



Growth of E-commerce and Single Use Cardboard Boxes Due to Covid-19

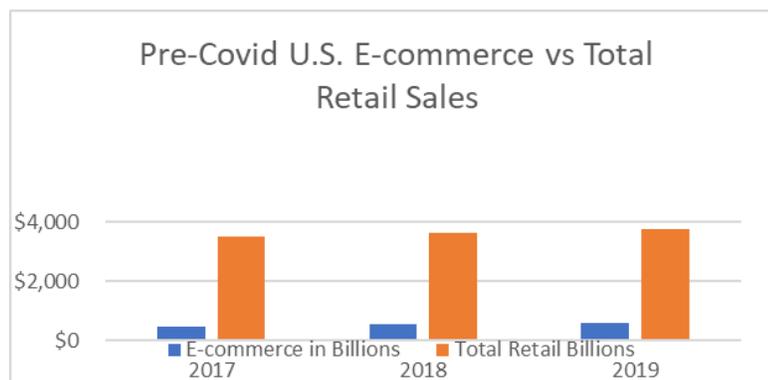
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E-commerce retail to home delivery has been on a rise since its inception. It has a percentage growth higher than general retail's percentage growth rate. Americans can shop multiple retailers to compare prices, check customers' reviews of item, and thus complete the purchase of an item without ever leaving their home. In 2018 e-commerce grew by 18% globally – consumers spent \$2.86 trillion in online sales. The top 10 global e-commerce retailers are Amazon.com, JD.com, Suning Commerce Group, Apple, Walmart, Dell Technologies, Vipshop Holdings, Otto Group, Gome Electrical Appliances, and Macy's.



(Digital Commerce 360, 2020)

With the success that e-commerce enjoyed, it still could not overcome certain aspects of the traditional brick and mortar stores. Retail allowed for immediate purchase of items and thus a quick

return if necessary. The purchaser did not incur a shipping cost. Nor did they fear damage or wrong item upon delivery. Retail also allowed the customer a chance to see, hold, or try an item on for size before the purchase. To address these changes, e-commerce companies not only improved process and delivery time but offered free shipping. Additionally, if it were the wrong item or not to the buyer level of satisfaction, the buyer could return it at no charge. Again, e-commerce had adapted to the desires of the customers and grown to the point of vanishing brick-and-mortar stores. Retail sales via the Internet have more than quadrupled over the past decade (Goodchild, et. al., 2016).

Corrugated cardboard (CCB) boxes are an essential part of e-commerce. The packaging is a necessary part of the delivery system as its basic functions are transportation, storage, and distribution (Koskela, et al., 2014). The most valuable function of the CCB box is to protect the items that are contained. E-commerce items will travel across multiple conveyor belts, separation stations, ride on forklifts, pass through the hands of warehouse personnel and travel on multiple delivery trucks before it reaches its final destination, the purchaser's doorstep. If it arrives damaged, the supplier will not only incur the cost to return the item, re-send a replacement item, and the loss of customer satisfaction. In addition to protection from damage, the items themselves are protected from pilferage while in-route. With the contents unknown to the handlers and the obvious indication if opened prevents partial or full theft as it travels through many hands to its final stop. With the obvious requirement to have cardboard boxes to ship items, make them into a shape that is easy to handle by humans, store or stack maximum product in warehouses and delivery trucks. Rough Handling of Express Parcels (RHEP) increases the risk of courier cargo damage and hurts the reputation of the express industry. Meanwhile, RHEP indirectly caused excessive use of packaging materials and cushioning materials, thereby aggravating environmental and social problems, such as waste disposal pressure and waste of resources (Ding, 2020). Until a better packaging material is created, paper, cardboard, and CCB boxes will be in high demand to support the growing e-commerce industry.

At this point, we have seen that e-commerce was steadily increasing popularity before COVID-19. The U.S. Postal Service estimated it would deliver 10 percent more packages in 2017 than the year before. Amazon, the leader in online shopping, said it shipped more than five billion items for Prime members in 2017. All that cardboard is a huge recycling challenge (Recycling centers struggle to manage the uptick in cardboard boxes, 2018). Even with old CCB boxes being recycled to new boxes, virgin material is still required for the final product. CCB is the highest value in the paper market due to the required long fibers and multi-panels. The rise of the green movement has made recycling a household

