PACKAGING DESIGN IN THE CIRCULAR ECONOMY: REUSE MODELS IN FAST-MOVING CONSUMER GOODS

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ABSTRACT

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Multinational fast-moving consumer goods corporations such as Procter & Gamble, Unilever, and Coca-Cola are the highest producers of plastic pollution in the world, and yet take little-to-no responsibility for the waste after the end of their product's useful life. Single-use plastics, such as those used for bottles, wrappers, straws, bags, and more, end up wasted in landfills, waterways, and ecosystems all around the world. The challenges associated with managing large and diverse streams of waste are complex, and the repercussions can be far-reaching, but the circular economy has proved to be promising in eliminating some of this stress. The circular economy is a proposed economic system aimed at eliminating waste and the continual use of resources and has tremendous organizing potential. In this thesis, I will discuss the catastrophic impact of the United States' single-use plastics addiction and evaluate the reusable methods of packaging among various types of household products in an attempt to drastically cut single-use plastics output. I will specifically focus on the opportunities and challenges of "refillables," or items where consumers can easily obtain regular household items in bulk. I will evaluate similar circular economy projects that already exist in the market using reuse models, such as the Unboxed Market in Canada that has completely eliminated single-use plastics, and create a cost-savings model to demonstrate how a company can implement circular economy into their overall strategy.

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Introduction

My freshman year of undergraduate, I was assigned a book called *Garbology* by Edward Humes for a Plan II class project. *Garbology* contains a detailed history on how the U.S. became addicted to throw-away products and describes some of the social and economic dilemmas that come from the garbage crisis. This book became a catalyst for my academic interests in waste management, and I pursued many unique opportunities in my college career that taught me more about the waste and recycling industries. One well-known type of waste is plastic, and it was jarring for me to discover that plastic has significant environmental and social impacts at every step of its creation, from when crude oil, its central component, is first drilled to long after the product's useful life.

The production of all plastic materials begins with raw material extraction, or more specifically, the drilling of oil, which contributes harmful chemicals in groundwater that has been known to cause fertility problems, respiratory issues, and cancer in many communities across the U.S. Plastic pollution normally enters the ecosystem through stormwater drainage, illegal dumping, lost maritime gear, or by blowing off beaches or coastal structures. According to the Convention on Biological Diversity, plastic pollution has impacted over 663 species of marine life, including dolphins and whales, birds, reptiles, and fish. Perhaps worst of all, microplastics have been found in the intestines of humans, consumed through contaminated food or water.[1] The accumulation of plastics in humans over time has the potential to create a myriad of health problems, including cancers, birth defects, and immune system problems.

[1] Bouwman, Hendrik. "Impacts of Marine Debris on Biodiversity: Current Status and Potential Solutions." *Secretariat of the Convention on Biological Diversity CBD Technical Series* No. 67 (2012).

Plastic packaging, which can be found on most consumer goods items such as food, household goods, and hygiene products, accounts for 36% of all plastics made, but over 47% of all plastic waste. Plastic packaging that is used once and then discarded ("single use plastic"), created by mass manufacturing, contributes significantly more to the enormous streams of waste in the United States than other materials.[2] Commonly encountered types of plastic include low-density polyethylene (LDPE), high-density polyethylene (HDPE), and polyethylene terephthalate (PET), but thousands of different plastics exist in the marketplace, very few of which can be recycled.

Plastic waste presents serious public health and environmental implications for the next generation, and many countries have tried to implement recycling services. Recycling can be helpful for diverting plastics from landfills, but unfortunately only a few types of plastics are able tobe recycled. Additionally, not all parts of the U.S. have recycling services or facilities - the EPA reported only a 32.1% recycling rate in 2018, as compared to higher metrics in some European countries.[3] While effective waste management is important to preventing plastic pollution, reducing the creation of products that eventually become waste is critical to preventing an environmental catastrophe.

Before the United States can manage the waste currently created, it must first "turn off the tap" to prevent the flow of waste from being too large to handle. The circular economy isa theory which could serve as a solution to the overproduction of waste. The EPA defines the circular economy as "restorative or regenerative by design", essentially aiming for the

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[2] Rhodes, Christopher J. "Solving the Plastic Problem: From Cradle to Grave, to Reincarnation." *Science Progress* 102, no. 3 (2019): 218–48. https://doi.org/10.1177/0036850419867204.

[3] EPA. Environmental Protection Agency. Accessed May 1, 2022. https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials.

elimination of waste through the improved design of products, materials, and systems. A circular economy is meant to redesign products to be more durable, utilizing fewer resources and recapturing waste after the product's useful life to generate new materials or products. This process helps companies reduce the creation of waste before it moves through the economy. However, achieving this is far more difficult in practice than in theory.

In this work, I will explain why plastic waste is a problem, explain how a circular economy might help reduce waste and how the theory can be effectively applied to plastic packaging, particularly in the fast-moving consumer goods industry. I focus particularly on the four reuse models and how they can be relevant in reusable packaging. In order to establish that any company can apply circular economy in a cost-effective way, I have created a cost-savings model utilizing industry averages in order to show the differences between single-use and reusable packaging.

I. The Problem of Plastic Waste

"One truckload of plastic waste is dumped into the oceans - every minute of every day. To tackle the plastic pollution of the oceans, we need to turn this tap off."

- David Katz, founder and CEO, Plastic Bank

Why Waste Presents Threats

Modern Americans like to see their waste disappear instantaneously, whether it's through the trash can, the sink, or the toilet. However, only a century ago, waste was mostly a household issue, and municipal solid waste (MSW) collection as we know it did not start to appear until well into the 20th century. MSW that ends up in landfills typically consists of food scraps, product packaging, furniture, clothing, appliances, newspapers, and more. Other materials that might end up in landfills include construction materials, wastewater treatment sludge, and industrial wastes. MSW management varies largely by region, especially between developed and developing countries.

Landfills are the most common waste-management practice, but contribute heavily to climate change. For one, the creation of all waste products requires energy and thus already-emitted greenhouse gasses, and trucks and other equipment that are used to haul waste also create such emissions. Perhaps more shockingly, landfills release significant quantities of methane from the anaerobic decomposition of organic materials, otherwise known as fermentation. Anaerobic decomposition refers to breaking down of biodegradable material by microorganisms in an oxygen-free environment. In order to redirect some of their MSW, Germany banned traditional landfills in 2005 and now recycles and incinerates most of its trash. On the other hand, landfills are the third-largest human source of methane emissions in the U.S. Even more, toxic chemicals in landfills often sink below ground into groundwater, which many

communities use as a source of drinking water. The long-term effects of these "leaks" are still being studied.

Aside from emissions, waste has several implications for public health, but the characteristics of where waste often lands varies wildly from region to region. Those in affluent regions often do not need to consider waste through the lens of public health, as their waste often ends up in a combination of landfills, incinerators, and recycling facilities. However, less affluent regions with poor waste management are often left with waste in their nearby waterways or parks, along their roadways, or in large piles in the streets. The term "collective coverage" refers to the area serviced by the municipal waste stream, and it varies wildly in developing countries between "slum" and "nonslum" households. Any uncollected waste has the potential to clog drains or sewers, causing flooding and therefore the spread of infectious diseases, often spread by mosquitoes or rodents. Even after it is collected, though, waste has the potential to cause public health problems. There is evidence to suggest that living near landfills or MSW processing plants can cause low birth weight, birth defects, and certain types of cancers.

Of all the many types of waste that exist, plastic waste does the most environmental damage by far. It is estimated that there are currently 5.25 trillion pieces of plastic debris in the oceans.[4] Unfortunately, as production of plastic has grown from 2 million tons in 1950 to 288 million tons in 2012, even the most remote regions of the planet now contain plastic debris, from the deserts to the deepest trenches in the oceans.[5] This pollution is degraded by sunlight, biodegradation, and erosion, and the resulting plastic fragments accumulate in massive circular

[4] Carolan, Michael S. *Society and the Environment: Pragmatic Solutions to Ecological Issues*. London: Routledge, 2020.

[5] "Plastics–The Facts 2013: An Analysis of European Plastics Production, Demand and Waste Data for 2013." *PlasticsEurope*, 2013.

currents in the ocean called subtropical gyres. The famous Great Pacific Garbage Patch is an example of micro and macro plastics accumulating in the South Pacific in subtropical gyres.[6] As the pieces break down further and multiply in number, microplastics are mistaken for food and enters organism digestive systems, and subsequently, the food chain. The long-term effects of the bioaccumulation of these compounds in humans from plastics is currently being studied, but the questions on the impact of consumer plastic products on human health is mostly unknown.[7]

Plastics also contribute to the transportation of invasive species, as they can carry organisms to nonnative regions, and can cause harm to sea creatures when ingested. Some persistent pollutants, including flame-retardant chemicals used in plastic manufacturing, can transfer to fish and birds when ingested, and over time these chemicals and fragments accumulate in the fish that humans harvest for food. The durability and versatility of plastic materials, the reasons they became popular, has unfortunately also resulted in enormous social and environmental consequences that have only worsened over time.

History of Plastic Production

Plastic, a word that means "pliable and easily shaped", became a name for materials made of synthetic polymers. Synthetic polymers are made of chains of repeating atoms that are much longer than those found in nature, making the materials strong, lightweight, and flexible. The synthetic polymers in plastic have become central to our lifestyle and culture over the last 50 years, as we have learned to manipulate them to fit our needs. The first synthetic polymer was

[6] Eriksen, Marcus, Nikolai Maximenko, Martin Thiel, Anna Cummins, Gwen Lattin, Stiv Wilson, Jan Hafner, Ann Zellers, and Samuel Rifman. "Plastic Pollution in the South Pacific Subtropical Gyre." *Marine Pollution Bulletin* 68, no. 1-2 (March 2013): 71–76. https://doi.org/10.1016/j.marpolbul.2012.12.021.

