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TWM

TISSUE WORLD MAGAZINE

The independent news provider for the global tissue business

CHINA

A STUNNING "V" SHAPED RECOVERY

Country Report
The 1.4bn population tissue market, AfH 'back to normal', Record performance levels, Surge in e-commerce

Plus ...

MarketIssues
How top companies achieve higher performance levels

The Barometer Issue
Climate report on growth

Technical Theme: Chemicals
Unleash your fabric showering potential

ExitIssues
Bamboo tissue products on the rise online

ConsumerSpeak
'Quilted, cushiony, extra touch, perfumed, sensitive, bamboo ... I almost had to sit down and think about it all.'

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"Where we see a change is in consumer behaviour and ultimately product development," Zhang Ge, Chief Executive of APP China's Gold Hongye Paper Group Co., speaks to TWM.

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Cover: China's "V-shaped" economic recovery following the global outbreak of Covid-19. Image by Contrast Creative, Manchester, UK

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IN 2020 CHINA SWUNG FROM HISTORIC CONTRACTION TO WORLD LEADING GROWTH

Helen Morris
Senior Editor, Tissue World Magazine

Not only is China's economic performance in 2020 a classic "V shaped" slump and recovery, when the multi-complexities of such a populous nation are reduced to a convenient shape on a performance chart, this "V" is steep and straight out of the economics manual.

In the turbulent year just gone, China was the only major economy to grow, at an aggregate 2.3%. That was a relative slump, the lowest figure for four decades, but the plain figure hardly begins to tell the story.

Severe virus containment measures saw a historic 6.8% contraction in Q1. By Q4, a unified national effort to contain the pandemic, and emergency business relief brought a near 14% upwards transformation to see growth at 6.5%. It's expected to remain at that level this year.

The statistics on the general and tissue economies in China are in a league of their own. Historically, it has been the main driver of global tissue business expansion since 1997, and by a considerable margin. Volume growth has been well into the 30% category, the nearest regional rival being North America at an average of 14%.

China now leads the global volume tissue market space. Today, tissue products are part of normal daily life in an ever-increasing number of Chinese households.

Potential for growth is huge. From a relatively low tissue product usage base, a population estimated at 1.4bn has progressively more spending power and well-defined tastes for tissue products which are also now driven by increased concerns over hygiene. Traditional tissue-use regions on the eastern seaboard and the Beijing metropolitan area are now being widened into the hinterland of central and northern China. On the supply side there are few signs that investment activity is calming down. Investment figures have exploded in recent years, with major restructuring introducing new, modern PMs and older capacity closed for a combination of reasons.

2017 was the most recent peak year with more than 2 million tonnes of new tissue capacity starting up. The 1.9 million tonnes of new PMs each year for the period 2018-2020 includes the relatively slow year of 2018.

TWM's Country Report on China takes in independent analysis from Leo Chen of Euromonitor International in Shanghai, and from Fisher International, among whose headline claims is that in the relatively near future Chinese tissue consumption could double even without any demographic change.

We also report from APP China with Zhang Ge, Chief Executive of the Gold Hongye Paper Group Co. She discusses the surge of new machinery sweeping away the old as revealed in TWM's last edition's annual Projects Survey, and makes clear that China's recovery from the Covid-10 pandemic is more advanced than many other countries: The evidence ... AfH is more or less "back to normal."

An end-of-year report by the China National Household Paper Industry Association takes a detailed look at margins, soft and hardwood pulp and parent roll prices, investment, capacity, import and export and e-commerce business levels across China's tissue companies.

We also look at the surge in popularity of WeChat, the Chinese multi-purpose messaging, social media and mobile payment app developed by Tencent, and used to engage with a company or brand about products. First released in 2011, it became the world's largest standalone mobile app in 2018, with over 1 billion monthly active users. And we look at China coming to America. During the earlier stage of the pandemic Chinese-produced bamboo tissue products appeared for the first time on the shelves of American chain stores to meet unprecedented demand. Their presence didn't last, as buying levels dropped and consumers reverted to earlier preference. But Chinese bamboo tissue already has a presence online, and more enterprises are offering impressive varieties to attract price-concerned savers, "green" loyalists and "white cloud" softness devotees. In ExitIssues, industry analyst Gregory Grishchenko looks at bamboo's American future as production in China gears up.

HOW THE TOP TISSUE COMPANIES ACHIEVE THEIR HIGHER PERFORMANCE LEVELS

The pandemic meant record sales for retailers. But beyond external market demand spikes and input cost deflation, strategic and operational planning led to top EBITDA performance. Sanna Sosa, Senior Principal, and Sivashankari Bharathi, Analyst, AFRY, explore the intrinsic and longer-term drivers.

Sanna Sosa
Senior Principal, AFRY

Sivashankari Bharathi
Analyst, AFRY

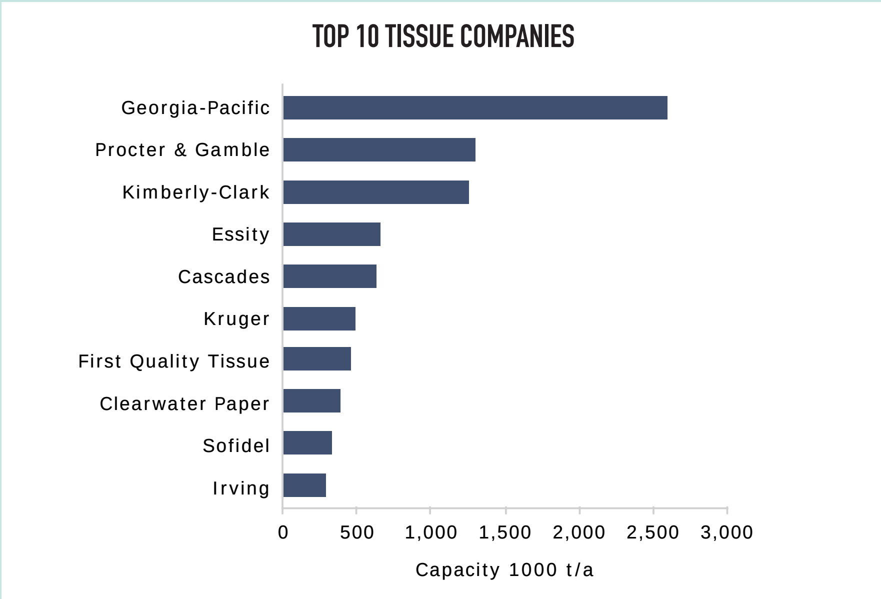

Figure 1: *Top 10 North American tissue companies*

The North American tissue manufacturing landscape consists of about 20 companies. The top 10 largest tissue product manufacturers represent 90% of the total industry capacity [Figure 1]. Out of the top 10 tissue companies, five - Procter & Gamble (P&G), Kimberly-Clark (K-C), Cascades, Kruger and Clearwater - are public companies and offer visibility into their tissue business performance. We will focus our lens on these five companies, their EBITDA performance and differences in strategic approaches and operating models.

In 2020, tissue companies' EBITDA margins increased to the highest level during the past five years [Figure 2]. P&G's tissue business has consistently had the highest EBITDA performance against its peers at about 20% or above. K-C is the next best performer with tissue business EBITDA steadily above 15%. Clearwater, Kruger, and Cascades have all had their EBITDAs mainly under the 15% threshold, dipping sometimes even in single digits.

Fundamental strategic decisions

As we try to understand which company strategic and operational choices are more conductive to higher performance, let's start with some of the most fundamental strategic decisions for any company: in which businesses and markets to participate, i.e. diversification; in which product market segments to position its products, and how to grow [Table 1].

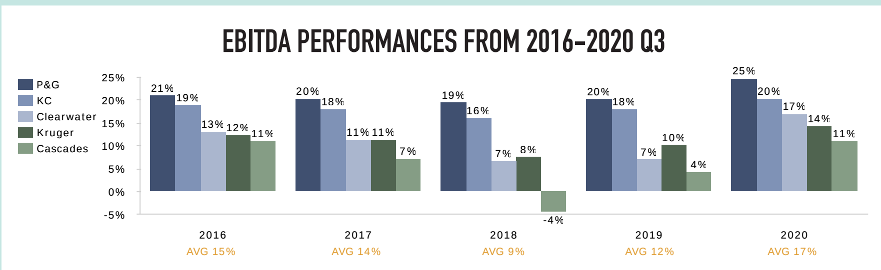

Figure 2: *EBITDA performances*

Diversification

Tissue companies are typically either diversified across other consumer and healthcare products (e.g., diapers, razors, skin and personal care products) or other pulp and paper products (e.g., containerboard, cartonboard packaging). The top EBITDA performers P&G and K-C are diversified in the consumer and healthcare product segments. Both also see lower variability in their tissue business EBITDA margins, compared to their other pulp and paper sector diversified peers. As Covid-19 cases fluctuated throughout the year, consumers began hoarding household cleaning and disinfectant wipes. Manufacturers were not prepared for the sudden increase in demand for wipes and began working "around-the-clock" to supply consumers, who emptied the shelves within the restocking hour. K-C, which reported a decline in its AfH segment sales overall, announced that sales for wipers increased by double digits in North America. Many companies have also been investing in their nonwovens segment. K-C reported investing nearly $140m at its nonwovens manufacturing site to expand capacity, while Georgia-Pacific (GP) recently announced the sale of its nonwovens business to Glatfelter for $175m.

	Diversification		Target product segments				
	Share of Tissue business of total revenue (2019)	Other business sectors	AH	AFH	Brands	Private Label	Ultra-premium / TAD share
P&G	26%	Razors, skin & personal care, products, etc.	✓ In Target segment	✗ Does not produce tissue for these segments	✓ In Target segment	✗ Does not produce tissue for these segments	100%
KC	50%	Diapers, personal and adult care products, etc.	✓ In Target segment	✓ In Target segment	✓ In Target segment	✓ Marginal volume	50%
Clearwater	51%	High-quality virgin cartonboard	✓ In Target segment	✓ Marginal volume	✗ Does not produce tissue for these segments	✓ In Target segment	30%
Kruger	40%*	Containerboard, newspaper, other paper specialties	✓ In Target segment	✓ In Target segment	✓ In Target segment	✓ In Target segment	30%
Cascades	30%	Recovery facilities, containerboard	✓ In Target segment	✓ In Target segment	✓ Marginal volume	✓ In Target segment	10%

** Share of tissue capacity vs total company capacity*

✓ In Target segment ✓ Marginal volume ✗ Does not produce tissue for these segments

Table 1: *Tissue company strategic approaches*

The North American tissue market consists roughly of a 70% steady demand for the At-Home tissue segment and 30% of a more cyclical AfH tissue segment. Except for P&G, the four other public tissue companies are all diversified across At-Home and AfH products. Looking at some of the other top tissue players in North America, Sofidel, Irving, and GP are similarly diversified across both At-Home and AfH tissue product markets. Of the top tissue players, only Essity in North America and First Quality are concentrated in just the one segment, AfH and At-Home tissue and hygiene products respectively.

Target product segments

The highest performing tissue company P&G solely manufactures and markets branded tissue products, while at the other end of the spectrum Clearwater manufactures only private label products. The three other companies in focus manufacture both branded and private label products. However, K-C, the second-highest performer, only allocates a small percentage (estimated around 5%) of its retail tissue capacity towards private label products. While private label products have been gaining market share, branded tissue products still typically command a 25% or higher price premium in bath tissue and 40% or higher price premium in towels over private label products. Hence, it is easy to understand the higher overall business profitability of the branded players. Brands continue to offer competitive advantage, sometimes referred to as a moat. Of course, creating strong consumer brands has taken decades of marketing effort and investment to create, and are best managed by companies with consumer products and marketing business focus and DNA.

However, private label's market share has been steadily growing. In 2020, at the onset of the pandemic, more consumers got familiar with private label tissue products when the store shelves were empty of their regular brands. And those experiences with tissue private label products were often positive and many consumers have reported willingness to increase their use of private label tissue products, hence supporting further growth of the private label market segment [Figure 3].

The North American tissue market is not only very brand oriented, it is also very quality oriented. With consumers actively looking for higher quality ultra-premium products, companies have invested in new ultra-premium quality TAD machines. Measured by the type of installed manufacturing capacity, the highest quality producing TAD technology represents almost 50% of the total North American retail tissue capacity. P&G and K-C both have TAD capacity shares at or above 50%, with P&G having 100% of its capacity TAD machines. Clearwater, Kruger, and Cascades have much lower TAD capacity shares. Kruger has been growing its ultra-premium capacity by investing in TAD machines in the upcoming capacity at Sherbrooke, QC.

Growth

Although P&G has been active on the M&A front in its other consumer products, it has not had tissue business M&A or machine capacity growth in North America since a greenfield tissue mill investment in Box Elder, UT, in 2015. K-C has been working on its global restructuring programme, aimed to reduce its global workforce by 12% and close around ten production sites to improve costs. The restructuring programme included the closure of its Fullerton, CA, mill site in 2020, with machine replacement and investment programs in Jenks, OH, and Mobile, AL, although with net zero impact on K-C's total tissue manufacturing capacity.

AS COVID-19 CASES FLUCTUATED THROUGHOUT THE YEAR, CONSUMERS BEGAN HOARDING HOUSEHOLD CLEANING AND DISINFECTANT WIPES. MANUFACTURERS WERE NOT PREPARED FOR THE SUDDEN INCREASE IN DEMAND FOR WIPES AND BEGAN WORKING "AROUND-THE-CLOCK" TO SUPPLY CONSUMERS, WHO EMPTIED THE SHELVES WITHIN THE RESTOCKING HOUR. K-C, WHICH REPORTED A DECLINE IN ITS AFH SEGMENT SALES OVERALL, ANNOUNCED THAT SALES FOR WIPERS INCREASED BY DOUBLE DIGITS IN NORTH AMERICA.

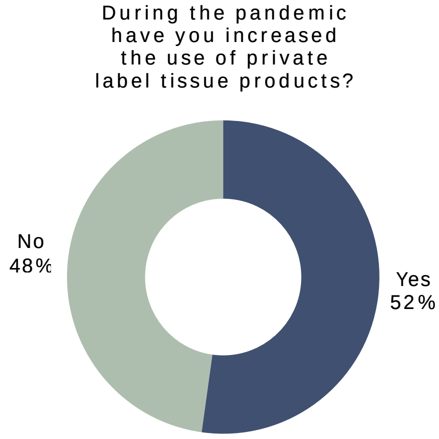

Figure 3: *Private label boost during Covid-19*

DURING THE PANDEMIC, THE TISSUE INDUSTRY REGAINED ITS RECOGNITION AS AN ESSENTIAL INDUSTRY AND RETURNED TO HIGHER PROFITABILITY DRIVEN BY THE SPIKE IN DEMAND AND DEPRECIATION IN FIBRE COSTS.

North American tissue growth has been driven by the medium size players. The medium size, privately owned Sofidel and First Quality have been tissue capacity growth leaders. Clearwater and Kruger, in recent years, have also increased their tissue capacity. In 2019, Clearwater installed a new PM at its Shelby, NC, facility producing 65,000tpy of tissue.

In 2017, Kruger installed a second-hand PM at its Crabtree, QC, facility and brought a new 70,000tpy TAD machine online in the first quarter of 2021 to supply ultra-premium bath and paper towel tissue at Sherbrook. In early 2021, Kruger announced it would continue with its $240m expansion plan at Sherbrook by adding a 30,000tpy light dry crepe (LDC) tissue machine and two converting lines over the next three years.

On the inorganic growth front, Cascades acquired Orchids Paper in 2019, growing its tissue capacity by nearly 90,000tpy. Cascades has also recently shut down 60,000tpy of aging, low profitability capacity at Ransom, PA, and rationalised its converting footprint. Cascades reported that the closure is a part of its ongoing strategic initiatives to improve its tissue business's profitability.

Companies' operational approaches

North American tissue companies have a variety of operations approaches when it comes to scale and technical age, i.e. asset quality, of their tissue manufacturing footprint as well as integration – both forward integration to converting of tissue products, as well as backward integration to fibre raw material.

Asset quality

Our asset quality chart [Figure 3] illustrates how the investments made by the medium size players such as Clearwater, Kruger, Sofidel, First Quality, have made their asset footprints amongst the most modern tissue manufacturing platforms in North America. The high performing incumbent tissue giants still tend to have larger machines producing their large manufacturing run branded tissue products than the medium size companies, although the medium size tissue companies have started to close the gap by installing larger scale tissue machines.

Integration

Tissue manufacturing is typically forward integrated into converting of the final products, but un-integrated into fibre, meaning highly reliant on market pulp. Most tissue products are converted on-site, at the tissue mills, to save on costs. Off-site converting is another operations configuration employed, but to lesser extent. Companies such as Cascades has recently been rationalising its converting footprint by closing three off-site converting facilities within the last year to optimise its tissue business' operational efficiency.

Fibre costs can represent 40-60% of jumbo roll tissue manufacturing costs, which makes tissue company EBITDAs highly sensitive to fluctuation in fibre costs, whether recycled fibre or market pulp. Based on AFRY estimates, only about one quarter of retail tissue products in North America are made with integrated pulp. Backward integration of tissue manufacturing has been a growing trend globally, whether through forward integrating market pulp operations and co-locating tissue assets at, or adjacent, to partner companies' pulp mills.

Performance during and beyond Covid

During the pandemic, the tissue industry regained its recognition as an essential industry and returned to higher profitability driven by the spike in demand and depreciation in fibre costs.

Focus on the premium product quality branded tissue market segment seems to still be the driver for highest margins, due to its continued ability to command a premium price. Yet, tissue companies have turned into asset footprint rationalisation and restructuring programmes to improve EBITDA performance from the cost side.

