

## ***Productivity in the Pulp and Paper Industry***

***By Patrick McCarthy***

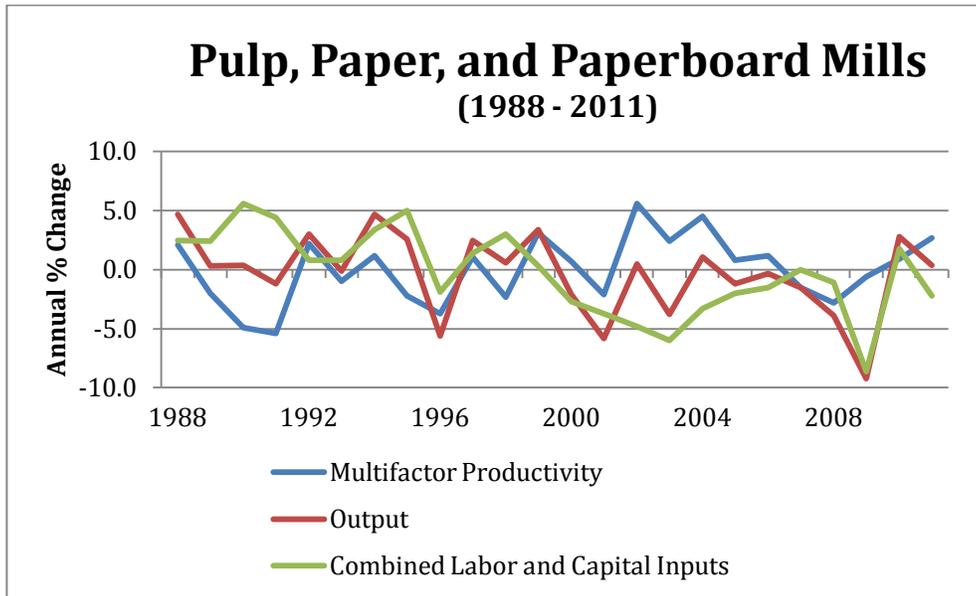
The Bureau of Labor Statistics recently reported (BLS News Release, July 9, 2014) preliminary results for multifactor productivity trends in 2013. Multifactor productivity (MFP) is intended to measure the effect on economic growth due to factors other than labor and capital. That is, after accounting for changes in labor and capital, MFP reflects the net effect of technological change, energy and labor efficiency improvements, scale economies, reallocation of resources, research and development, and other factors on economic growth. The 2013 estimates are preliminary because the BLS does not yet have all of the data that it needs to calculate the final MFP. With this in mind, the BLS reported that private business sector MFP increased at a 0.7% annual rate in 2013. Based on the preliminary figures, private business sector output increased 2.5% in 2013 and combined inputs of capital and labor increased 1.8%. The difference between these two numbers (2.5 – 1.8) is the net effect of all other factors affecting economic growth, i.e. MFP growth. How does this compare to prior years? According to the BLS, the annual 0.7% growth in MFP between 2012 and 2013 matches the compound annual growth in MFP during the period 2007 – 2013 period, which is half the 1.4% average compound annual growth in 2000-2007.

For specific industries, the most recent MFP annual growth rates are for 2011. Figures 1 and 2 provide annual growth rates for the pulp, paper, and paperboard and converted paper product manufacturing sectors for 1988 through 2011. Recalling that MFP growth is the difference between output and combined input growth rates, we see that MFP during the latter part of the 1980s and early 1990s bottomed out in 1991, at -5.4%. This

