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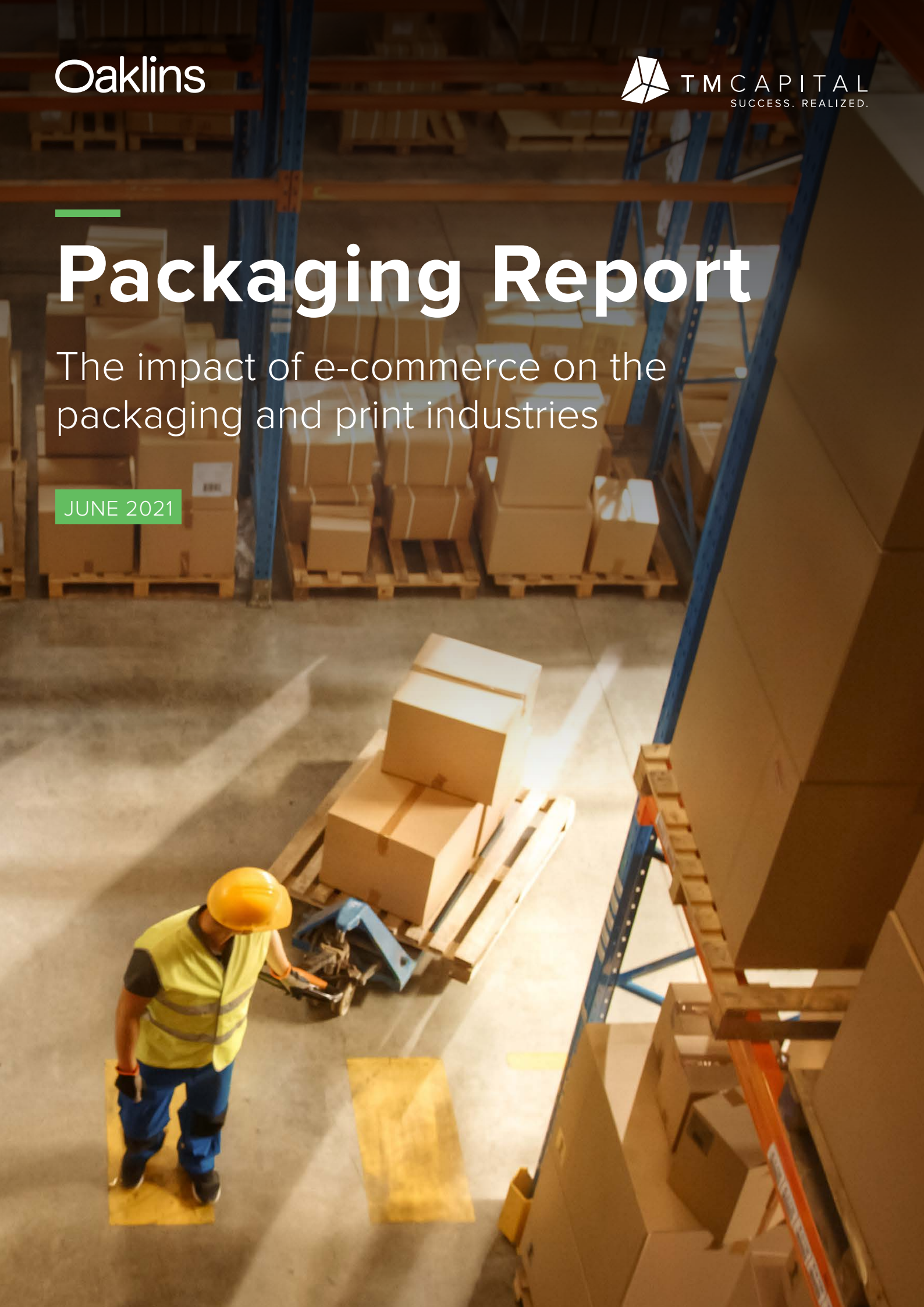
Packaging Report

The impact of e-commerce on the packaging and print industries

JUNE 2021



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Overview

Though the packaging sector might not be top of mind as an industry heavily impacted by the digital revolution, the migration of retail away from brick-and-mortar in favor of e-commerce and the ever-expanding complexity of logistics and fulfillment are forcing big changes. These shifts are driving a revolution in packaging engineering, growing the use of substrates such as paper and aluminum, and changing the role of packaging in promoting customer satisfaction.

One dollar spent online generates seven times as much corrugated usage as a dollar spent in a store.

As more purchase decisions are made in front of a computer (or on a smartphone) rather than in a store aisle, the role of graphics as a marketing tool has also changed. For the e-commerce consumer, their first physical exposure to the product will be when it arrives at the doorstep. The challenge for the brands and the packagers is to make the customer feel good when she opens the package, the “unboxing” experience. This has also reduced the need for exterior graphics that call out to customers shopping in brick-and-mortar retail.

New challenges, tied to the acceleration of e-commerce and direct-to-consumer (DTC) retail, have increased the dependence of retailers and brands on logistics, package engineering and fulfillment in ways not previously encountered.

The growth of e-commerce and the changing ways our society transmits information have also increased the dependence of the print industry on packaging. In general, the move to DTC shipping has increased the importance of package structure to ensure a shipment survives the longer supply chain, while reducing the importance of graphics as fewer purchase decisions are made in a terrestrial retailer.

Three substrates that have benefited from the move to digital are the corrugated box, mailers and aluminum cans. These formats benefit from an attractive combination of strength and reduced weight, low cost and a sustainable image.

Packaging companies and the brands and retailers they serve have taken the initiative to address challenges related to sustainability, durability, traceability, graphic design and automation. Of course, the dominant player in e-commerce, Amazon, has had a corresponding impact on packaging design and selection. Amazon has developed standards to maximize consumer satisfaction with the shipped product while minimizing packaging costs.

This spotlight report explores how e-commerce is driving rapid evolution throughout the print and packaging sectors, particularly for consumer goods, and what this means for the future.

E-commerce was already growing fast; COVID-19 only accelerated the trend

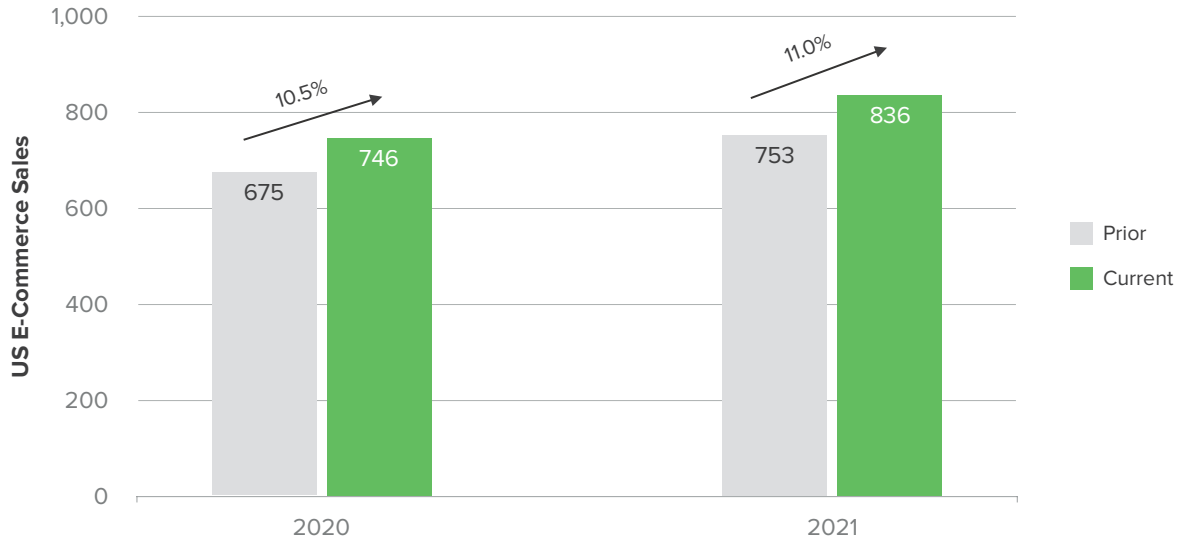
Before COVID-19, online retail sales had been growing at a rate of over 15% annually, more than three times the rate of overall retail sales.

The onset of the pandemic dramatically accelerated this shift. According to Morgan Stanley Research, the coronavirus pandemic propelled e-commerce to a 58% year-over-year growth rate in April 2020, four times faster than in 2019 and the first quarter of 2020.[1] Online revenue growth continued strongly in Q3 2020 with a reported 57% year-over-year increase, lower than the 81% growth in Q2 2020, but nearly five times the growth in the same 2019 period.[2] Goldman Sachs projects 24% annual growth in e-commerce for the next three years.[3] Pre-pandemic, brick and mortar was already under immense pressure as record store closures plagued even the "healthy" economic years of 2017 through 2019. A cottage industry has grown up to facilitate repurposing old shopping malls.

PROJECTED GROWTH OF E-COMMERCE HAS ACCELERATED

US e-commerce sales are on track to grow to US$836 billion in 2021 – accounting for nearly 17% of total retail sales – up from US$602 billion or 11% of total retail sales in 2019.[4]

Forecast: Impact of COVID-19 on previous e-commerce projections (in US$bn)



[1] Morgan Stanley Research, "COVID-19 Boosts E-Commerce, Resizing US Retail" (June 2020)