[7] Eriksen, Marcus. "The Plastisphere—The Making of a Plasticized World." *Tulane Environmental Law Journal* 27, no. 2 (2014): 153–63.

invented in 1869 as a substitute for ivory, and advertisements praised it as an environmentally friendly alternative to elephant and tortoise materials. Synthetic polymers developed slowly until the onslaught on World War II, which necessitated the expansion of the plastics industry. Plastics were used during the war in parachutes, armor, helmets, and aircrafts, and during World War II, plastic production in the United States increased by 300%. After the war ended, surges in plastic production continued as the material became utilized in a variety of industries, including packaging, furniture, and automobiles.[8] Life Magazine enthusiastically described single use plastics in household goods as "Throw Away Living" in 1955 to cut down on household chores. The desire for more convenience therefore contributed to an increasing demand for plastic that has persisted to the 21st century.[9]

Plastic gives many benefits to both the consumer and the producer, and has played a central role in the development of modern life. Plastics have led to the creation of modern marvels such as cell phones, laptops, and lifesaving medical supplies, including IVs, needles, and masks. Even more, the abundance of plastics has raised the standard of living and abundance of material resources for many. The creation of plastics also helped people living under economic constraints that limited their access to resources, making material wealth far more attainable for the average person. Historically, replacing materials with plastics has made many of our possessions cheaper for both consumers and producers, more durable, and more lightweight. In fact, many types of plastic are so well engineered that they can survive in extreme environments without degrading.

[8] "History and Future of Plastics." Science History Institute, November 20, 2019. https://www.sciencehistory.org/the-history-and-future-of-plastics.

[9] "Throwaway Living." *LIFE*, August 1, 1955.

Plastic serves as an incredible packaging material due to its low cost and excellent printing ability, which helps products clearly market their branding and entice potential customers. Most packaging serves as an effective sales tool, as it gives customers basic product information that would secure a customer's interest. More importantly, the strength and durability of plastic packaging keeps products safe and protected during transit.

Trends in Plastic Packaging

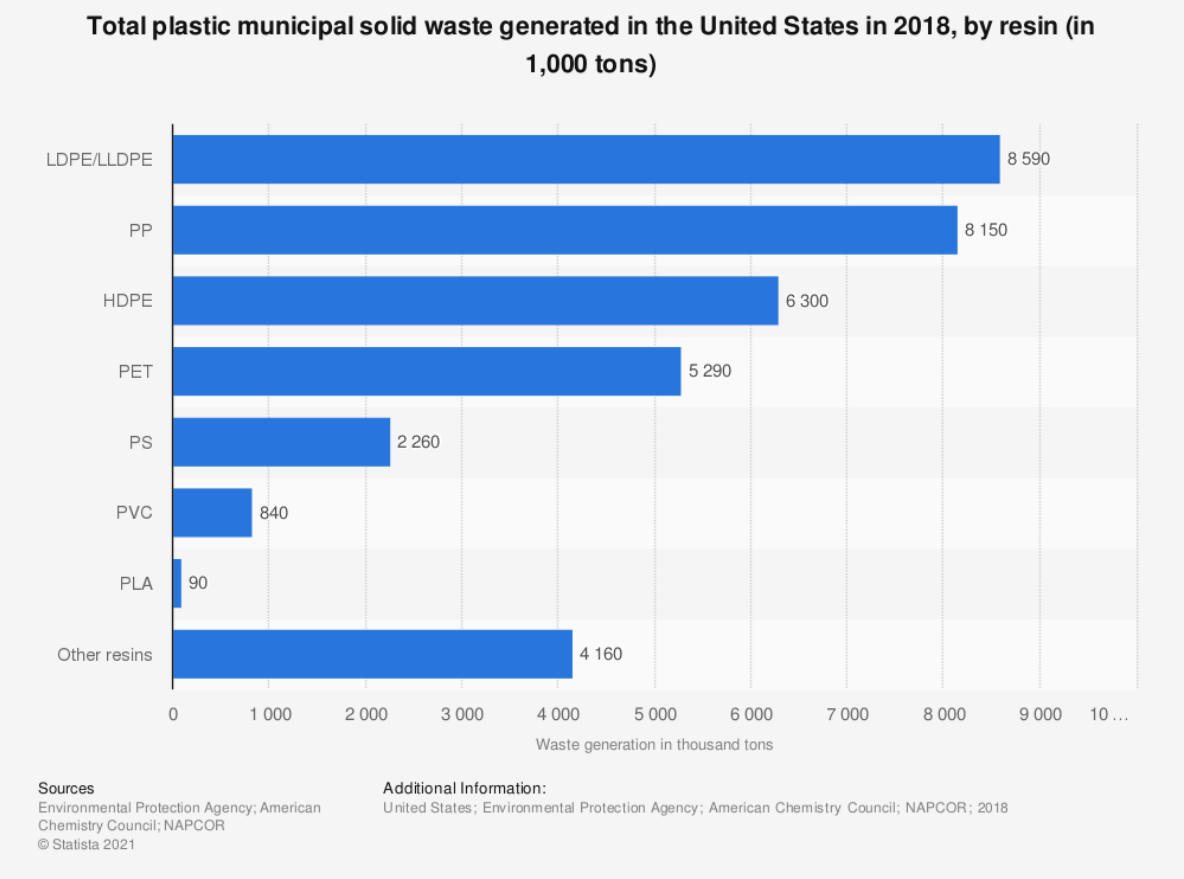
The global plastic packaging market size was valued at $348.08 billion in 2020 and is expected to grow at a compound annual growth rate of 4.2% from 2021 to 2028. Growth is expected to be robust for the food and beverage industry, as urban population growth and the penetration of eCommerce are among the many factors driving the growth of the packaging industry. Even more, the demand for food is expected to increase exponentially along with the global population, which is in turn expected to increase the need for plastic packaging materials. Some of the key players in the plastic packaging market include Amcor plc, Sealed Air, Coveris, Mondi, Constantia Flexibles, and so many more.[10] As the eCommerce sector grows over time, these companies prefer lightweight and condensed packaging to reduce the cost of transportation. However, there is indeed rising awareness regarding the sustainability of plastic packaging and a few bans on single use plastics, particularly in Europe, which has the potential to threaten the plastic industry. The convenience of plastic packaging is unparalleled with any other type of material, but the social and environmental cost of such convenience is becoming one of the most pressing problems of the next generation.

[10] "Plastic Packaging Market Trends & Growth Report, 2021-2028." Plastic Packaging Market Trends & Growth Report, 2021-2028. Bank of America, March 2021. https://www.grandviewresearch.com/industry-analysis/plastic-packaging-market.

Although there are thousands of different types of plastic used in packaging, five types are the most popular in consumer goods packaging. High density polyethylene (HDPE) is the most common type of plastic, as it is used in many types of bottles and containers, from milk gallons to detergents and bleach. HDPE has good chemical resistance and has good barrier properties that make it well suited to products with a short shelf life. Low density polyethylene (LDPE) is mostly used in film applications, particularly shrink wrap and bags for fresh produce, frozen foods, breads, and garbage. LDPE can also be found in squeezable bottles and container lids due to its toughness and flexibility. Polyethylene terephthalate (PET, PETE) is common in beverage bottles and food jars. PET is known for its clear and smooth surfaces as well as high impact capability and shatter resistance. Polypropylene (PP) is found in medicine bottles and containers for margarine, yogurt, takeout, and other foods. Finally, polystyrene (PS) is a versatile plastic that is clear, hard, and brittle, and is typically used in food service items like cups, plates, bowls, cutlery, and other food containers.[11]

As shown by the below data from the Environmental Protection Agency, LDPE is the most common type of plastic found in the United States municipal solid waste, followed closely by PP, HDPE, and PET. This is likely because LDPE is not as conducive to recycling as other types of plastics. However, the disposal of plastic after its useful life is not the only step in the supply chain of plastics that causes social and environmental damage. The long-term social, environmental, and health implications from all steps of the production process emphasize the need to move away from plastic packaging altogether.

[11] "Resins and Types of Packaging." Advancing Circular Packaging. American Chemistry Council, February 11, 2021. https://www.plasticpackagingfacts.org/plastic-packaging/resins-types-of-packaging/.



[12]

Supply Chain of Plastic Packaging

Every step of the supply chain of plastic production and the health and environmental implications clarifies the need to move away from plastic production overall. Unfortunately, there is a huge lack of transparency from the players in the plastics industry regarding the plastics supply chain. Little-to-no information exists for the public to learn about the flow of materials from raw material extraction, to production, to collection and recycling at end-of-life. Because of this, it is estimated that the social, environmental, and economic impacts of the plastics supply chain is largely underreported. Greater supply chain transparency on the part of the plastics supply chain would provide more industry accountability, consumer awareness and

[12] "Total Plastic Municipal Solid Waste Generated in the United States in 2018, by Resin." *Environmental Protection Agency; American Chemistry Council*, Statistica, 2018.

action, and overall positive environmental and social change. Even more, it would allow legislators to effectively create new policies for plastic pollution and hold producers accountable for their contribution to plastic pollution. In order to increase transparency in the plastics supply chain, the Minderoo Foundation suggests reporting based on collection, analysis, and publication of data and knowledge by academic institutions, NGOs, and commercial analysts, as well as increased public and investor pressure for the voluntary disclosure of data and information. Even more, policymakers and legislators should implement increased disclosure of data and information on plastic use and provide mitigation strategies.[13] For the purposes of this research, I am working with the limited data on the average plastics supply chain available to the public.