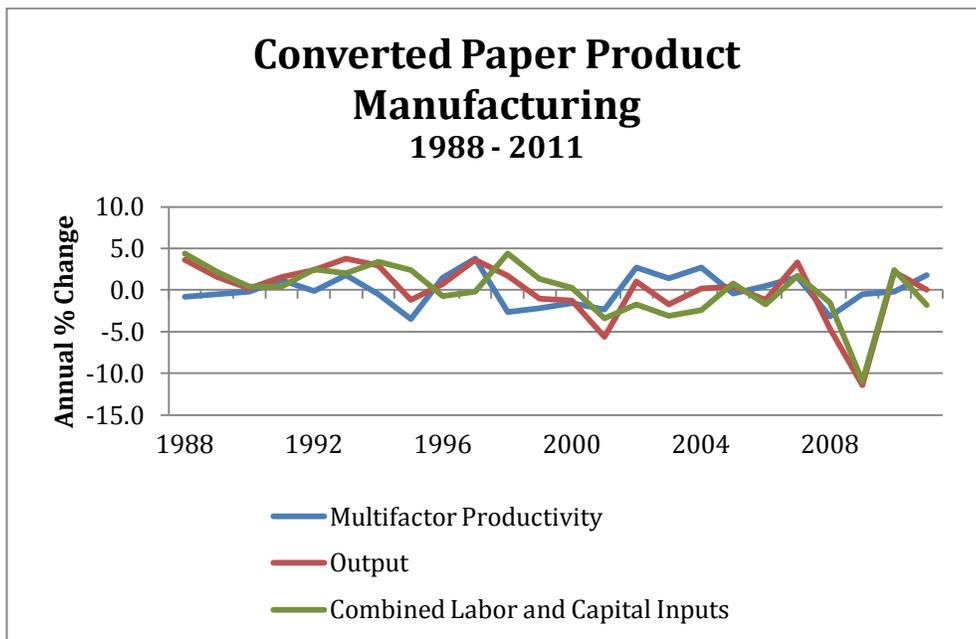
reflected a high growth of inputs with a lackluster growth in output, which respectively equaled -4.4% and 1.2% in 1991 (noting that the difference is greater than -5.4% change in MFP due to rounding). Hovering around 0% growth during the mid-later 1990s and early 2000, MFP was positive from 2002 – 2006, reflecting a larger decrease in combined inputs relative to the sector's output. The effect of the great recession is clear in the graph from the sharp decreases in output and combined capital and labor inputs. The trough occurred in 2009 with a 8.6% and 9.2% decrease in combined inputs and output respectively, leading to a 0.6% drop in MFP. In contrast, as the mill sector rebounded, output grew at a faster pace than capital and labor inputs so that the annual increase in MFP was 2.7% in 2011.

For the converted paper manufacturing sector, Figure 2 presents a productivity picture where there is generally less volatility in annual MFP growth rates and, particularly during the early 2000 period, where output and combined labor and capital inputs changed at similar rates than was seen in Figure 1 for the mills sector. But the great recession hit this sector harder than the mills sector. Combined inputs and output decreased 1.5% and 4.6% in 2008, reducing MFP growth 3.2%. In 2009, the full effect of the recession was felt, with combined inputs decreasing 11% and output falling 11.4%. Sector growth from other factors was 0.5%. And 2011 growth in this sector has been weaker than in the mills sector. Combined inputs of capital and labor fell 1.8% and there was no growth in output, leading to a 1.8% drop in MFP for the year.

Multifactor productivity helps industry stakeholders understand the sources of sector growth and decline. In measuring changes in output per unit of combined capital and labor, MFP distinguishes labor productivity and capital intensity from other factors that influence output growth.



**Figure 1. Annual growth rates for the pulp, paper and paperboard sector**



**Figure 2. Annual growth rates for the converted paper product sector**

And although not discussed here, MFP also has implications for a sector's prices. Output price changes are positively related to labor compensation and the price of capital services but inversely related to MFP. To the extent that MFP explains output growth, MFP growth will to a

greater or lesser degree offset increasing input prices which restrains increases in output prices.