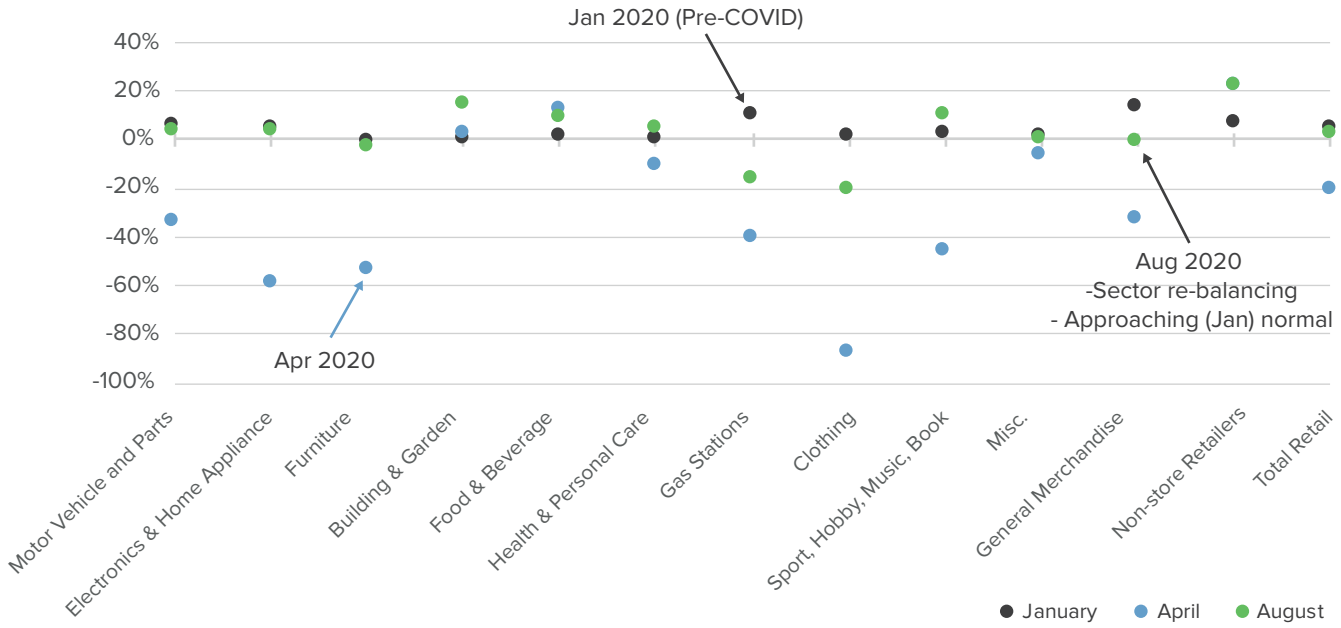
[2] Digital Commerce 360, "US e-commerce Sales Jump 37% in Q3" (November 2020)

[3] Goldman Sachs, "E-Commerce's Steepening Curve" (August 2020)

[4] Morgan Stanley Research, "COVID-19 Boosts E-Commerce, Resizing US Retail" (June 2020)

SOME RETAIL CATEGORIES RECOVERED FASTER THAN OTHERS

YOY US Retail Growth/Decline in 2020 by Month

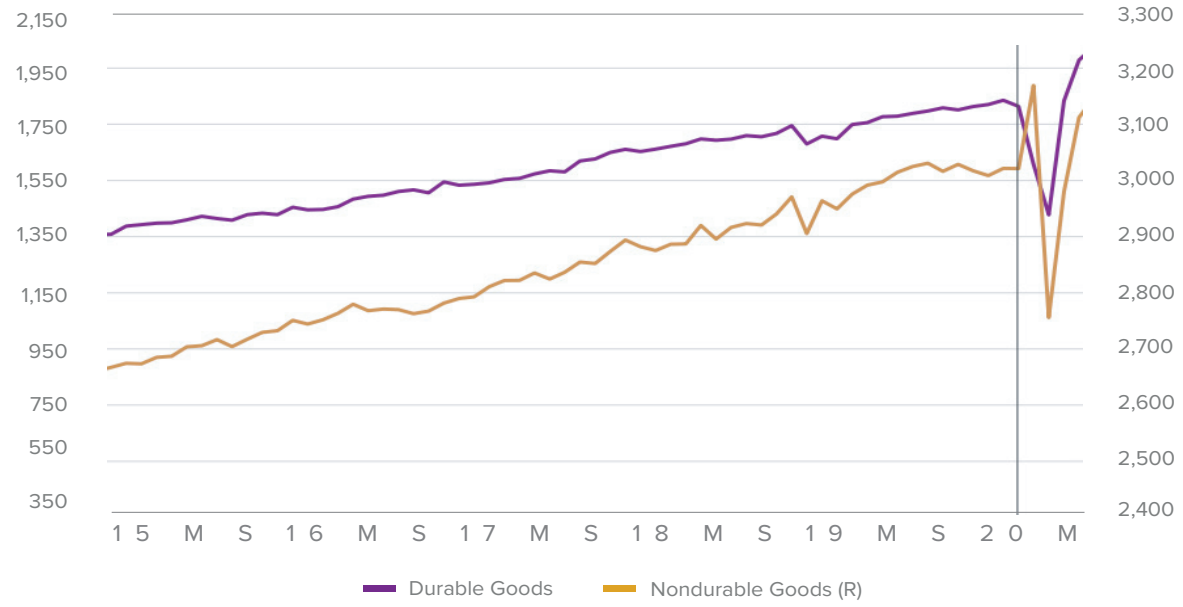


Retail Sectors	January	April	August
Motor Vehicle & Parts	6.70%	-33.00%	4.50%
Electronics & Home Appliance	-0.80%	-53.10%	-2.40%
Furniture	5.60%	-58.70%	3.80%
Building & Garden	1.00%	3.10%	15.49%
Food & Beverage	1.50%	12.40%	10.00%
Health & Personal Care	1.00%	-9.90%	5.60%
Gas Stations	10.50%	-39.30%	-15.40%
Clothing	1.80%	-87.30%	-20.40%
Sport, Hobby, Music, Book	2.50%	-44.70%	11.10%
Misc.	14.30%	-31.60%	-0.60%
General Merchandise	1.70%	-5.90%	0.80%
Non-store Retailers	7.90%	22.80%	22.40%
Total Retail	**4.70%**	**-19.90%**	**2.60%**

This chart describes how 11 different retail categories changed from January to April to August 2020. Covid stunted US retail sales, especially in April, although many sectors recovered by August. Those experiencing the biggest rebounds have been essential and close-to-home sectors, including building & garden, food & beverage, and sport/hobby/music/book ("SHMB"), and non-store (DTC) retailers. e-commerce had already penetrated the recreational goods sector, including SHMB, so consumers were comfortable acquiring such goods via that channel. The duration of the pandemic forced consumers to expand their online purchases beyond discretionary items like sports equipment to include essentials like hygiene products, food and beverages.

Legacy SHMB retail had already struggled, as evidenced by notable bankruptcies in recent years of terrestrial retailers such as Borders and Sports Authority. The e-commerce sector (non-store retail) saw the quickest rebound as the digital infrastructure was already in place and well-suited to accommodate the wave of consumers shopping online from home. These sectors saw sales leap to higher year-over-year growth in August compared to pre-pandemic times in January. Within the non-store retail sector, groceries/food/beverage and the softline markets, including apparel, have seen the greatest growth.

Consumer Spending (in US$ billion)



Source: Fastmarkets RISI, "Containerboard outlook: North America and beyond" (September 2020)

Not surprisingly, the rebound in general consumer spending has predominantly benefited the e-commerce segment. e-commerce penetration rose from less than 11% in 2019 to 14.5% in 2020 and is projected to break the 20% and 35% marks in 2025 and 2030 respectively.[5]

At-home food spending grew 4%, beverages expanded by 14% and recreational products grew by 20%. The corrugated box industry and mailers have been the most direct beneficiaries of the growth of e-commerce within the packaging sector.[6]

[5] Nasdaq, "E-commerce: Entering the Next Wave of Growth" (October 2020)

[6] Fastmarkets RISI, "Containerboard outlook: North America and beyond" (September 2020)

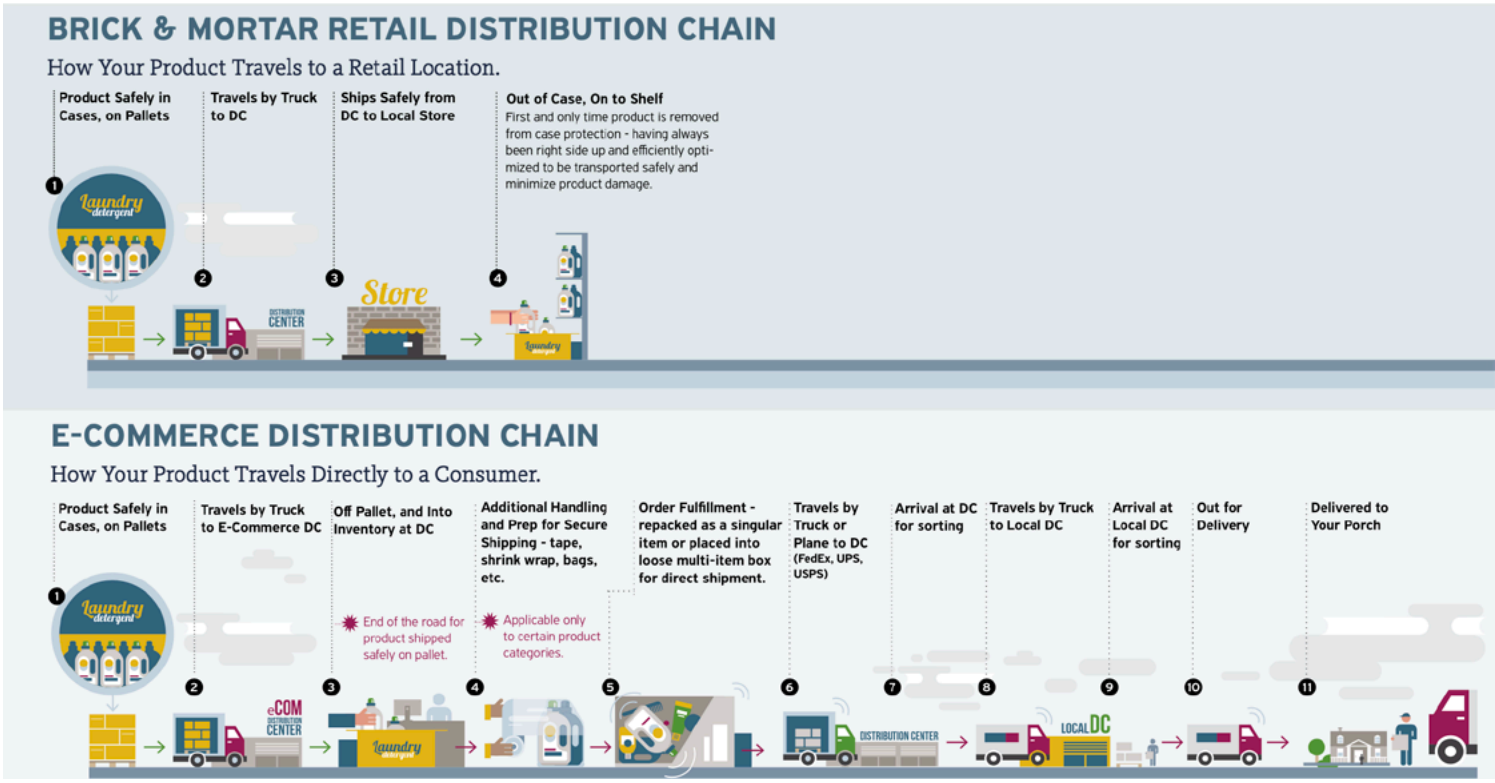
E-commerce is driving changes in packaging design

While businesses that adopt e-commerce strategies will see substantial revenue growth, increased ROI and a lower cost for customer acquisition, the e-distribution model also requires brands to solve complex logistics issues that are driving many of the changes in packaging design.