The large At-Home, brand-oriented tissue companies still have a clear margin advantage to their smaller, private label-oriented competitors. The growth of medium-size companies will also challenge the incumbents with their modern manufacturing assets and focus on the continuously expanding private label market.

NORTH AMERICA TISSUE CAPACITY VS TECHNICAL AGE BY COMPANY

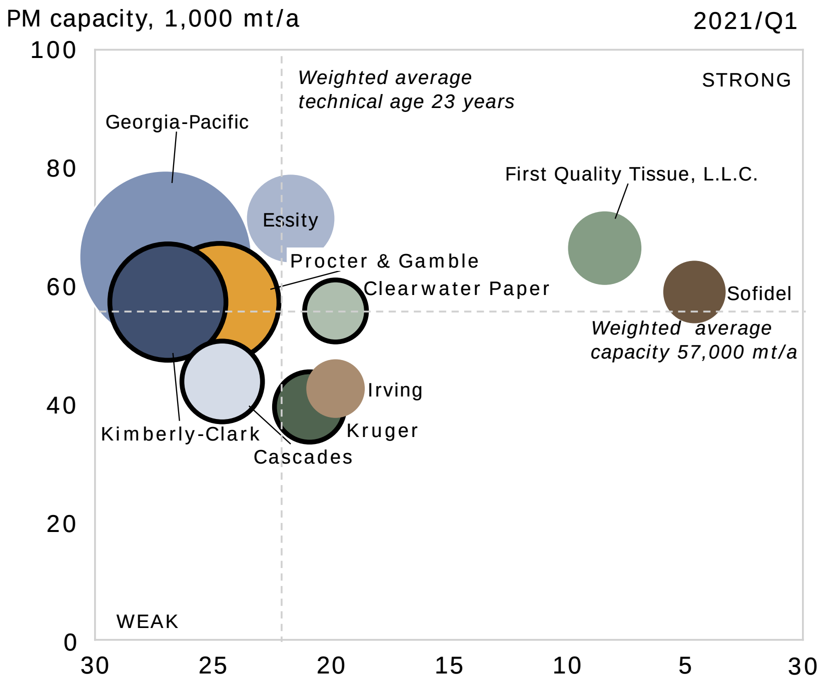

Figure 4: *North American tissue asset quality graph*

**bubble size reflects the allocated grade capacity*

AS CHINA'S CONSUMER-DRIVEN ECONOMY TAKES ROOT AND EXPANDS, DOMESTIC TISSUE CONSUMPTION COULD EASILY DOUBLE – EVEN AT THE SAME POPULATION LEVEL

As the world tissue leader continues its rapid growth stage, sectors in which it lagged behind are also being swept away as old, slow and narrow machines and replaced with world-class technology, and inefficient, polluting mills are closed.

China is papermaking's birthplace and possibly the first to use hygienic paper frequently and consistently.

Papermaking then kickstarted a whole new age in Europe before spreading to North America with the Fourdrinier continuous paper machine's invention.

The development of tissue-making technology started in North America over 100 years ago in order to create a new class of consumer hygienic paper use that eventually spread to developed countries worldwide.

However, China's rapid economic development has now returned to become the centre of global papermaking. In less than 15 years, tissue production and consumption grew swiftly to make the country the new centre of the tissue business. Figure 1 shows the current top ten tissue producing countries with their relative production rates. As we can see, China has more than double the production rate of the United States, the next largest producer.

Because of this rapid growth, the installation of new tissue machines each year was required, as shown in Figure 2. This recent growth period from 2007 to projected 2022 saw China driving most new global tissue machine installations (about 65 to 95%) each year. This has been a boom to both the European tissue machine builders and the development of home-based tissue production machine builders in China. This addition rate slowed in 2015 as we see some machines were taken out as replacements came in. 2018 and 2019 saw more machine reductions as older mills with high pollution effects were removed.

The trend also shows that commercial tissue or AfH tissue production capacity began to grow. In 2021, we will see the pace of new machines increase and the 2022 rate shown is expected to be revised upward. Fisher International's China Insights February report projects that around three million tonnes of new tissue capacity will be released in 2021.

China's tissue machines have not employed advanced technology to produce textured or structured tissue except for anecdotal evidence of home-grown TAD experimentation. This has changed as Hengan International Group announced two Toscotec TADVISION TAD tissue machines in 2022 at its Shandong and Hunan mills.

Bruce Janda
Senior consultant, Fisher International

CHINA'S RAPID ECONOMIC DEVELOPMENT HAS NOW RETURNED TO BECOME THE CENTRE OF GLOBAL PAPERMAKING. IN LESS THAN 15 YEARS, TISSUE PRODUCTION AND CONSUMPTION GREW SWIFTLY TO MAKE THE COUNTRY THE NEW CENTRE OF THE TISSUE BUSINESS.

Figure 1

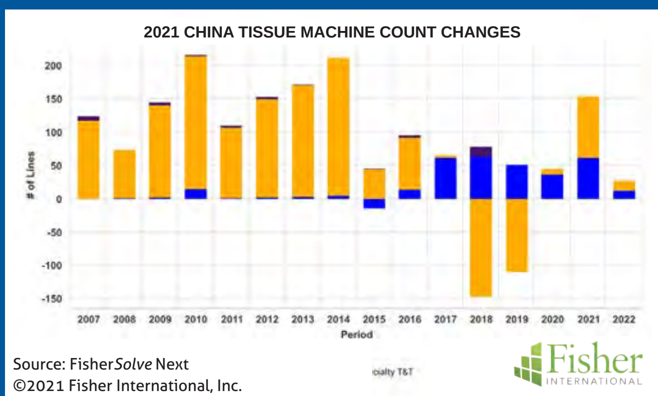

Figure 2

This technology is "designed to ensure superior bulk, softness, and absorbency". Hengan's announcement claims to "break through the barrier of conventional and textured tissue in the Chinese market, aiming to manufacture top quality structured tissue with the highest bulk, softness and absorbency properties" — which is not as surprising as it may first appear. Consumer kitchen roll towels are becoming more popular with consumers in the big coastal cities. Since China must import pulp, this technology will help with the efficiency in producing the most absorbency of water from a gram of pulp.

This rapid growth in tissue capacity has resulted in a very fragmented market. Figure 3 shows the current hyper fragmented share of production by the numerous Chinese tissue companies and suggests that market consolidation can be expected in the intermediate-term after the current growth phase.

China can build this colossal tissue manufacturing business due to its large population and low tissue consumption base per capita. Its population is forecasted to reach 1,397,897,720 by July 2021 according to the World Factbook. Tissue consumption per capita was estimated

CHINA CAN BUILD THIS COLOSSAL TISSUE MANUFACTURING BUSINESS DUE TO ITS LARGE POPULATION AND LOW TISSUE CONSUMPTION BASE PER CAPITA. ITS POPULATION IS FORECASTED TO REACH 1,397,897,720 BY JULY 2021 ACCORDING TO THE WORLD FACTBOOK.

at 6.9kg per year in 2019, however, the country's consumer culture is in different stages of development in other areas. The Southeast coastal areas tend to lead, and the Northeast follows with the Western regions lagging. The overall consumption rate is about one-third to one-half the South Korea and Japan rate and one-quarter the United States, making it easy to expect that China's tissue consumption and production could double in the next decade.

Figure 4 shows the population and per capita disposable income growth from 2007 to 2020. The population scale on the left (blue) is small and conceals the slowing growth rate, as China is forecasted to see only a 0.26% growth rate in 2021. This is about one-third of the population growth rate for the United States, which is expected to see a 0.7% growth rate. The bars in Figure 4 represent continued growth in consumer income to support the transition to a consumer-driven economy with increased tissue consumption. China's economy weathered the Covid-19 pandemic much better than most other countries and resumed growth quickly in a "V-shaped" recovery, making it the only major economy with growth in 2020 at 2.3% (and it's expected to exceed 6% in 2021).

The country's labour force unemployment rate and inflation are shown in Figure 5. Unemployment has come down to about 3.6%, while inflation was rising at about 2.8% in 2019. These positive trends also support the continued growth in tissue consumption.

China's economy experienced the immediate impact of the Covid-19 pandemic first. Figure 6 shows the average number of cases per month as well as the cumulative total. The average infected rate was back in control by April 2020.

China became a global source of

CHINA TISSUE COMPANIES

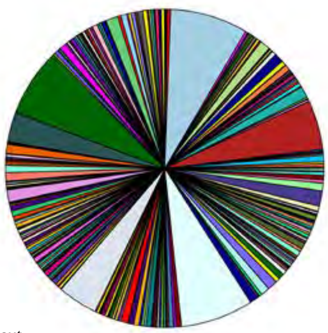

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Figure 3

CHINA TISSUE GDP/CAPITA AND POPULATION

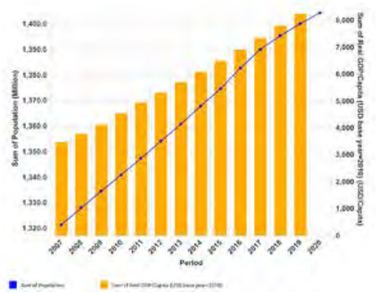

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Figure 4

CHINA TISSUE PRODUCER CPI AND UNEMPLOYMENT

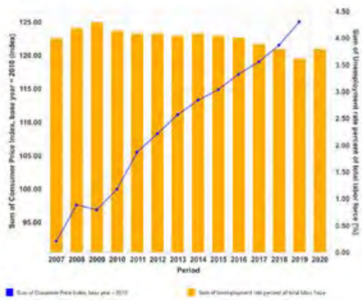

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Figure 5

CHINA TISSUE ACTIVE COVID-19/CAPITA AND TOTAL COVID-19/CAPITA

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Figure 6

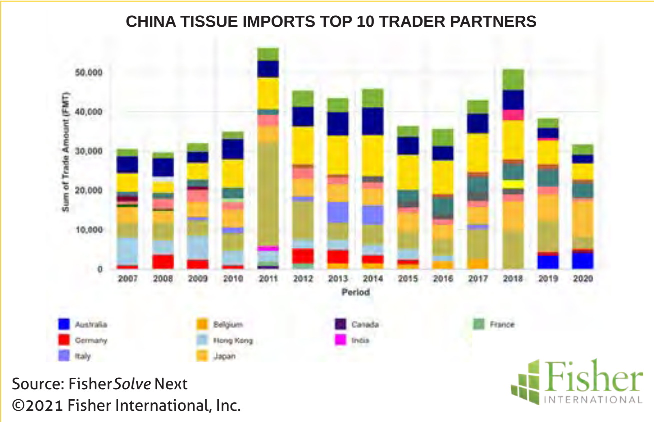

Figure 7

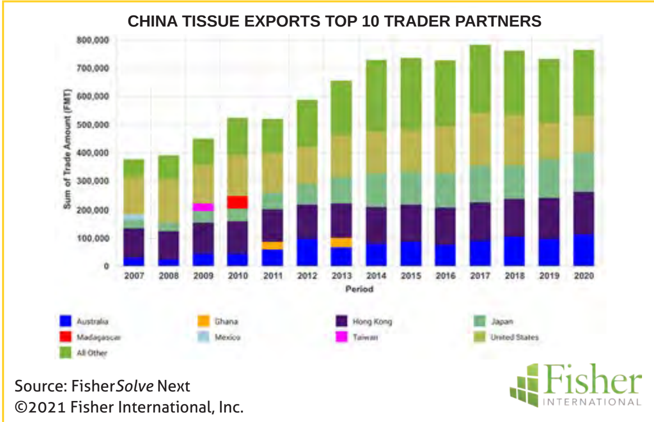

Figure 8

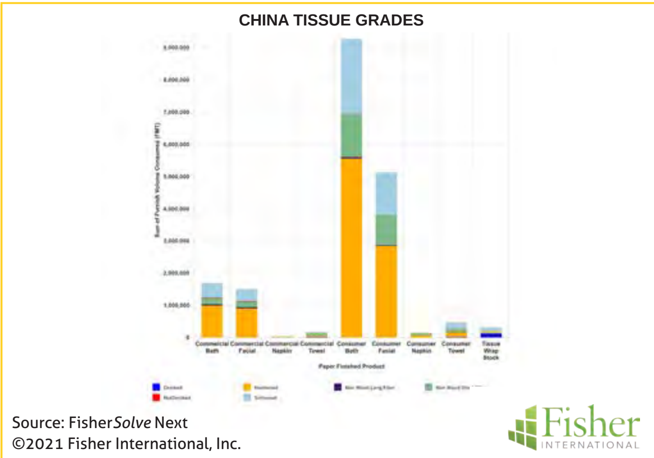

Figure 9

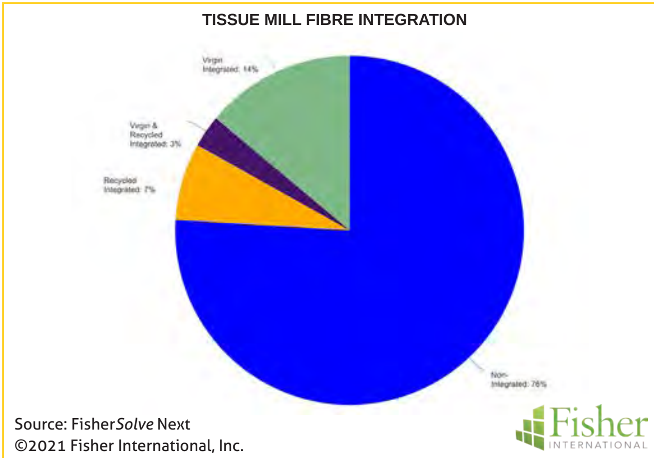

Figure 10

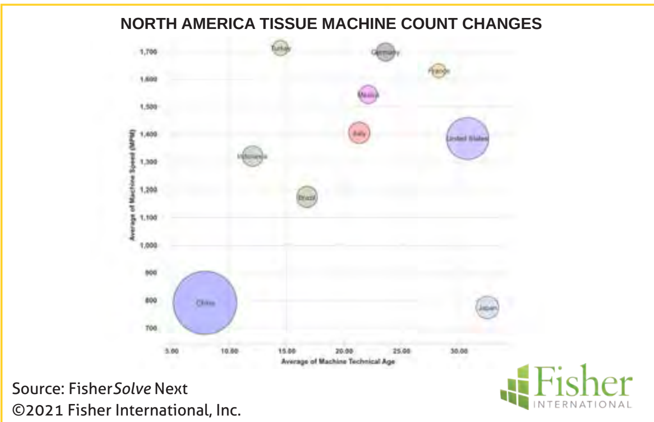

Figure 11

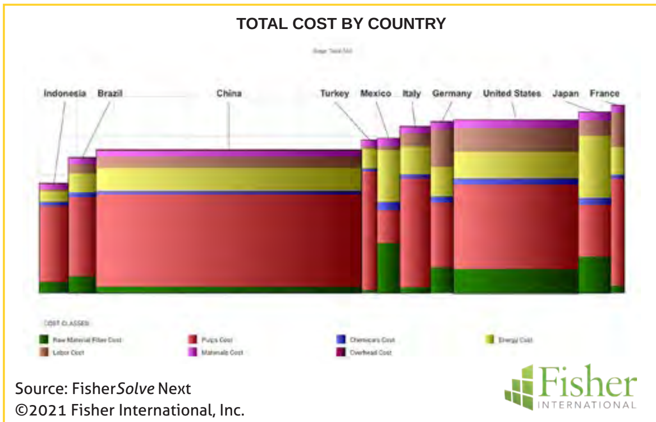

Figure 12

manufactured goods over the past few decades, despite the relatively small volume of tissue exports they've been experiencing. Tissue is challenging to ship as both finished products and parent rolls tend to place disproportionate space to their weight. China's tissue imports are a relatively small fraction of total domestic tissue production (less than 1%), and tissue import volumes are trending downward. Tissue imports and trade partners are shown in Figure 7, and these top ten partners will be used as a comparison set for its tissue assets quality.

Tissue exports in China have grown and then levelled out during the study period, with Hong Kong, Taiwan, Japan, and the United States as the major trade partners. This trade is still a small percentage of production at less than 5%, and its tissue business is focused on domestic consumption.

TISSUE IS CHALLENGING TO SHIP AS BOTH FINISHED PRODUCTS AND PARENT ROLLS TEND TO PLACE DISPROPORTIONATE SPACE TO THEIR WEIGHT. CHINA'S TISSUE IMPORTS ARE A RELATIVELY SMALL FRACTION OF TOTAL DOMESTIC TISSUE PRODUCTION (LESS THAN 1%), AND TISSUE IMPORT VOLUMES ARE TRENDING DOWNWARD.

Figure 8 presents a close view of the production of tissue finished product types and the furnish used for each. Consumer

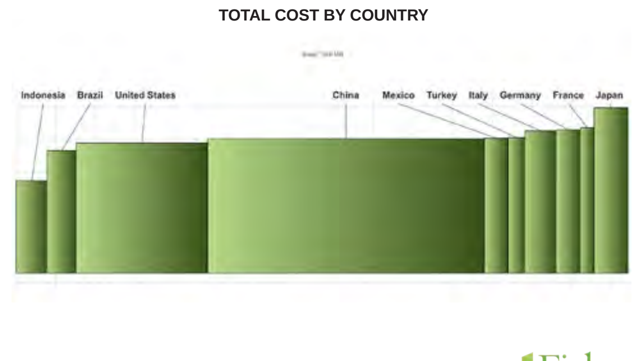

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Figure 13

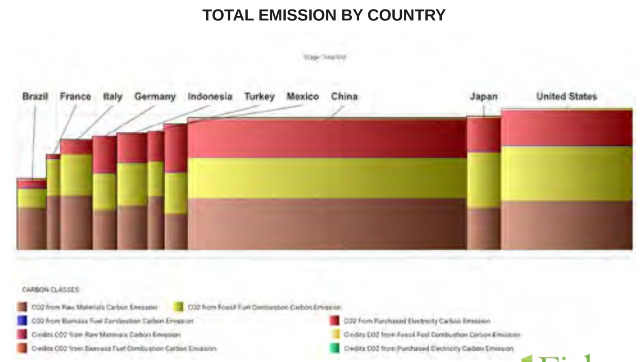

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Figure 14

bath tissue and facial tissue are the leading product formats. Consumer towel is small overall but reported to be larger in urban areas, and commercial bath and towel are starting to grow.