### ***Paper Innovates***

CPBIS director Pat McCarthy is one of a group of industry professionals and observers that has examined the paper industry's record of innovation during the past thirty years. The group, led by industry veteran Ben Thorp, summarized the results in a recent

publication (“Pulp and Paper Innovations,” Paper 360<sup>0</sup>, July/August 2014, pages 12-16, 36). It highlighted eight of the industry’s significant innovations and outstanding accomplishments. The list:

1. Aseptic packaging. Sterilized packaging can keep perishable contents fresh for months. Think, for example, the fruit drinks and milk found in kids’ lunch boxes.
2. Chlorine-free bleaching. Eliminating the use of chlorine allowed the industry to ensure that no toxic chlorinated compounds are released to the environment.
3. High filler content paper. Chemical systems were developed to allow paper to be made under slightly alkaline conditions instead of the traditional acidic ones. This allowed low-cost fillers to be incorporated in substantial amounts. Among the benefits were significant improvements in paper permanence, brightness, opacity, and recyclability, as well as improvements in paper machine durability, environmental impact and energy savings.
4. Twin wire forming retrofits. The previously ubiquitous fourdrinier paper machine forming sections removed water from only one side of the developing sheet, resulting in two-sidedness. To mask it, publication papers had to be heavier, incurring high mailing costs, among other problems. Retrofitting machines to remove water from both sides eliminated the problem.
5. Extended nip presses. Pulp stock is fed to paper machines as a very dilute suspension in water. On the machine, the water is removed in three stages: in the forming section (easy), the press section (not so easy) and the dryer section (expensive). Extended nip press technology developed in the 1980s enabled much more of the water to be removed in the press section. This reduced drying energy by up to 40% and enabled paper machines to run faster and make more tonnage.
6. Highly energy efficient chemical recovery boilers. Older, conventional units produced steam at pressures ranging from 600 to 900 psi and had thermal efficiencies of 35-40%. The new technology generates 1600-psi steam and has thermal efficiencies of about 60%. One US

installation has allowed the mill to discontinue power purchases.

7. Millwide control systems. Digital sensors and controls were developed and made available as prepackaged systems that enabled high operating rates, process optimization and the production of grades that could not otherwise be made.
8. Production of biochemicals. Increasingly mills have achieved success in developing processes for the recovery and production of value added chemicals and other products from woody biomass. In addition, much work is underway to enable the repurposing of mills that shut down because of decreasing demand for their paper products. Such mills are positioned to take advantage of existing infrastructure, wood sources, wood handling equipment and energy production and distribution capabilities.

In their conclusions, the authors state that, “ ... the pulp and paper industry is resilient and continues to find ways to meet marketplace, energy and environmental challenges as well as respond to emerging issues and opportunities.”

### ***Trend Indicators from Industry Intelligence Inc.***

[Industry Intelligence Inc.](http://www.industryintel.com) has provided market intelligence to more than 600 companies worldwide since it began as Forestweb in 1999. Industry Intelligence delivers a daily report featuring news of the paper and forest products industries. For your subscription visit: <http://www.industryintel.com>

Below is a small sampling of recent Industry Intelligence headlines, chosen to mirror significant trends in and around the paper and forest products industries.

***Finland recycles up to 80% of all paper and paperboard consumed in 2013, reaching new records despite drop in paper consumption, reports FFIF; most of the recovered paper used to make new paper products, some for insulation and other purposes***

Europe in general leads the world in the rate at which it recycles paper products. In 2012 It was 70 percent, while the global recycling rate was less than 60 percent. It will be difficult to maintain these figures, as the decline in the consumption of printed media reduces the amount of paper that gets recycled. The consumption of hygiene paper products is increasing but they are not recyclable. Overall, 21 percent of paper consumed is not suitable for recycling.

***Global dissolving pulp capacity rises by about 18% in 2013, to 5 million tonnes, dampens prices by about 16%, to US\$895/tonne, compared to US\$1,060/tonne in 2012, US\$1,870/tonne in 2011; excess capacity expected to prevent price increases in near future***

There was only a slight increase in the prices due to the anti-dumping import duties imposed by China on dissolving pulp from Canada, Brazil and the US.

***National Geographic begins incorporating recycled fiber in all pages of National Geographic Magazine, National Geographic Kids and National Geographic Little Kids; move is a 'tipping point' for recycled paper in magazine industry, says Green America***

For large publishers that have been slow to adopt recycled fiber for their publications, the latest move by National Geographic—one of the most widely read and admired publications in the world—sends an important signal to the industry.