E-COMMERCE LOGISTICS ARE MORE COMPLEX THAN LEGACY DISTRIBUTION MODELS

As consumers opt for the convenience of online shopping and trackable delivery, many retailers have adopted distribution models specific to e-commerce to ship directly to customers. Whereas the legacy brick-and-mortar supply chain requires relatively few steps to deliver a product from the manufacturer to the consumer, e-commerce involves more interface points, including manufacturer delivery to a fulfillment center, onward delivery to a sorting center, and parcel delivery to the customer. More hands (or robots) touch each product. This puts a greater burden on brands, retailers, distributors and shippers to maximize the package integrity consistent with minimum weight, among other constraints. Whether the brands or retailers manage their own fulfillment or rely on third-party providers, they must reconsider their packaging to ensure that goods can reach the customer cheaply and undamaged.

DISTRIBUTION CHAIN(GES)



Source: Bemis E-Book, “Packaging for a New Era of E-Commerce” (2018)

More brands and retailers are turning to these new logistics. Of the CPG brands interviewed in a 2020 PMMI Secondary Packaging Report, 66% indicated that they support DTC shipping, compared to only 28% in the 2018 PMMI e-commerce Report.[7] Though DTC represents only 5% or less of total sales in the CPG industry, its recent growth has been explosive and analysts expect a significant expansion in this delivery channel.

Both e-commerce and DTC models require more nuanced package engineering considerations than legacy retail. There are two main types of packaging: primary and secondary. Primary packaging refers to the last inner layer of packaging between the product and consumer, while secondary packaging refers to the outer packaging that contains individual units of the product for delivery of distribution center or retail store quantities. Even if the products and the primary packaging themselves are generally the same in legacy retail and e-commerce, the differing distribution channels mandate a change in the design of the secondary packaging. The extra touch points in e-commerce and DTC retail increase the possibility of damage to the product and make robust packaging more important.

E-commerce logistics, which rely on pallets of wrapped or bundled products for distribution, involve the breaking down and repackaging of the secondary layer several times. After the bulk totes or pallets are broken down, the individual items should be easily accessible and repackaged. The durable primary packaging needs to maintain its integrity given the increased number of touchpoints and changes in secondary packaging.

As with pure e-commerce distribution, DTC products are not designed to be shelf-ready. However, they also do not travel through the business-to-business distribution supply chain, which entails much more shipping on an aggregated basis as well as lightweight and robust packaging. DTC products, which will arrive directly at the consumer's doorstep, call for additional package engineering considerations, including late-stage customization and carton size diversity.

INCREASED COMPLEXITY OF E-COMMERCE LOGISTICS REQUIRES GREATER ABILITY TO TRACK AND MONITOR SHIPMENTS

The increase in the complexity of logistics and the greater sensitivity to product quality and safety, particularly for food and pharmaceuticals, have increased the need for the ability to trace and monitor a shipment at all points from production to final delivery. Smart tracking technology, or traceability, serves a vital role in the integrated supply chain, visual inspection, and increased transparency for consumers who demand smooth package delivery. Traceability allows for easier inventory tracking and product identification so that any bottlenecks, missing products or quality issues can be identified quickly. Customers appreciate the transparency that comes with traceability. Amazon has worked to integrate technology and protocols to ensure transparency and product integrity. Their proactive counterfeit protection installs multiple transparency checks, while their authentic verification and customer transparency protocols allow consumers to find out about unit-level product information and the product's journey through the supply chain.

[7] PMMI, "Secondary Packaging Trends" (2020)

At the same time, the ability to ship more products directly to consumers and the ability to track and label individual products, a function of advances in digital printing and labeling, has created opportunities in a range of industries. For example, the ability to customize a package has benefited the pharmaceutical clinical trial industry by enabling better methods to prevent counterfeit medicines from entering the supply chain.[8] New regulations require the industry to track products and shipments with greater detail. Pharmaceutical manufacturers must customize labels for specific markets, customers and products by adding variable data to labels at a late stage, ensuring that all the data complies with regulations. Variable labeling and product serialization reduce counterfeiting with advanced supply chain tracking and anti-tampering security. Pharmaceutical manufacturers must adapt late-stage customization for more efficiency and flexibility as trends point toward smaller batch sizes. The capacity for customization sidesteps the big setup costs that would otherwise be associated with printing these smaller runs.

As the DTC model has expanded to food, meal kits and pharmaceuticals, its cold chain packaging needs go beyond the exterior box. As part of the packaging, this channel requires effective and lightweight thermal insulation that fits into the shipping container. Depending upon the shipping method, the insulation must keep the product refrigerated for up to 48 hours. Because of more demanding product specifications, thermal insulation for healthcare uses tends to be of a higher standard, although not all uses require the maintenance of Arctic-level refrigeration such as the Pfizer-BioNTech COVID-19 vaccine. Within the cold chain distribution model, tags or labels enable a brand to ship and monitor temperature within the container, essential for food and pharmaceutical products.

INCREASING PRODUCT DIVERSITY DEMANDS GREATER FLEXIBILITY FOR PACKAGING SIZES

The proliferation of SKUs, a phenomenon marked by retailers expanding their product lines over the past decade, has increased the need to accommodate a variety of packing sizes.[9] This increased product diversity has forced manufacturers to carry out shorter production runs at faster speeds using packaging machine configurations with high levels of flexibility and automation. Similar products have evolved into different iterations, requiring many more secondary packaging formats. Examples of this are two companies that have developed technologies to quickly adjust box sizes: Plymouth Packaging's "Box on Demand" system, acquired by WestRock in 2017, and privately held Packsize. These companies use fanfold corrugated to produce custom, on-demand corrugated packaging that is accurately sized for any product type according to the customer's specifications. The solution reduces the need for paper, reduces the void fill or other "fillers" such as plastic peanuts, and lowers the weight of the package. The companies have also developed software to integrate their machinery into a package fulfillment line.

WestRock

PACKSIZE®
ON DEMAND PACKAGING

[8] Healthcare Packaging, "Late Stage Customization Benefits Biotest" (2018)

[9] PMMI, "Secondary Packaging Trends" (2020)

Secondary packaging represents the first area to see significant deployment of automation technology. Among those who took part in the PMMI secondary packaging report, 67% stated that their end-of-line operations already utilize heavy automation. However, manual labor remains a crucial part of secondary packaging, with 21% of respondents mentioning operations that rely on human labor. The continuing shortage of human labor provides automation more space and tasks to expand into. Manufacturers also aim to automate line integration within their secondary packaging operations: case packing, palletizing, loading/unloading, in feeding products, cartoning, harvesting, lifting, and pick and place. Some companies are even exploring the use of autonomous guided vehicles on the plant floor to deliver products.

Robots are expected to operate on 95% of all secondary packaging lines within a decade.[10]

Automated secondary packaging line

Box on demand customization

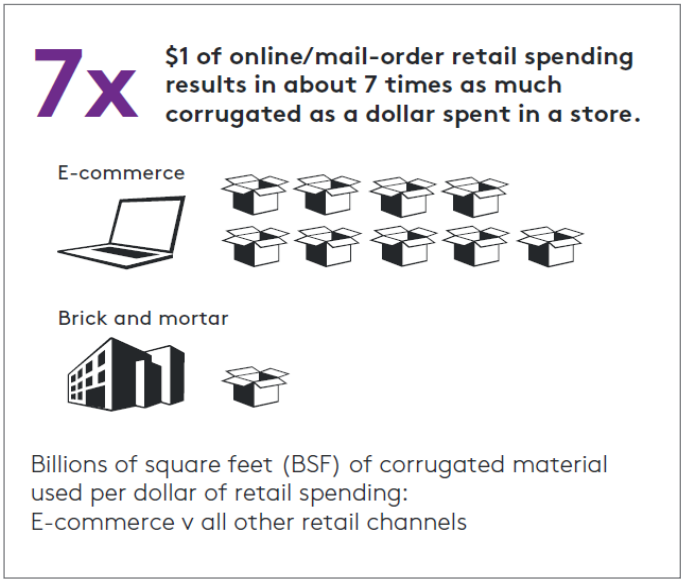
[10] Ibid

Impact of E-commerce on packaging substrates and engineering

The extended and complex logistics of e-commerce force businesses to make crucial decisions about the packaging substrates they utilize. Corrugated boxes have become the substrate benefitting the most from e-commerce, which explains their significant growth both before and during the pandemic. Corrugated's low cost of production, its combination of light weight and strength that are perfect for the lengthy journey from manufacturer to consumer, and its sustainability explain the prominence it enjoys in the e-commerce channel.

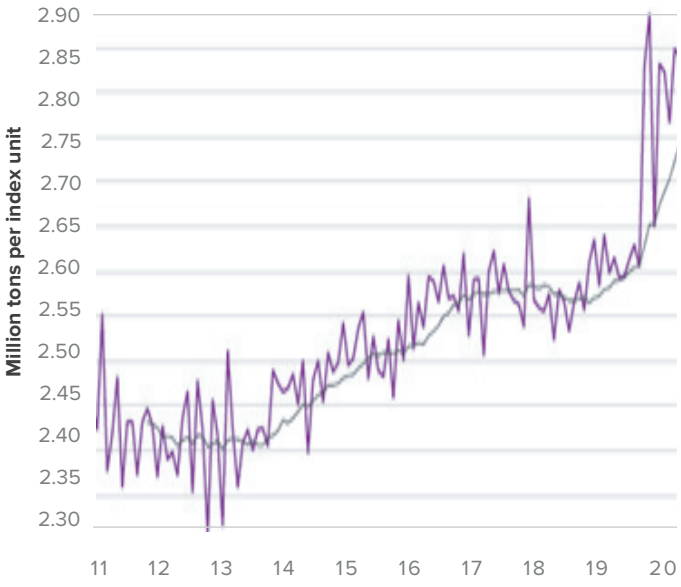
E-COMMERCE USES A LOT MORE CORRUGATED PER DOLLAR OF SALES

E-commerce retail uses seven times more corrugated packaging per dollar than traditional retail. Historically, containerboard "cutup," a measure of box production, correlated closely to demand for consumer non-durables and generally remained stable even in times of economic downturn.