China's tissue furnish may seem strange to North American and European readers, as most of the pulp used in tissue manufacturing is imported hardwood and softwood pulp. Non-wood short and long fibre is also present from local sources such as straw and bamboo. Recovered paper or recycled fibre as deinked or not deinked represents a minimal contribution in the industrial-grade tissue wrap stock. This is very different from the commercial grades produced in North America with about 80% being recovered fibre and seen as green or saving trees. Recovered fibre is also seen as beneficial for the environment in Western Europe, but China's regulations and customs see potential recycled fibre in producing tissue as a risk to human health and safety.

More than three-quarters of tissue mills are not integrated and instead buy pulp, as shown in Figure 9. Virgin integrated mills make up 14% of the total and most of these are hardwood-based with some straw and bamboo pulping. However, some of these other pulp mills are very small and old with renewed investment in this sector.

China has the most tissue production as well as the newest fleet of tissue machines. Figure 10 shows the relative tissue machine quality against the top ten countries importing Chinese tissue. The size of the bubble represents the relative production capacity of each country. The X-axis represents the average tissue machine technical age or how well it matches current standards. The Y-axis is the average machine speed used in production. These show that the average China tissue machine is very new but running very slowly compared to Turkey, Mexico, or Western European nations. The much older United States fleet is also much faster and Japan appears far behind.

This analysis could also be run against machine trim width to show that China's tissue machine fleet is also producing the lowest width parent rolls. Average tissue widths and speeds are expected to evolve quickly as the newer world-class machines replace some of the old, slow and narrow existing machines, which could also be a factor in the consolidation of tissue mill ownership. Chinese environmental regulations could also accelerate this as we've seen other paper grades consolidate as inefficient, polluting mills are closed.

Figure 12 shows a benchmark of the average cash cost of manufacturing for China versus the comparison set. Labour costs are low, similar to Brazil and Indonesia, while energy costs are moderate. The United States shows a higher average cost per tonne driven by increased drying of high crepe adhesive additions and non-pressed advanced technology used for the large share of ultra-premium products.

Figure 13 restates this cost in terms of average cash cost per case to reflect the lower grammage of advanced technology products at better performance levels. This adjustment shows the United States' tissue fleet at a lower average cost than China. It is not surprising to see that China will install two new TAD machines next year since fibre is an imported cost for their higher quality consumer tissue production.

Carbon Emissions from the production of tissue will be an increasingly significant factor in operating permits, the investment required, and ongoing cash costs. Figure 14 shows the cradle-to-gate carbon (CO2) equivalent tons emitted for China and the comparison set in producing a tissue ton in parent roll format. The United States and Japan have higher carbon intensities than China, Brazil has the newest pulp technology that supports carbon-neutral pulp production and France enjoys nuclear power generation. Each region can be expected to impose different types of restrictions or taxes on carbon emissions that could shift the associated cash cost curve in Figure 12.

China's tissue business continues in a rapid growth stage with larger and more technically advanced machines on the way. The smaller sizes and slower speeds of most of China's tissue fleet motivates quicker replacements as regulations change and tissue producers consolidate.

Most of this capacity is focused on domestic consumption that could easily double at the same population as a consumer-driven economy takes root. This will require importing the consumer habits for tissue use as seen in South Korea or Japan. Still, this change appears to be underway, supported by an expanding economy and consumer per capita income, and commercial tissue seems to be a growing segment as well.

An analysis of competitive positions requires specifics on tissue producers and individual machines. This article presents a static summary of China's tissue industry today. Fibre prices, exchange rates, and environmental regulations will change, providing some participants with advantages and others with new challenges. Tissue mills will continue to change hands and consolidate, and neighbouring countries may invest in tissue-making capacity, affecting China's imports and exports. Chinese consumer tissue consumption trends are still evolving, so stay tuned for rapid changes.

COVID HAS ACCELERATED THE ALREADY RAPIDLY CHANGING SHOPPING LANDSCAPE IN CHINA

As economic recovery is well underway, major tissue companies are increasing investment in digital spaces as almost half of consumers now buy by ecommerce. By Leo Chen, Euromonitor International, Shanghai.

Similarly to many other markets operating under the Covid-driven conditions, home seclusion policies in China led to the uptake in At-Home demand for consumer tissue in 2020. Paper towels in particular recorded a surge in sales at 29% in volume terms, or more than double the growth from the previous year. At the same time, sales of AfH tissue products declined following a slump in business activities, manufacturing, public activities, entertainment and travel.

In the changing consumer and business environment of the 2020, leading tissue players such as Hengan Fujian, Vinda International, and C&S Paper have been gaining share of consumer tissue sales on the strengths of brand awareness, wider channel exposure, products selection, and innovation.

The three leaders invested in e-commerce development well before the pandemic, integrating e-commerce giants into their retail strategies as well as building presence on popular social media platforms like WeChat. Euromonitor International Digital Consumer survey fielded in April of 2020 revealed that 37% of consumers in China use WeChat to engage with the company or brand about products and services, 44% turn to WeChat to look for information about company/brand or product and services, and 39% of consumers buy products and services via WeChat platform.

Broader understanding of the evolving retail landscape and investment in digital spaces positioned the key tissue companies well in the rapidly changing Covid-driven shopping landscape. Euromonitor International Digital Consumer survey indicated that while 55% of consumers in China still purchased household essentials in stores in 2020, 31% of respondents bought their products via e-commerce platforms using mobile phones, 36% used computer for online purchases, and 22% of consumers used a tablet.

In 2020, retail sales of tissue products via e-commerce accounted for 17% value share of retail tissue sales in China, representing a significant uptake from 2019. In addition to well-established e-commerce platforms like Tmalland JD and popular social media, orders on smartphones via meal delivery apps such asMeituanand Eleme and fresh food delivery apps such as Hema and Miss Fresh also witnessed robust growth, attesting to the ever-changing and evolving ways consumers in China have been shopping for their household needs.

Complementing agility in retail

By Leo Chen
Research Analyst,
Euromonitor International

IN THE CHANGING CONSUMER AND BUSINESS ENVIRONMENT OF THE 2020, LEADING TISSUE PLAYERS SUCH AS HENGAN FUJIAN, VINDA INTERNATIONAL, AND C&S PAPER HAVE BEEN GAINING SHARE OF CONSUMER TISSUE SALES ON THE STRENGTHS OF BRAND AWARENESS, WIDER CHANNEL EXPOSURE, PRODUCTS SELECTION, AND INNOVATION.

Table 1: China, use of WeChat social media platform, 2020

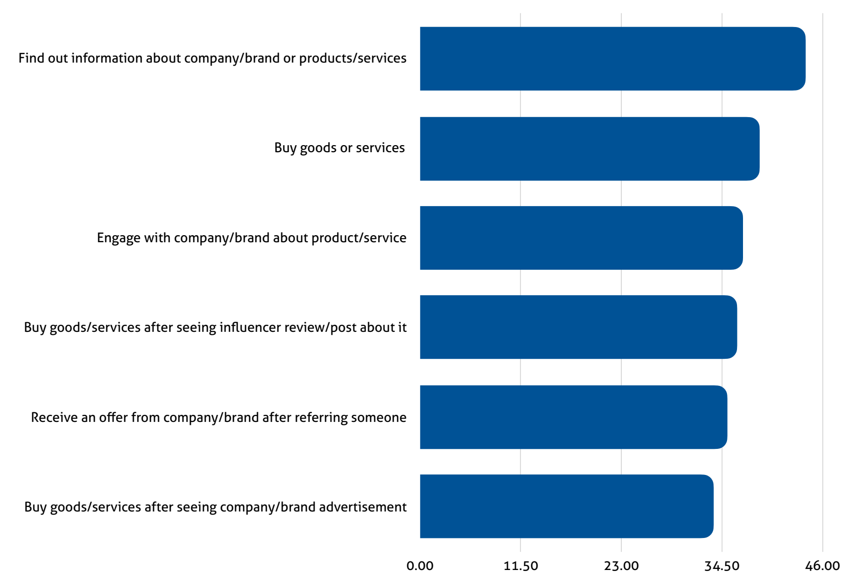


Table 1 *Source: Euromonitor International Digital Consumer Survey, 2020*

Table 2: China vs North America and Western Europe, retail tissue per capita, kg per capita, 2020/2025

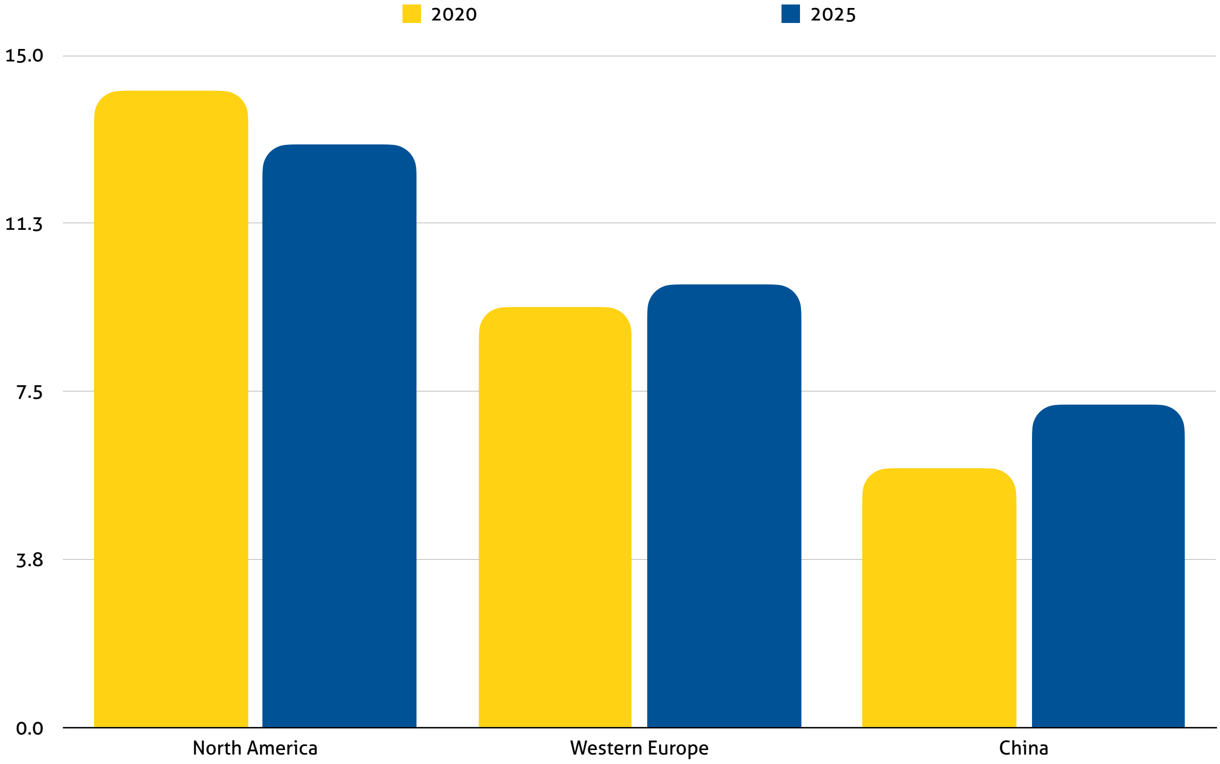


Table 2

Source: Euromonitor International

distribution strategies, continuous focus on innovation played a role in the strength of the key category players in the country in 2020. Example can be found in C&S and its focus on high quality premium tissue, with upgrades to lines like Clean & Soft Face Water-Tolerant series to tap into consumer pursuit of quality products to meet heightened hygiene needs.

Looking ahead, consumer tissue demand in retail will normalise somewhat in 2021. However, while developed markets are expected to return to generally sluggish growth in the post-Covid world, in China retail sales will remain positive in both volume and value terms with projected CAGR of 5% in volume terms over 2020-2025, or two million tonnes in incremental retail sales by 2025. With per capita consumption of retail consumer tissue in China still well below that of developed regions, the market continues to present significant opportunities for long term growth.

Paper towels will continue to benefit fromincreasing number of players expanding in the category. SichuanHuanlong'snew material is a case in point with the launch of unbleached bamboo paper towels under the brandBabo, followed by expanding distribution across key retailers in stores and online. Innovation certainly adds to the current and future category dynamic. Fuelled by Covid-19, consumer awareness of paper towels is expected to grow, with households turning to the products for a variety of household needs - from cleaning kitchen surfaces to cleaning fresh food and draining grease from fried food.

LOOKING AHEAD, CONSUMER TISSUE DEMAND IN RETAIL WILL NORMALISE SOMEWHAT IN 2021. HOWEVER, WHILE DEVELOPED MARKETS ARE EXPECTED TO RETURN TO GENERALLY SLUGGISH GROWTH IN THE POST-COVID WORLD, IN CHINA RETAIL SALES WILL REMAIN POSITIVE IN BOTH VOLUME AND VALUE TERMS WITH PROJECTED CAGR OF 5%.

On the whole, properties related to hygiene and broader wellness, such as non-bleached, food-grade and broader sustainability like the use of fast-renewable fibre sources, as well as high quality attributes such as improved strength and water resistance will likely gain more popularity among China's households.

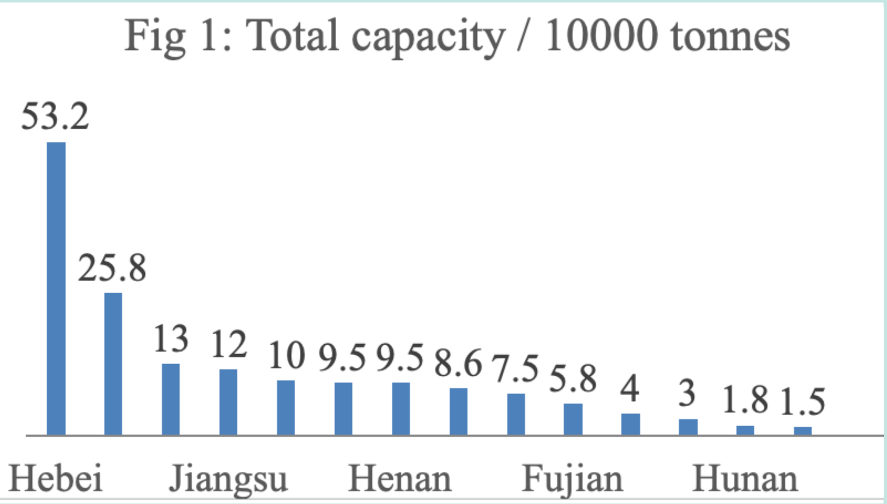
Retail consumer tissue aside, demand for AfH products is expected to gain further strengths as China's economy and business activities recover. In fact, China's economic activity signalled the recovery of economic activity to above pre-pandemic levels in Q2 of 2020, along with recovery of employment trends and other indicators.

These come with improved levels of consumer confidence and spending, along with re-opening of foodservice and other AfH activities. These tendencies contributed to the recovery of some demand in away-from-home segment already in 2020, far ahead of many other markets. Continuing strengths of recovery is expected to stimulate positive growth of away-from-tissue long-term.

20%
LIKELY AFH DECLINE IN VOLUME AND VALUE IN 2020

INTENSE MARKET COMPETITION SEES CHINA'S TISSUE INDUSTRY SETTING RECORD PERFORMANCE LEVELS

A November 2020 report by China National Household Paper Industry (CNHPIA) Association looks at margins, soft and hardwood pulp and parent roll prices, investment, capacity, import and export and e-commerce business levels across China's tissue companies.



In 2020, China's tissue paper industry was mainly influenced by four factors: the Covid-19 pandemic, investment, pulp prices and overcapacity.

In the first quarter, production and logistics of industrial manufacturers were affected and the total production and sales volume decreased year-on-year. However, investment was still high throughout the year and new capacity launched by the end of November exceeded the whole level of 2019.

Overcapacity continues to be ever-present across the Chinese tissue industry, with the intense market competition meaning that projects are delayed and the average product price of the whole industry is still low. Figure 1 shows the distribution of new capacity in all provinces: by the end of November 2020, new capacity reached about 1.65 million tonnes, exceeding the total of 2019.

The new capacity includes 60 companies in 14 provinces. Some 84 tissue machines were put into operation in total, including domestic tissue machines launched by SME companies and four imported tissue machines. The new capacity is mainly located in Hebei and Guangxi.

The top four companies including Hengan, Vinda, Gold Hongye and C&S didn't launch any new capacity.

At present, only three listed companies take tissue paper as their main business. The performance of the three companies greatly increased this year, mainly because of low pulp prices and continual optimisation of product structure. This is from data from the first half year or the first three quarters of 2020.

Vinda: In the first three quarters of 2020, the company achieved total revenue of 11.464bn Hong Kong Dollar. Its total net profit reached 1.8bn Hong Kong Dollar and its gross margin increased by 8.8% points, reaching 38%.