The process of oil and natural gas extraction begins first with preparing the drilling site, and then putting the rig together. After the drilling is complete, the workers are able to test the well and complete the process of fracking, a dangerous way of extracting oil and gas that involves injecting fracking liquid into the rock bed to extract the resources.[14] According to the USGS, the environmental considerations of drilling for oil include land surface disturbance, groundwater and air contamination, oil spills, and disposal of the materials used on-site, including non-potable water.[15] The fracking process in particular directly contributes chemicals to groundwater, putting pregnant women and their babies at risk of miscarriage, infertility,

[13] "Greater Transparency across the Plastics Supply Chain Crucial to Ending Ocean Plastic Pollution." The Minderoo Foundation. Minderoo Foundation, May 18, 2021. https://www.minderoo.org/no-plastic-waste/news/greater-transparency-across-the-plastics-supply-chain-crucial-to-ending-ocean-plastic-pollution/.

[14] "The Seven Steps of Oil and Natural Gas Extraction." Coloradans for Responsible Energy Development, April 8, 2021. https://www.cred.org/seven-steps-of-oil-and-natural-gas-extraction/.

[15] "What Are the Environmental Considerations of Drilling for Oil?" U.S. Geological Survey. Accessed May 1, 2022. https://www.usgs.gov/faqs/what-are-environmental-considerations-drilling-oil.

impaired learning development, birth defects, cancer, and so much more.[16] Unfortunately, there is very limited information available to the public on the total environmental impact of drilling for oil and gas, including greenhouse gas emissions and groundwater pollution.

After the oil is obtained and stored, it must be transported to an oil refinery for monomer and polymer production. At the refinery, oil and gas are refined into propane, ethane, and hundreds more petrochemicals. Ethane and propane become ethylene and propylene from heat exposure, which are then combined with a catalyst that turns into a polymer "fluff" that resembles detergent. From there, the fluff is combined with additives, melted, and cut into plastic pellets, which are then shipped to producers and manufacturers to become the bottles, tubes, and tubs we use on a regular basis.[17] However, the production of plastic inside refineries has been known to emit greenhouse gas emissions that contribute to climate change. The net heat generation from plastic making between 1939 and 2000 is estimated to contribute about 0.5% of the total global warming.[18] The public health implications from living near refineries is also startling - a study in Jordan demonstrated that residents living close to oil refineries suffered from respiratory problems, including asthma, a reduction of lung function, and airway inflammation.[19]

The plastic pellets that are made in the refineries, about the size of a lentil each, serve as the basic building blocks for nearly all plastic products. Once they reach the plastic

[16] "Exposing the Dangers of Fracking." Center for Environmental Health, January 24, 2020. https://ceh.org/fracking/.

[17] Pleasant, Ron. Oil to plastic: A lesson on how plastic is made, March 13, 2016. https://inbound.teamppi.com/blog/oil-to-plastic-a-lesson-on-how-plastic-is-made.

[18] Gervet, Bruno. "The Use of Crude Oil in Plastic Making Contributes to Global Warming." Renewable Energy Research Group, 2007.

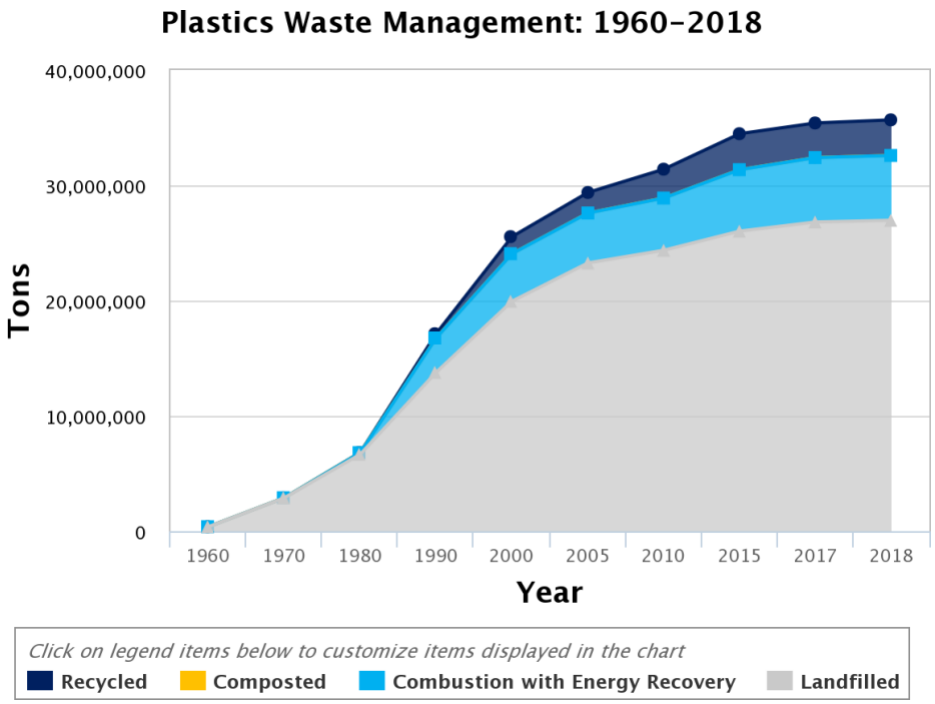
[19] Khatatbeh, Moawiah, Karem Alzoubi, Omar Khabour, and Wael Al-Delaimy. "Adverse Health Impacts of Living near an Oil Refinery in Jordan." *Environmental Health Insights* 14 (2020): 117863022098579. https://doi.org/10.1177/1178630220985794.

manufacturers, the pellets are melted down and reshaped into the final product. Unfortunately, plastic pellets tend to escape at every stage of production, including transportation and final manufacturing, because of their small size. These pellets can be mistaken for eggs by fish or other animals, transferring toxins used in plastic production to wildlife. As You Sow, a non-profit, is working to challenge seven plastic resins manufacturers, including Chevron, Dow Chemical, DuPont, and Exxonmobil, to disclose actions to prevent plastic pellets from entering waterways.[20]

After the product is used by the consumer, it reaches its end-of-life stage, which requires some method of collection, whether that is traditional waste management collection, recycling, or a materials take-back program run by the producer. It is in this stage where we hear the most about environmental impacts, as plastics usually end up landfilled, recycled, incinerated, or in the natural environment. However, the environmental implications vary widely among the materials and their final destinations.

The data below from the Environmental Protection Agency demonstrates the changing waste management of plastics in the United States from 1960 to present day. It shows that much, much more plastic is landfilled than recycled or used for energy recovery in the United States. Unfortunately, this chart does not consider plastics that never reached the waste management system and may be adrift in the natural environment. To ensure that far less plastic is landfilled, producers are starting to take responsibility for the end-of-life recovery of plastic products. This is largely due to increasing public pressure for corporations to adhere to strict environmental regulations, a stark contrast from the initial Keep America Beautiful campaigns that suggested that consumer behavior was the primary cause of plastic pollution.

[20] "Plastic Pellets." As You Sow, 2021. https://www.asyousow.org/our-work/waste/plastic-pellets.



[21]

Producer Responsibility for Plastic Waste

Recent academic focus has shifted to producer responsibility for product and packaging design rather than consumer behavior as the main cause of plastic pollution. More specifically, accountability for the product's end of life impact is shifting to the ethics of extended producer responsibility (EPR), which adheres that a manufacturer that creates plastic products or packaging must demonstrate a successful system of recovery after the product's useful life. The motto "benign by design" suggests that products must now be biodegradable, or the company must be prepared to implement a successful product recovery plan. EPR aims to reduce waste volume and phase out relying on taxpayer-funded waste management services.

This isn't to say that consumers don't have a responsibility to prevent plastic pollution in their day-to-day lives. In fact, we should all be taking in active role in reducing our waste output

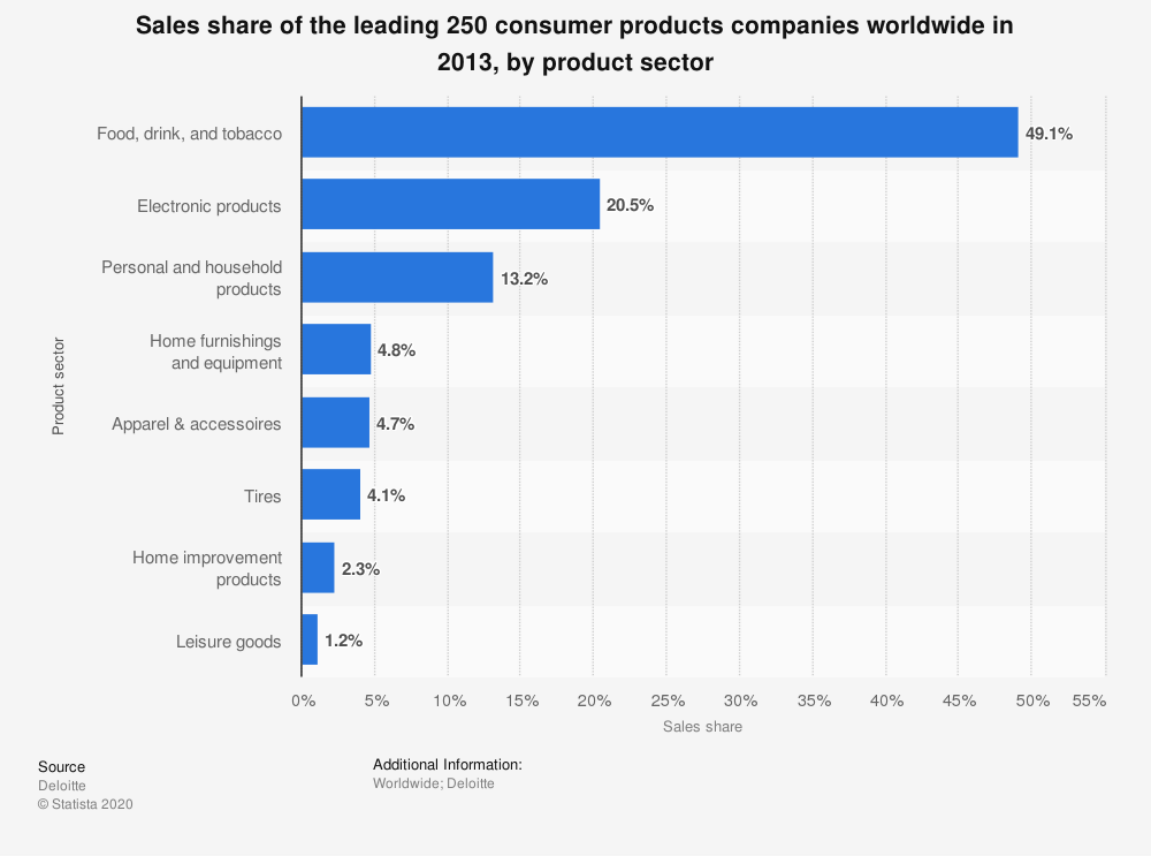
[21] "Plastics: Material-Specific Data." EPA. Environmental Protection Agency. Accessed May 1, 2022. https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/plastics-material-specific-data.

for the next generation. However, curbing the creation of plastic pollution through effective product and packaging design is a far more effective solution than relying on changing consumer behavior.[22] This is largely because instructional campaigns on littering, like Keep America Beautiful, have been proven to be largely ineffective at preventing plastic pollution. The fast-moving consumer goods industry in particular is being called to take a greater interest in corporate responsibility and preventing plastic waste. The next section will discuss the fast-moving consumer goods industry and its use of plastics for packaging.