***British Columbia's Port Alberni Port Authority in talks with company over possibility of using its facilities, part of the docks to manufacture biocoal from biomass feedstocks***

Wood debris would be converted to biocoal and shipped to China

***Pulp mills in Finland today could make synthetic natural gas from carbon dioxide profitably, methane production would require investment of about €10M per mill, says VTT Technical Research Centre of Finland***

According to researcher, plant that is planned in Äänekoski could produce about 10 terawatt hours of methane; the requirement of Finland's road traffic is 55 terawatt hours.

***Total European paper and paperboard production falls 1.2% year-over-year in 2013, to 91.1 million tonnes, the third consecutive yearly decline, reports CEPI; decrease mostly due to drop in graphic paper consumption, but tissue and packaging demand grew***

On the whole, the European pulp and paper industry continues to suffer from the slow economic recovery.

***World containerboard demand to reach 115 million tonnes/year by 2019, up from 90 million tonnes/year in 2013, forecasts Smithers Pira; growth is tied to increased use of packaging, driven by more online shopping and more retail-ready packaging***

In 2019 production is expected involve more than 750 paper mills producing the grade worldwide.

***US Dept. of Labor to provide US\$1.8M in emergency grant funding to workers affected by closure of IP's Courtland, Alabama, paper mill***

The grant will be used to provide the affected workers with the training and case management services they need to successfully find employment in their area.

***Morningstar: IP's massive corporate restructuring has been bold and expensive, but given old business model's inability to sustainably generate returns above cost of capital, such a move was necessary and new model will increase shareholder value***

The company has shed more than \$11 billion worth of timberland and noncore businesses and strengthened its position in industrial packaging by acquiring Weyerhaeuser's packaging division in early 2008 and Temple-Inland in 2012. These acquisitions have resulted in IP having an approximate one-third share of the North American containerboard industry, compared with 19% for its closest competitor, Rock-Tenn. IP also has paper operations or investments in emerging markets, including its joint venture with Ilim, the largest pulp and paper company in Russia. Ilim has two pulp mills in Siberia that provide daily rail deliveries into China, the country with the world's biggest fiber deficit.

***Sequencing of eucalyptus genome could improve paper production***

Oregon State University scientists recently published findings in which they assigned functions to the more than 36,000 genes of *eucalyptus grandis*, one of the world's most widely planted trees. Individual genes correspond to everything from growth rate to wood hardness. Plant breeders, for example, would be able to use the genome to breed for less lignin, which would be ideal for making paper because its production would require less energy and fewer chemicals.

***Electric hand dryers on the rise in US public restrooms, leaving many Americans and paper towel industry unhappy; dryer manufacturers say hand dryers are cheaper and eco-friendly, consumers say towels are quicker to use and help germaphobes more***

An article in the June 24 issue of the Wall Street Journal notes that electric hand dryers have been replacing paper towels in more public restrooms over the years, despite the fact that, according to a 2009 study by Facility Cleaning Decisions, people preferred paper towels over hand dryers by a 4-to-1 margin. Leading paper towel providers like Georgia-Pacific

and Kimberly-Clark said they will continue launching new lines of hand towels.

***Glatfelter's specialty papers business appoints Timothy R. Hess as VP of sales and marketing, and Calvin Staudt Jr. joins company as VP of manufacturing; changes are intended to create more integrated leadership structure, accelerate product development***

Mr. Hess earned a Bachelor of Science in Engineering Physics from the United States Military Academy, West Point and a Master of Science in Pulp & Paper from the Institute of Paper Science and Technology, a CPBIS founding institution.

### **Paper Quotes**

“ ... we think the Americans win the most. The Europeans are OK because they have a pretty balanced market, but Asia will be challenged because so many boxes leave Asia, and guess what, you can't collect them there” – *Chip Dillon, a partner at Vertical Research Partners, on the effects of expected increases in OCC prices in a June 24 i2live webinar on the outlook for containerboard. (Full transcript available from Industry Intelligence.)*

### **Technology for the Nontechnical: Wood and Pulp Fiber Structure**

Picture a bunch of parallel, straight, stiff pipes bundled together so that an end view of them resembles a honeycomb. Now imagine that the walls of the pipes are made up of several layers and the pipes are glued together, with some of the glue having soaked into the walls of the pipes, which are slightly porous. The glue inside the walls is what makes the pipes stiff.