Source: Fastmarkets RISI, "The Impact of E-Commerce on North American Paper Packaging Markets" (August 2019)

Containerboard cutup relative to non-durable goods production



Beginning in about 2014, the ratio of containerboard cutup to production of non-durable goods started to increase coincident with the growth of e-commerce. With the pandemic, box shipments have reached historic levels, up 6.4% for the fourth quarter and 2.7% for the full year.[11] The ratio of containerboard cutup to non-durable goods production reflected these highs by soaring to nearly 2.79 million tons per capita in November 2020 compared to 2.57 in November 2018.[12] These figures appear to have become the new normal as containerboard cutup demand shows no signs of slowing down. Even with diminished manufacturing levels (non-durable goods production remained 2.5% below its year-ago level in September), corrugated box demand has remained strong.[13]

[11] Fastmarkets RISI, "Paper Packaging Monitor" (November 2020)

[12] Ibid

[13] Ibid

The growth in e-commerce demand has also benefited demand for padded and thermal mailers. While this is a much smaller category than corrugated boxes, analysts project growth to be around 12% per annum, double the rate for corrugated boxes. Mailers benefit because they typically use less packaging material (film or paper) than boxes or cartons and are thus cheaper. They are also easier to open, which addresses a concern of e-commerce customers, and are also better for smaller packages such as clothing, pharma and electronics. We are also seeing growth in the use of thermal mailers for perishable foods.

AMAZON HAS SET ITS OWN SHIPPING STANDARDS TO REDUCE ITS DISTRIBUTION COSTS AND THE COST OF PACKAGING MATERIALS

The company already accounts for more than one in every three dollars spent online in the United States. To reduce its own distribution costs, Amazon has set standards that regulate the form and engineering of any package sent through its system. Its prominence means that these "guidelines," as Amazon calls them, will reverberate throughout the packaging universe. To improve its distribution and fulfillment process, and to reduce the cost of packaging, Amazon pioneered a three-tiered system comprising of Prep-Free Packaging (PFP), Ships In Own Container (SIOC), and Frustration-Free Packaging (FFP). PFP, its lowest tier, checks for items not capable of being shipped in their own container, such as certain liquids, and designates the package a PFP-certified shipping overbox.[14] Amazon employs this PFP packaging, usually in the form of a sturdy corrugated box, to ensure safe delivery without tacking additional costs on vendors. At the same time, Amazon is working with the consumer brands to make their packaging of liquids easier to ship, for instance through the use of "bag in box" structures that incorporate a plastic "bladder" inside a corrugated box. High-end shipments costing over US$400 will also have an additional layer of custom-fitted corrugated box for extra protection. Its second tier, SIOC, minimizes waste by ensuring that packaging is designed to ship without the need for an Amazon overbox, playing towards sustainability trends. The company says that its attempts to reduce substrate waste with the SIOC protocol do not compromise the integrity

of the product. Finally, the highest tier, FFP, incorporates a substrate with minimal, fully recyclable and easy-to-open packaging to eliminate what Amazon calls "wrap rage." To encourage compliance, the company charges lower rates for SIOC and FFP packages. Beyond these categories, Amazon uses Machine Learning (ML) to reduce the volume of packaging required and optimize packages for lessen damage and lower costs. For example, as of 2020, Amazon says that it has used ML to identify packaging solutions that have reduced the use of boxes from 69% to 42% in favor of padded mailers.[15]

Amazon delivers many of the packages, including corrugated boxes and mailers, that show up at doorsteps around the world. In Q3 of 2020, Amazon's revenue grew 37% year-over-year.[16]

[14] Anderson & Associates, "Amazon SIOC Certification Requirements"

[15] Packaging Digest, "Amazon brings Machine Learning to E-Commerce Packaging" (December 2020)

[16] CNBC, "Amazon reports sales growth" (October 2020)

The effort appears successful. Since 2015, Amazon says, it has reduced the weight of outbound packaging by 33% and eliminated more than 900,000 tons of packaging material, the equivalent of 1.6 billion shipping boxes.[17]

Over time, we can expect that the spread of these efforts to other shippers will bend the curve in the growth of corrugated boxes.

THE DEMOCRATIZATION OF RETAIL

The growth of DTC has led to another trend within retail that is having an ancillary effect on the corrugated box sector. The lower barriers to entry that e-commerce affords start-up brands have fostered the "democratization" of retail. While they might be growing quite fast, many of these new brands are smaller with more modest packaging needs. For this reason, along with some others, we are seeing a very rapid growth of smaller box converters known as sheet plants. (A sheet plant does not have a corrugator but does have converting equipment. Sheet plants purchase sheets from a corrugator or sheet feeder.) In 2018, the average sheet plant converted 65% of the volume of the average box plant; their size makes them better able to handle the shorter runs that an emerging DTC brand would require.[18] (A box plant has a corrugator and converting equipment, and runs both sheets and boxes.) From 2016 to 2018, sheet plants accounted for 44% of the increase in corrugated volume in the United States even though they only represented 21% of the aggregate volume.

While corrugated appears to be the substrate that benefits most directly from e-commerce, as the online channel expands into under-penetrated segments, those packaging materials that serve a particular segment will also benefit. As an example, the food and beverage ("F&B") category has lagged behind other retail segments in e-commerce shipments. Research suggests that consumers initiated only 2% of F&B sales online in 2019, below the average e-commerce penetration of retail. Going forward, analysts project F&B e-commerce sales to grow at almost 18% per annum in a sector that otherwise grows very modestly, close to GDP.[19]

[17] Amazon, "Amazon Certified Frustration-Free Packaging Programs" (2020)

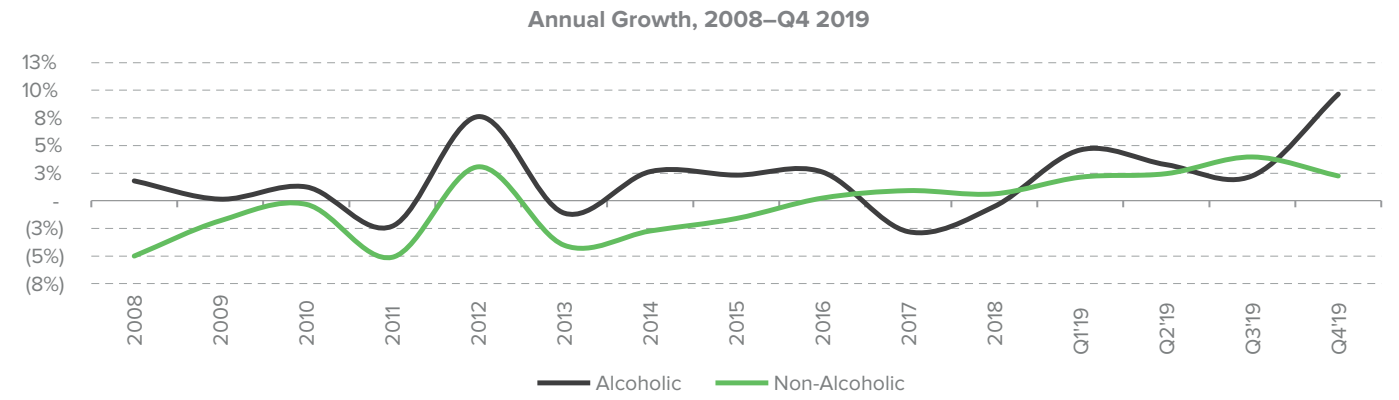
[18] The Fibre Box Association Industry, "Annual Report" (2018)

[19] Tech Crunch, "US E-Commerce Sales to Jump" (June 2020)

That will spark demand for various forms of protective packaging, including permeable and non-permeable films and thermal insulation with the objective of keeping food fresher (or warmer or colder) longer and retaining its quality in transit. Many of these forms of packaging are only now being developed. Accelerating online grocery adoption has led to other changes to primary packaging, including the use of lighter substrates such as plastics for easier delivery and sturdier supplementary packaging like a film overwrap to prevent last-mile delivery leakage.

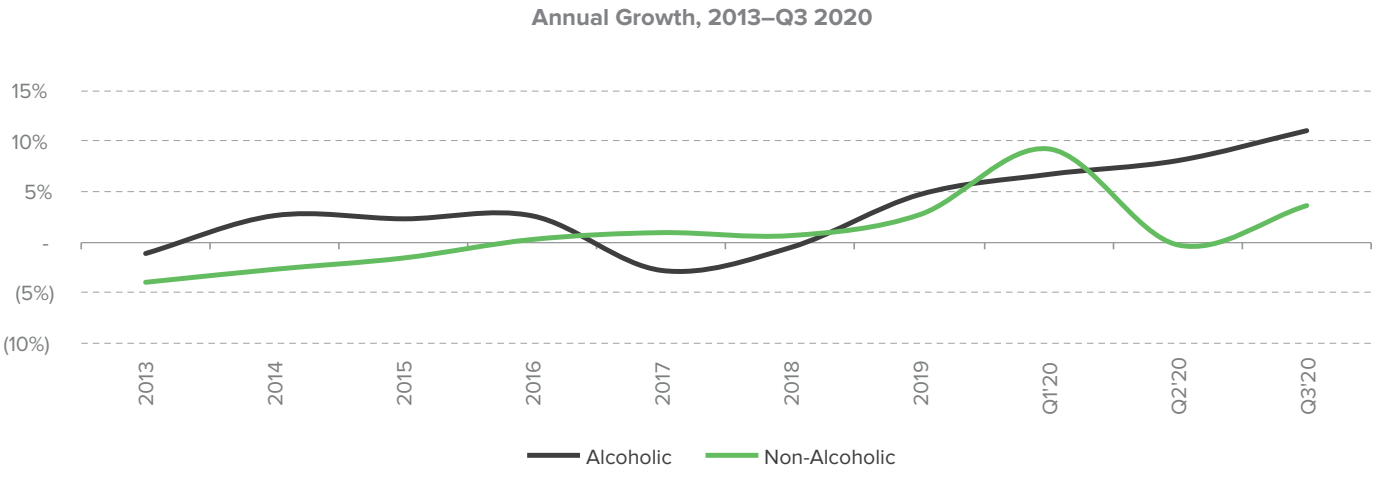
Among other substrates, beverage cans have surged the most in recent years, although the pandemic accelerated growth in 2020 as restaurants and bars were forced to shut down, which led to greater home consumption of beverages. Away-from-home consumption (such as in bars or restaurants) is more oriented to glass containers while home consumption favors aluminum cans. As the beverage industry continues to grow, cans account for 75% of new beverage introductions. As the dominant beverage substrate, cans are capitalizing on the non-alcoholic beverage growth rate of 7-8%, compared to a metal can CAGR of 2.23% over the next five years.[20]

