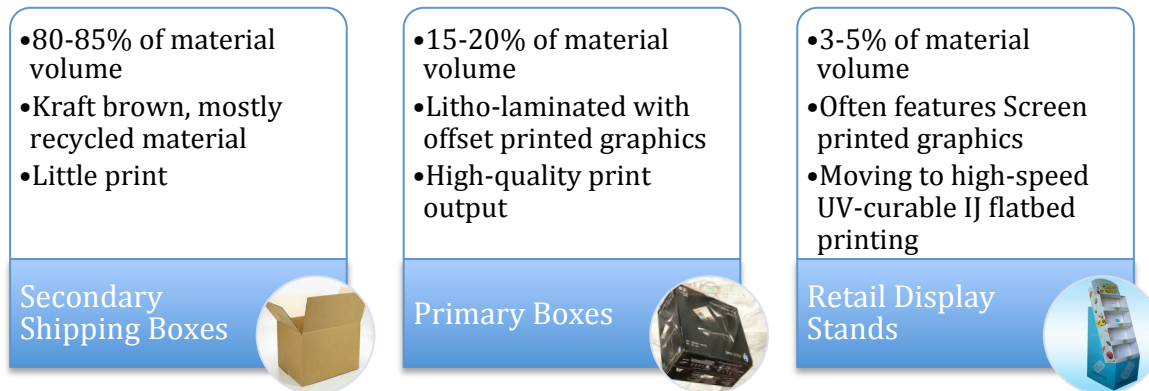


## A Brief Introduction to Corrugated Packaging Markets

Corrugated packaging in terms of volume of material is the largest sector of all the packaging markets. It is so large that the industry measures it in tons of material rather than square meters or square feet. Corrugated packaging is used effectively for three major purposes: secondary shipping boxes, primary boxes for larger goods, and retail display stands.



The largest use of corrugated packaging is for secondary shipping boxes. This is a highly tactical and functional use of corrugated where the highest protection at the lowest cost trumps all other requirements. There is little print requirement beyond simple one or two-color, with secondary labels typically being the lowest common denominator for any type of variable print.

Corrugated is also used for primary packing, mainly for consumer electronic products. Those boxes sit prominently on the shelves of consumer good retailers and often feature color graphics printed using offset presses. The graphics are printed on paper, which is then laminated onto the corrugated material. The industry term for this is litho-lamination or litho-lam for short.

Corrugated retail display stands are becoming more popular as a way to differentiate and stand out to impulse buyers. The size of these displays is typically dictated by the size of available floor space, which varies by store. Hence they are often printed in shorter run lengths than one might imagine due to the variations in output sizes. Consumer good manufacturers usually pay a premium to supermarkets and other retailers for the in-store floor space used to exhibit the retail display stand and its goods. Corrugated displays are an economical way to temporarily promote specific products in a display intended to most effectively highlight that products specific benefits.

It is difficult to size each of these segments of the corrugated industry as the publicly available figures can vary dramatically. As an anchor, we refer to the data recently presented by the world’s largest corrugated manufacturer and converter, International Paper. At a recent 2013 investor presentation International Paper shared the following data:

Figure 1 Corrugated Packaging Volume (millions of tons)