What is a Fast-Moving Consumer Good (FMCG)?

A consumer good is simply a product bought for consumption by the average consumer in order to satisfy the wants and needs of the buyer. The following data from Deloitte demonstrates that around 50% of all consumer goods products in 2013 were food, drink, and tobacco products, followed by electronics at 20.5% and personal/household products at 13.2%. A fast-moving consumer good (FMCG) is a type of consumer good, meant for personal use, with a useful life of shorter than a year. Single-use packaging is more common in fast-moving consumer goods than in other consumer goods.

[22] Eriksen, Marcus. "The Plastisphere—The Making of a Plasticized World." *Tulane Environmental Law Journal* 27, no. 2 (2014): 153–63.



[23]

FMCGs are normally products that are bought frequently with recurring expense, including products in categories such as food and beverages, personal care, and cleaning/home care products. Fast-moving means the products are usually relatively inexpensive and are needed almost daily, meaning they need to be readily available in stores near residential areas and affordable for all. Because of this definition, electronics, home furnishings, and a few other well-known consumer goods are not considered fast-moving and will therefore not be a main consideration in this thesis.

[23] "Sales Share of Consumer Products Companies 2013, by Product Sector." Statista. Deloitte, April 15, 2015. https://www.statista.com/statistics/256239/sales-share-of-the-leading-250-consumer-products-companies/.

Product Marketing and Branding

Major players in the FMCG industry rely on product marketing, rather than company marketing, in order to create brand loyalty among their customers. Product marketing is the process by which consumers learn the unique value of a particular product and how it can be set apart from competitors in the marketplace, much of which is done through product packaging. Some of the major companies in the FMCG industry include Unilever, Procter & Gamble, Johnson & Johnson, and Nestle, each with several different brands that require different product marketing on its packaging. Unilever operates in the major segments of FMCG, including home care, personal care, and food and drink. Unilever brands include Hellmann's, Ben & Jerry's, Magnum, Dove, Knorr, and dozens more in the international market. On the other hand, Procter & Gamble (P&G) produces the widest variety of consumer goods and is dominant in household care with brands including Bounty, Dawn, Pampers, Duracell, Charmin, and more. P&G brands in personal care and beauty include Crest, Fusion, Gillette, Olay, and Pantene. The packaging for each brand, including the text, color, and shape, is designed with the intention to attract consumers to the product.

Leading FMCG corporations utilize a network of retailers to deliver products to customers, which requires costly logistics and distribution networks. However, in our time-poor society, many millennial customers now no longer want to visit stores for their everyday consumer goods items – they expect these products to be delivered to their doorstep to save time and energy and to improve the overall shopping experience. Even more, customers are learning to value green, environmentally-friendly products and companies as well as corporate

responsibility and accountability.[24] Therefore, more and more consumers are choosing brands that offer circular packaging options, whether that's compostable, recyclable, or reusable.

To fit the rising demand, household and personal care products are creating more plant-based, sustainable packaging alternatives, with Unilever among them. Changing consumer preferences for circular business models have forced around 60% of FMCGs to invest in recycling infrastructure and packaging alternatives. Yet, over 60% of the top 10 revenue generating brands for each major FMCG have failed to deliver low carbon innovations in the past 10 years. This is because most consumer goods corporations are focusing on acquiring small, sustainable brands to capture more of the market share, while leaving their fundamental business models and many of their major brands unchanged.[25] Plastic packaging remains a tenant of product marketing in FMCGs, mostly due to the benefits of plastic packaging as a marketing tool. Every choice made in the packaging design process, from the aesthetic to the materials, will affect the way that customers perceive the product.[26]

Why Plastic is Used for Packaging in Fast-Moving Consumer Goods

One of the main ways companies brand a product is through the use of packaging. Plastic is one of the main packaging materials that is used to establish a brand, as mass economies of scale have allowed plastic to be the dominant material used in fast-moving consumer goods packaging. According to the British Plastic Federation, plastics are used in packaging in order to

[24] Phạm, Long. "FMCG Industry 2019 Overview and Outlook." Abivin, October 14, 2020. https://www.abivin.com/post/2016/12/20/fmcg-industry-overview-and-outlook.

[25] Kiadeh, Rojin. "Top Fmcgs in Race to Keep up with Conscious Consumers." CDP, February 25, 2019. https://www.cdp.net/en/articles/media/top-fmcgs-in-race-to-keep-up-with-conscious-consumers.

[26] Spagnola, Barbara. "The Role of Packaging in Marketing." MarketingSource, April 29, 2022. https://www.marketingsource.com/post/the-role-of-packaging-in-marketing.

protect, preserve, store, and transport products easily. Plastic packaging allows many fragile or perishable products to survive in good condition long enough to be used, as plastic is incredibly difficult to break yet remains low in weight and cost. Even more, because plastics technology has advanced into a number of processing techniques, the manufacturer of the packaging has access to a variety of shapes, colors, and properties, as well as the ability to print text and other details on plastic. Examples of plastics packaging include bottles, bulk containers, pails, pots, trays, and more. Ironically, plastic packaging can save energy in the transport of packed goods because it is lightweight and therefore less fuel is used in fleets. Plastic also protects perishable food from deterioration and increases the shelf life of produce, which is objectively helpful for eliminating food waste in a supply chain.[27]

There are also many social reasons why plastic packaging is popular. Plastic packaging facilitates the ease of packaging marketing, which can make or break a product for many customers. Consumers tend to make snap decisions about a product, so packaging must be eye-catching, informative, and include any relevant branding. This is particularly relevant for new products entering the market, as they are attempting to change consumer purchase behavior. Suitable packaging design is critical to building brand image, as it can clarify to consumers what the product is and how it can solve a need of theirs.[28] Even more, consumers are increasingly interested in the "aesthetic" of their everything purchases. Colors and themes share information about the products' dependability and credibility, and premium packaging increases the value of the product overall. Attractive packaging shows that the product is high cost or from a premium

[27] "The Benefits of Using Plastic Packaging." British Plastics Federation. Accessed May 1, 2022. https://www.bpf.co.uk/plastipedia/applications/about_plastics_packaging.aspx.

[28] Stanley, Jenny. "Packaging Strategies in Marketing and What to Consider for Strong Packaging Design." The Drum, October 4, 2021. https://www.thedrum.com/opinion/2021/10/04/packaging-strategies-marketing-and-what-consider-strong-packaging-design.

segment, which many customers are happy to pay for. Plastic packaging needs to be functional and accessible, where the user can open and close conveniently and easily, but its most critical function for the producer is to establish the brand of the product as well as protect the product from damage.

Many companies are experimenting with bioplastics as a replacement to regular plastics, which are made with plant-based materials rather than petroleum-based materials. Some of these plastics, although not all, are developed to be fully biodegradable, and are able to serve the same functions as regular plastics without causing the same level of environmental harm as oil-based counterparts, making them much more marketable to consumers. Even more, many bioplastics are non-toxic and do not contain the same additives and phthalates that regular plastics contain. However, bioplastics are not cost-competitive to regular plastics and have the reputation of being two or three times more expensive. Some of the expense decreases with economies of scale, but some bioplastics have a shorter shelf life than regular plastics due to weaker mechanical properties, adding to the expense. Bioplastics also require a long-term disposal procedure involving industrial composting in order to prevent them from going to landfill, where they break down much more slowly than they would in a composting environment. Although bioplastics have a number of benefits over regular plastics and scientists are developing new applications for them, they do not seem to be the best replacement material for plastic because of the expense as well as the need for a more advanced composting system, which the United States lacks.[29] Despite the many potential solutions that companies are working on, including bioplastics, the topic that is most relevant to sustainable product design is the circular economy, which will be discussed in the following chapter.

[29] "Advantages of Bioplastics vs. Disadvantages: Memo for Product Designers." Quality Inspection, March 26, 2020. https://qualityinspection.org/advantages-of-bioplastics-vs-disadvantages/.

II. One Solution: The Circular Economy

Branding and Sustainability: Industry Initiatives to Improve Sustainability

Major FMCG corporations are already aware of upcoming environmental and social corporate responsibility trends in the industry and have taken initiatives to apply social and ethical standards to their business models. For instance, P&G has already implemented a few corporate social responsibility (CSR) policies in order to divert 1,565 tons of waste into reusable materials.[30] Even more, Unilever has implemented the Unilever Sustainable Living Plan (USLP), with the tagline "Doing Well by Doing Good", in order to research and develop solutions to environmental problems rather than waiting for government guidance. The USLP, announced in November 2010, aims to halve the environmental impact of Unilever products and to improve the livelihood of all people in its value chain, providing competitive advantage for thecompany that cannot be matched by lesser competitors.[31] These initiatives are designed to improve the reputations of the corporations in order to make their products attractive to the environmentally-conscious consumer. Changing business models and practices is incredibly challenging for producers, but the trends are clear – companies are facing increasing pressure from consumers and governments to be more thoughtful of their material management.