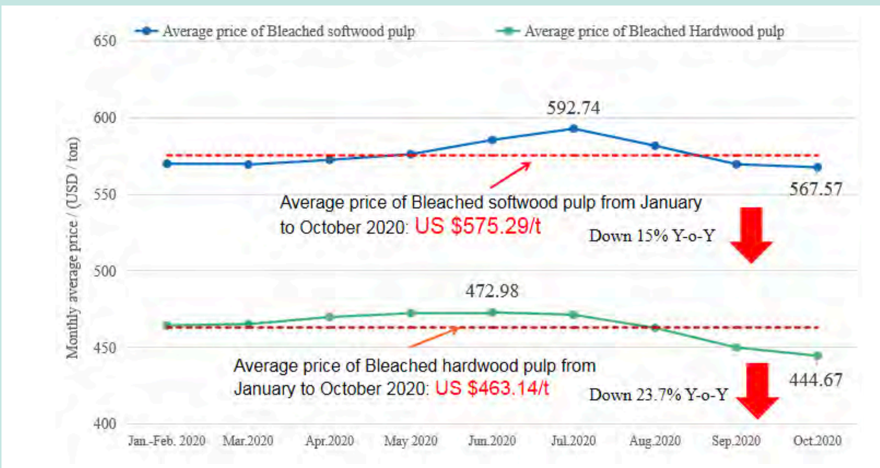
C&S: In the first half of 2020, its net profit in tissue paper business rose by 65%, reaching four hundred and fifty-three million yuan. It expects that net profit belonging to the shareholders of listed companies in the first three quarters of 2020 was about six hundred and fifty-seven million to seven hundred and forty-four million yuan, up 50% to 70% over the previous year.

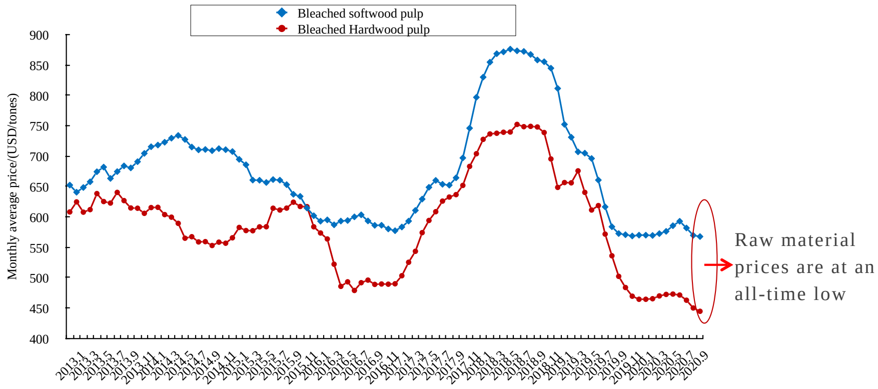
Price of raw materials and products

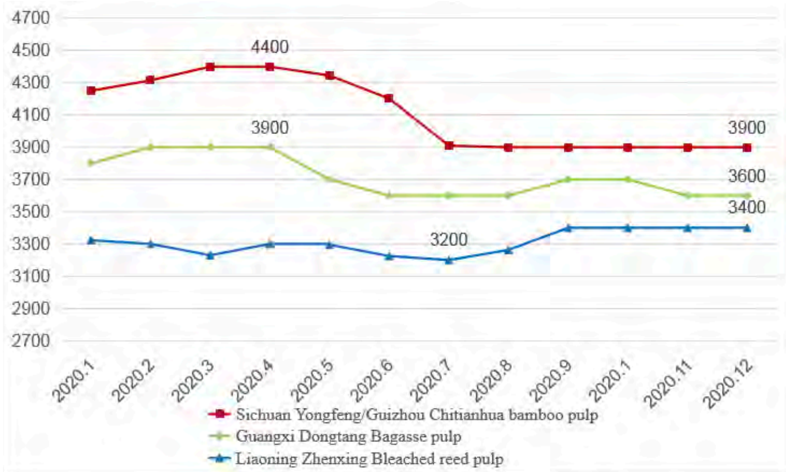
The price of imported market pulp remained low throughout the year. This figure is based on the customs' pulp import data. From January to October 2020, the average price of China's imported hardwood pulp and softwood pulp fell by 23.7% and nearly 15% year-over-year.

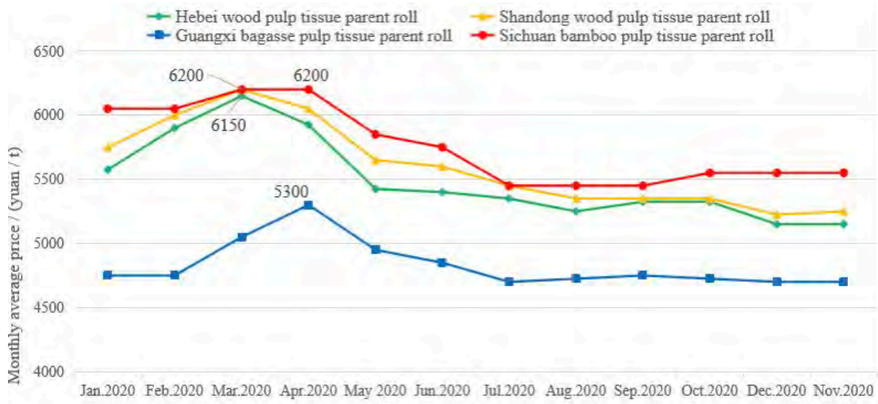
This figure shows the monthly average price of imported pulp in China from 2013 to 2020. We can see that the average prices of softwood pulp and hardwood pulp from January to October 2020 were the lowest in seven years.

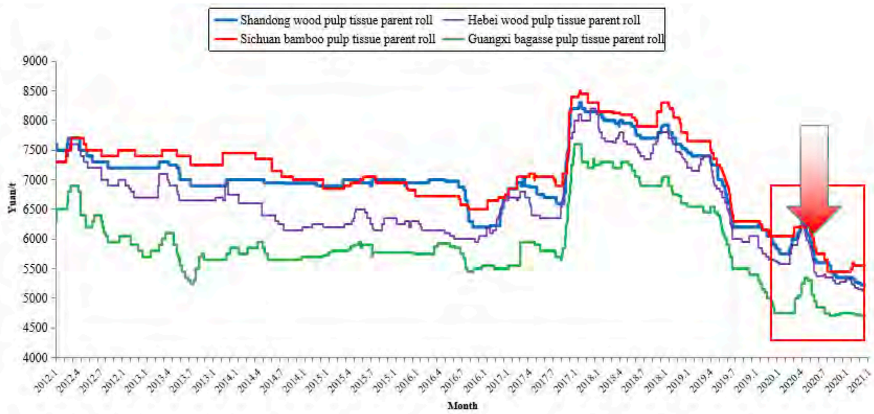
Low prices of wood pulp will benefit tissue paper companies, reduce production costs and increase the gross margin of products. The price of wood pulp sharply fell, greatly affecting the manufacturers using non-wood pulp such as bamboo











pulp and bagasse pulp, and increasing the material cost of companies. The profit of bamboo paper companies in Sichuan and bagasse paper companies in Guangxi was lowered.

This figure shows the monthly average price of non-wood pulp in 2020. We can see the low price of non-wood pulp this year.

This figure shows the monthly average ex-factory price of tissue parent roll in 2020 according to the statistics of Sublime China Information. In 2020, the price of tissue paper started to rise in February, but fell from mid-April until now. Let's take December as an example:

In Hebei and Shandong, the average ex-factory prices of tissue parent roll with wood pulp as raw material decreased by 8.8% and 11.8%.

In Sichuan and Guangxi, the average ex-factory prices of tissue parent roll with bamboo pulp and bagasse pulp as raw material decreased by 8.3% and 4.1%. We can see the low price of tissue this year from historicaldata.

This figure shows the average ex-factory price of domestic tissue parent roll from 2012 to 2020. It shows that the price of tissue parent roll in the second half of 2020 was the lowest in eight years.

Product upgrade and innovate

In 2020, product innovation is mainly about lotion tissue, flushable toilet tissue, embossed tissue and unbleached tissue continuously upgraded. Antimicrobial and sterilising lotion tissue and more novel embossed tissue were introduced to make products more soft and comfortable and absorb oil and water well. More companies were involved in the production of these products.

New equipment and technology

Foreign new technology of tissue machine includes: NTT, QRT and other technology of Valmet and TEX technology of Andritz strengthened their presence in the Chinese market.

The use of new technologies will promote the quality upgrade of high-end tissue paper products in the Chinese market. From the domestic suppliers of tissue machines, this includes:

- Baotuo built an intelligent manufacturing cloud serviceplatform;
- Qingliang has introduced remote intelligent management system;
- Dazheng and Weituo are promoting

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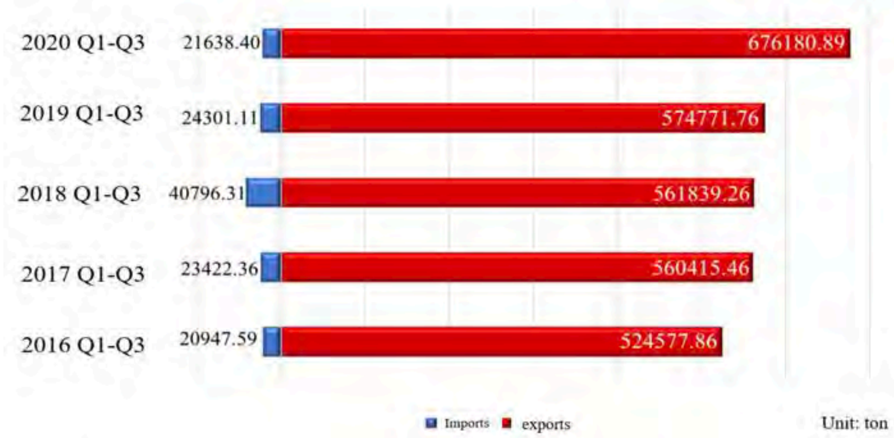
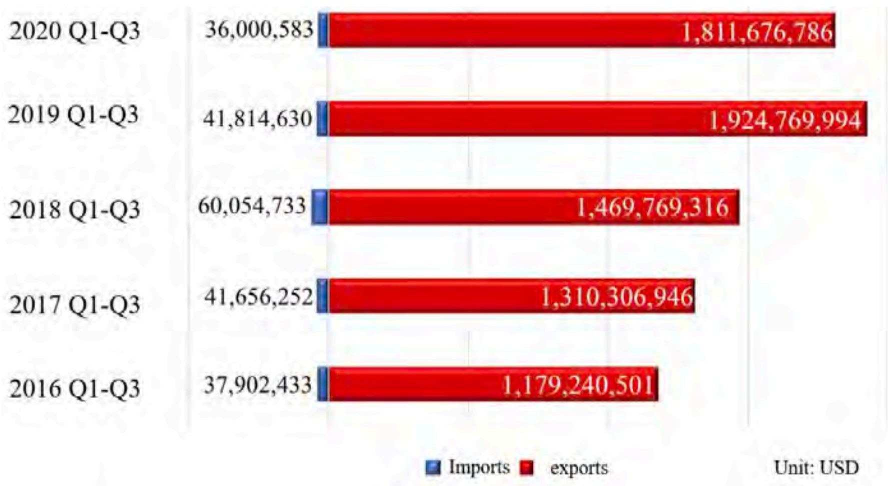




energy-saving tissue machines;

- Xinhe introduced the wide width tissue machine and hand towel machine;
- TAD tissue machines developed by Bingzhi is now being marketed.

New technology of processing equipment includes:

- Baosuo introduced the high-speed ultra-wide slitter in China, automatic plastic-pack tissue production line compatible with "glue-free lamination" and "four-sides positioning embossing" technology, and rewinding production line of toilet rolls;
- OK introduced the wide width plastic-pack facial tissue automatic folding machine;
- Fabio Perini – now Körber Tissue - brought the tissue paper processing line adopting Aqua-Bonding embossing technology to the Chinese market.

Further combination of equipment companies

Valmet acquired PMP Group in 2020. This acquisition will cover more customers, improve the centralisation of global toilet tissue equipment suppliers and benefit small and medium tissue paper companies in the Chinese market.

A.Celli announced its acquisition of PMT Company in 2020. This acquisition helps to strengthen A.Celli's competitiveness in the field of tissue machine.

Change of marketing channel

In order to reduce the risk of virus infection caused by offline shopping during the pandemic, consumers shifted towards online shopping, the advantages of e-commerce were enhanced, and the shares of e-commerce channel grew rapidly.

In 2020, driven by the pandemic, marketing channel quickly transformed in domestic market, such as cooperation with e-commerce platforms, and live commerce. Affected by the pandemic, offline channels were blocked, and companies paid more attention to the promotion and expansion of online channels.

From the annual reports of listed companies, we can see that the e-commerce accounted for 33% of Vinda's revenue in the first half of 2020, up 7% points compared with the same period of 2019.

Hengan's revenue of e-commerce business exceeded 2bn yuan in the first half of 2020, accounting for 18% of total sales of the group.

Import and export market:

This figure is based on the customs' data. We can see the contrast of tissue paper import and export volume and value in China from 2016 to the first three quarters of 2020.

Import:

According to recent import data, China's tissue paper can completely satisfy the consumer demands of the Chinese market, so import volume is very low each year. Only twenty-one thousand six hundred tonnes were imported in the first three quarters of 2020, with lower proportion in total market consumption.

Export:

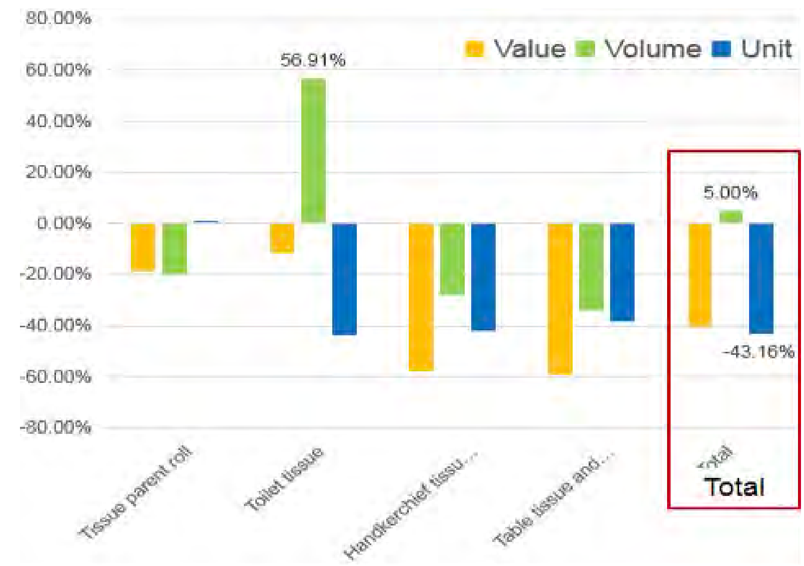
In spite of the pandemic, the export of tissue paper continued to grow in the first three quarters of 2020. The total export volume rose by 17.6%, reaching six hundred and seventy-six thousand two hundred tonnes. The export value declined by 5.88% on year-on-year basis, and the average price of exported products fell by nearly 20% on year-on-year basis, but was still higher than average price of domestic market.

The export took on the trend of quantity increase and price fall as a whole. The export volume and value of tissue parent roll maintained growth, with export volume up 50%, total export value up 33.3% and average export price up 12.6% on year-on-year basis. The average export price of other finished tissue paper fell sharply.

Exports of tissue paper to the USA increased. In the first three quarters of 2020, China's export volume to the USA was ninety-two thousand three hundred

IN SPITE OF THE PANDEMIC, THE EXPORT OF TISSUE PAPER CONTINUED TO GROW IN THE FIRST THREE QUARTERS OF 2020. THE TOTAL EXPORT VOLUME ROSE BY 17.6%, REACHING SIX HUNDRED AND SEVENTY-SIX THOUSAND TWO HUNDRED TONNES.

tonnes, up 5%, and average price fell by 43.16% on year-on-year basis. The fall in price is because the tissue paper exported to the USA is mainly toilet tissue, accounting for nearly 60% of total export volume. Moreover, the export volume of toilet tissue rose by 56.91% on year-on-year basis. The export volume of tissue parent roll and other products declined.



Tissue companies increased the production of anti-pandemic supplies

Some tissue paper production and equipment companies switching to the production of masks and mask machines during the pandemic. While supporting the fight against the pandemic and taking social responsibility, these companies have also achieved certain economic benefits.

Future projects:

By the end of November 2020, modern capacity announced to be launched by industrial companies in 2021 exceeded 3.8m tonnes.

This table lists the provinces, number of companies and tissue machines, and capacity in 2021, and these machines are mainly located in Jiangsu, Hebei and Guangxi. Some 163 tissue machines will be put into operation in total. Modern capacity to be launched in 2022 and after was nearly nine hundred thousand tonnes.

Major planned projects in 2021 to 2022 include:

Hengan will launch a total capacity of two hundred thousand tonnes.

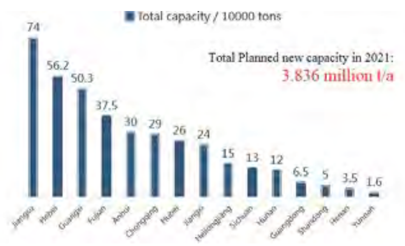
Gold Hongye plans to launch a total capacity of nine hundred thousand tonnes.

C&S plans to launch one hundred thousand tonnes of capacity in 2021. Lee & Man plans to launch a total capacity of one hundred and seventy thousand tonnes in 2021.

Taison plans to launch a total capacity of nine hundred and fifty thousand tonnes in 2021.

Sun Paper, Shaoneng Group, Jingxing Paper, Liansheng Paper, and so on, also plan to continue expanding capacity.