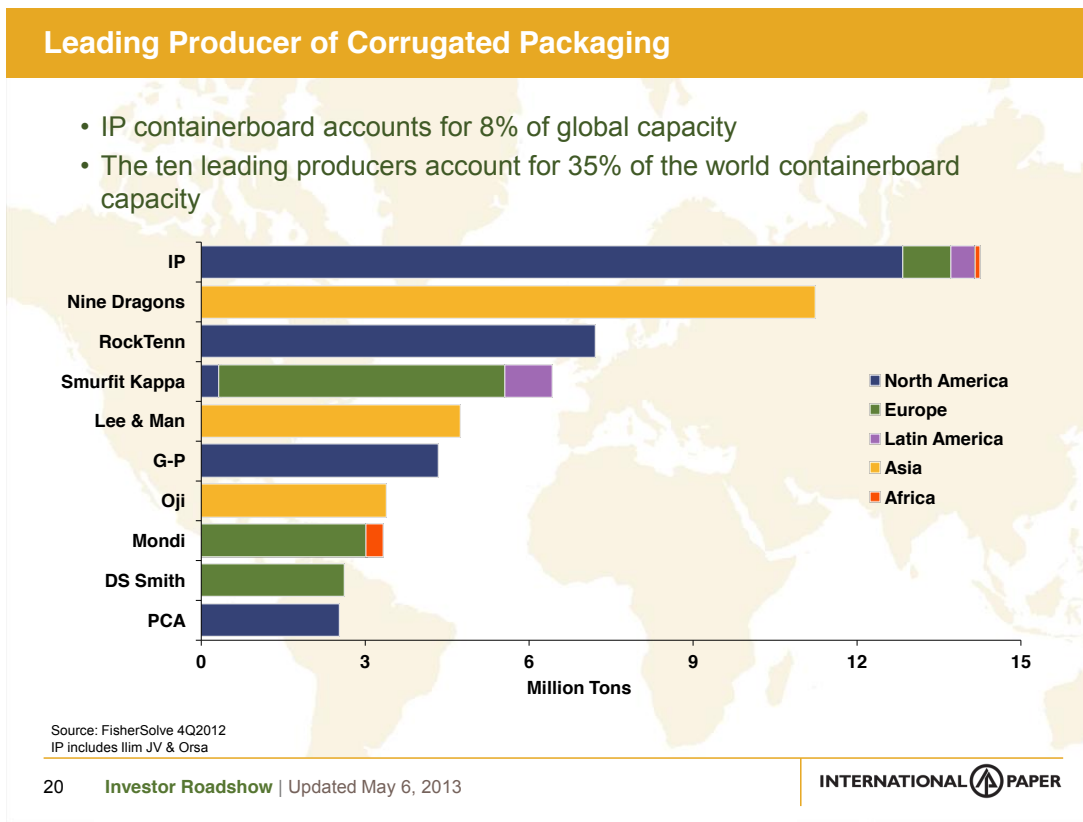


As the world’s factory China has retained its place in the world as the leading domestic consumer of corrugated boxes. Very few if any of these boxes are printed. Hand stamping of boxes with company logo and contents remains common; even stenciling continues to play a big role. After China demand for corrugated boxes is growing fastest in Latin America, followed by other emerging economies.

This is mainly driven by increasing labor cost, making China a less attractive place to manufacturer in compared Turkey, Mexico, and other countries within driving distance to Europe and the US market.

The producers of corrugated packaging material are also often converters. They score the corrugated so it can be easily folded and often will laminate offset print (often procured outside of the company) onto the corrugated boards to create what is called litho lamination. According to the data shown by International Paper, it is the world’s largest manufacturer capturing 8% share of the corrugated packaging markets.

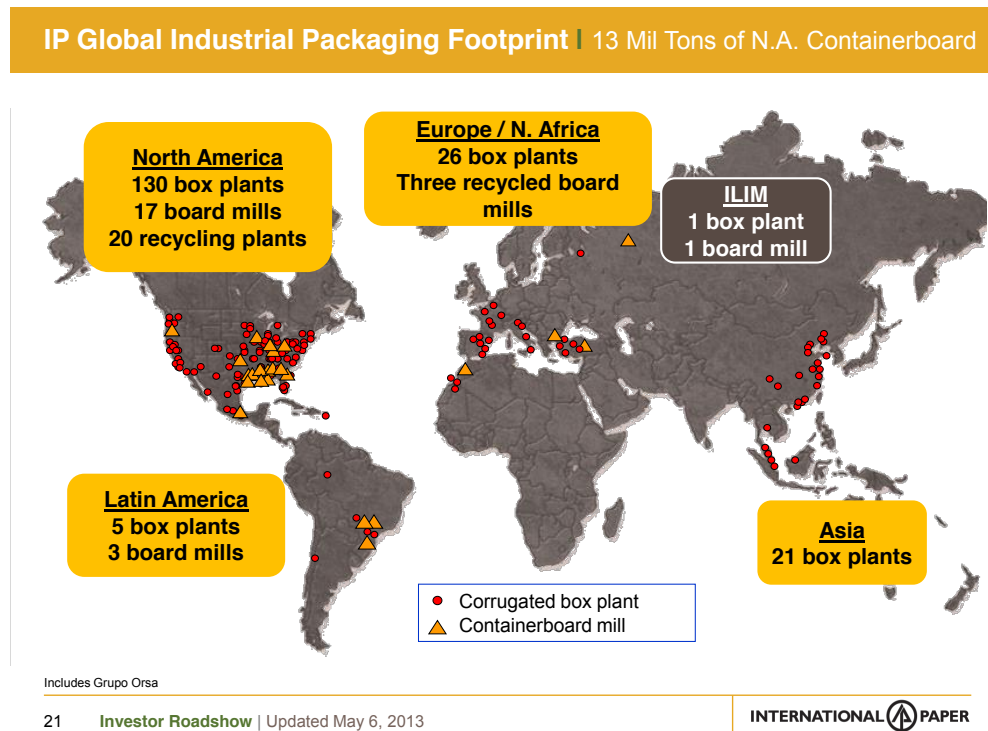
Figure 2 Top 10 Producers of Corrugated Packaging



Looking at figure 2, International Paper claims to have nearly 50% of the market in North America for corrugated board. It captures this volume in North America with approximately 130 plants (see figure 3). If International Paper follows market trends and converts litho lamination at 10% of those plants, in theory it would need 13 sites to be able to create litho laminated corrugated packaging.