However, although many companies are taking on extended producer responsibility (EPR), few have scaled their efforts into overall company strategy. In order to establish real sustainable packaging options in FMCGs, these companies would have to make reusable and refillable packaging more mainstream. One way to do that is to adopt a circular economy. There

[30] "P&G 2016 Citizenship Report." P&G, 2016. https://ddd.uab.cat/pub/infsos/47122/irsPGa2016ieng.pdf.

[31] "Unilever Celebrates 10 Years of the Sustainable Living Plan." Unilever. Unilever PLC, February 15, 2022. https://www.unilever.com/news/press-and-media/press-releases/2020/unilever-celebrates-10-years-of-the-sustainable-living-plan/.

is a major economic and financial incentive to pursue a circular economy: in Europe, the net benefit of applying circular economy principles could be worth €1.8 trillion annually by 2030. Companies that successfully design circular economy products for the new age of consumerism stand to reap a considerable amount of financial gain as well as form lasting relationships with customers. This is particularly true for corporate leaders in the fast-moving consumer goods industry. Research suggests that $2.6 trillion worth of material in fast-moving consumer goods is thrown away and never recovered, around 80% of the material value.[32] A circular economy would serve as a method for companies to scale their sustainability efforts into overall packaging strategy.

Circular Economy Explained

Some say that in the natural world, waste does not exist. Everything in nature that is emitted, released, or discarded is meant to act as a source for another natural process. As humanity floods nature with excess waste, such as CO2 in the atmosphere or plastics in the oceans, nature is thrown outof balance, and the end result is highly undesirable. There arises a need for a new economy, vastly different from our current linear economy with waste as the final destination. As stated in the introduction, EPA defines the circular economy as "restorative or regenerative by design", with the goal of eliminating waste through the improved design of products, materials, and systems. A circular economy is meant to redesign products to be more durable with fewer resources as well as recapture waste after the product's useful life.

[32] Hannon, Eric, Marianne Kuhlmann, and Benjamin Thaidigsmann. "Developing Products for a Circular Economy." McKinsey & Company, May 11, 2019. https://www.mckinsey.com/business-functions/sustainability/our-insights/developing-products-for-a-circular-economy.

Even more, the circular economy is meant to design products without harmful substances or materials that could impact human health. Human biomonitoring demonstrates that humans are being exposed to a complex mix of chemicals, and most European chemical legislation focuses on restricting the use of these hazardous substances, especially as studies on the effects of these chemicals are limited. Circular economy works to prevent these chemicals from reentering the material stream, which can be done by physically sorting waste, removing chemical contaminants, and promoting alternatives that can be biologically mineralized to non-toxic products. There is high potential for economic growth through the circular economy, especially as the world's natural resources diminish and we move away from a linear economy. The following sections will explore the history and theory of the circular economy, key characteristics and applications, and the relevance of product design to a successful circular business model.

Timeline of Thinking

The origin of the term circular economy, also known as closed loop, cradle-to-cradle, and zero waste, comes from the observances on the circularity of nature, as water and carbon cycles and weather patterns complete without waste. Long ago, early man was forced to survive only with what resources were available, with circularity becoming a necessity for most and only the rich living in excess. During the Industrial Revolution, the world mostly shifted to a linear economy, extracting resources to produce goods and then throwing away the excess. Iron ore and coal mining led to the development of iron and steel; steam engines overtook horses; electricity decentralized the use of power. These new technologies facilitated the development of mass production of goods, vastly decreasing the scarcity of material goods in the U.S., but also

disregarding the long-term effects. The end result was extreme overproduction and exponentially increasing waste streams.

In the 1970s, following a period of high economic growth and increases in consumption, economists began laying the foundation for a new economic thinking called circular industrial economy (CIE). CIE began generating interest outside of academia in the 1980s, when ideas for a functional service economy were proposed in Europe. Many studies were conducted detailing the potential for service-life extension and the sustainability prospect of selling goods as a service. As case studies developed, the distinction between CIE and a functional service economy are increasingly relevant to successful business models. The CIE is focused on the use of objects, specifically managing their value. New activities such as operation and maintenance that have extended the useful life of products has led to the development of eco-design. On the other hand, the functional service economy focuses on the system, selling the performance of objects through lease and rental contracts. The consumers of products then instead become users of a larger system.[33]

The circular economy also cannot be successful without the principles of low-carbon economy, which seeks to minimize greenhouse gas emissions from production. As producers minimize the demand for raw materials, they also tend to reduce their overall carbon waste. On the other hand, policies on energy efficiency and renewable energy also reinforces circular economy principles. From a product life-cycle perspective, 55-65% of greenhouse gas emissions come from the handling of materials, including production, transport, and disposal. In a truly

[33] Stahel, Walter R. "History of the Circular Economy. the Historic Development of Circularity and the Circular Economy." *The Circular Economy in the European Union*, 2020, 7–19. https://doi.org/10.1007/978-3-030-50239-3_2.

circular economy, all aspects of the supply chain are renewable; therefore, adopting a circular economy would therefore contribute significantly to overall emission reduction targets.[34]

Government Policy on Circular Economy

It is critical for governments, cities, and other institutions to create policy that enables conditions for a circular economy to emerge. Circular economy policies tend to set the direction of innovation and therefore, investment. The Ellen MacArthur foundation, founded in September 2010, is a registered charity with the aim of inspiring companies to re-design and rethink product design utilizing circular economy principles. The foundation has set a series of universal circular economy policy goals to provide a blueprint for cooperation across private and public sectors. The goals are meant to make relevant policies interconnected in order to prevent friction with fragmented solutions and instead lower costs for the transition to a circular economy. The first goal is to stimulate design for the circular economy with an emphasis on durability, recyclability, reusability, and encouraging regenerative production through product design. The second goal is to manage resources to preserve value by implementing tax and procurement policies that foster reuse in order to maximize asset use. This goal also focuses on Extended Producer Responsibility (EPR) and Deposit Return Schemes (DRS) to transition to reuse models.The third goal is to make the economics work; in other words, to align taxation and fee incentives as well as incorporate circular economy principles into trade policies. The fourth goal is to invest in innovation, infrastructure, and skills by providing research funds, supporting blended finance solutions for infrastructure, and incorporating circular economy materials in school and higher education programs. The fifth and final goal is to collaborate for system change, meaning that

[34] "Circular by Design: Products in the Circular Economy." European Environment Agency, March 27, 2018. https://www.eea.europa.eu/publications/circular-by-design.

we must promote the establishment and adoption of multi-stakeholder, cross value-chain, inclusive initiatives to develop long-term system solutions and build policyalignment toward durable change.[35]

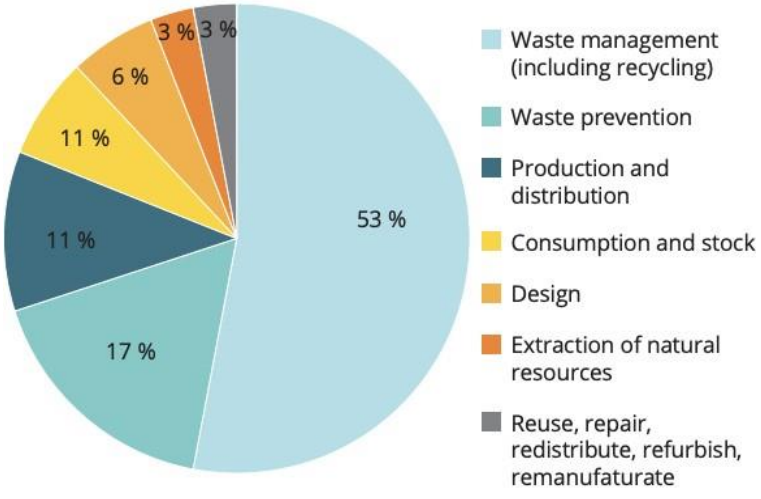
Although there are a few circular economy policy initiatives in the works in the United States, including the federal 2020 Break Free from Plastic Act, Europe has led the global charge on circular economy government policy. Germany was the first to enact a law of circular economy, and policy implementations grew in Europe as CIE gained increasing academic attention. In 2015, the European Commission adopted the Circular Economy Package, which includes legislative proposals on waste management, including water reuse, and guidelines for materials management at all parts of the production process. Aside from the EU and other larger institutions, many cities in Europe are also taking drastic policy measures to move toward a circular economy. For instance, the London Waste and Recycling Board has created Advance London, a circular economy program that offers business advisory services and investment guidance to support small and medium-sized enterprises in the transition to a circular economy. Even more, Brussels has created the Brussels Regional Programme for a Circular Economy (BRCPE) in order to reconcile economic and environmental objectives, support local production,optimize land use, and more.[36] While federal initiatives are absolutely critical for guiding business decisions, local and state policies stimulate local economic activity, create new jobs, and improve the quality of life of local citizens.

[35] "Universal Circular Economy Policy Goals." Ellen MacArthur Foundation. Accessed May 1, 2022. https://ellenmacarthurfoundation.org/universal-policy-goals/overview.

[36] "Working with Circular Economy Principles within Governments and Policy." Ellen MacArthur Foundation. Accessed May 1, 2022. https://ellenmacarthurfoundation.org/resources/government-and-policy/overview.

The following chart from the European Environmental Agency shows the distribution of policy approaches in EU member states across different product life-cycle stages. It is clear that the policy focus has historically been on waste management and waste prevention, but as explained by the Ellen MacArthur Foundation's goals for CE policy, more proposals supporting product design and reuse/repair/refurbishment is needed to support transitioning businesses.