Seen from new capacity to be added, capacity growth will be higher than the increase of market consumption and market competition will be moreintense. But at the same time, in order to improve the market competitiveness of manufacturers, new technology for tissue paper production will be promoted and applied.



Project location	Total capacity / (10000 t / a)	Starting time
Jinjiang, Fujian	1.5	2021
Yunfu, Guangdong	12	2022
Weifang, Shandong	7	2022 and beyond
Total	20.5	

Project location	Total capacity / (10000 t / a)	Starting time
Xiaogan, Hubei	12	Early 2021
Rudong, Jiangsu	78	End of 2020 to 2021
Total	90	

Project location	Total capacity / (10000 t / a)	Starting time
Chongqing	12	May 2021
Jiangxi Jiujiang	5	August 2021
Total	17	

Project location	Capacity/ (10,000 t/a)
Suzhou, Anhui	25
Chongqing	17
Jiujiang, Jiangxi	19
Leshan , Sichuan	10
Nanping , Fujian	24
total	95

Company name	Project location	Capacity/ (10,000 t/a)	Starting time
Sun Paper	Beihai, Guangxi	12	2021
Shaoneng Group	Leiyang, Hunan	32	2021—2022
Jingxing Paper	Weifang, Shandong	12	2022
Liansheng Paper	Zhangzhou, Fujian	12	End of 2021

AFH IS MAKING A STRONG COMEBACK IN CHINA AND ACROSS ASIA

People want to return to their traditional lifestyles . . . vacations, going to restaurants, theatres, bars, or just simply getting out, and a resurgence in commercial tissue shows it's happening. Senior Editor Helen Morris interviewed Zhang Ge, Chief Executive of APP China's Gold Hongye Paper Group Co.

It's fair to say that Asia Pulp & Paper (APP), as with other leading tissue companies operating in Asian and particularly in China, is viewing the Covid pandemic from a more advanced stage of recovery that many other nations.

Perhaps the most reassuring proof of that is the performance of AfH products, much the industry's most serious product casualty during the pandemic year 2020.

For Zhang Ge, Chief Executive of APP China's Gold Hongye Paper Group Co., this is doubly good news.

A greater emphasis on organic rather than acquisitional growth has now put parent company APP in third place globally, trailing Kimberly-Clark in terms of total capacity, and Essity, which takes the number one position as the world's leading tissue supplier. APP China - APP's China-based headquarters - would also belong in the world's top 10 tissue suppliers as a stand-alone independent company.

Organic growth is favoured by the recovery seeing an increase in the previously deflated AfH business - with levels slowly returning to normal - but a significant new cultural change is seeing new revenue streams emerging ... the expansion of product lines such as disinfection tissue as the essential need for hygiene awareness takes on greater importance in the minds of the public.

"Where we see a change is in consumer behaviour and ultimately product development," Ms. Zhang says from APP China's 570 hectares plant in Rudong city, in the Jiangsu province on the Yellow Sea coast north of Shanghai.

"Consumers are paying much more attention to personal health and sanitary issues, which greatly supported the market demands on disinfection tissues, wet tissue products, etc.

"People want to return to their traditional lifestyle, including vacations, going to restaurants, theatres, bars or just simply getting out. This 'return to normal' will most definitely see a resurgence of the AfH marketplace. We are already seeing this taking place today, with our AfH sales volume increasing quarter by quarter from last year.

"Most recently, we have seen a rise within the on-line distribution marketplace, allowing us to grow and expand our direct-to-consumer business model."

That significant change in the retail commercial model has surged across much of the rest of the pandemic world, but it appears to be more so here, and again showing space for substantial growth.

Just over half of the population, a huge number of people but a lower percentage than other Asian nations, are internet users. But Covid has accelerated the already rapidly changing shopping landscape.

Major tissue companies are increasing investment in digital spaces as almost half of consumers now buy by e-commerce. WeChat is the Chinese multi-purpose messaging, social media and mobile payment app developed by Tencent. First released in 2011, it became the world's largest standalone mobile app in 2018, with over one billion monthly active users engaging with a company or brand about products.

So flexibility in market response and production will remain of the highest importance. APP China focuses on three key business sectors comprised of Paper, Packaging & Tissue. Its tissue business supports the retail and AfH market sectors with a full line of branded and white label products including facial, bathroom and kitchen towels.

Currently, APP China operates 14 tissue mills across the country and produces approximately 0.62 million tonnes annually", the annual production in 2020 was 1.77 million tonnes. Gold Hongye (Nantong) Co. is its latest investment, becoming operational in 2021, and produces high-grade tissue. TAD products, not to date a significant presence in China, are a new emerging trend. Infrastructure to capitalise on the technology is in planning.

Ms. Zhang adds that APP China's focus "has always been quality tissue products across all sectors regardless of AfH, retail, or private label, already an established business model in China.

"As a fully integrated pulp, paper and tissue manufacturer, we can adjust our markets and adapt to any conditions, allowing us to shift production to other high-value sectors during these times such as retail space.

"We definitely have seen an increased demand for high-quality tissue products. We believe this is being driven by economic growth across the country and the rise of personal hygiene and health awareness. Currently, major cities have the largest demand for these products such as Beijing, Shanghai, Guangzhou, and Shenzhen. However, it is the surrounding areas that have the most growth potential."

China is now the world's largest tissue using nation, having overtaken the US. With a population forecasted to reach 1,397,897,720 by July 2021, what opportunities does that present for APP?

"Of course, based on population alone, China remains one of our primary markets. However, tissue consumption levels within China remain far lower than other countries. We believe that as the economy grows,

A GREATER EMPHASIS ON ORGANIC RATHER THAN ACQUISITIONAL GROWTH HAS NOW PUT PARENT COMPANY APP IN THIRD PLACE GLOBALLY, TRAILING KIMBERLEY-CLARK IN TERMS OF TOTAL CAPACITY, AND ESSITY, WHICH TAKES THE NUMBER ONE POSITION AS THE WORLD'S LEADING TISSUE SUPPLIER.

consumption levels will ultimately increase, presenting new opportunities for our business." Key growth areas she sees are in the more developed eastern regions of China.

We close with an assessment of wider issues ... ongoing overcapacity with China, the Belt & Road initiative, and environmentally-friendly production.

It is estimated that three million tonnes of new tissue capacity will be released in 2021. Is there overcapacity in the Chinese tissue market, and if so, what are the opportunities here?

"In general, we see more opportunities than potential threats within the China tissue sector. While overcapacity in the China tissue market is not a new topic, as market demands grow, this gap will shrink and eventually balance."

On Belt & Road: "All programmes are still in a preliminary stage of development, we believe this is an exciting opportunity to expand and grow our business. APP China is currently working with local government authorities to explore these opportunities and further develop our overseas business along the one belt one road strategy."

On sustainability: "Regardless of Covid, sustainability remains core to our business. Our global forest conservation policy commits APP to zero deforestation among other key environmental elements, and we remain true to those values. Over the past several years we have seen sustainability emerge as a critical issue for consumer purchasing decisions. Both consumers and retail brands are seeking full transparency within their supply chains, from fibre sourcing right through to end-of-life capabilities, guaranteeing sustainable development.

"At APP China we continue to maintain a multi-stakeholder, collaborative approach towards sustainability. Customers, brands/ buyers, NGOs, and government authorities all have a voice within all our product development and environmental policies."

Above: *"We believe the increase in demand for high-quality tissue is being driven by economic growth across the country and the rise of personal hygiene and health awareness." Zhang Ge, Chief Executive of APP China's Gold Hongye Paper Group Co.*

ON THE BELT & ROAD INITIATIVE: "WE BELIEVE THIS IS AN EXCITING OPPORTUNITY TO EXPAND AND GROW OUR BUSINESS. APP CHINA IS CURRENTLY WORKING WITH LOCAL GOVERNMENT AUTHORITIES TO EXPLORE THESE OPPORTUNITIES AND FURTHER DEVELOP OUR OVERSEAS BUSINESS ALONG THE ONE BELT ONE ROAD STRATEGY."

SHOULD WE NOW GO FOR 3-PLY, OR QUILTED, CUSHIONY OR EXTRA TOUCH, BLEACHED, UNBLEACHED, PERFUMED, SENSITIVE SKIN VARIATIONS OR BAMBOO. . . I ALMOST NEEDED TO SIT DOWN AND THINK ABOUT IT ALL.

Michael Jackson, professional conference presenter, and media host of Tissue World TV at the last several live Tissue World events, recently relocated with his wife Carol back to the UK after living in Africa for many years. His shopping habits have had to change completely too!

Whilst settling back into the UK on a permanent level recently after having a home base in South Africa for many years, my wife and I have had to learn and adapt to new shopping habits and products.

Familiarising ourselves with the English supermarkets was obviously a priority for us, so suitably masked and warmly dressed, we headed cheerily off to investigate the realms of Sainsbury's, Tesco, Morrisons as well as Booths, known as the local 'Waitrose', a local chain in the North of England, on familiarisation missions.

Even if we were going to order in bulk as Amazon Prime customers, clearly initial ground-level research was called for!

Toilet tissue choices have grown enormously in the couple of decades that we've lived away from England, and of course, as expected, the massive in-house brand plethora of options (never considered as an option in the Jackson household) were all widely available, along with Andrex, Cushelle, Regina, Nicky, Kleenex and even Cheeky Panda brands, clearly on display.

Baffling, yet intriguing were the latest promised beneficial delights of all the available variations! Should we now go for 3-ply, or quilted, cushiony or extra touch (whatever that meant)? There were now bleached, unbleached, perfumed, sensitive skin variations and even bamboo options.

I almost needed to sit down and think about it all.

I'd been quite happy with a bog-standard 2-ply previously, but now, no longer! We experimented. We sampled. With a new sense of purpose, all at my wife's insistence, we then found ourselves at loggerheads, in somewhat of a dilemma. We'd even argued over breakfast, faces becoming flushed with heated discussions...

I had come to prefer a particular Supreme Quilted version of a particular brand whilst she, who must usually be obeyed, preferred to indulge with a somewhat royal sounding brand of 'Seriously Soft, Indulgent Toilet Tissue made from biodegradable and compostable packing', which was also proudly forest friendly, and manufactured using only 100% green energy'.

I had unwisely interjected at that point, explaining I'd never had the need to carry a roll of toilet tissue into a forest, but was browbeaten back with a withering glance.

Mine retailed, I had even argued somewhat sensibly I thought, for nine rolls at £5.25/unit,or 36p/100sht (which had taken some careful reading).

Hers? She'd shot back with a similar, something neither here nor there price, of around 43p/unitor 43p/100sht. I was defeated at all levels and have come to discover that when it comes to quality

toilet tissue, price doesn't even enter into it in our home.

This explains why, should you visit, you'll now find her brand in the main bathroom and mine in the guest loo. Where I've been delegated an official seat.

"TOILET TISSUE CHOICES HAVE GROWN ENORMOUSLY IN THE COUPLE OF DECADES THAT WE'VE LIVED AWAY FROM ENGLAND, AND OF COURSE, AS EXPECTED, THE MASSIVE IN-HOUSE BRAND PLETHORA OF OPTIONS (NEVER CONSIDERED AS AN OPTION IN THE JACKSON HOUSEHOLD) WERE ALL WIDELY AVAILABLE."

BAROMETER 2021: TWM LOOKS BACK AT 2020 – A YEAR LIKE NO OTHER – AND HOW THE INDUSTRY FACED UP TO COVID

Everything changed as the pandemic struck. In 2020 TWM interviewed tissue mills in Canada, Scandinavia, Turkey, Serbia and Japan for our Country Reports. Here, we revisit a selection of those companies to see how they took on the challenge, and what they learned to advance their businesses.

'WHAT SEEMED IMPOSSIBLE TO ACCOMPLISH REMOTELY BECAME SUDDENLY POSSIBLE.'

What changed last year is the way of doing business," says Jean-David Tardif, president and chief operating officer of Cascades Tissue Group. "What seemed impossible to accomplish remotely became suddenly possible. We leveraged the uses of technologies for more efficient follow-up with our entire network. We gained in time and in efficiency and we reduced traveling costs."

During the course of 2020, the group focused on the completion of its assets' modernisation and optimisation of its network in North America, including the integration of the Orchids Paper Products plants. It has also started-up 13 converting lines in six plants both in Canada and the USA and in both the AfH and Consumer Products markets. "We invest our time to improve the synergies, the quality and our competitiveness," he says.

Above: *Jean-David Tardif, President and Chief Operating Officer of Cascades Tissue Group*

"WE ARE ALWAYS ON THE LOOKOUT FOR NEW M&A OPPORTUNITIES THAT WOULD CREATE VALUE FOR OUR CUSTOMERS AND OUR SHAREHOLDERS. BUT FOR NOW, WE WOULD LIKE TO TAKE ADVANTAGE OF OUR RECENT INVESTMENT AND MONITOR THE RAMP-UP. WE ALSO WANT TO CONTINUE TO INCREASE OUR INTEGRATION RATE."

In terms of changes to the local tissue market, Tardif says Covid-19 had "a big impact" in 2020. "We were hit by the closure of schools and offices by a reduction of sales in the AfH market. In retail, we saw an increase of sales."

The company partnered with its key customers to be more efficient. "As a result, we reduced the number of SKUs and we focused on the best items. We also see a trend in the progression of the private labels and sustainability is back on the top priorities for our customers."

On future growth: "We are always on the lookout for new M&A opportunities that would create value for our customers and our shareholders. But for now, we would like to take advantage of our recent investment and monitor the ramp-up. We also want to continue to increase our integration rate. We do have some projects in mind that we can't talk more about at this time, but for sure our growth plan is strongly related to our top customers. We are committed to support their growth."

And the key challenges: "Raw material price increases will be challenging in 2021. It is hard to predict how the economic conditions will dictate the consumer's behaviour. We see the return of the product promotions and we anticipate the reopening of office buildings. As the situation evolves, the challenge will be to predict the demand properly and make sure we have the right product in the right location for each customer. Both market segments, AfH and Consumer Products, are experiencing important variation in demand."

He adds that the AfH market "will rise and get through this situation".

"We believe that our hygiene habits in general will change. Private labels are our main focus, and these products will continue to gain market shares. Sustainability is back in the top priorities. It is in our DNA and we have the opportunity to maintain our pole position in this category."

Above: Lazar Stevanović, Commercial Director of Čačak-based manufacturer Camelia

"AS A COMPANY BASED IN SERBIA, WE MUST PRIMARILY ACHIEVE GOOD RESULTS IN OUR MARKET. THAT BEING SAID, WE ARE MORE THAN SATISFIED WITH OUR CURRENT POSITION ON THE DOMESTIC MARKET, AND THIS THEN ALLOWS US TO ALSO FOCUS ON THE WHOLE REGION."

CAMELIA EXPANDS ITS PRODUCT OFFERING INTO PRIVATE LABEL FOLLOWING THE ARRIVAL OF LIDL

In an awakening market with more and more company start-ups, Serbia's tissue industry was in a constant state of growth when TWM interviewed Lazar Stevanović, commercial director of Čačak-based manufacturer Camelia.

Fast-forward a year, and he says the company has had to focus its efforts from previous years on curbing the effects of the pandemic: "The measures we implemented since day one of the outbreak and consistently over the course of the past 12 months have given results, and we have avoided any major inconveniences so far," he says.

"We made a decision to change the design of certain products – a decision we did not take lightly. In these situations, the new design should not deviate much from what the customers are familiar with. Although we believe that an update in design was necessary, it was done with minor changes."

The key investment this year is the company's new facility, as well as the production line it bought from PCMC and Stax. "During this time, both companies proved to be valuable partners to us, and even more – friends. We are continuously investing in employee training, thus we have a large budget set aside for such activities in 2021. These changes were also accompanied by the expansion of our vehicle fleet."

He adds that the largest shift in the Serbian and surrounding country's tissue markets is the arrival of Lidl. "This has affected the operations of both large and local systems, which in turn led to price adjustments. The fall in prices in the market led to some very high losses on the part of several systems. Despite the changes, I firmly believe that Lidl's arrival into Serbia signifies a stronger market and a growth of the purchasing power of consumers."

In response to the changing market conditions, the modernisation of the company's products entailed new opportunities. Now it is in a position to offer a wide range of new products to its customers. "This is a very good thing for us as a business and negotiations are also underway with a foreign manufacturer

regarding the purchase of a new production line, which will complete our assortment. I sincerely hope we will achieve the closure of the deal by the end of the year."

For 2021, a key priority for the business is to maintain the wellbeing of its employees and partners, as well as the local community in which it operates. From a business standpoint, the company's strategy indicates "great potential" for exports: "As a company based in Serbia, we must primarily achieve good results in our market. That being said, we are more than satisfied with our current position on the domestic market, and this then allows us to also focus on the whole region."

A main objective for 2021 is the expansion of the company's new product lines and their launch into the market.

"The expansion of our capacities has given us an opportunity to cooperate with private labels. At the moment, due to capacity fulfilment, we were not able to make many offerings. However, private labels occupy an increasingly significant portion of the market and I believe this is an area where we will see noticeable growth in the future."

Above: *Essity's Lilla Edet Plant Manager Christian Carlsson*

"IT'S BEEN A THREE-PILLAR FOCUS. CARING FOR OUR PEOPLE, SUPPORTING SOCIETY AND SECURING THE BUSINESS. THIS HAS LED TO CHANGES IN WAYS OF WORKING TO PREVENT INFECTIONS ON SITE AND VERY CLOSE COLLABORATION WITH MARKET ORGANISATIONS IN ORDER TO SUPPORT OUR CUSTOMERS IN THE RIGHT WAY."