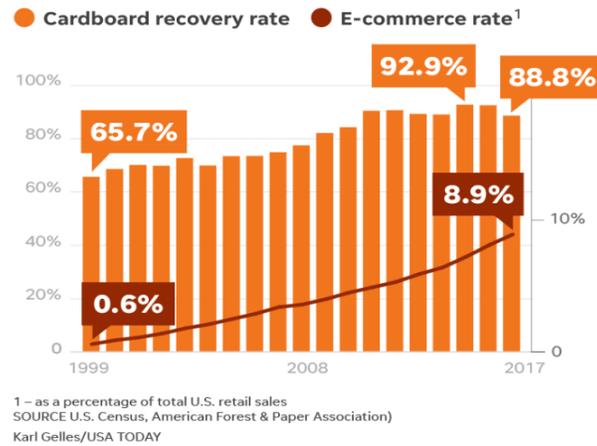
project and helped to increase the number of recycled products. The recovery rate for OCC jumped from 72% in 2006 to 89.5% in 2014, according to the [Corrugated Packaging Alliance](#). As more is recovered, less goes to landfill. This reduction results in lower methane emissions. The corrugated industry reduced its greenhouse gas emissions by 35% between 2006 and 2014 as a result of increased recycling of old corrugated cardboard/containers (OCC) and its use as a fuel in place of fossil fuels (LeBlanc, 2019). Recycled CCB boxes can be reused to help make new CCB boxes. Recycled CCB boxes are estimated to contain 50% recycled material. Recycling OCC reduces energy and water usage while cutting the production of greenhouse gas and certain air pollutants like total reduced sulfur (TRS), volatile organic chemicals (VOCs), and hazardous air pollutants (HAP). It takes approximately three tons of trees to manufacture just one ton of virgin cardboard. Recycling helps reduce waste tipping fees as well. The recycling of one ton of cardboard saves more than nine cubic yards of landfill space. (LeBlanc, 2019). The positive impact of recycling is the reduced amount of product going in landfills. We conserve natural resources such as water and timber. The recycling process creates less pollution than the collecting of natural resources. We have seen that CCB boxes are being recycled, but at what expense? Where does this material go to be recycled? The movement of recycled material still uses fossil fuel to be transported. Much of it goes as far as overseas to be recycled. China's need for raw materials created a purchaser for United States' recycled items. Along with plastics and paper products, the demand for imports of old, corrugated cardboard (OCC/Containerboard) from the U.S. has continued to decrease this past year following import policy changes in China and other major buyers (Has the Cardboard Recycling Industry Fallen Flat?, 2019). No, we are facing limited countries to export products for recycling. The price to send to the remaining countries has become an increased expense. Will it become too expensive to recycle? Will the product just end up in landfills? Low and flat demand for OCC has put the price at a 25-year low, causing existing inventories to build up and influencing a decision in many communities and businesses to stop recycling it altogether. The price for OCC is at the lowest it has been since December of 1993, decreasing from \$66/ton in June of 2018 to \$25/ton this past May (Has the Cardboard Recycling Industry Fallen Flat?, 2019). We know there is a requirement for CCB boxes to support the e-commerce market. We know the recycling of the boxes does not free us of the requirement of virgin resources. Furthermore, at the time we have fewer options to recycle and the ones available are more expensive. Does sending our waste to other countries with lower regulations solve our problem? It was seen that the collection of packaging material had always positive effect on the environment. However, social impacts may be the negative side of these positive pictures. While

recycling is good, we can do better. With the “3-Rs”, there is not just one but two options that are considered more environmentally friendly than recycling: reducing and reusing.

To reduce usage is the best environmental option. An item will be evaluated to see if it is necessary for every application. Does it need to be of virgin quality in each usage? In the event the item is not required as much then there will be a reduction in harvesting raw materials and less substance to address at end-of-life. The second-best option is to be reused. If an item can be reused then again, less will be required to meet the existing demand and less to dispose at end-of-life. Solid waste management at present has graduated from a use-dump-forget mentality to complex realms and intricacies involving high stakes in the economic arena; sophisticated engineering, science, and management applications; sensitive political and legislative issues; and local, regional and inter-state issues (Kollikkathara, et. al., 2008). According to the Environmental Protection Agency, Americans are still on the plus side of making waste every day. The total generation of municipal solid waste (MSW) in 2017 was 267.8 million tons (U.S. short tons, unless specified) or 4.51 pounds per person per day. Of the MSW generated, approximately 67 million tons were recycled and 27 million tons were composted. Together, more than 94 million tons of MSW were recycled and composted, equivalent to a 35.2 percent recycling and composting rate. In addition, more than 34 million tons of MSW (12.7 percent) were combusted with energy recovery and more than 139 million tons of MSW (52.1 percent) were landfilled (EPA website). Each day, we create more and more excess waste. Besides, the recycle amounts do not absolve us of virgin materials or required fossil fuel to transport products and potential social implications in developing countries.