Figure 5.1 **Distribution of responses on policy approaches to closing material loops in the economy/circular economy across different life-cycle stages**



Source: EEA, 2016b.

[37]

Policy levers are needed to stimulate changes in consumer behavior. For example, a proposal in Sweden that reduces value-added tax rates for repair services is intended to encourage consumers to choose repair of old products rather than purchasing new products. Monitoring on this policy measure will be needed to provide insight into its effectiveness and therefore provide guidance for developed nations looking to implement their own consumer behavior for circular economy policies. Policy is absolutely critical to guiding stakeholder

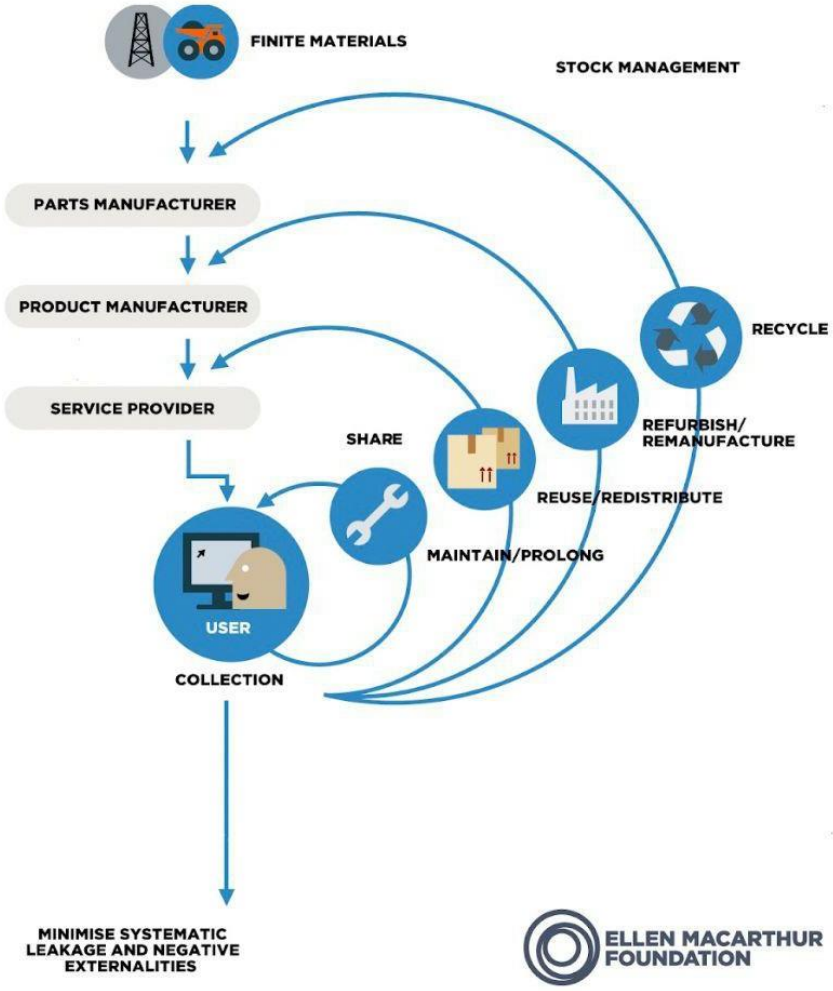
[37] "Circular by Design: Products in the Circular Economy." *European Environment Agency*, https://www.eea.europa.eu/publications/circular-by-design.

decisions and making larger strides for a circular economy. For the purposes of my research and model, I assume that the conditions for a circular economy to thrive already exists, and it is solely up to the producer to establish more sustainable product design processes.

Necessity of Product Design for a Successful Circular Economy

Efficient product design is critical for a successful circular economy, as we must learn to rethink products, business models, urban planning, and linear systems of economy. As one of the major leaders in the circular economy space, the Ellen MacArthur Foundation defines "design" as creation with intent, or the mechanism by which we use our surroundings to meet society's wants and needs. When a product is designed, involved decisions are made regarding the way the product is manufactured, how the consumer uses the product, and what happens at the end of the product's useful life. It is incredibly difficult to undo any negative consequences of these decisions after they have already been made. Therefore, thoughtful design processes are necessary in order to "design out" waste and pollution from business models, but it is a process that never finishes. Testing and refining product design as one learns about how users interact with a product is critical for achieving a circular economy.

The following graph from the Ellen MacArthur Foundation demonstrates a circular economy system diagram. The closer the loop is to the center of the diagram, the more valuable the approach is to the circular economy. Approaches such as reuse, sharing, remanufacturing and refurbishment sit closer to the center of the multiple material loops, while recycling sits further away. When innovative companies design products to be easily repaired or create new business models to facilitate sharing or reuse, they are unlocking value for both themselves and their customers.



As demonstrated by this diagram, product design in the circular economy contains five key topics: recycling, refurbishment, reuse/redistribution, maintenance, and sharing. Recycling, which sits farthest away from the user, is typically the last option to recover any remaining value from the product. It is a strenuous process, as the materials must return to the parts manufacturer as raw materials, move to the product manufacturer, and eventually transport to theservice provider before it can reach the user. Each step of this process increases transportation and operational costs, contributes to emissions, and lowers the value of the materials. Recyclability is determined by the type of materials used as well as the number of different types of materials. A product that consists of multiple material types, such as plastic, metal, and wood,

are unable to be easily recycled. The product's ability to be taken apart also determines the recyclability, as it is not cost effective to spend a lot of time taking apart products to be recycled.

Refurbishment/remanufacturing, which sits next to recycling, consists of the prolonged use of components, perhaps in a different product. To accomplish this, the product must return to both the product manufacturer and the service provider. However, because reuse and maintenance involve the prolonged use of the product itself, the product doesn't need to be taken apart entirely. Easily maintained products, that can be taken apart and the parts easily replaced, are most conducive to prolonged reuse and redistribution in the circular economy. Maintenance can be also optimized through lifetime prognostics, which can predict the future performance of the product and can help track use conditions.[38]

The last and most crucial key activity is sharing. Because this diagram demonstrates how sharing is one of the most valuable activities to establish a circular economy, it begs the question of whether ownership of products is necessary. As the circular economy is studied, researchers have begun to understand that it only requires access to a product for a short period, after which it can be returned. The shift from ownership to access is reflected in new business models. For instance, Vigga, a Danish maternity and kids-wear brand, allows parents to lease clothing for their babies who are rapidly outgrowing them. The parents are then able to save up to $2,100 in the first year of parenting, while Vigga reduces up to 80% of the child's textile waste. Many circular economy success stories, such as Vigga, are able to both reduce costs for their consumers as well as the environmental impact of the typical competitor in their industry. However, the sharing economy is only successful if the products that are exchanged are durable, easily maintained, and easily repaired, making product life extension even more relevant.

[38] van den Berg, M. R. "A Product Design Framework for a Circular Economy." PLATE, October 5, 2016. https://www.plateconference.org/product-design-framework-circular-economy/.

Products that resist damage, retain their aesthetic appeal, and are able to be used andreused multiple times, are critical to the core principles of the circular economy.

The Ellen MacArthur Foundation has created a "Circular Design Guide" in partnership with Cradle to Cradle, a product innovation institute, and IDEO, a global design firm. This guide is a free resource for designers with a collection of tools, methods, resources, and mindsets to incorporate circular design.[39] The Ellen MacArthur Foundation is not the only resource for discussing circular design: the European Environment Agency, in its report on circularity by design in 2017, intended to clarify the circular economy concept and highlight knowledge gaps. The report explains that reuse, repair, redistribution, and refurbishment have received far less attention than waste-related issues. Designing products in a more thoughtful way will extend their useful lives, but also change the role of such products in their respective ecosystems.[40] Although linear economies have become the dominant economic model to cater to social needs, largely due to the availability of abundant and cheap resources and technical innovations, emerging trends suggest the role of products is changing. Dedicated and consistent monitoring and analysis is crucial to continue identifying trends in this area.

According to the global consulting firm, McKinsey & Co., design thinking for circular economy products relies heavily on collaboration with all organizations in the value chain. In order to transition from theory to practice, working sessions should be conducted with all affected parties by the relevant product developers in order to discuss customer needs and changing business operations. From there, the product-development team would create prototypes based on the suggestions from the stakeholders. These prototypes would be evaluated

[39] "Circular Design." Ellen MacArthur Foundation. Accessed May 1, 2022. https://www.ellenmacarthurfoundation.org/explore/circular-design.

[40] "Circular by Design: Products in the Circular Economy." *European Environment Agency*, https://www.eea.europa.eu/publications/circular-by-design.

by the same stakeholders, and little by little, product developers refine their design until the product and the relevant business operations can capture maximum value over the product's life cycle.[41]

Measuring the success of thoughtful product design in terms of sustainability can be difficult, as the process of designing, prototyping, and implementing can take years to perfect. However, looking at the successes of well-designed products for the circular economy can help producers gain a sense for the changing marketplace. For example, office furniture manufacturer Orangebox has designed an ergonomic, user-friendly, and sustainable office chair called the "Do". The Do chair is made entirely from recyclable/recycled materials, and the chair was designed for easy disassembly; the seat, arms, and fabric easily clip on and off to make repair and remanufacturing as simple as possible. The number of materials in the chair has also been reduced to facilitate recycling, and Orangebox works with local suppliers to drive sustainability approaches at every step in the value chain. Another example, the Optimist toaster,designed by the Agency of Design, has only a few moving parts, all of which can be easily removed and replaced. All pieces are made of highly recyclable aluminum so 100% of the product is made of recycled materials.