ESSITY'S NEW FOLDED HAND TOWELS LINE MET CUSTOMERS' URGENT NEED FOR CLEANING SURFACES

TWM visited Essity's Lilla Edet plant, located an hour's drive north of Gothenburg, Sweden, in January 2020, just weeks before the outbreak of the pandemic. Made welcome by plant manager Christian Carlsson and five of his colleagues, we toured the facility to see it in the context of circular economy, carbon neutrality, benchmarking and driving fossil-free packaging growth.

Essity has owned Lilla Edet since 1986, and production has remained at 94,000tpy; 60,000tpy for the professional hygiene market and 40,000 tonnes for the consumer market. Interviewed again in April 2021, and Carlsson says that in the past year the focus has been on handling the pandemic in a good way.

"It's been a three-pillar focus. Caring for our people, supporting society and securing the business. This has led to changes in ways of working to prevent infections on site and very close collaboration with market organisations in order to support our customers in the right way. Looking back on how we tackled the big changes, we can be proud of our people that really showed great commitment and ability to adapt fast to the change."

The plant has also made investments over the past 12 months. A new converting line has been installed to produce folded hand towels. "The demand for these products is high in the Nordic market, and now we will be able to produce closer to our customers. This will have a positive effect on the environmental footprint."

Across Scandinavia, he weighs the effect of the pandemic: "We have seen a small shift in volume between the two business units, consumer goods and professional hygiene. Since people are spending more time at home the volume for these products has increased a bit. The products we produce for restaurants, hotels and airports have had an opposite development and decreased a little."

One clear increase in demand he adds is for wiping products, as the need for the cleaning of surfaces "increased significantly."

"Since the pandemic is far from over, the main challenge from 2020 remains into 2021. We have high ambitions to further improve sustainability and have started the year with large scale tests using bio-gas instead of natural gas with the ambitions to become free of fossil CO2 emissions. Our main focus from a delivery perspective is to get the new line fully up to speed and to deliver on the rest of our ambitious targets."

"IN MARCH 2020, WE ENCOUNTERED A FOUR-FOLD INCREASE IN DEMAND," LILA GROUP CHAIRMAN ORHAN ÖĞÜCÜ, IN TURKEY

"2020 was a year in which we experienced many firsts. None of us have ever experienced such a process before. We have all experienced radical changes in many aspects such as our business processes, consumption habits, social life, the education process of our children, and our shopping habits.

"The most important and pleasing effect of this difficult process we are going through is the understanding of how important the hygiene factor is in our country and the world, and that hygiene is not a luxury but a need. It has been a means to increase awareness.

"As of March 2020, when the pandemic started we encountered a four-fold increase in demand. Such a sudden increase was a process we have never experienced before. We all witnessed that toilet paper was plundered on market shelves. We have taken all possible precautions both in our production area and in the collective use areas: we were very aware of our responsibility in a process where hygiene was so important.

"For the health of our employees and the sustainability of our business, we have taken the highest level of measures from the first day and received the TSE Covid-19 Safe Production Certificate. And we have continued to bring our consumers together with our Sofia branded products in the premium segment, Maylo in the value for money segment, Berrak in the economic segment and Nua in the global markets. The diversity of the market is very important to us.

"We contacted our Ministry of Health in line with our responsibility principle and conveyed that we want to donate our examination tablecloths that we produce as Lila Group. In this context, we donated 100,000 roll examination tablecloths to all our public hospitals and ambulances. We have also met the three-month hygienic cleaning paper requirement of state hospitals and ambulances in Çorlu, where our production facility is located and Tekirdağ and Çerkezköy. We made revisions and plans in our production lines to meet the hygienic tissue paper needed by the society. In this period, we also exported to countries we don't normally export to. We did not refuse the demands of our customers.

"We continue to implement investment projects so that we can achieve regular sustainability. In the last quarter of 2019, we announced our new facility investment with a total investment value of $100m and we commissioned this new facility in March 2020. Because of this project, we closed the year 2020 with a turnover of TL1.3bn and a growth of over 25%. With the commissioning of our new facility, we have increased our existing jumbo roll paper production capacity by 50% and reached a total capacity of 220,000tpy as well as converting our branded product capacity from 100,000tpy to 120,000tpy with a total investment value of $15m. We will launch our second $100m investment in the second half of 2021.

"The timing of our facility, which we commissioned in March 2020, was quite meaningful. As the first case of Covid-19 emerged in Turkey immediately after our facility was put into operation, the demand for hygienic tissue papers increased by four times. We were able to meet the hygiene needs of both our country and more than 80 countries in five continents to which we export. We are also operating in the energy sector with the paper and textile industry, one of Turkey's leading industrial companies."

"Of course, the increase in hygienic tissue paper products has also affected the consumption of people's previous consumption in restaurants, schools, workplaces, hotels, shopping centres, and the home environment. During this period, demand for the AfH channel purchases decreased, and consumer domestic use increased. So not only toilet paper, but also paper towel and napkin consumption shifted to domestic consumption and brought about an increase in purchases.

"With the effect of Covid-19, the use of pocket and facial tissue for less surface contact has also increased. Due to the decrease in consumption due to the sectors that were adversely affected an incentive price policy was implemented in which product prices were kept low.

"We were aware that this tendency to stockpile was a temporary situation. Later, an alignment process started and our industry did not grow as expected last year because AfH consumption decreased due to temporary shutdowns.

"Although the demand for domestic use increases in the sector in 2020, it is possible to call 2020 as the year of balancing and protection, as AfH consumption has decreased. If the pandemic effect ends and normalisation occurs, 2021 will bring a little growth for our industry. For Lila Group, 2020 can be defined as the year of growth due to our investments, and 2021 will be a year of growth with the impact of these and new investments.

"This year, we are experiencing the excitement of our new facility, which has an investment of TL450m in tissue paper production and will be operational in the second half of 2021. Our new facility will increase our total production by 33% and will enable us to become one of the largest production centres under a single roof not just in Turkey but also in Europe.

"Our first goal for 2021 is to maintain our company's growth and profitability in domestic and international markets. We have a target to increase our turnover by 50% in 2021 with the effect of our investments. Currently, we are aiming to increase our market share by adding 25-30 countries to which we export and to reach almost 50% of the world population by means of the countries we export to.

"We are in target growth with new acquisitions after our investments.

"If we define 2021 as the year of getting used to living and working with the pandemic rather than the difficulty, we can still talk about the difficulties of getting used to this process. Our colleagues at our headquarters are still working remotely. I can say that we got used to this process easily. We are ready to overcome any challenge that will come our way.

"Considering that every crisis contains new opportunities, we can say that this process offers us opportunities to gain a foothold in new markets. I wish such a painful experience had never been experienced, but there were countries where we started exporting for the first time, especially in the first months of the pandemic. We anticipate that this situation will continue. We are in a cooperative relationship with different customers and we have introduced our new product developments, which will also protect the consumers' skin in terms of hygiene, with our Sofia Premium series."

KLIPPANS BRUK BEGAN PAPERMAKING IN 1573, BUT IT TOOK THE 2020 PANDEMIC FOR IT TO DIVERSIFY INTO THE PRODUCTION OF TOILET TISSUE

When TWM met Klippans Bruk Chief Executive Per Skoglund and Sales and Marketing Director Susanne Hägerstrand at their plant in Skåne County, Sweden, the company had just started-up a Recard-supplied PM to quadruple its production, making it a global player in the deep-coloured tissue market.

With plans to increasingly sell abroad into the USA and Asia, the company's core business was very simple – high coloured tissue, for napkin and end-use.

The outbreak of Covid-19 changed that. Hägerstrand says that over the past year the company has had to diversify its product offering: "Even though the Swedish market has not been as heavily affected as some, since we haven't faced as serious lockdowns as a lot of other markets, we still saw a lot less demand for our main products, coloured and white tissue for napkins. As hotels, restaurants and bars have been closed due to Covid, we faced a big loss of orders last springtime. So in order to keep producing, we re-set our new paper machine to additionally produce toilet tissue."

Klippans Bruk finalised the investment of a new paper machine, rewinder and wrapping station. It also invested in surrounding equipment and worked to optimise and trim its new line as well as training its operators.

"The plan is to continue to grow in napkin tissue, coloured and white. And while we plan growth in our existing market, we have also started producing tissue for decor printing and new selected export markets for a defined product segment."

For the remainder of 2021, she says that it is difficult to anticipate the market demand and development because of the pandemic, but says that "pulp price development can be an issue".

"Once the world opens up again, we are ready to fulfil the market demand and serve our customers."

"INTERNAL COMPETITION IN THE TURKISH TISSUE MARKET HAS INCREASED; THE DIFFERENCES BETWEEN BRANDS AND PRIVATE LABEL PRICES ARE DECREASING." ALPAY YALÇIN, EXPORT SALES AND OPERATIONS MANAGER, EUROPAP TEZOL KAĞIT

"Over the past year, we initially saw a rapid rise in finished product sales, together with an increase in stock speed which resulted in a slowdown in the third quarter. There was a return to normal sales levels in the last quarter.

"In jumbo roll sales, we saw a slowdown in certain parts of the world as a result of lockdowns which then revealed new opportunities in other regions. As a result, we managed to stay above the expected figures at the end of the year.

"We have also invested in new machinery and R&D in the field of converting. We realised a full-line installation in our new facility in Mersin, together with a Fabio Perini-supplied myline flexy and packaging unit. In addition, we have also installed the ICM fully automatic multifold Handtowel. In R&D investments; perfumed new household products and high-scale household and AfH products can be counted in the finished product sector. In the production of jumbo roll, we improved the production of brown (kraft) napkins and towels with new equipment in production and raw material supply.

"In the domestic Turkish tissue market, what strikes us most is that growth in the private label market continues. Additionally, we have also seen that the amount of production has grown more than the growth rate of the market. This has increased the internal competition and therefore the differences between brands and private label prices are decreasing.

"Our biggest investment that we will declare for next year will be our new tissue mill which will start-up in our Mersin facility. This is a repeat order for Toscotec which has already supplied a TT SYD steel Yankee dryer installed on PM1 in 2012.

"The new line is scheduled for start-up in mid-2022. The AHEAD 2.2S machine has a sheet trim width of 2.9m, a maximum operating speed of 2,100mpm, and an annual production capacity of over 40,000 tonnes. It is equipped with TT NextPress with upgraded design, third-generation TT SYD, TT Reel-BulkyReel for optimal preservation of bulk and softness, and high efficiency TT Hood with automatic balancing system. We believe that our new investment will enable us to grow in our existing markets as well as enter new markets.

"As for the remainder of 2021, the biggest challenge we are experiencing is transportation. Struggle with this deprivation and high costs caused by lack of equipment threatens all exporting companies. Another threat is the lockdowns caused by outbreak and the uncertainty caused by this situation. Paper mills and converters cannot predict when and in what quantity to produce. Retailer/wholesaler companies on the other hand are having difficulties in controlling the stock situation due to this uncertainty.

"We always believe that the supplier and customer portfolios of companies change when such uncertainties are too high. We believe that if we can achieve product quality, service and price conformity according to the region, we can turn this situation into an advantage in our favour."

"AS FOR THE REMAINDER OF 2021, THE BIGGEST CHALLENGE WE ARE EXPERIENCING IS TRANSPORTATION. STRUGGLE WITH THIS DEPRIVATION AND HIGH COSTS CAUSED BY LACK OF EQUIPMENT THREATENS ALL EXPORTING COMPANIES. ANOTHER THREAT IS THE LOCKDOWNS CAUSED BY OUTBREAK AND THE UNCERTAINTY CAUSED BY THIS SITUATION."

UNLEASH YOUR FABRIC SHOWERING POTENTIAL

By Buckman's Rémi Charron, Business Development Manager – Tissue, Daniel Glover, Global Tissue Technology Director, Mark Christopher, Global Market Development Manager – Tissue

Rémi Charron
Business Development Manager

Daniel Glover
Global Tissue Technology Director

Mark Christopher
Global Market Development Manager

In an unprecedented time for the tissue industry, maximising production is more important than ever. Maintaining machine efficiency is a critical measure of success. Of course, the mechanical operation of all the tissue production's assets is considered. These assets should include consideration of the proper selection of wires, felts and other clothing. Furthermore, the selection and synergism offered by the safe use of chemistry should not be overlooked.

A modern crescent former being able to take a pulp slurry and form, dewater, dry, crepe and wind up a tissue paper sheet in the span of two seconds or less is an amazing technological feat. OEM suppliers have continued to devise technological solutions in the area of fabrics, felts and showering that allow for ever greater speeds and quality. However, when furnish and process conditions change, these systems can be overcome, and the result is increased felt filling and surface deposition on fabrics that the showering system cannot prevent or remedy, which results in:

- Reduced water removal capacity and machine performance
- Increased variability in the sheet moisture profile
- Sheet transfer problems
- Sheet defects such as crushing or uneven formation.

Tissue makers understand that chemistry can complement fabric showering to preserve the performance of clothing. In choosing the chemistry, companies are also focusing on both the environmental and worker safety aspects of the approaches.

Traditional fabric cleaning chemicals include some harsh concentrated chemical components such as:

- Hydrochloric acid
- Sulfuric acid
- Sodium hydroxide
- Solvents (mineral spirits, kerosene, xylene, toluene, trichloroethylene, methylethylketone).

The increased focus on worker health and environmental regulations is restricting the use of these components in many regions. Further, in the case of the solvents, there are many local emission laws that prohibit the use altogether or require monitoring and reporting the quantity used per month or year. These volatile organic compounds, or VOCs, are under increased scrutiny by state and local authorities.

These VOC-containing solvents have long been known to be effective at cleaning tissue machine clothing but are not necessarily the best method. Below we will describe alternative approaches to keeping forming and press fabrics cleaner for longer with safer chemistries that are better for the environment. These new approaches of chemical fabric care are intended to work synergically with the showering system and make the mechanical cleaning system more effective at preserving the maximum performance of the wet end at all times.

Wire Passivation

The tissue industry's first solution to stickies was to allow them to build up on wires over time until there was enough

THE INCREASED FOCUS ON WORKER HEALTH AND ENVIRONMENTAL REGULATIONS IS RESTRICTING THE USE OF THESE COMPONENTS IN MANY REGIONS. FURTHER, IN THE CASE OF THE SOLVENTS, THERE ARE MANY LOCAL EMISSION LAWS THAT PROHIBIT THE USE ALTOGETHER OR REQUIRE MONITORING AND REPORTING THE QUANTITY USED PER MONTH OR YEAR.

Hydrophobic Cationic Passivation

Hydrophilic Non-Ionic Passivation

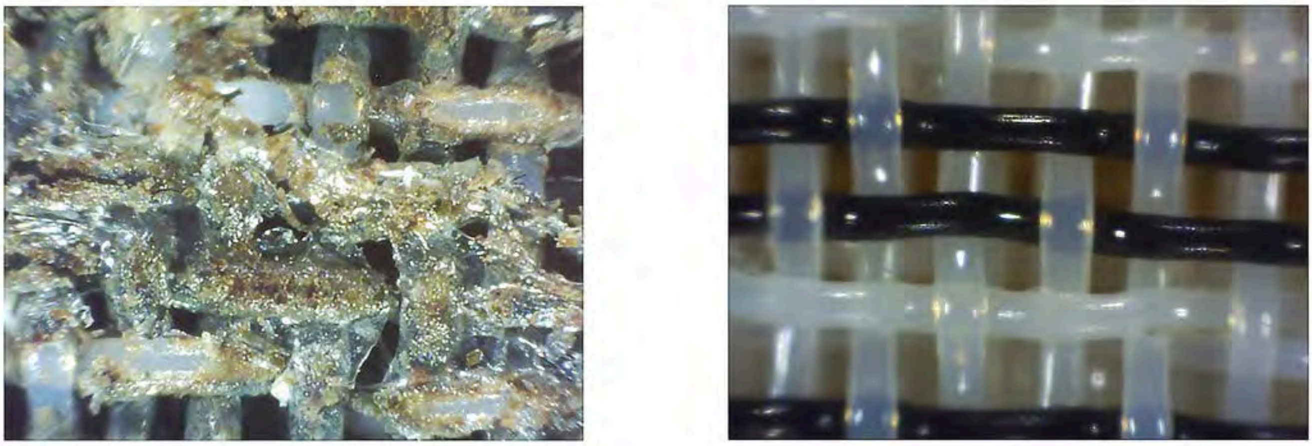


Figure 1: *Examples of tissue machine wires treated in a lab with the differing approaches.*

accumulation to cause sheet defects or affect formation quality. Often, mineral spirits or kerosene were used during a stoppage or a batch cleaning event to remove the stickies.

The second generation of stickies treatment is hydrophobic cationic wire passivation. Cationic polymer solutions are sprayed on a forming wire in batch mode or continuously to create a barrier that stickies can agglomerate to in lieu of the wire yarns. This barrier can then be removed with a solvent or sodium hydroxide during a machine down. The advantage of this application is a reduction in solvent required to remove the contaminants adhered to the polymer film that are more easily removed than if they were stuck directly to the wire yarns.

The latest technology in wire passivation uses hydrophilic non-ionic chemistry that adsorbs on the machine's hydrophobic forming wire to create a temporary barrier that can be removed by the mechanical showers. This results in continuous removal of the stickies by the showers and Uhle boxes. With this approach, a temporary barrier is regenerated at every wire cycle, and it reduces or even eliminates the need for batch washing the fabric with hazardous chemicals.

Up to 50% solvent-use reduction has been achieved by changing from a traditional cationic polymer wire barrier to the latest non-ionic hydrophilic wire passivation technology. This provides the tissue maker with a combination of reduced costs and reduced environmental impact.