What you now have in your mind is a simple model of the structure of wood on a microscopic scale. The pipes are the wood fibers and the glue is lignin. In the case of southern pine the fibers are about a fifth of an inch long and two thousandths of an inch in diameter, which is about the same as the thickness of a human hair.

The pulping process consists of subdividing the wood into small pieces (chips) and using pulping chemicals to dissolve most of the lignin that held the fibers together in the wood. This allows the fibers to separate. It also makes them flexible because much of the lignin that was inside the fiber walls is also removed; it was this “intrawall” lignin that was responsible for the stiffness of the fibers as they

existed prior to pulping. Flexibility is important because it allows the “pipes” to collapse, becoming more like ribbons than pipes and increasing the surface area available for contacting neighboring fibers. In the papermaking process, the fibers are diluted with a large amount of water to enable the formation of a uniform ‘web,’ or wet paper sheet. When, on the paper machine, water is removed from the resulting dilute suspension, the collapsed fibers, by virtue of their ribbonlike shape, can come into intimate contact with neighboring fibers, allowing them to become bonded to one another. The degree to which this collapse occurs and the strength of the resulting interfiber bonds is further enhanced by bleaching to remove residual lignin and by “beating” or “refining” the pulp, as will be described in subsequent articles.

### **AF&PA Statistics**

Since our last reporting of American Forest and Paper Association statistics releases, the Association has issued its May and June 2014 Printing and Writing Reports, its May 2014 Kraft Paper and its June Containerboard and Paperboard Reports.

#### **Printing and Writing**

**June:** Total shipments decreased 5 percent in June compared to June 2013, with total paper inventories flat compared to May. Uncoated free sheet (UFS) paper shipments in June decreased 8 percent compared to June 2013. YTD shipments are down 8 percent in 2014. Imports of UFS increased year-over-year for the seventh consecutive month, and were up 19 percent in 2014 relative to the same five-month period in 2013. Coated free sheet (CFS) shipments decreased 1 percent compared to 2013. YTD shipments of CFS grades are also down 1 percent and imports through May are down 3 percent. Uncoated mechanical (UM) shipments increased 7 percent in June, the fifth consecutive month of year-over-year increases. Year-to-date shipments of UM are up 4 percent compared to 2013. Coated mechanical (CM) shipments in June decreased 8 percent relative to June 2013 and are down 5 percent for the year. Imports of CM through May were down 12 percent compared to the same period in 2013 and CM exports increased 25 percent in May, the first year-over-year increase in the past seven months.

**May:** Total shipments decreased 7 percent in May compared to May 2013, with total paper inventories increasing 2 percent from April levels. Uncoated free sheet (UFS) shipments in May decreased 10 percent compared to May 2013. YTD shipments are down 8

percent in 2014. Year-to-date UFS imports through April are up 19 percent compared to the same period in 2013. Coated free sheet (CFS) shipments decreased 6 percent compared to the first five months of 2013. YTD shipments of CFS grades are down 1 percent and imports through April are down 4 percent. Uncoated mechanical (UM) shipments increased 8 percent in May, the fourth consecutive month of year-over-year increases. Year-to-date shipments of UM are up 3 percent compared to 2013. Coated mechanical (CM) shipments in May decreased 7 percent relative to May 2013, the second year-over-year decrease in the last three months. Imports of CM through April were down 12 percent relative to the same four-month period in 2013.

#### **Kraft Paper**

**May:** Total shipments were 128.9 thousand tons, 3.4 percent lower than in April. Bleached Kraft paper shipments dropped from 11.8 thousand tons in April to 9.4 in May, while unbleached Kraft paper shipments decreased from 121.7 thousand tons to 119.5. Overall, shipments for the first five months of 2014 were 1.4 percent lower than the same period last year. Total month-end inventories increased 6.4 percent compared to April.