North American bevcan shipments — y/y volume growth



Source: BMO Capital Markets, "3Q20 Beverage Can Shipments: Crack Open a Drink...or Three" (October 2020)

North American bevcan shipments — y/y volume growth (2013–Q3 2020)



Source: CMI and BMO Capital Markets

[20] BMO Capital Markets, "BMO's Growth & ESG Conference – Key Packaging Takeaways" (December 2020)

Some of the beverage sub-categories experiencing the most growth are hard/spiked seltzers, sparkling water, canned cocktails, energy drinks and wine. Growth has been so strong that some of the biggest participants in the beverage can industry – Crown Holdings, Ball and Silgan – struggle to keep up with demand and have committed to expanding capacity. A 2018 PPMI report estimates that the most popular beverage packaging substrates in 2028 will be plastic and aluminum, which will account for 55% and 26% of all packaging materials, compared to a decrease of 5% from 17% to 12% for glass packaging.[21] Though glass bottles often radiate a more premium and environmentally conscious image, the lack of durability in the complex e-commerce shipping channel compared to the more pragmatic plastic and aluminum will set glass back. In addition, the complicated nature of the e-commerce supply chain, glass bottles are much more likely to break. Aluminum cans and plastic bottles as packaging substrates have room to grow as can and bottle graphics continue to benefit from improvements in temperature and light-responsive inks, print quality, tactile effects, and the growth of shrink sleeves. Covid has also accelerated e-commerce grocery, food and beverage growth, which bodes well for aluminum can and plastic bottle packaging. In 2018, e-commerce's only impact on the beverage industry was in secondary packaging robustness. However, the pandemic and accelerating online grocery adoption have led brands to adopt other changes to their primary packaging. Many are optimizing for easier delivery – by utilizing lighter substrates such as plastics – and last-mile delivery leakage prevention – by implementing supplementary packaging like film overwrap.[22]

DESIRE FOR SUSTAINABLE PACKAGING ALSO DRIVING SUBSTRATE SELECTION

Another issue affecting the industry is rising consumer concern about sustainability, which does not always align with industry goals to ship packages manufactured with the most durable and cost-effective materials. Many of these concerns can be attributed to millennials' and Gen Z's environmental awareness and health consciousness. As brand manufacturers seek out innovative materials for packaging to factor in environmental friendliness, they must also balance these considerations with the effectiveness of the packaging. In a survey, 65% of participants stated that the sustainability of their products is a top concern, while 59% of consumers polled by GlobalWebIndex said that they would pay a premium for more sustainable packaging options.[23] In regard to the beverage can and bottles industry, many respondents to a survey conveyed a strong dislike of the secondary packaging of plastic rings that hold cans or bottles together as harmful to the environment. One option large beverage companies have considered is the adoption of photo-degradable and other biodegradable plastics. In general, some of the initiatives companies have taken to tackle packaging sustainability issues include: minimizing the amount of waste generated by packaging, designing fully recyclable packaging, implementing reusable packaging, redesigning packaging to utilize more sustainable materials, and choosing materials derived from renewable sources. For example, Amazon's Frustration-Free Packaging initiatives aim to reduce waste with minimized and fully recyclable packaging. Companies are also taking advantage of earth-friendly inks and adhesives that are water-based.

However, many challenges with sustainability still stand in the way. Beverage packaging substrates such as glass may be more prone to damage despite their overall advantage in terms of recyclability and reusability.

Companies are considering other substrate changes including a shift away from cases and towards more trays with shrink film. Companies are also switching to using tape for e-commerce packaging for additional protection, while some manufacturers are considering a move away from rigid formats and towards flexible packaging.[24]

[21] PMMI, "Beverage Trends in Packaging and Processing Operations" (2018)

[22] L.E.K, "Online Food and Beverage Sales..." (2019)

[23] PMMI, "Secondary Packaging Trends" (2020)

[24] Ibid.

E-commerce impact on packaging graphics

The changing nature of retail distribution has impacted the role of graphics in packaging. In legacy brick-and-mortar retail, an attractive presentation was an important way to connect with those consumers who made their buying decisions at the point of purchase, the store aisle. It was the "last chance" to convince the undecided shopper. For those segments of retail where e-commerce is relatively under-penetrated, such as food and beverage, packaging graphics and the need to attract shoppers at the store shelf level remain important. For those products oriented to e-commerce or DTC, Amazon was explicit about the changing role of packaging in their "Frustration-Free Packaging Program Certification Guidelines," when they wrote, "Standard retail packaging is often designed to grab a customer's attention by utilizing full-color glossy printing, being oversized to gain more shelf presence, or by employing windows, cutouts and other costly packaging features not necessary for Amazon customers. By optimizing packaging for Amazon fulfillment and eliminating unnecessary package marketing features, vendors can reduce waste, enhance sustainability and realize cost savings."

THE "UNBOXING" EXPERIENCE IS REPLACING PACKAGING GRAPHICS AS A DRIVER OF CUSTOMER SATISFACTION

In the e-commerce channel, the first opportunity that a consumer has to see and experience the physical product arrives when it has been delivered; what the industry refers to as the "unboxing" experience. The role of the packaging to promote customer satisfaction in the e-commerce context is to reassure the customer about the purchase decision, and avoid what marketers call "cognitive dissonance." Companies have identified "unboxing" as a major step in the product's journey from manufacturer to consumer, and one that can define the latter's perceptions of and satisfaction with the product.

Amazon has already taken proactive steps within its Frustration-Free Packaging tier, engineering the boxes explicitly to provide for seamless unboxing and consumer ease. The moment when a consumer tears open a box and removes the product can lead customers to become so enamored with the item that they are willing to share it on social media. As companies focus on the consumer unboxing experience, they are using several techniques to maximize customer satisfaction, including the use of print to integrate highly decorated box interiors, innovative package formats, and personalized messaging. Some brands are even exploring how to craft the secondary packaging into a functional product, such as replacing cartons with reusable bags, printing coloring-book inspired patterns on the inside of secondary cartons or utilizing stylish and durable bubble-reinforced resealable mailers that can double as protect pouches. Many of these customized packaging formats are made possible by a growing array of digital print technologies. Packaging substrates such as plastic are especially receptive to digital print for high-impact branding and customization.

Other "unboxing" solutions also work. A joint study between Seaman Paper and Package InSight involving 120 Clemson University students found that 84% of participants self-reported that tissue-wrapped interior packaging improved their purchase experience because of the premium "feel."[25] These consumers were more likely to reorder and recommend the brand to friends and family. Items wrapped in decorative tissue paper received valuations as much as 24% higher than the exact same items packaged with traditional void fill.

[25] Seaman Paper and Package InSight, "Tissue Paper in Packaging Boosts Quality and Value..." (May 2020)

The addition of the decorative tissue significantly improved customer retention; two out of three respondents were more likely to recommend the product on social media while respondents had 40% greater recall of brand and product after 90 days compared to traditional void fill. These strategies might be even better suited for smaller brands, which grew four times faster than large brands in 2018 compared to 2019. These smaller brands may be able to make a stronger value proposition with better customization. Millennials and Gen Z, groups with increasing spending power, are three times as likely to find trendier brands with this customization more appealing.

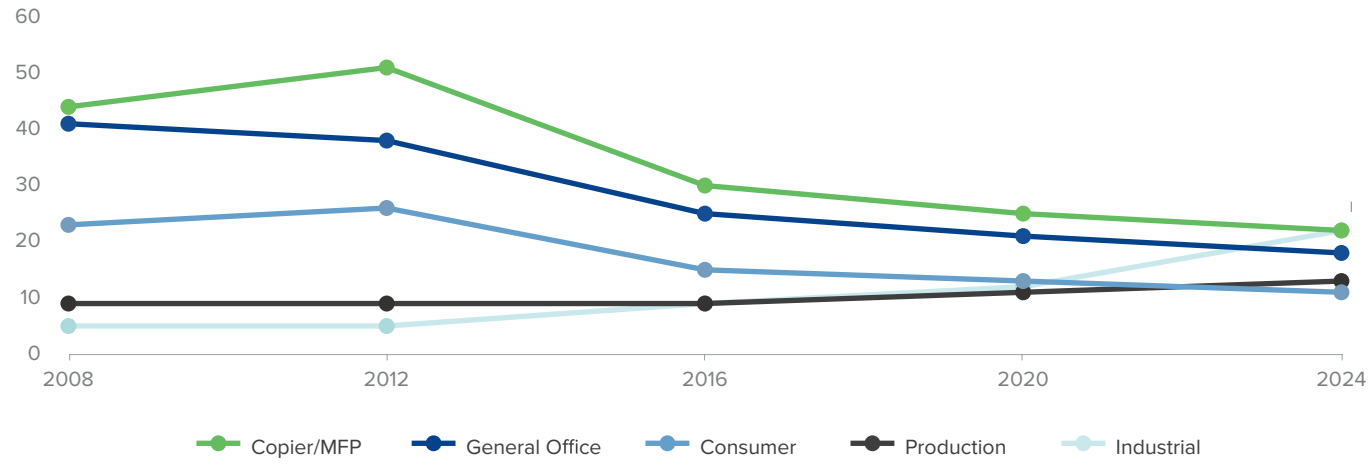
The declining role of conventional home and office printers and the changing way society communicates information have made the digital print industry increasingly dependent on the packaging industry. Digital print is a direct printing process, where ink is applied straight onto the substrate. Digital differs from traditional print methods such as flexography or litho lamination, which utilize print plates and a series of cylinders to transfer the image onto the board or material. Because no print plates are required, digital delivers many benefits including speed, quantity control and print quality.

Some international players in the digital print industry

PACKAGING AND OTHER INDUSTRIAL USES ARE INCREASINGLY DRIVING THE DIGITAL PRINT MARKET

The chart below illustrates the diminished role of legacy print and the growing importance of digital print for industrial purposes, including digital packaging, textile, ceramics and 3D printing. Industrial uses is set to rise from just US$5 billion of the US$122 billion (4.1%) printing business in 2008 to a projected US$22 billion of US$86 billion (25.6%) in 2024.[26] All other segments, including copier/multi-function printer (MFP), general office, consumer and production witnessed significant drops.