International Paper is an exception however as they are vertically integrated. There are hundreds of independent box manufacturers who print and convert corrugated material into boxes. How many might need a digital printing system to print corrugated? We don't know as many of the smaller plants may well be satisfied with mid-range and high-end UV-curable flatbed ink jet printers rather than dedicated corrugated digital printing systems.

**Figure 3 International Paper Corrugated Plants**

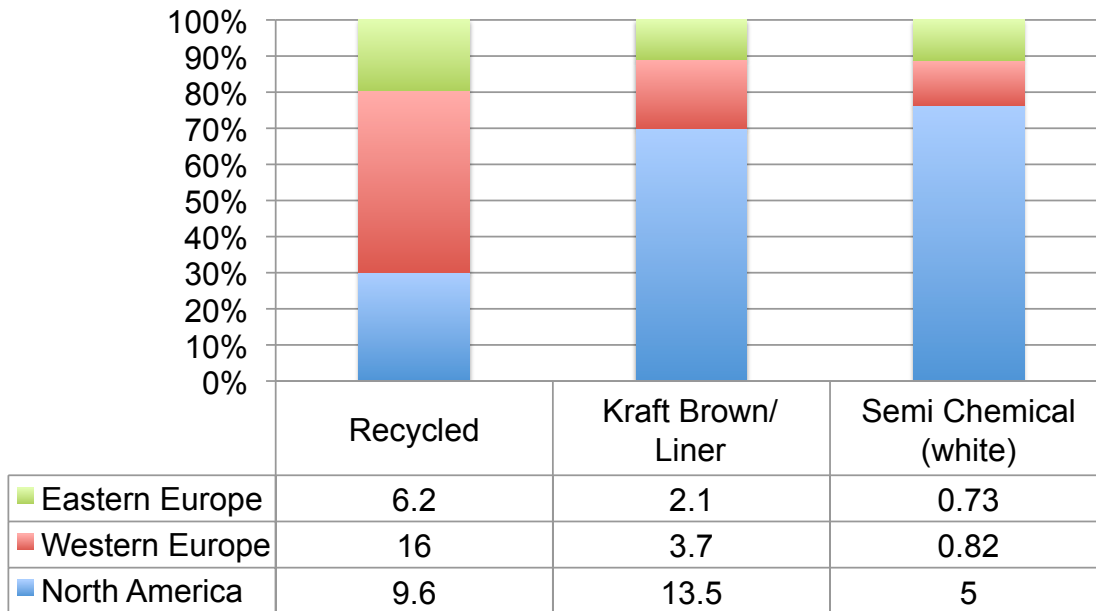


Additionally one needs to include the flexo/screen/offset printers who are printing and creating corrugated retail display stands. But here too there may well be a finite number of customers. With over 100, \$1M price tag high-end production UV-curable flatbeds installed worldwide already there is bound to be an upper limit to foreseeable demand for digital ink jet production systems dedicated to printing corrugated retail display stands.

While we don't know the exact number of eligible converters that could adapt digital ink jet printing systems, we do know that litho lamination or its digital single-process cognate is one of the last high margin sectors left within the oversupplied corrugated packaging industry.

Out of the Western markets, North America may well be the place to start, as it is the highest volume user of virgin white corrugated board in the world.

Figure 4 2012 Corrugated Board by Type, North America and Europe (M of tons of corrugated material)



Source: www.risi.com

Virgin corrugated is easier to print on, as there is less concern about ink opacity requirements and the hiding of recycled board pieces. While a large potential market, it will also be full of technical challenges for digital ink jet printing (note it will likely be ink jet as corrugated prefers a non-contact printing technology and it will require wider printing widths than 29”). The minimum print width requirement is estimated to be 48”, the printing systems will likely be in a non-office, non-climate controlled environment, and the operating environment may be dusty with recycled fibers floating in the air.

All of this indicates to us that digital printing of corrugated packaging will be a journey, a journey that has commenced with non-application specific wide format UV-curable flatbed printers. It also means that with all the barriers indicated it will remain a low-volume, but high-value application for digital printing. As Ralph Waldo Emerson stated, “life is a journey, not a destination.” Let the journey continue.