#### **Containerboard**

**June:** Containerboard production was essentially flat compared to both May of this year and June of last year. The month-over-month average daily production increased 2.5 percent. Shipments for June were 2,968.4 thousand tons, representing 167.8 billions of square feet. The containerboard operating rate for June rose slightly by 0.1 points compared to May, from 97 percent to 97.1 percent.

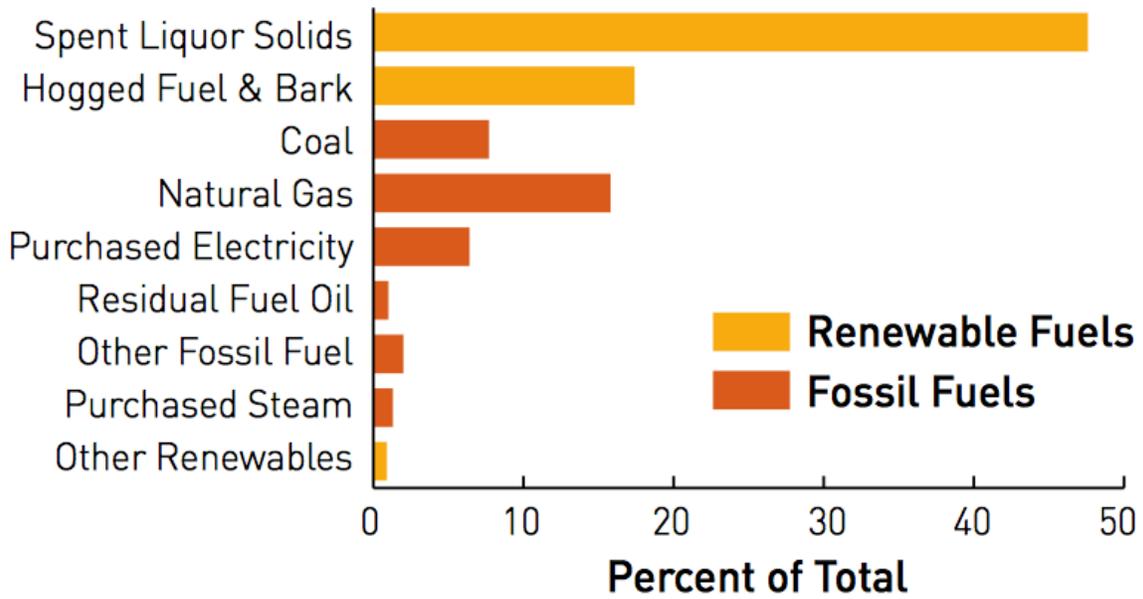
#### **Paperboard**

**June:** Total boxboard production increased 1.2 percent when compared to June 2013 and decreased 0.6 percent from last month. Unbleached Kraft Boxboard production increased over the same month last year, and increased compared to last month. Total solid bleached boxboard & liner production was flat compared to June 2013 and to last month. The production of recycled boxboard increased compared to June 2013 and decreased when compared to last month.

#### ***Statistics Corner: Mill Energy Sources***

Figure 3 shows the sources of the energy used by the US pulp and paper mills of American Forest and Paper Association member companies (believed to encompass nearly all US mills) and the percentage of the total energy used that is provided by each. The figure is taken from the Association's 2014 Sustainability Report, which may be accessed at <http://www.afandpa.org/sustainability>. The report states that, "We self-generate most of our energy needs; more importantly, most of that is renewable energy. On average, about 66 percent of the energy used at AF&PA member pulp and paper mills is generated from carbon-neutral biomass. In fact, forest and paper products facilities accounted for 62 percent of the renewable biomass energy consumed by all manufacturing facilities in all sectors. Fifty-nine percent of the electricity used by our members was self-generated. Indeed, 42 percent of our members' mills self-generated more than half of their power, and 23 percent sold excess power back to the grid, much of it renewable as well."■

# 2012 Pulp and Paper Mill Energy Sources



**Figure 3. Sources of the energy used by AF&PA member company mills during 2012**

*(Source: AF&PA 's 2014 Sustainability Report: <http://www.afandpa.org/sustainability>)*