The digital print sector broken down by sub-sector (in US$)



Sub-sectors	2008	2012	2016	2020	2024
Copier/MFP	44	51	30	25	22
General Office	41	38	25	21	18
Consumer	23	26	15	13	11
Production	9	9	9	11	13
Industrial	5	5	9	12	22
Total	**122**	**129**	**88**	**82**	**86**

Reduced spending on printing equipment and other forms of packaging technology comes in the context of lower capital goods spending generally. The economic uncertainty brought on by COVID-19 has lowered the level of corporate discretionary spending. Much of the sluggish production stems from the cutting of CapEx for industrial equipment. From Q3 2019 to Q3 2020, business fixed investment declined by 4.2%. Although Q3 2020 represented a recovery from Q2, it was the largest decline since the Great Recession. Without CapEx investments, spending on all forms of print and packaging equipment has abated. Companies scrambling to maintain profits have less incentive to invest in R&D, CapEx and newer experimental print technologies, including digital.

Despite these setbacks, we still see an upside for digital print's role in packaging. The current low penetration of digital print in the folding carton and corrugated board markets indicates significant potential upside. Digital print penetration in the folding carton market is projected to rise from 0.5% in 2019 to 0.8% in 2024, a CAGR of 14% while penetration in the corrugated board market is expected to increase from 1.3% in 2019 to 3.4% in 2024, a CAGR of 24%.[27] In both cases, market share as measured by value far exceeds the metric by volume, which suggests that while the jobs might be short run, they are relatively profitable. This makes sense as printers and packagers typically employ digital for their more complex, and thus higher-value, projects.

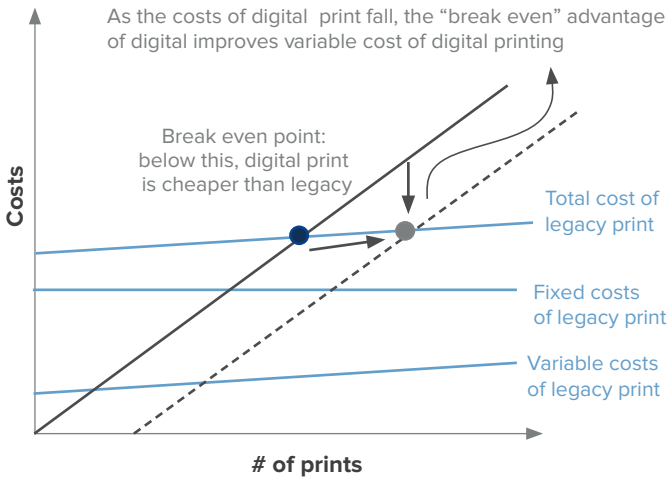
[26] Digital Packaging Summit (2020)

[27] Ibid

Because the digital process has very modest set-up costs and quicker turnaround time, companies use it to execute their shorter runs (see chart on the right). Digital print's advantage with shorter runs positions it well to capitalize on e-commerce and DTC consumer preferences for more customization and personalization. As digital technologies improve and variable costs drop, the chart to the right shows how digital will increase the "break even" number of print impressions where it is competitive with flexographic or offset printing.

Digital printing is currently most cost-effective at lower volumes because the price per unit (even allowing for higher variable costs from the more complex inks required) is lower than the combination of higher set-up costs and lower variable costs associated with offset and flexographic printing.[28] The speed of digital print for customized projects such as labels with unique codes, cards with specific names and addresses, and flyers for varying dates and locations is unmatched. However, as digital printing technology continues to improve in the future, investing in digital printing may increase the initial fixed costs but lower the variable costs where variable data is involved. On top of variable data customization, digital print allows for more flexibility with the print substrates and inks. This will increase the break-even point and the profit margin even for larger runs. Digital print already benefits certain larger volume runs such as books and magazines with many pages as the digital equipment collates the sheets and saves offline bindery steps.

Costs of legacy vs. digital print



* Assumes no or minimal fixed digital print set up costs

THE LABEL SEGMENT HAS BEEN THE FASTEST ADOPTER OF DIGITAL PRINTING

Digital has seen its greatest penetration in the label segment, where it represents 5-10% of print volume but 15% as measured by value.[29] For both primary and secondary packaging, labels represent the greatest opportunity for the digital print sector to lever the growth in e-commerce. Several reasons explain this, including the growing demand for package tracing, the versatility and flexibility of digital print, and its improving graphics standards. The ease with which the industry has adopted digital printing technologies explains at least part of the very high growth trajectory for labels, which are projected to grow about 4.2% per annum from 2020 to 2025.[30]

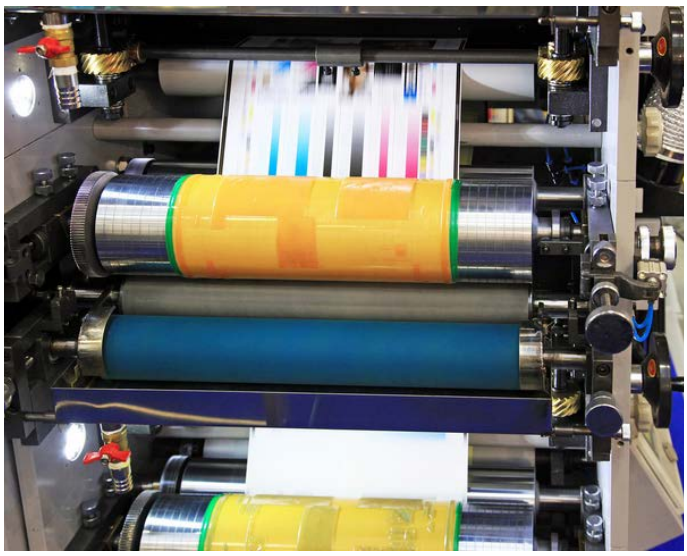
[28] The Print Authority, "Offset vs. Digital Printing" (2020)

[29] Digital Packaging Summit (2020)

[30] Ibid.

Digital technology also enables direct print onto primary and secondary packaging. Manufacturers seeking to improve the accuracy of product packaging and shipments for purposes of labeling, including printing, inventory management, tracking and application, are turning towards printing information directly onto secondary packaging.[31] Indeed, 85% of manufacturers have reported investigating printing directly onto secondary packaging. Additionally, direct printing barcodes, branding labels and custom imaging onto corrugated cases can lower the incremental cost of labels, in line with sustainability efforts, and drive down fulfillment costs in the long term. Digital print often produces higher-quality graphics, which are well-suited towards clear and bright printability. Many manufacturers hope to leverage the high-resolution graphics to facilitate easier automated inspection of all packages, including product authentication, damage control, and general inventory management and tracking. Direct print onto secondary or primary packaging will begin to supplant labels when the technology advances to where the speed, cost and "break-even" volumes become lower than the incremental cost of applying labels to packaging.

The legacy technology type of print utilized for packaging is flexographic printing, which is projected to grow at a CAGR of 1.6% – this is high compared to the overall printing industry.[32] Fast-drying ink is applied to the flexible printing plate, which transfers the image to the substrate. This type of printing produces the best results on packaging materials such as plastic bags, labels, foils and wrappers. Despite the decline in the direct mailing market, which utilizes flexographic printing, it has remained resilient for the packaging and label markets with increased demand from e-commerce, grocery and other



active sectors. Flexographic printing, driven by package and label printing, holds a significant advantage over direct and digital print for higher volume print jobs. High versatility, ease of operation, and improving print consistency/quality have all contributed to the growth of flexographic printing while other sectors of print such as offset have declined significantly. Growth in the food and beverage industries remains strong; F&B is expected to be one of the most significant consumers of flexible packaging products, increasing demand for flexographic printing machines produced by leading companies such as Windmöller & Hölscher, Bobst, Mark Andy, Heidelberg, Edale and Wolverine Flexographic. The use of quick-drying and non-toxic inks in flexographic printing make it a pragmatic choice for print in the food and beverage industry.

Leading printing machine companies

WINDMÖLLER & HÖLSCHER

BOBST

mark andy

HEIDELBERG

WOLVERINE FLEXOGRAPHIC
EST. 1945 • MADE IN THE USA

edale®

[31] PMMI, "Secondary Packaging Trends" (2020)

[32] Smithers, "The Future of Flexographic Printing to 2025" (2020)

Digitalization of packaging/ internet of packaging

Digital innovations and the internet of things continue to disrupt the print and packaging industries as they do with every industry. Digitalization of printing and developing packaging technologies enable integration with smart mobile devices and scanning applications. This becomes the Internet of Packaging (IoP), or "intelligent packaging." Smart tracking technology will improve supply chain efficiencies and help detect anomalies or bottlenecks. Technology such as RFID or NFC-enabled chips ("near-field communication") enhances the tracking of packages. This technology enables much more to be included on, or in, packaging location tracking, as some packagers, particularly in the cold chain segment, are employing sensors on their packaging that enable the consumer to check the temperature to which the product was exposed.

DIGITAL TECHNOLOGY IS ALSO IMPROVING THE ABILITY TO MONITOR THE CONDITION OF PACKAGING WHILE IN TRANSIT

One of the most popular examples of smart packaging at an industrial level is in the food sector, where shippers attach thermal labels to the container to identify, for example, whether the cold chain has been broken during the transfer or storage of the item. The stickers attached to the outside of the secondary (or primary) packaging change color when exposed to temperature extremes or physical trauma, helping the shipper monitor the integrity of the product without forcing the company to tear open the box. This capability is very important for distributors of pharmaceuticals and foods that require refrigeration. Brands are adopting these data-driven approaches to find efficiencies in marketing, logistics and supply chain control.

Another example is the inclusion of RFID systems, a technology that allows chips embedded in a package to identify the location of the object by means of a radio signal. This facilitates the distribution of goods and allows greater precision in storage management. Commercial examples include Temptime, a subsidiary of Zebra Technologies focused on the healthcare industry, and PakSense, a subsidiary of Emerson focused on the perishable food segment.[33]

[33] Market Watch, "Global Smart Packaging Market" (April 2020)

Xeikon, Magic Add and UPM Raflatac worked together to develop an integrated workflow solution for companies aiming to utilize smart labels for real-time digital interaction data to build efficient marketing, tracking, process optimization, authentication and safety control.[34] Vellamo, a premium water brand, utilized their services to enable consumers to scan a label, unique to every product, and learn about their products' origin. By collecting user data, brands like Vellamo can share tailored digital content and set digital KPIs for physical products. The integration between the digital and physical experience enhances the user experience by discovering and delivering what content consumers respond to best. The smart labels give Vellamo an advantage with the transparency of their brand, taking advantage of industry tailwinds as consumers focus more and more on organic and premium food and beverage.