Historically, goods were shipped to retail outlets in a large CCB box than contained quantities of the same product. There, employees are paid to breakdown boxes, separate them and if there is enough waste, locations will invest in cardboard balers. With the growth of e-commerce, that one large box with masses of the product being shipped to the retail outlets is replaced by many smaller CCB boxes that contain only one item and they are being delivered to homes. In a USA Today article, the American Forest & Paper Association is quoted as saying while online sales have surged in the past few years and cardboard use has jumped 8% in the same period, cardboard recycling has dropped (Weise, 2018).

Cardboard recycling down as online sales rise



(Weise, 2018)

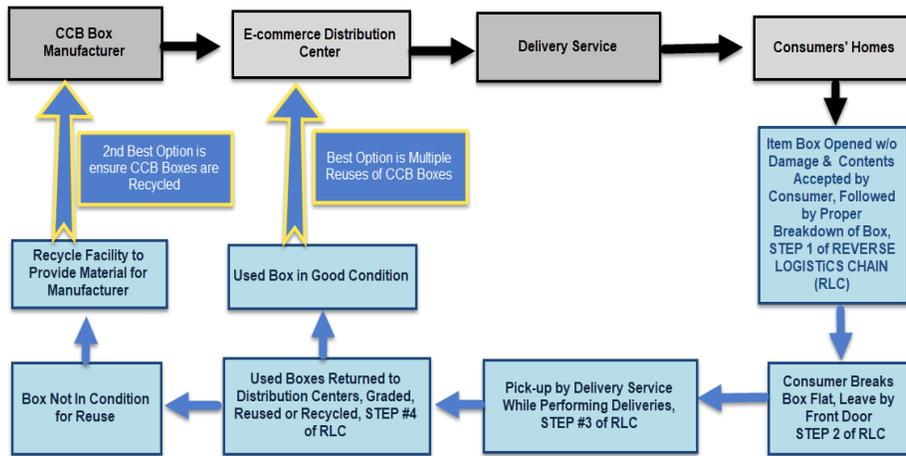
We know why there is an increase in demand for the required CCB boxes. The problem is expected to become more urgent. E-commerce [will make up 25% of all retail sales by 2025](#), according to ABI Research, suggesting even more boxes could go from doorstep to trash (Weise, 2018). Recycling is not the best option even when it is used. So where do we go? The proposal is to address the e-commerce market of Amazon, Wal-Mart, and other online retailers. When they shipped items that are already in their retail package.

A reverse logistics chain will have to be free and easy to access for consumers, the corporations that financially benefit from the e-commerce to home are expected to contribute if there is to be a success. The purpose of a reverse logistics is to take an item from point of consumption to the point of origin to recapture value or proper disposal. In my proposed reverse logistics chain, the intent is to capture the CCB boxes used for home delivery and return them to the e-commerce retailer to be sorted. The optimum option would be to reuse the CCB box for additional deliveries. If the box is not to standards for reuse, the online retailer will be responsible for the waste and ensuring it is properly recycled or used in a secondary manner that is in cooperation with the environment. The wastepaper needs immediate attention to reduce environmental pollution and different designs are proposed for the reverse and the closed-loop paper supply chain (Safaei, et. al., 2017). In a reverse supply chain, typically there are costs that no one or no company wants to assume. In this proposal, the existing forward logistics chain will serve as the reverse logistics plan.

Proposed Reverse Logistics Process Flow

It starts with the consumer receiving a parcel package at their home. When the opportunity presents itself, the consumer will place the folded box by their front door or mailbox. The next part will require responsibility from corporations that financially benefit the box during the forward logistics. While in their forward logistics function, carriers continue to deliver filled CCB boxes to residents, they should retrieve the folded boxes. The used CCB boxes will be returned to distribution warehouses in the same way the forward logistics send the filled boxes. Boxes that meet the criteria will go directly back into service. Boxes that do not meet the criteria of reuse will be sent to a recycling facility

Forward Logistics Flow



Reverse Logistics Flow

The businesses involved are required to have a value-based concern for environmental stewardship. The idea is to start with the largest ones and have led by example. The consumers will see the efforts put forward to put the environment-conscious decisions over a little more bottom-line profit. There is no plan to ask a company to ignore profit for the planet as it is a balance of the TBL that leads to success. In their study for a closed-loop supply chain for cardboard, Safaei, et. al., stated that 30–70% of waste generated in the cities of developing countries is collected for disposal. The proposed CLSC takes the waste from the consumer and returns it to the warehouse where the choice is to reuse the CCB box as many times and possible. It is not an option; it is ensured the box will enter the recycle stream to replace virgin materials.