Applying Circular Economy to Fast-Moving Consumer Goods

Improving a product's ability to be recycled, repaired, and remanufactured is critical to the success of a circular economy product, and product designers should implement processes like the examples above in order to facilitate product durability, schemes for reuse, and waste

[41] Hannon, Eric, Marianne Kuhlmann, and Benjamin Thaidigsmann. "Developing Products for a Circular Economy." McKinsey & Company, May 11, 2019. https://www.mckinsey.com/business-functions/sustainability/our-insights/developing-products-for-a-circular-economy.

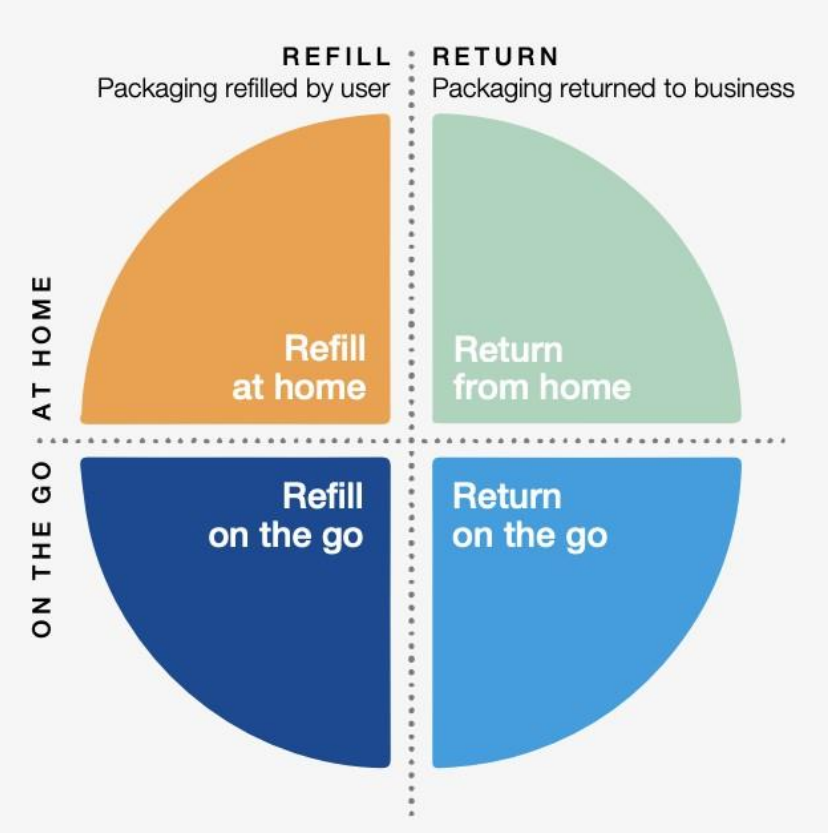
minimization.[42] In the next chapter, I will be evaluating reuse models as a method of thoughtful circular economy product design in fast-moving consumer goods as well as the benefits and challenges of each reuse model in order to determine their best applications.

[42] Perchard, Edward. "Product Design for the Circular Economy." Resource Magazine, September 2, 2016. https://resource.co/article/product-design-circular-economy-11338.

III. The Circular Economy for FMCGs: Four Reuse Models

Applying Reuse Models to the FMCG Industry

A series of four reuse models defined by the Ellen MacArthur Foundation serves as a template for sustainable packaging solutions in business-to-consumer (B2C) applications. The objectives of these models is to provide alternate models of consumption and give leaders in business a clear roadmap for reducing their environmental footprints. The reuse models are named as follows: refill at home, refill on the go, return from home, and return on the go. Each reuse model differs greatly in terms of packaging ownership and user requirements. At-home models tend to have little need for significant consumer changes in behavior while on-the-go models require greater adjustments to consumer habits.



[43]

[43] "Reuse – Rethinking Packaging." Ellen MacArthur Foundation, 2019. https://ellenmacarthurfoundation.org/reuse-rethinking-packaging/.

In order to increase circular economy practices in the FMCG industry, major corporations such as Unilever and P&G should apply the Ellen MacArthur Foundation's reuse models to their product design. In this section, I go into detail about how these companies can apply these reuse models in order to minimize their environmental impact and maximize their financial gains in accordance with the circular economy.

The first model, **refill at home**, consists of users refilling a reusable container at home, with refills delivered through a subscription service. An example of refill at home would be Blueland, a soap and cleaning supplies company that provides all product refills via tablets that are smaller and lighter than more conventional bottles. The tablets, as well as the refillable cleaning bottles, are shipped via a subscription service and are made of only ingredients contained on the EPA Safer Chemical Ingredients List.[44] Benefits of refill at home include cutting transportation and packaging costs by supplying products as refills or concentrates, and these savings can be passed onto the consumer. Even more, users' individual needs or preferences can be more easily met with customizable products and packaging, resulting in higher brand loyalty and convenience with automatic reordering. However, challenges to refill at home products include attracting customers to refill packs instead of full-sized products and communicating the benefits of buying in concentrate format to users. Luckily, delivery of refills and packaging can utilize already-existing direct-to-consumer channels.

Refill on the go, the second reuse model, consists of consumers refilling their reusable container at an in-store dispensing system. This model is more well suited to traditional retail outlets and can accommodate customers' needs for smaller quantities without using single-use packaging. An example of refill on the go models includes public water fountains, which are popular among those who carry refillable water bottles. Benefits of refill on the go initiatives

[44] "Our Mission." Blueland. Accessed May 1, 2022. https://www.blueland.com/our-mission.

include allowing the customer to choose desired quantities at dispensing systems, while at the same time, businesses can collect consumer data on preferences at dispensing systems. Users can also benefit from improved access to dispensable products that are placed in public spaces or are mobile. Drawbacks and challenges of refill on the go include motivating users to clean and carry their own refillable containers, as well as ensuring that the dispensing systems are easy to use and clean. Integrating dispensing systems at retailers is also incredibly challenging, especially as businesses want to ensure that the dispensable products live up to the brand experience and comply with product safety standards and policies. While this system can add travel time and education requirements for consumers, bulk dispensing systems are simple to set up for retailers that are willing to dedicate accessible shelf space.

Return from home, the third reuse model, occurs when reusable packaging is picked up from the user's home using a pick-up service. This is the classic "milkman" model, in which the used packaging is exchanged for a fresh product, via the company's service, and is best suited for urban areas with minimal travel distances. Benefits of return from home initiatives include incentivization of packaging return through deposit and reward schemes, as well as the improvement of operations through the standardization of packaging across brands and sectors. Even more, return from home products can improve brand loyalty through auto-replenishment services which prevents users from needing to keep track of stock and reorder through a subscription service. Challenges to the return from home model include establishing local reverse logistics programs that include cleaning and refilling infrastructure, both of which are necessary for economic and environmental feasibility. Even more, developing deposit and return schemes can be challenging without scaring customers away with a high initial deposit. Scaling quickly to maintain affordability for customers as well as developing a system to track deposits

and handle payouts can also present risks and challenges to return from home initiatives. Reuse providers need to handle logistics of return and cleaning of products to deliver the reuse solution at its full potential.

Return on-the-go, the fourth and final reuse model, occurs when a consumer returns reusable packaging at a store or drop-off point. This reuse model is highly applicable as most single-use packaging can be substituted without changing the purchase model. A press release from *Waste360* details how TerraCycle, an innovative recycling company that offers a range of programs for waste collection, launched a new in-store refillable packaging platform called Loop. In order to use Loop, customers purchase products in reusable containers for which they pay a refundable deposit. After using their products at home, the customers return the empty containers to the store in exchange for their initial deposit, where the packaging will be cleaned and reused. These deposit fees can range from $1 to $10. In order to collect the used containers, Loop has developed receptacles that are able to scan empty containers and issue immediate deposits and can even send refunds to customers' bank accounts.[45] Benefits of return on the go include improved brand loyalty, optimization of operations through shared drop-off points, logistics, and cleaning facilities, and improved convenience for users. However, challenges of return on the go initiatives can include ensuring ease of return for users by providing convenient and frequent drop-off points, as well as establishing take-back infrastructure and storage of empty containers.

[45] "TerraCycle's Refillable Packaging Platform Coming to Retailers in 2021," August 2020. search.ebscohost.com/login.aspx?direct=true&db=sur&AN=145262057&site=ehost-live.

Benefits of Reuse Models

There are many benefits to establishing reuse models, both for the consumer and the producer. For instance, reuse models can save food service businesses money, with the average savings for a small business being between $3K and $22K. Even more, environmental benefits for a small business include eliminating 110,000 to 225,000 packaging items and 1300-2200 lbs of waste. Even more, switching ongoing inventory management for disposables to one-time purchases for on-site renewables can drastically cut packaging and inventory costs. Reuse also increases customer and operator satisfaction. According to a survey, 71% of UK shoppers polled said they would buy food from a refill store, if the option were available to them.[46] Reuse also builds brand loyalty, as brands that are switching to reuse are capitalizing on increasing customer consumer support for moving away all single-use packaging. Reuse can also offer valuable customer behavior data, as apps and digital platforms that are associated with consumer participation in reusable systems allow companies to gather data on user preferences. All in all, reuse saves communities money and creates new opportunities for entrepreneurs, investors, and customers all around.