THE INTERNET OF PACKAGING HAS IMPROVED THE INFORMATIONAL CONTENT OF LABELS

These Internet of Packaging trends coincide with advances in digital print, which is improving the speed, accuracy and graphic quality of printed labels. These clearer labels facilitate automated inspection, which has become more crucial with SKU proliferation. Automated machines can sort through, identify anomalies or damages, and flag products with a unique identifier many times faster and more accurately than a human worker could. Non-packaging companies that support these logistics have also benefited from e-commerce. Examples include companies like Zebra Technologies and Honeywell that manufacture barcode scanners, RFID readers, mobile computers, and printers that capture real-time data. As data becomes an ever larger part of the industry, it's essential to capture more and more of it through such devices. The surge in e-commerce demand means more investment in logistics, which means more demand for data capture products.

IoP can also be utilized for security measures, including authentication and tampering control. Premium brands often face illegitimate competition from counterfeit brands. Consumers and companies alike can scan microchips and verify the authenticity of products from companies such as MK, Chanel, Louis Vuitton and Levi's. These chips can also detect whether that product has been tampered with, providing extra assurance to the consumer that the products they purchase have been properly sealed.

All this smart technology improves supply chain transparency and can be used to authenticate products, monitor quality and environmental conditions, track supply chain conditions, provide predictive analytics, and enhance customer experiences. It can also allow retailers to automatically reorder products when shelf stock runs low to keep pace with consumer demand.

[34] Xeikon, "Streamlined Printing for Smart Labels" (October 2020)

Packaging trends in legacy retail

For about 100 years, since the first department stores began to offer fixed pricing, through the growth of shopping centers, brick-and-mortar retail grew at a steady pace. e-commerce and the DTC trend have shaken that up. Legacy retail requires less robust packaging compared to DTC and e-commerce models. The supply chain involves fewer steps, generally just from the manufacturer to the warehouse (one or two such stops) to retail store to consumer. Like e-commerce, items are typically shipped on pallets. Of course, the primary purpose of packaging is to protect, and packaging for traditional retail is following some of the same footsteps as e-commerce and DTC packaging. For example, legacy retailers are focusing on creating returnable and reusable packaging in line with consumer demands for sustainability. The need for traceability also remains important for all distribution channels. Secondary packaging for legacy retailers serves the purpose of protecting the product but must also accommodate the trend towards shelf-ready packaging so must be easy to open with the branding immediately visible. These cases of products are often much larger, with pack counts from 12 to 36. The varying pack counts require extra reinforced stack strength and perhaps special labeling to maximize product visibility.[35] Because these traditional retailers do not have to focus as much on varying package sizing and customization, automation already enables much faster speed and accuracy for these end-of-line operations.

GROWTH OF "SHELF-READY" PACKAGING

Shelf-ready cases are one category within legacy retail that has seen growth. Big box stores like Costco and Sam's Club are even shifting towards taking in larger shipments with custom pallet configurations, so that the front-facing products on the shrink-wrapped pallets are ready for display as soon as they hit the retail floor in their original form. Brands also like these configurations because they enhance brands' end-of-line strategy.

When interviewed, 75% of companies supported moving to shelf-ready displays or wrap-around cases. Besides lowering labor costs, shelf-ready packaging reduces the absolute amount of packaging required, an important cost and environmental consideration. Graphics must be robust enough to survive the distribution supply chain and impact the consumer with proper and effective branding. This unique type of packaging has led more manufacturers to eye automated vision inspection systems to assist in detecting graphic and labeling defects, which are more important than ever for these shelf-ready products. Common forms of shelf-ready primary packaging include stand-up pouches with gusseted bottoms, flow packs, cartons, thermoformed trays, card-backed products and bottles. The case, or secondary packaging, must be customized for shelf-ready display, most commonly utilizing paperboard for attractive shelf appearance and corrugated for its durability. According to PMMI, the reason many shelf-ready cases are shifting to adhesives such as hot-melt glue instead of tape is because the aesthetic of the case and packaging are important, with smoothed edges and without protruding tape. Many retail-ready cases often have tear-off tops for easy access, which require die-cut case blanks with folds, creases and scoring.

[35] PMMI, "Secondary Packaging Trends" (2020)

Glossary

- **Corrugated Packaging:** Made of corrugated pleated material with three different layers of paper – an inside liner, outside liner, and rippled sheet which runs in between. Most common applications are shipping boxes and retail displays.
- **Digital Printing:** Method of printing that does not require a printing plate but prints directly onto a surface by processing artwork through a computer.
- **Flexible Packaging:** Lightweight packaging whose shape can be readily changed, such as bags, pouches and plastic films.
- **Flexographic Printing:** Method of printing that uses a flexible relief plate wrapped around rotating cylinders to transfer an image onto a surface. Compared to offset printing, uses a wider range of water-based inks, can print on a wider variety of materials, and has faster production times.
- **Offset Printing:** Method of printing that uses a printing plate to transfer an image onto a rubber blanket and then onto a surface, using oil or water-based inks. The traditional form of printing – excels in providing high-quality images and is currently the lowest cost method of long-run production.
- **Primary Packaging:** The packaging in direct contact with the product itself. Serving as the first layer between containing the product, the primary packaging acts to contain, protect, and/or preserve the finished product, particularly against contamination.
- **Printing Plate:** A sheet of thin and flexible metal or polyester; transfers an image to paper or other surface. A plate is prepared for each color used.
- **Rigid Packaging:** Packaging which cannot be easily molded; can be made of plastic, metal, wood, glass or paperboard.
- **Secondary Packaging:** The second layer of packaging used on top of the primary packaging to group a certain number of products into a SKU or serve as the shipping container for small shipments. Corrugated boxes, providing supplementary protection, are a common form of secondary packaging.
- **Smart Packaging:** Packaging systems that have function beyond containment of the product – can provide information on product quality, help extend shelf life and measure the inner atmosphere of the package or the shipping environment.
- **Substrate:** Base material onto which images will be printed.

Print & Packaging

SELECTED PUBLICLY TRADED COMPANIES

Flexible Packaging (in US$ millions)

Company	As of 04/06/21	Revenue		EBITDA		TEV/EBITDA		Revenue Growth		EBITDA Margins	Share Performance
	Firm Value	2019	2020	2019	2020	2019	2020	5 yr. CAGR	1 Year	2020	2 Year
Amcor plc (NYSE:AMCR)	24,423	9,458	12,468	1,316	1,821	18.6x	13.4x	5.9%	31.8%	14.6%	(2.3%)
Avery Dennison Corporation (NYSE:AVY)	17,881	7,070	6,972	975	1,050	18.3x	17.0x	3.2%	(1.4%)	15.1%	61.7%
CCL Industries Inc. (TSX:CCL.B)	11,244	4,103	4,114	786	844	14.3x	13.3x	11.5%	0.3%	20.5%	28.7%
Intertape Polymer Group Inc. (TSX:ITP)	1,859	1,159	1,213	149	173	12.4x	10.7x	9.2%	4.7%	14.3%	61.7%
Sealed Air Corporation (NYSE:SEE)	10,365	4,791	4,903	910	975	11.4x	10.6x	2.1%	2.3%	19.9%	1.4%
Winpak Ltd. (TSX:WPK)	1,878	874	852	199	192	9.4x	9.8x	1.4%	(2.4%)	22.5%	5.5%
Median	**10,804**	**4,447**	**4,509**	**848**	**909**	**13.4x**	**12.0x**	**4.6%**	**1.3%**	**17.5%**	**17.1%**
Mean	**11,275**	**4,576**	**5,087**	**723**	**842**	**14.1x**	**12.5x**	**5.6%**	**5.9%**	**17.8%**	**26.1%**

Rigid Packaging (in US$ millions)

Company	As of 04/06/21	Revenue		EBITDA		TEV/EBITDA		Revenue Growth		EBITDA Margins	Share Performance
	Firm Value	2019	2020	2019	2020	2019	2020	5 yr. CAGR	1 Year	2020	2 Year
Ardagh Group S.A. (NYSE:ARD)	11,776	6,660	6,731	1,155	1,141	10.2x	10.3x	1.1%	1.1%	17.0%	97.2%
AptarGroup, Inc. (NYSE:ATR)	10,495	2,860	2,929	589	590	17.8x	17.8x	4.8%	2.4%	20.2%	36.6%
Berry Global Group, Inc. (NYSE:BERY)	18,892	8,878	11,709	1,461	2,118	12.9x	8.9x	17.9%	31.9%	18.1%	7.6%
Crown Holdings, Inc. (NYSE:CCK)	21,213	11,665	11,575	1,670	1,725	12.7x	12.3x	5.7%	(0.8%)	14.9%	73.8%
O-I Glass, Inc. (NYSE:OI)	7,216	6,691	6,091	1,053	866	6.9x	8.3x		(9.0%)	14.2%	(37.1%)
Silgan Holdings Inc. (Nasdaq GS:SLGN)	7,719	4,490	4,922	624	770	12.4x	10.0x	5.5%	9.6%	15.6%	45.5%
Median	**11,135**	**6,676**	**6,411**	**1,104**	**1,004**	**12.5x**	**10.2x**	**5.5%**	**1.8%**	**16.3%**	**41.0%**
Mean	**12,885**	**6,874**	**7,326**	**1,092**	**1,202**	**12.1x**	**11.3x**	**7.0%**	**5.9%**	**16.7%**	**37.3%**

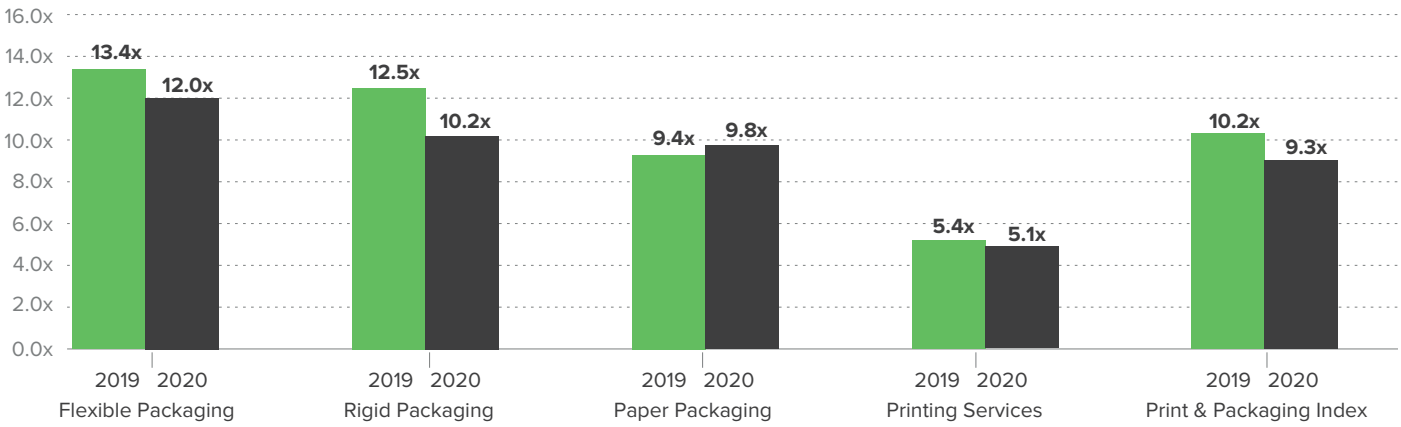
Paper Packaging (in US$ millions)

