
Domtar	5,519	Domtar	4,447
Temple Inland	3,045	Resolute Forest Products	3,774
NewPage	2,933	Graphic Packaging	3,084
MeadWestvaco	2,665	Paper Excellence	2,694
Weyerhaeuser	2,517	Verso Corporation	2,315
Packaging Corporation of America	2,458	Rayonier Advanced Materials	1,851
Top 10 Total	60,222		64,777
Total N.A. Capacity	100,618		89,545

Source: Forisk

Two: Current R&D Points to Massive Growth Potential in Forest-Derived Products

When those making lumber and panels upgrade mills, technological improvements focus on getting more value from logs, chips and boards. Examples include high-tech scanning, sawing and drying in mills, and the development of products such as OSB and CLT. For solid wood products, firms basically moved from Lincoln Logs to advanced LEGO sets.

Compare this to the pulp sector. In addition to capturing gains in efficiency and yields, firms support research and development (R&D) for potentially massive technological innovations that start at the cellular level. Examples include efforts to produce carbon fibers from lignin to compete with petroleum-based carbon fibers. As a biomaterial, wood fibers and sugars support healthy niche industries that run in parallel to the traditional, high volume paper and paperboard sectors. Consider the implications if wood-based polymers someday replace petrochemical products. Advanced pulp and cellulosic applications could literally reshape industries and change the world.⁵

Meanwhile, tangible technological gains with wood raw materials accumulate. In the summer of 2019 alone, firms announced efforts to make blown-in fiber insulation from softwood chips⁶,

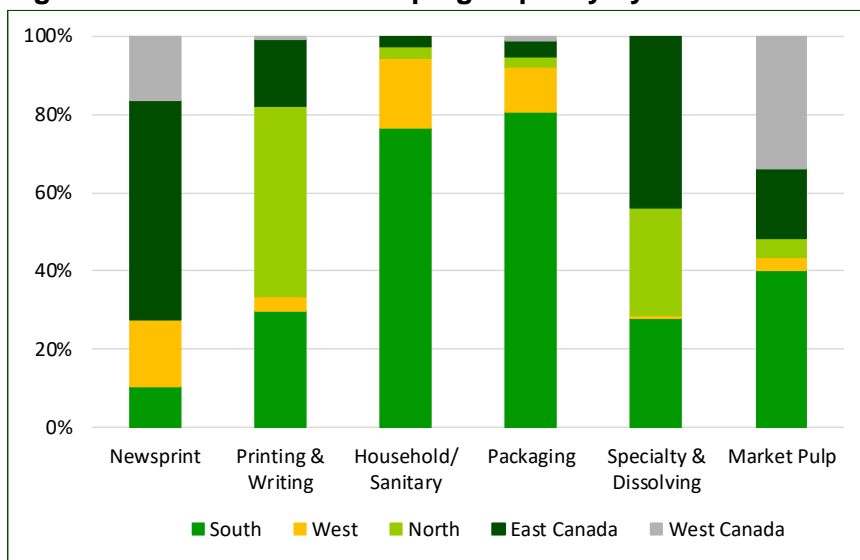
⁵ Nanocellulose, for example, satisfies our screening criteria as an industrial disruptor. See Part III on “Thinking Beyond Deviations,” Forisk Blog posted September 4, 2018. Available at: <https://forisk.com/blog/2018/09/04/thinking-beyond-deviations-changes-disrupt-forest-industry-part-iii/>

⁶ “Belfast company gets another grant to make less toxic insulation at former Madison paper mill,” *Bangor Daily News*, May 13, 2019. Available at: <https://bangordailynews.com/2019/05/13/business/belfast-company-gets-another-grant-to-make-less-toxic-insulation-at-former-madison-paper-mill/>

waterproof wood composites⁷, and cellulosic products fully biodegradable in soil, fresh water and salt waters⁸. As a group, these R&D efforts enhance the profile of wood fiber as a solution for problems related to plastics and synthetics in drinking water, marine waters and ecosystems, and wastewater treatment plants.

Figure 4 shows where specialty product investments take place. Eastern Canada, the second largest pulping region, has the largest proportional representation in newsprint. With newsprint production shrinking, the region’s paper industry is vulnerable. Capacity in the U.S. North is also aligned with a shrinking sector: printing and writing papers. This explains why Eastern Canada and the U.S. North are two of the three largest regions, in relative and absolute terms, with respect to investments in advanced specialty and dissolving pulp markets, as investors attempt to repurpose old mills for newer and growing markets.

Figure 4. North American Pulping Capacity by End Market and Region, 2019



Source: Chapter 4 from Forisk’s 2019 North American Forest Market & Industry Rankings.

Three: Forest Industry Technologies Can Help Firms Attract Talent

To quote what one forest industry executive asked me, “Where do we find the folks that both ‘want’ it and can do what we need? I’m tired of explaining that we’re not in the hunting and fishing business.” While this may sadden some applicants, it will excite and attract others.