Felt Cleaning

To ensure quality products and avoid paper machine runnability problems, it is imperative that tissue machines have a good felt conditioning system. Felts need to maintain their void volume and caliper, take water and be conditioned uniformly throughout their life. A press section's three primary purposes are:

- water removal
- sheet quality development
- sheet transfer to the Yankee without defects and rejection.

THE LATEST TECHNOLOGY IN WIRE PASSIVATION USES HYDROPHILIC NON-IONIC CHEMISTRY THAT ADSORBS ON THE MACHINE'S HYDROPHOBIC FORMING WIRE TO CREATE A TEMPORARY BARRIER THAT CAN BE REMOVED BY THE MECHANICAL SHOWERS. THIS RESULTS IN CONTINUOUS REMOVAL OF THE STICKIES BY THE SHOWERS AND UHLE BOXES. WITH THIS APPROACH, A TEMPORARY BARRIER IS REGENERATED AT EVERY WIRE CYCLE, AND IT REDUCES OR EVEN ELIMINATES THE NEED FOR BATCH WASHING THE FABRIC WITH HAZARDOUS CHEMICALS.

Traditionally, felt cleaning strategies allowed felt filling to occur to a critical point which required a chemical batch reset with a hazardous concentrated product. Your programme should remove contaminants in the felt chemically and/or mechanically, weaken and reject solids through use of sufficient water and remove the solids and water through a suction system.

This approach presented a few challenges:

- Accepting periods of suboptimal felt performance and variation in runnability
- The cost of the downtime
- The irreversible compaction from the deep deposition filling
- The damage to batting or yarns from the harsh acids, caustics or even oxidants in some cases
- Safety concerns with handling and applying the caustic and bleach
- The use of mono-component products that only clean certain types of contaminants.

New generation felt cleaning technology has moved away from concentrated mono-component products and evolved to blends of multiple ingredients that are less hazardous and work synergistically to cover the full spectrum of felt contaminants.

Choosing the right chemical conditioning is important and based on what works best with your paper machine.

1. Batch Cleaning is done during a machine outage or break. Because the machine is not in operation there are no concerns about impacting machine

performance or contaminating the tissue sheet with residual cleaner, as aggressive cleaning approaches can do. Because of the cost of the downtime associated with the cleaning, this approach is best suited to either felt filling issues that occur both slowly and predictably or for severe contamination that occurs infrequently.

2. Batch On-The-Fly is completed during normal production. Because some of the chemistry will inevitably be in contact with not just the felt, but the sheet itself, the choice of suitable cleaning chemistries is greatly reduced as is the maximum concentration of the chemistry that can be used. This approach allows for milder cleaning done more frequently and as such is suited to felt contamination problems that occur slowly and predictably over time and are less difficult to remove.
3. Continuous cleaning and conditioning is focused on preventing filling of the felt as opposed to allowing deposition to occur over time and then resetting performance with a batch clean. The chemistry is focused on surface active agents designed to keep contaminants moving through the felt and reducing the tendency for adherence onto or into the felt structure. It is fed at lower concentrations and prevents buildup of contaminants throughout felt life.
4. Combination is the most effective method for maintaining maximum felt performance, as it combines continuous felt cleaning with periodic batch washing.

Which approach is applied is, of course, dependent on the nature of the problem. A combination of approaches may be required for machines that swing from wet strength grades to bath, use recycled furnish or impart significant wet end chemistry variation through the use of dry strengths, temporary wet strengths, starches, etc.

One of the biggest and most common sources of felt filling for tissue makers is related to the use of polyamide epichlorohydrin (PAE) wet strength resin (WSR). The filling of a felt with WSR is a mostly unrecoverable condition for the tissue maker.

Once this happens, very harsh oxidant chemistry is required to remove it.

ONE OF THE BIGGEST AND MOST COMMON SOURCES OF FELT FILLING FOR TISSUE MAKERS IS RELATED TO THE USE OF POLYAMIDE EPICHLOROHYDRIN (PAE) WET STRENGTH RESIN (WSR). THE FILLING OF A FELT WITH WSR IS A MOSTLY UNRECOVERABLE CONDITION FOR THE TISSUE MAKER.

Because the chemistry of most felt yarns is also polyamide based, any chemical approach harsh enough to dissolve and remove the WSR will inevitably degrade and damage the surface properties of the felt fabric. This creates a "two steps forward, one step backwards" scenario where each cleaning allows partial recovery of the felt performance while incrementally reducing the service life of the felt. In the case of WSR use driving felt filling, a continuous approach that prevents its occurrence often outperforms a batch cleaning methodology in terms of total economic return for the tissue maker.

In other words, preventing reactive chemicals from cross linking in the felt makes the showers and vacuum system more efficient at removing them.

Since the felt does not fill up as quickly with this approach, the downtime to wash the felt can be significantly reduced or in some cases can be eliminated. Other benefits include reduction in the quantity of sheet defects, maintenance of felt performance throughout its life, and an increase in felt life - extending the time between machine shutdowns for felt replacement.

Recent Application of the Combination Felt Treatment

Tissue mill producing AfH bath and towel grades from 100% recycled fibre (MOW).

Challenge

A mill using both recycled and virgin furnish to make both tissue and towel had suffered for years with felt filling. The mill dealt with the problem via high pressure needle shower and batch washes and as a result incurred a felt change every five weeks and lost time leading up to the change due to filled felt issues.

Solution

Introduction of a continuous based programme with concurrent reduction in both the intensity and frequency of use of the needle showers. The hypochlorite-based batch wash was replaced with a less damaging alkaline approach.

Results

The benefits included:

- Reduced drying costs through lower gas usage
- Reduced needle shower use by 45%
- Acceptable CD profile maintained to the end of the fabric life reducing breaks by 30%
- 20% increase in felt life to six weeks.

Summary

The tissue industry is evolving from using harsh mono-component concentrated chemicals to treat fabrics to using multicomponent combinations that work continuously to enhance the performance of the mechanical cleaning system including showers and vacuum. Keeping the performance of the wet end at its maximum potential and reducing variability are key advantages to reaching the full potential of your tissue assets.

References

1. Ferguson, T. ; Fabric Cleaning-Conditioning Plays Key Role in Press Section Efficiency. PaperAge June 2003, p. 18-21.
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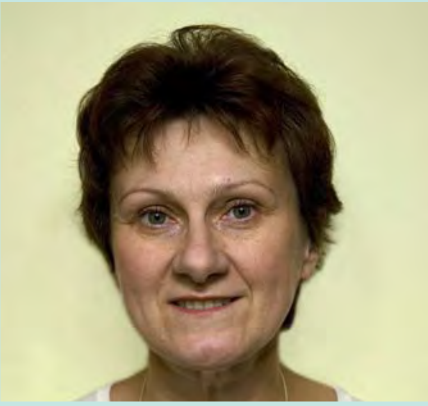
A COMPREHENSIVE APPROACH FOR TISSUE PAPER CHARACTERISATION – KEMIRA TISSUE QUALITY ANALYSIS.

By Kemira Chemicals' Tiago de Assis, Research Scientist, R&D & Technology, and Lucyna Pawlowska, Senior Applications Specialist, Strength & Tissue.

Tiago de Assis
Research Scientist, R&D & Technology



Lucyna Pawlowska
Senior Applications Specialist, Strength & Tissue

A comprehensive analysis of tissue properties can reveal root causes for a variety of problems that impact both product and production performance. This article discusses the innovative, data-driven approach to tissue quality analysis by Kemira. By combining the basic tissue properties with the more detailed qualitative and quantitative analysis on the sheet structure, tissue producers can optimize product performance, improve process efficiency, and increase the overall economics of production through optimized chemical treatment.

Kemira's Tissue Quality Analysis (TQA) [as illustrated in figure 1] combines basic tissue properties (caliper, basis weight, dry strength, wet strength, absorbency, softness, disintegration) with the patented KemView Sheet Structure Analyser (SSA) for a complete characterisation of tissue sheet quality. This approach provides a more comprehensive understanding about the cause-and-effect relationship between product performance and tissue making variables. The combination of basic tissue properties and KemView SSA capabilities represents a powerful approach to fully characterize tissue products, identify the root cause of problems associated with product performance and process

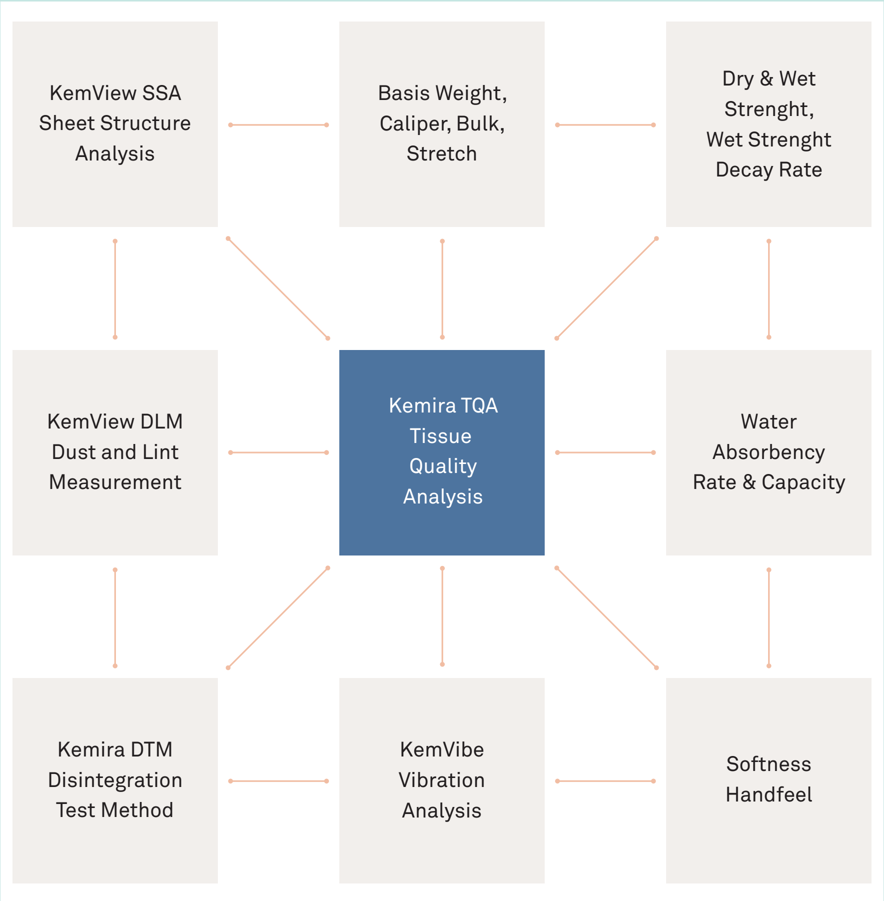
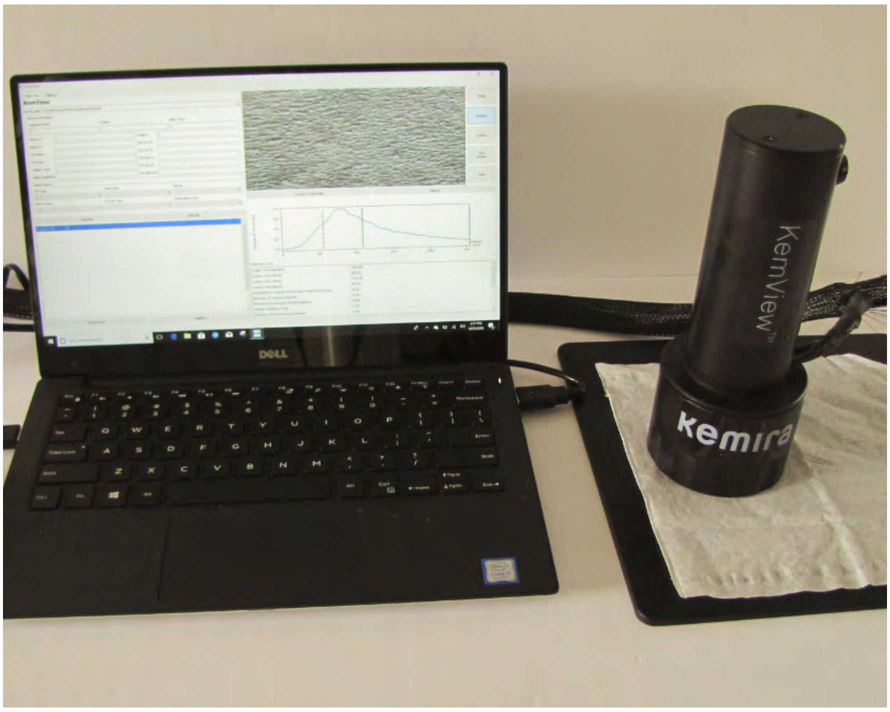


Figure 1: *Kemira's Tissue Quality Analysis provides a comprehensive understanding about the cause-and-effect relationship between product performance and tissue making variables.*



Picture 1: *KemView Sheet Structure Analyzer is a novel, image-based instrument for easy and effective measurement of sheet properties.*

efficiency, support product and process improvement activities, and select the best chemical treatment solutions.

3D analysis of sheet properties that impact product quality and process efficiency

The patented KemView Sheet Structure Analyzer Generation II [picture 1] is a novel image-based instrument that provides 3D analysis of the tissue sheet structure. KemView SSA is a small and portable instrument that can be effectively used as a laboratory or field support tool. KemView SSA has the size of a flashlight and consists of a digital optical detector with multiple LED light emitters that illuminate the sheet sample. Sheet analysis is easily done by simply placing the device on top of the sheet sample and clicking the analysis button. Each measurement takes only seconds to perform.

The collected images are analysed by the KemView SSA software and the measured sheet properties are easily exported to excel for quantitative analysis. The images can also be saved for qualitative visualization of the sheet structure.

KemView SSA measures different sheet properties that are known to have a strong impact on tissue performance and are utilized to improve product quality and process efficiency:

- Crepe bar count: number of crepe bars created during the creping process
- Surface roughness: deviation of surface height
- Regular markings: visibility of patterns created by structured fabrics and converting operations
- Pinholes: sheet area covered with holes larger than 200 μm
- Free fibre ends: number of fibres extending more than 50 μm out of the sheet plane
- Dust and Lint: amount of fibre, fines, and ash particles loosely attached to the sheet surface.

Qualitative and quantitative sheet structure analysis help optimise production

Table 1 presents practical examples for the type of qualitative and quantitative analyses that can be done with KemView Sheet Structure Analyser.

For conventional tissue, fine crepe structure is achieved with a high number of crepe bars and is important to control sheet caliper, softness, and absorbency. Fineness of crepe structure is an indicator for the correct time to change the creping blades and the correct balance between the adhesive and release properties of the Yankee coating, which are important factors for the proper delamination of the fiber web structure during the creping process. Surface roughness is also used as an indication for the fineness of the crepe structure. High number of crepe bars creates a tissue sheet with lower surface roughness and superior surface feel. Low sheet adhesion at the Yankee drier surface and wear of doctor blade will develop a product with low crepe bar count, high surface roughness, high caliper, and low softness.

Low area of pinholes is important to achieve desired sheet strength and reduce basis weight at the same time. High number of pinholes is detrimental for product strength due to the introduction of excessive number of weak points on the sheet. In addition, excessive number of pinholes can cause dust and lint issues. Pinholes are directedly correlated to the quality of sheet formation. Pinholes are also introduced to the sheet when the Yankee coating adhesion is very high. The areas of high adhesion between the sheet and the Yankee coating will create small holes on sheet as these areas are not easily scrapped by the creping blade and remain attached to the Yankee surface.

For structured tissue, proper formation of structured pockets is important to maximize product caliper, softness and absorbency. Quality of structured sheets is also used to indicate excessive wear of structured fabrics and to adjust tissue machine components (e.g. molding boxes, vacuum systems, pressure rolls, and through air driers). Different sheet structure variables can be used to monitor the quality of structured sheet. Regular markings and surface roughness indicates the proper formation of structured pillows during the manufacturing of structured tissue. Regular markings and surface roughness are also used to monitor the adequate imprint of embossing marks during converting operations. For structured tissue, the number of crepe bars is used to monitor the total area of the sheet that is glued on the Yankee surface.

Tissue dusting and linting is a major problem for many tissue producers and converters as it can affect occupational health and safety (e.g. fire hazard, respiratory hazard), process efficiency (e.g. equipment failure, unexpected shutdowns, frequent cleaning), and end-user satisfaction (e.g. dust build-up around tissue dispensers, lint build-up during surface cleaning, sheet pilling during personal use). Typically, tissue products that are manufactured to provide high softness with low strength, such as bath and facial tissue, have the highest tendency for dust and lint issues.

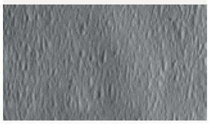
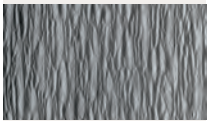
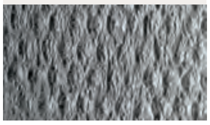
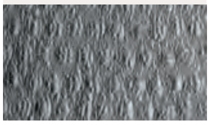
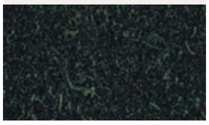
TISSUE GRADE	KEMVIEW SSA ANALYSIS		IMPLICATIONS
Conventional	Fine Crepe Structure Crepe bar count = 90 bar/inch 	Coarse Crepe Structure Crepe bar count = 58 bar/inch 	Softness Creping blade wear Yankee coating performance
Conventional	Low Area of Pinholes Pinholes = 0.08 % 	High Area of Pinholes Pinholes = 0.46 % 	Strength Dust and lint Formation Yankee coating adhesion
Structured	Good Sheet Structure Surface roughness = 12.3 µm Regular markings = 12.4 Crepe bar count = 84 bars/inch 	Poor Sheet Structure Surface roughness = 10.3 µm Regular markings = 6.0 Crepe bar count = 96 bars/inch 	Softness Absorbency Caliper Structured fabric wear Machine set up
Structured	High Dust Count Dust Index = 500 	Very High Dust Count Dust Index = 900 	Softness Strength End user satisfaction Safety hazard Machine and converting efficiency

Table 1: *Practical examples of the qualitative and quantitative sheet structure analysis from KemView SSA.*

Other potential sources for dust and lint problems are:

a) Process design: layering of short fibres on sheet surface, fines generation due to excessive refining and inadequate use of enzymes, weak tissue surface due to high Yankee coating adhesion, low sheet moisture creping, lack of strength additives to improve the bonding ability of fibers.

b) Furnish type: high content of short fibres, high content of fines, high content of recycled fibres

c) Sheet structure properties: high number of free fibre ends, high number of pinholes.