Company	As of 04/06/21	Revenue		EBITDA		TEV/EBITDA		Revenue Growth		EBITDA Margins	Share Performance
	Firm Value	2019	2020	2019	2020	2019	2020	5 yr. CAGR	1 Year	2020	2 Year
DS Smith Plc (LSE:SMDS)	10,773	8,039	7,614	1,066	1,110	10.1x	9.7x	8.6%	(5.3%)	14.6%	(2.3%)
Graphic Packaging Holding Company (NYSE:GPK)	9,385	6,160	6,560	977	913	9.6x	10.3x	9.5%	6.5%	13.9%	61.7%
International Paper Company (NYSE:IP)	29,463	22,376	20,580	3,647	2,979	8.1x	9.9x	(0.1%)	(8.0%)	14.5%	28.7%
Mondi plc (LSE:MNDI)	15,465	8,156	8,150	1,771	1,615	8.7x	9.6x	(0.5%)	(0.1%)	19.8%	61.7%
Packaging Corporation of America (NYSE:PKG)	14,581	6,964	6,658	1,455	1,245	10.0x	11.7x	3.0%	(4.4%)	18.7%	1.4%
Smurfit Kappa Group Plc (ISE:SK3)	15,301	10,154	10,434	1,668	1,672	9.2x	9.2x	1.0%	2.8%	16.0%	5.5%
Sonoco Products Company (NYSE:SON)	7,980	5,374	5,237	751	748	10.6x	10.7x	1.1%	(2.5%)	14.3%	5.5%
WestRock Company (NYSE:WRK)	23,406	18,289	17,579	2,981	2,718	7.9x	8.6x	7.8%	(3.9%)	15.5%	5.5%
Median	**14,941**	**8,097**	**7,882**	**1,562**	**1,430**	**9.4x**	**9.8x**	**2.0%**	**(3.2%)**	**15.0%**	**17.1%**
Mean	**15,794**	**10,689**	**10,352**	**1,789**	**1,625**	**9.3x**	**9.9x**	**3.8%**	**(1.9%)**	**15.9%**	**26.1%**

Printing Services (in US$ millions)

Company	As of 04/06/21	Revenue		EBITDA		TEV/EBITDA		Revenue Growth		EBITDA Margins	Share Performance
	Firm Value	2019	2020	2019	2020	2019	2020	5 yr. CAGR	1 Year	2020	2 Year
Dai Nippon Printing Co., Ltd. (TSE:7912)	4,978	12,648	13,029	999	1,045	5.0x	4.8x	(1.7%)	3.0%	8.0%	(1.2%)
HP Inc. (NYSE:HPQ)	43,683	58,756	56,639	5,009	4,710	8.7x	9.3x	3.0%	(3.6%)	8.3%	51.6%
Quad/Graphics, Inc. (NYSE:QUAD)	1,173	3,923	2,930	340	264	3.5x	4.4x	(8.6%)	(25.3%)	9.0%	(58.2%)
R. R. Donnelley & Sons Company (NYSE:RRD)	1,779	5,473	4,766	373	346	4.8x	5.1x	(7.1%)	(12.9%)	7.3%	(8.8%)
Toppan Printing Co., Ltd. (TSE:7911)	5,519	13,219	13,810	956	1,137	5.8x	4.9x	(0.5%)	4.5%	8.2%	17.7%
Transcontinental Inc. (TSX:TCL.A)	2,329	2,327	1,958	381	357	6.1x	6.5x	4.4%	(15.8%)	18.2%	29.3%
Median	**3,654**	**9,061**	**13,029**	**668**	**1,045**	**5.4x**	**5.1x**	**(1.1%)**	**(3.6%)**	**8.2%**	**17.7%**
Mean	**9,910**	**16,058**	**18,040**	**1,343**	**1,519**	**5.6x**	**6.1x**	**(1.8%)**	**(5.0%)**	**10.0%**	**17.7%**

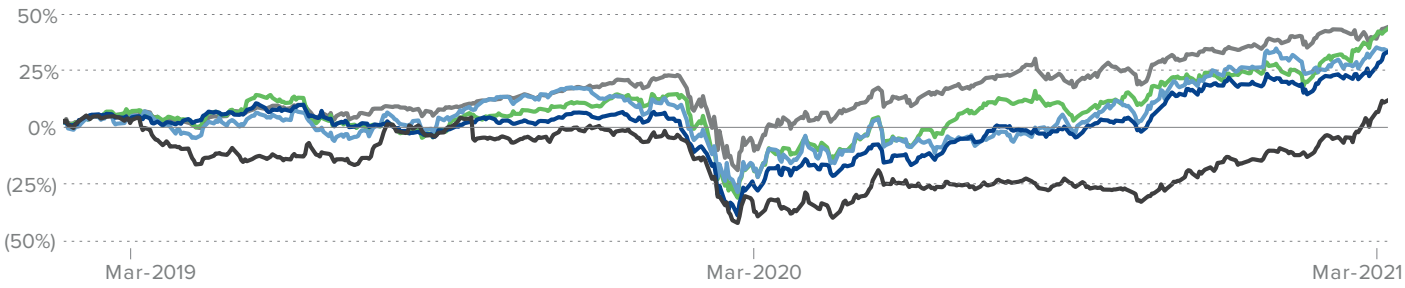
Guideline public company median TEV/EBITDA multiples



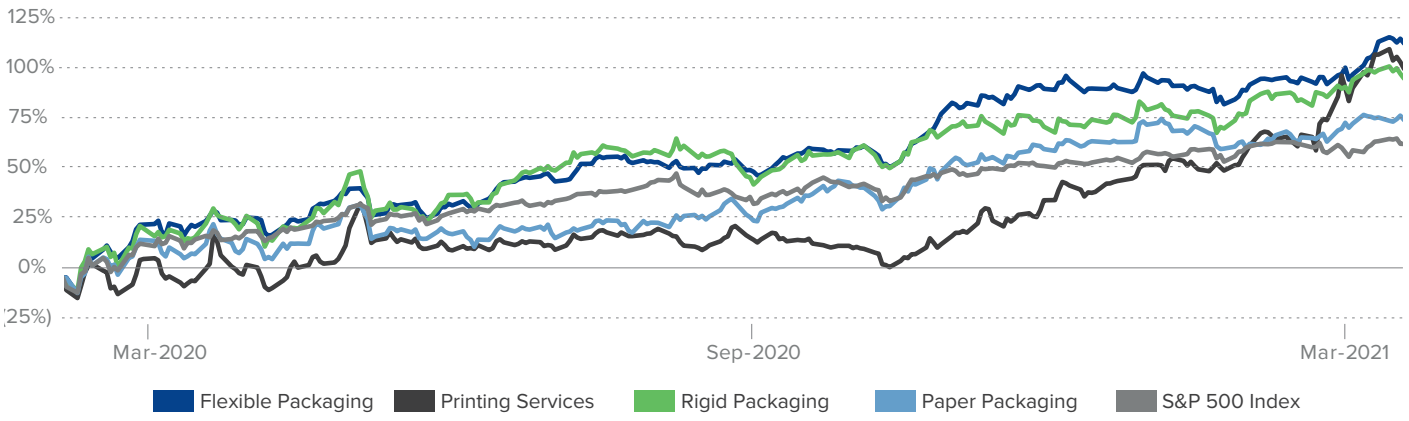
Print & Packaging Selected Publicly Traded Companies

COMPARATIVE SHARE PRICE PERFORMANCE

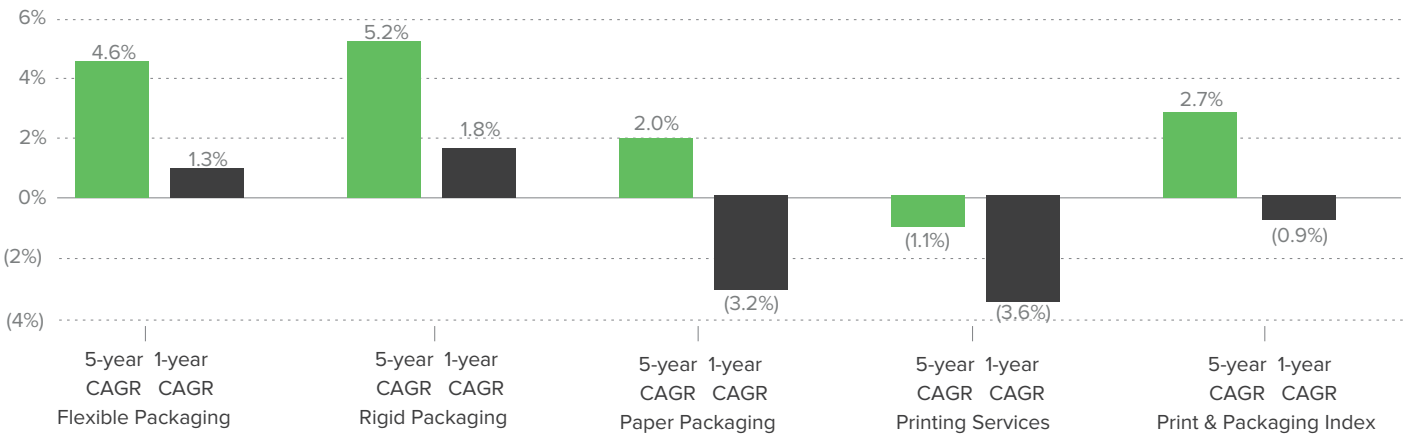
2-year stock performance



1-year stock performance



Median revenue growth



Source: Capital IQ (last updated March 2021)

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