In a December 2018 TED talk in Portland, Maine, Donna Cassese of Sappi noted that, rather than paper makers, professionals at her firm think of themselves as “cellulose manipulators.”⁹

⁷ “Metsa Spring invests in Woodio, leader in waterproof wood composite technology,” press release. August 1, 2019. Available at: <https://www.metsagroup.com/en/media/all-news/Pages/News.aspx?EncryptedId=097833A3C82760E5&Title=MetsaSpringinvestsinWoodio,leaderinwaterproofwoodcompositetechnology>

⁸ “Wipe without worry: Lenzing fibers certified biodegradable,” *Biofuels Digest*, September 2, 2019. Available at: <http://biofuelsdigest.com/nuudigest/2019/09/02/wipe-without-worry-lenzing-fibers-certified-biodegradable/>

⁹ “Why I think the paper industry is sexy,” December 17, 2018. Available at: <https://www.bing.com/videos/search?q=TEDxTalks+cassese&&view=detail&mid=D0FB602F6070B0F02817D0FB602F6070B0F02817&&FORM=VRD GAR>

She highlights the many high tech wood fiber applications as well as the associated growth opportunities for people in technical, operational and leadership roles.

Previous Strategy Notes reinforce the need for a “people strategy.”¹⁰ Executives seek individuals with a passion for some aspect of the work and a desire to grow professionally. The technological advances occurring in the forest industry, and especially in the pulp sector, require folks who can communicate, lead and solve problems with teams of colleagues and external collaborators. And this need creates opportunities for exciting, rewarding and diverse careers.

Conclusion: Strategic Implications

For forest industry executives and investors, the lessons in this Note reinforce the scale and potential of technological innovations in pulp and paper to reshape industries outside of traditional forest products. Research and development projects now meet at the cell wall, where researchers work to remove, separate or modify lignin and hemicellulose from cellulose for applications from pulp to cellulosic ethanol to nanocellulosic applications to the development of “super-materials” for cars, trucks, boats, building construction and body armor.¹¹

In the end, if researchers untangle ways to create cellulose-based products at costs near petroleum-based products, then we would expect massive shifts in global productive and economic capacities. And this, in turn, highlights the critical need and opportunity for talented individuals to contribute and grow.

¹⁰ See Part III on “Wood pallets and the forest industry,” Forisk blog posted December 11, 2018. Available at: <https://forisk.com/blog/2018/12/11/reinvention-competition-wood-pallets-forest-industry-part-iii/>

¹¹ “Stronger than steel, able to stop a speeding bullet—it’s super wood!” *Scientific American*, February 7, 2018. Available at: https://www.scientificamerican.com/article/stronger-than-steel-able-to-stop-a-speeding-bullet-it-s-super-wood/?utm_source=twitter&utm_medium=social&utm_campaign=sa-editorial-social&utm_content&utm_term=chemistry_news_text_free&sf181542729=1

Appendix A: About Forisk

Our team conducts research to understand how things in the forest industry work. We use this to help clients make better decisions with timber-related investments and wood-using industries. All Forisk researchers have direct forest industry and market analysis experience. This includes work in wood procurement, forest finance, forest operations, and timber market forecasting.

Forisk publishes the *Forisk Research Quarterly (FRQ)*, which includes timber forecasts, forest industry analysis, forest operations research and wood market rankings for North America. In total, Forisk subscribers own or manage over 100 million acres of timberland and use over 200 million tons of wood per year in the U.S. and Canada. This includes firms and organizations based in the U.S., Canada, Europe, Asia and South America.

Our consulting focuses on analyzing the supply and demand characteristics of local wood and timber markets and, from this analysis, developing forecasts and strategic guidance related to investment decisions and the management of assets. To support this research, Forisk maintains the most complete databases of mill level capacity for solid wood-using mills in North America.

Forisk Product and Services

- Products
 - *Forisk Research Quarterly (FRQ)*
 - 2019 North American Forest Market & Industry Rankings
 - North American Forest Industry Capacity Database
 - North American Timberland Owners & Managers database
 - Forest management benchmarking for the US South and Pacific Northwest
 - Wood Bioenergy US database
- Services
 - Timber market and wood basket screening, ranking and feasibility analysis
 - Property and mill-specific timber price forecasts
 - Stumpage and delivered
 - Forest operations analysis and benchmarking
 - Wood procurement, market infrastructure and logging/hauling capacity
 - Executive education and professional development
- 2019 Events
 - “Applied Forest Finance” short course, February 19, 2019
 - “Timber Market Analysis” short course, June 25, 2019
 - **3rd Annual “Wood Flows & Cash Flows” Conference**
 - **December 5th, 2019 in Atlanta**
- Previous Forisk Strategy Notes
 - *2019 Q2: Substitution in the Forest Industry: Lessons from Plywood and OSB*
 - *2019 Q1: Risk and Context in the Forest Industry: Lessons from Wood Pellets and Bioenergy*
 - *2018 Q4: Reinvention and Competition in the Forest Industry: Lessons from Wood Pallets*
 - *2018 Q3: Thinking Beyond Deviations: Changes that Could Disrupt the Forest Industry*
 - Available at <https://forisk.com/resources/white-papers-and-articles/>

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