In conclusion, E-commerce has made retail shopping very assessable to today's consumers. They can compare prices, quality, and reviews from their homes, place the order and wait a few days for its arrival to their front door. The plan addresses cardboard boxes that are mailed to homes and contain items that are already in a retail package. The retail package will do little to damage or contaminate these boxes. In doing have Closed-loop Supply Chain where the boxes can be reused without having to be recycled. If the boxes are not of good condition, we can be confident that they will be recycled into another CCB box or downcycled to other paper products thus reducing the demand on virgin materials.

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1. British Coatings Federation. (2019) (BCF) "Warns of raw materials shortages." *Adhesives & Sealants Industry* 13.11 (2006): 9. ProQuest. Web.
 2. Morgan, Jacob. (2014). "A Simple Explanation Of 'The Internet of Things.'" *Forbes*, page 2, 3. Accessed July 27, 2019.
 3. Marsillac, Erika Dr. (2019). "Malthus perspective." *Strategic considerations, part I, FS 3_4 student*. Old Dominion University
 4. Mokyr, Joel. (1977). "Demand vs. Supply in the Industrial Revolution." *The Journal of Economic History*, vol. 37, no. 4, 1977, pp. 981–1008.
 5. Morgan, Jacob. (2019). "A Simple Explanation Of 'The Internet of Things.'" May 13, 2014, 12:05am. *Forbes*, page 2, 3. Accessed July 27, 2019.
 6. Hofmann, M., Hofmann, H., Hagelüken, C., and Hool, A. (2018). "Critical raw materials:" *A perspective from the materials science community*. www.sciencedirect.com/journal/sustainable-materials-and-technologies/vol/1/suppl/C.
 7. Johnson, Keith., and Groll, Elias. (2019). "Foreign Policy news." *China Raises Threat of Rare Earths Cutoff to the U.S.*
 8. Mining. (2016). "Where do our raw materials come from?" November 16, 2016 | 5:10 am. Retrieved from: www.mining.com/web/where-do-our-raw-materials-come-from/
 9. Schmidt, Mario. (2018). "Scarcity and Environmental Impact of Mineral Resources." *An Old and Never-Ending Discussion. Resources*, 8(1), 2.
 10. Sick, Nathalie, Matthias Blug, and Jens Leker. (2019). "The Influence of Raw Material Prices on the Development of Hydrogen Storage Materials: The Case of Metal Hydrides." *Journal of the Knowledge Economy* 5.4 (2014): 735-60. ProQuest.
 11. Industrial Metal Supply Company. (2019). "Iron ore reserve by country." May 2019. www.industrialmetalsupply.com/blog/tag/iron-ore-reserves-by-country/
 12. European Commission. (2019). "Critical Raw Materials."
 13. Remondis Group. 2019. www.remondis-sustainability.com/vermitteln/rohstoffknappheit/?skip=1
 14. Anderson, Ponzio, Gauffin, Axelsson, and Nilson. (2017). "Sustainable Steel Production – Swedish Initiative to 'close the Loop'." *Mineral Processing and Extractiv*
 15. Marsillac, Erika Dr. (2019). "Malthus perspective." *Strategic considerations, part I, FS 3_4 student*. Old Dominion University
 16. Steel Recycling Institute. (2019). "Recycling." *Steel is the world's most recycled material*. July 2019. <https://www.steelsustainability.org/recycling>
 17. Maritime Connector. (2019). "Capesize." *VLOC Berge Nord*. Retrieved from: maritimeconnector.com/wiki/capesize/
 18. General Administration of Customs PRC. (2019). "Review of China's Foreign Trade in the First Quarter." *Imports of major bulk commodities such as crude oil and natural gas grew, while imports of iron ore*.
 19. Earth Justice. (2019). "Because the earth needs a good lawyer." *Stopping extraction and mining*. Retrieved from: www.earthjustice.org/climate-and-energy/stopping-coal/extraction

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20. Li, Ling Dr. (2018). "Power Point presentation." *Sustainability*. MSCM 641—Supply Chain Management and Logistics. Old Dominion University.
 21. Stopford, Martin. (2019). "Maritime economics. 3ed." *The ship recycling industry*. Page 651. Simultaneously published in the USA and Canada by Routledge. 270 Madison Avenue, New York, NY 10016 .
 22. Marsillac, Erika Dr. (2019). "Introduction to Reverse Logistics and Sustainable Operations." *Closed-loop supply chains*. PPT slide 5. Old Dominion University.