Optimising tissue strength, softness, and dust

More important than analysing the basic tissue properties or sheet structure properties individually is to have a clear understanding about the effect that a process change, made to improve a given tissue property, might have on other product attributes. We use Multivariate Analysis to study the relationship among different tissue properties and process variables during product optimisation activities. This approach helps with the identification of the best chemical solutions to improve a given tissue property without jeopardising the overall product and process performance.

A strong relationship between tissue strength, softness, and dust is typically observed in tissue products (as illustrated in Figures 2a and 2b). We rely on data analytics to select the adequate combination of Kemira's tissue chemistries (e.g. dry and wet strength additives, softeners, and creping additives) to develop tissue products with superior softness and minimum dust generation without sacrificing product strength. Due to the significant effect that wet strength chemistries have on tissue disintegration (as illustrated in Figure 2c), Kemira's temporary wet strength additives with high wet strength decay rate are designed to create tissue products with sufficient wet strength and very high disintegration.

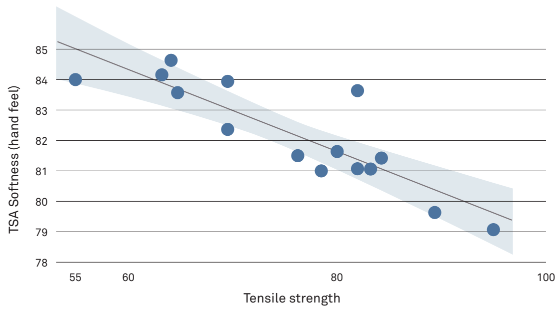


Figure 2a: *Softness vs. tensile strength.*

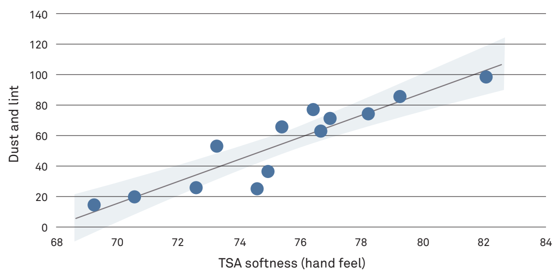


Figure 2b: *Dust vs. softness.*

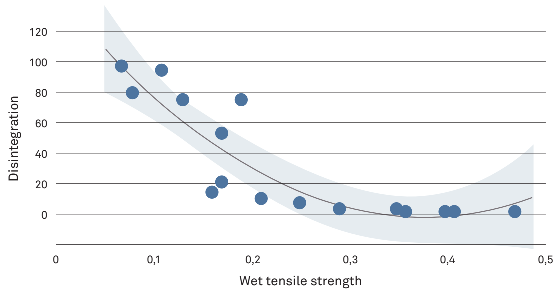


Figure 2c: *Disintegration vs. wet tensile strength.*

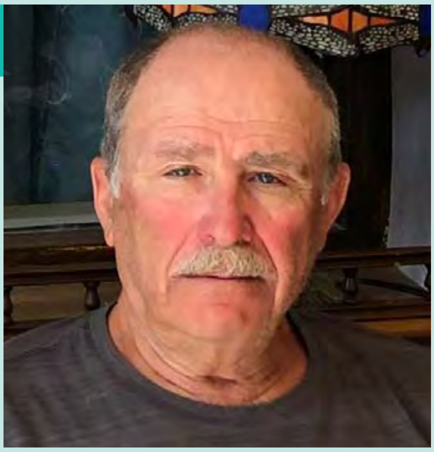
Summary

Kemira's Tissue Quality Analysis (TQA) is a complete approach to perform a comprehensive characterisation of sheet quality by combining basic tissue properties and the capabilities of the KemView Sheet Structure Analyser. TQA helps with the identification of the best chemical treatments to improve tissue performance, enhance machine efficiency, and improve the overall economics of tissue making processes.

This article was written for TWM by Kemira Chemicals' Tiago de Assis, Research Scientist, R&D & Technology, and Lucyna Pawlowska, Senior Applications Specialist, Strength & Tissue.

AFTER A BRIEF RETAIL APPEARANCE ON US CHAIN STORE SHELVES, BAMBOO HAS RETURNED TO E-COMMERCE

Online, bamboo tissue products - especially toilet paper - are on the rise with more enterprises offering impressive varieties to attract price-concerned savers, "green" loyalists and "white cloud" softness devotees. Industry analyst Gregory Grishchenko looks at its American future as production in China gears up.



Gregory Grishchenko
Industry Analyst

After the unexpected tissue product run caused by the outbreak of the Covid pandemic almost a year ago all major grocery chains across the US effectively restocked supermarket shelves with pre-pandemic varieties of local brands.

Even during that time of extreme demand, bamboo tissue, which has seen an explosive but exclusive online trade growth, did not feature prominently in American retail outlets. However, this year Babo toilet paper brand made of unbleached bamboo tissue appeared on display at several CVS pharmacies in Florida.

CVS Pharmacy is the largest pharmacy chain in the United States with almost 10,000 locations, and among its merchandise includes household items as tissue goods.

Babo brand supplier is Vanov Group from Sichuan province in Southwest China, a region known for rich bamboo vegetation and being the homeland of giant pandas.

At present, Sichuan province stands for a bamboo pulp-leading source with annual production capacity of almost three quarters of a million tonnes. Vanov uses bamboo pulp as raw material to produce unbleached tissue products including toilet paper and napkins. The company established its US sales office in New Jersey, claims the annual capacity of 200,000 tonnes of bamboo pulp and (according to its website) employs over 3,000 in three factories.

With such a solid production base, its products in the US can afford a nominal profit margin (if there is one) due to shipping and handling expenses.

Other bamboo tissue brands also appeared in major US chains - Target (unbleached bamboo toilet paper brand Caboo) and Costco (similar brand Reel).

However, as the tissue production crisis eased, suppliers for major brands and private labels resumed full volume deliveries. Apparently, bamboo toilet paper did not passalways consumers'cost/value test during the first months of the epidemic and was often the only product left on shelves at the tissue product isles after all conventional tissue goods were

Above: *Bamboo growing in a US restaurant*

gone. Bamboo toilet paper moved back to websites.

Challenges of switching to non-wood tissue

There are two categories of virgin fibre raw materials for tissue making mainly classified as wood and non-wood fibres. Perhaps the most eco-friendly tissue paper option among wood fibre materials, recycled paper, uses no new resources and makes use of materials that should otherwise go to waste. However, for a significant number of consumers, waste paper as a source is a turnoff, mostly due to the presence of process bleach and chemicals used to make a product safe and attractive.

Bamboo as a raw material for tissue production creates a number of challenges in stock preparation especially for refining. Bamboo pulp has shorter fibres than virgin wood and is therefore structurally weaker, so refinery technology is applied to bamboo biomass in the pulping process in order to preserve the flexibility of bamboo fibre. In general it takes lower flow, higher motor power and additional apparatus to meet raw material specification for tissue.

Many newcomers in premium bamboo tissue have arrived in the playing field of Charmin, Angel Soft and Cottonelle. Without bleaching or with only mild bleaching the bamboo pulp remains relatively original colour. In order to achieve a competitive "whiteness", the brand like No.2 points out the advantages of TCF (Totally Chlorine Free) mild bleaching process, using environmentally friendly bleaching agents such as oxygen, ozone, hydrogen peroxide and biological enzymes.

The brand Silk'n Soft, however, goes farther to whiten its 3-ply toilet paper. Its manufacturing plant processes ECF (Elemental Chlorine Free) bleached sulphate bamboo pulp using low chlorine content multi-stage bleaching and replacing chlorine with chlorine dioxide gas. Indeed, chlorine dioxide makeup is far away from chlorine's toxic nature, still it can harm humans in the long run.

Greenwashing helps

In recent years American shoppers have become more ecologically aware. As a result, a growing number of online enterprises selling bamboo tissue goods offer an impressive range of tissue grade varieties to capture an entire consumer array from a price-concerned saver to a "green" loyalist to a "white cloud" softness devotee.

Bamboo tissue products, especially toilet paper, are definitely on the rise in the United States. In unbleached bamboo tissue category there are numerous direct-to-consumer companies with sleek websites and catchy names (Tushy, Betterway, Who Gives a Crap, Bim Bam Bo, Cheeky Panda, Noo Trees and Smitten) promoting eco-friendliness and camouflaging dubious light brown aesthetics of unbleached tissue with paper wrap (no plastic) and soy inks graphics (no solvents).

The brand Rebel Green amplifies its statement of eco-kindness by pandering to 'bleeding heart' millennials with the claim that their bamboo source for such toilet paper is not extracted from regions in China inhabited by pandas.

Wholeroll toilet paper brand claims that its virgin bamboo pulp comes from FSC-certified, responsibly "well-managed" bamboo forests. The company does not use chlorine bleach, BPA, or any other harmful chemicals in its production process, however, the word "organic" for advertising seems kind of excessive. The absence of bleaching process chemicals may or may not convert a health conscientious consumer of wood-based recycled toilet paper to bamboo, which in general has a higher price tag.

Production rise in China

Primarily bamboo paper was processed at small factories using abundant local plant vegetation and providing hundreds of thousands of local residents with a way to make a living. The Chinese government was the original owner of the bamboo paper industrial units and later even patronised private business groups that took over bamboo tissue production by awarding them special permits.

They were not only authorised to harvest and process bamboo plants but also given a certificate recognising social and environmental efforts as beneficial for the country.

In the last decade the makeup of bamboo tissue manufacturing has changed drastically. Output volume from big players grew at the expense of small and mid-size companies. Adopting bamboo tissue production as an important part of business strategy, the major paper groups Taison, Lee & Man, Vanov, C & S, Hengan and Yibin are replacing outdated narrow trim and low speed tissue machines with state-of-the-art crescent formers from leading Western suppliers Andritz (Austria), A.Celli (Italy), Voith (Germany) and Valmet (Finland) supplied with entire stock preparation plants. Responding to this challenge, smaller businesses must choose between upgrading (with lower cost domestically made tissue and converting equipment) or go bankrupt.

The Taison Group is one of the largest producers of paper, board, and tissue in China, with a total tissue (including bamboo) capacity of over five million tonnes in 2018. The group planned to reach half a million tonnes of bamboo tissue a year by 2020 making it one of the key bamboo tissue processors in the country.

The group assigned the most modern tissue machines from Andritz to paper mills at Suzhou (Jiangsu Province) and Chishui (Guizhou Province) for bamboo tissue production. Two crescent former tissue machines PrimeLineSTat Suzhou with a design speed of 1,900 m/min, a paper width of 5.6m, 18 ft. Steel Yankee and a total design capacity of up to 120,000 tonnes of tissue per year may also process conventional virgin or recycled wood-based fibre pulp. The other two identical tissue machines, PrimeLineST are at Chishui with design speeds of 2,000 m/min and a width of 5.6m, each combine high performance PrimeDry 20 ft. Steel Yankees (among the largest in the world) with PrimeDry steam-heated hoods. Along with PrimeLineST tissue machines, Andritz also supplied complete stock preparation lines.

A few years back Andritz also delivered a smaller tissue machine for bamboo processing to Zhuji Paper mill in Nanxiong, Guangdong province. The new tissue machine has a trim width of 2.85 metres, a design speed of 1,600 m/min, a PrimeDry Hood ST with steam heating and an automated stock preparation system.

Hong Kong-based and privately owned Lee & Man Paper Manufacturing is one of the top suppliers of paper products to the Chinese market. It specialises in paper packaging, especially in containerboard. The company gained interest in tissue products and between years 2014 and 2018 purchased nine Advantage DCT 200 HS crescent former tissue machines with stock preparation systems from Valmet.

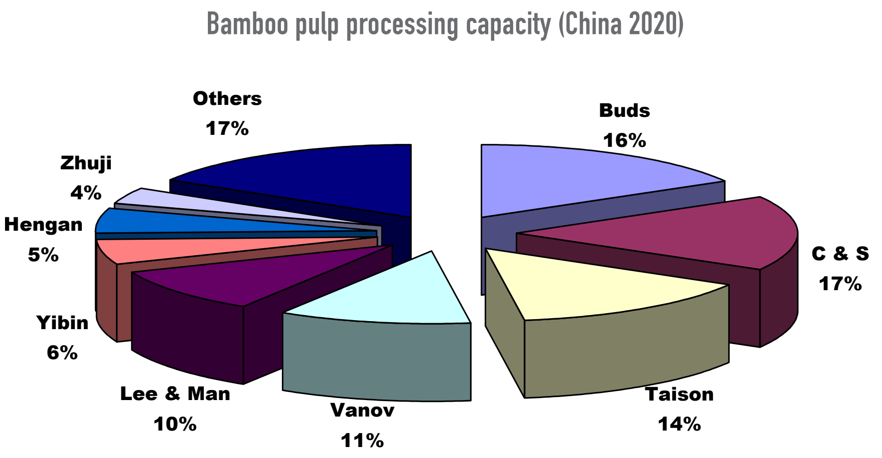
All these machines have a width of 5.6m and a design speed of 2,000 m/min, using virgin fibre or bamboo fibre slush as raw material. Lee & Man's Chongqing mill in the bamboo rich Sichuan area mainly uses bamboo fibre slush benefiting from the combination of steam-heated hood, Advantage ViscoNip press and cast Yankee dryer, a reliable configuration that enables low energy consumption with high production rate. The company is also experimenting to run different types of modern crescent formers from Voith (Germany) and Kawanoe Zoki (Japan) on bamboo pulp to make unbleached tissue products.

Yibin Paper, from Sichuan province was known for making disposable paper cups and bamboo board. Currently, the 70-year-old company owns a bamboo pulp mill and sets the goal to be China's largest bamboo tissue paper producer, using exclusively bamboo pulp (some bamboo tissue manufacturers add wood fibre pulp to improve strength and softness). The mill's layout was designed for exclusive bamboo slush pulp use, from stock preparation to tissue machine. Yibin Paper ordered five high-speed iDEAL tissue machines from A. Celli Group (Italy), with a speed of 1,800 m/min, a paper width of 2.85m, and a production capacity of 25,000tpy each. Four modern crescent formers are currently in operation using 16 ft. and 18 ft. diameter Steel Yankee dryers and latest-generation steam hoods.

Growing bamboo in America

In terms of sustainability, affordability and global availability, there is no resource that can match bamboo with its claimed three foot a day growth and unlimited usefulness. Naturally bamboo is becoming a popular alternative to trees as raw material and eco-friendly bamboo toilet paper may certainly become a choice for more people concerned with climate change. However, reducing carbon footprints also means sourcing materials from places close to

Cheeky panda: *Pandering to the green devotees*



home. Bamboo tissue goods in the US are currently all coming from China and the Far East, which makes it a snag.

There is some commercial bamboo farming in the area around the Gulf of Mexico. Only in these hot and humid surroundings will the Moso bamboo plant achieve its full size. Bamboo, however, is not a native for American soil, and it generally flowers only every 60 to 120 years and then dies. It is hard to grow bamboo from seed and growing it by dividing existing plants is very tricky as well.

A trained eye can find bamboo plants everywhere in Florida, from wild patches in natural preserves to small forest areas around golf courses to five star hotel shrubbery. There a bamboo plant is considered more like decoration or food than a paper source.

The US land in the south and notably in Florida, where limited bamboo harvesting takes place, may not provide enough raw pulp fibre to justify local tissue production, however jumbo rolls of bamboo tissue shipped from China can be converted and packaged with local sources.

Despite successful experimentation with growing bamboo in test tubes, there are still risks with harvesting Asian bamboo in North America, when some very adaptive bamboo varieties may drive native eco-systems into extinction.

Forecast

Almost a decade ago the trend of using alternative non-wood fibre resources such as wheat straw, bamboo, sugarcane, reed, corn stalks and hemp for tissue products began in China. After cutting off secondary paper imports, China still remains the largest worldwide market for imported wood pulp, comprising 41% of global imports. Expanding export of non-wood tissue products seems to be an expected move. Surviving wood pulp price wars and numerous bankruptcies of non-wood fibre enterprises, the bamboo tissue industry in the country established itself as a single leader in the alternative tissue supply channels.

According to Pierre Bach from Hawkins Wright Research, UK, non-wood fibre tissue products (essentially 90% bamboo) have held onto their niche purposes fluctuating around 2.7 million tonnes worldwide for the last decade. While China established itself as a major virgin fibre tissue exporter with over 40% of the world production growth seen over the past decade, the consumption of non-wood tissue however is apparently expected to gradually erode over time.

In the current state of Chinese-American trade relations a domestic consumer's perception in the United States may play a critical part in the development of bamboo tissue sales. A choice between coarse and brown feeling versus white and soft can make the near future of bamboo toilet paper look bleak. It will remain in a niche within 10% of imported tissue commodities coming to the US every year.

Above: *This year Babo toilet paper brand appeared at several CVS pharmacies in Florida*

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