Reusable packaging reduces supply chain costs in a variety of ways. For example, reusables can provide increased space efficiencies, as standardized designs optimize stacking efficiency for higher transportation and storage space utilization, which can reduce transportation and storage costs. For instance, providing refills in concentrated form can reduce transport costs by up to 90%. Even more, labor inefficiencies can be reduced by the optimization of both manual and mechanical handling of reusables. The product itself gains increased protection, as the sturdy reusable packaging reduces product damage during transit and handling. Additionally, reusable

[46] "Reuse vs Single-Use: Economics - Upstream: Sparking Innovative Solutions to Plastic Pollution." Upstream. Accessed May 1, 2022. https://upstreamsolutions.org/reuse-vs-single-use-economics.

packaging can eliminate typical safety hazards such as box cutting, exposed nails, or packaging debris. Finally, and perhaps most importantly, reusable packaging drastically lowers packaging costs, as the extended life of reusable packaging (measured in years) results in lower cost per use than single-use packaging.[47]

Additionally, many reuse models allow consumers to personalize their purchases and meet individual needs through customization, as well as improve customer experience with superior design and enhanced functionality. Even more, reusable packaging, when designed with sharing in mind, can be distributed across brands and value chains to achieve economies of scale for distribution and logistics. For example, Coca Cola Brazil designed a universal bottle program that can be reused among all Coca Cola brand bottles. All in all, according to the Ellen MacArthur Foundation, converting just 20% of all plastic packaging into one of the four reuse models presents a $10 billion business opportunity.[48]

The Challenges of Reuse Models

Despite the environmental benefits of reuse, there is little evidence that reusable solutions will scale if they are more expensive to manufacture than conventional packaging practices. For these models to evolve into retail at scale, they need to integrate with existing point of sale systems, reward programs, and in-store setups. One company facing fast adoption is Algramo, a vending machine company that dispenses staple household products by the gram to customers. Each customer reuses a single chip-enabled bottle to fill up products such as detergent, cleaner,

[47] "Cost Savings with Reusable Packaging." *Reusable Packaging Association*, 2021, https://www.reusables.org/reusable-packaging/cost-savings/.

[48] Ingilizian, Z., Wingstrand, S., & Lendal, A. (2019, July 29). *Reusable Packaging: 6 benefits beyond sustainability*. World Economic Forum. Retrieved October 29, 2021, from https://www.weforum.org/agenda/2019/07/reusable-plastic-packaging/.

and grains, saving customers money and accruing value with each use. The customers can pick up the reusable cup at the point of retail and drop it off at the most convenient drop-off spots. Algramo is experiencing an 82% rate of return in Chile and is planning an integration with Unilever. Fast adoption of models such as Algramo's is already being seen across the United States. In the following section, I will detail how establishing reuse models can lead to cost-savings and increased profit by comparing costs associated with both single-use and reusable packaging, like in Algramo's case.

IV. Creating a Circular Economy Cost-Savings Model with Reusables

Steps to Prepare for Transitioning to Reuse

In order to successfully transition to reusable packaging, companies need to be able to predict new impacts from changes in the supply chain, including maintenance needs, cleaning and washing infrastructure, and additional transportation costs. These companies need to be prepared to prove that the new impacts of reusable packaging are minimal compared to the impact of single-use packaging. Brands and retailers also need to pass strict health and safety standards to minimize risks, which governments can advance with regulations around the cleaning standards of reusable containers.[49]

To begin the process of transitioning to reusable packaging, companies should follow a series of steps in order to maximize return and minimize costs. First, the company should identify a potential product of theirs that is frequently shipped in large volumes and is consistent in type, size, shape, and weight. From there, the company should estimate the one-time packagingcosts for these products, which should include a geographical report that identifies shipping and delivery points. Once the company understands their current costs, they can review the different reuse models and select the one that integrates best with their current business model. Finally, thecompany should estimate the costs of reverse logistics and develop a cost comparison between the single-use packaging costs and the reusable packaging costs.[50] The next section details a model for cost-savings, based on the return-on-the-go reuse model.

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[49] Croke, Bridget. "Key Ingredients for Scaling Circular Reuse Business Models." Greenbiz, October 18, 2019. https://www.greenbiz.com/article/key-ingredients-scaling-circular-reuse-business-models.

[50] "A Cost Comparison Model for Reusable Transport Packaging." reusables.org, 2007. https://www.ecoconsilium.com/wp-content/uploads/2018/04/10Reusables_102.pdf.

A Reuse Model with Cost-Savings

Cost savings for reuse models can include decreased labor costs, decreased product damage costs, lower inventory costs, and lower raw material costs. However, reuse models are associated with new costs, including initial investment costs, new material handling equipment, reverse logistics, and maintenance and repair costs. All in all, though, switching to reusable packaging can result in high cost-savings, and eventually, greater profit. The greater the frequency of reuse, the faster the return on investment. Here I present a model that shows us how we can do this. This model allows us to compare the costs of single-use packaging and reusable packaging for a company and make strategic recommendations for that company based on various elements of circular economics. This model can be applied to any reuse situation, but is likely best used for the return-on-the-go reuse model.

To illustrate how this model works, I use an example of a fictional FMCG company that sells dish soap. This analysis is strictly for packaging and does not include the cost of the dish soap. In this case we will assume that the cost of soap procurement does not change. The following table lists assumptions made for cost calculation at each stage of both single-use and reusables packaging. Much of the following data is assumed based on industry averages, but these costs can fluctuate wildly based on a number of external factors.

Table 1 contains a list of assumptions about differing costs between single-use and reusable packaging that I will make for the following model. It shows raw material costs, manufacturing costs, shipping costs, and additional costs for storage, labor, disposal, and return. I utilize the assumptions made in the following table for the cost-savings model.

Table 1: Costs in the Model		
Assumptions	**Single-use Packaging**	**Reusable Packaging**
Raw Materials	Materials for 2,000,000 single-use plastic bottles are ordered at $0.05 per unit.	Units of raw materials needed drops 95% to 100,000 as the take-back program allows the producer to recycle damaged or broken bottles as new raw materials. The price remains at $0.05 per unit.
Packaging Manufacturing	2,000,000 single-use plastic bottles are manufactured at a cost of $0.10 per unit.	300,000 reusable bottles are manufactured at a cost of $0.60 per unit. It is also assumed that the producer will need to repair/replace every 1 out of 20 containers.
Packaging Storage Space	Assumes that 1000 sq. feet are needed to store the packaging at $8 per sq. foot.	Assumes that 800 sq. feet are needed to store the packaging at $8 per sq. foot. Less space is needed as the number of containers has decreased.
Labor	Costs to assemble bottles with dish soap, prepare and place plastic liners, seal liners, and prepare for shipment.	Costs to assemble reusable bulk containers, as well as the costs to wash and sanitize the reusable containers.
Product Damage/Spillage/Shrinkage	Costs to replace broken or faulty packaging is expected to be ~$15,000.	No costs to replace broken or faulty packaging, as the reusable containers are far more durable than single-use.
Shipping	Costs to ship 2,000,000 units, with an assumed limit of 4000 units per truckload at a cost of $1000 per truckload.	Costs to ship 300,000 units, with an assumed limit of 4000 units per truckload at a cost of $1000 per truckload.
Disposal	Costs to dispose of empty bottles usually falls on local municipal governments.	Costs of disposal are eliminated.
Return	No costs to return in single-use packaging, as the packaging is intended to be	Costs to return reusable packaging are identical to shipping costs.

	thrown away after use.	
Infrastructure Costs	No new infrastructure costs are necessary.	Investment in washers and sanitizers required, as well as bulk dispensing stations at partnering retailers.

The first takeaway from Table 1 is that the raw materials costs drop 95% with reusable packaging; however, the manufacturing costs for reusable packaging is higher as the product is required to be more durable. Secondly, shipping costs for reusables also drop, but the cost of return is higher for reusables. Table 2 details the total costs associated with single-use packaging and the total annual costs for every section listed in assumptions.

Table 2: Single-use Packaging Costs		
Costs	**What's included?**	**Annual costs**
Raw Materials	2,000,000 units of plastic x $0.05 per unit	$100,000
Packaging Manufacturing	2,000,000 units x $0.10 per unit	$200,000
Packaging Storage Space	Cost for warehouse space to store products. Requires 1000 sq. ft at $8 per sq. ft	$8,000
Labor	Costs to assemble bottles with dish soap, prepare and place plastic liners, seal liners, and prepare for shipment	$150,000
Product Damage/Spillage/Shrinkage	Costs to replace broken or faulty packaging	$15,000
Shipping	Costs to ship 2,000,000 units of product. Each truckload holds 4,000 units at a cost of $1000 per truckload.	$500,000
Disposal	Costs to dispose of empty	$0

	bottles (usually falls on local municipal governments)	
TOTAL COST		***$973,000***

As demonstrated by Table 2, the approximate annual costs for manufacturing and distributing 2,000,000 units of single-use packaging for dish soap would be approximately $973,000. Comparatively, Table 3 below details the total costs associated with reusable packaging. It shows the drop in raw materials and shipping costs, and the increase in manufacturing and return costs.

Table 3: Reusable Packaging Costs		
Costs	**What's included?**	**Annual costs**
Raw Materials	100,000 units x $0.05 per unit	$5,000
Packaging Manufacturing	Cost to manufacture 300,000 reusable containers at $0.60 per unit, as well as the cost to repair/replace ($9,000) assuming that every 1 out of 20 containers (15,000) will require replacement ($0.60)	$189,000
Packaging Storage Space	Costs for warehouse space to store 300,000 reusable containers throughout the supply chain. Less warehouse space is required as the number of containers has decreased. Requires 800 sq. ft at $8 per sq. ft	$6,400
Labor	Costs to assemble reusable bulk containers, as well as the costs to wash and sanitize the reusable containers	$125,000
Product Damage/Spillage/Shrinkage	There are no failed reusable bulk containers that would damage the product	$0
Shipping	Costs to ship 300,000 units of	$75,000

	product. Each truckload holds 4,000 units at $1000 per truckload.	
Disposal	When bulk plastic containers reach the end of their useful life, they are recycled to recover value.	$0
Return	Cost to return 300,000 bulk containers for cleaning and refurbishment	$75,000
Infrastructure Costs	Investment in washers and sanitizers required (5 stations at $7,600 each), as well as bulk return stations at partnering retailers ($40,000)	$78,000
TOTAL COST		***$553,400***

Table 3 demonstrates that the total annual cost for manufacturing and distributing 300,000 units of reusable containers for dish soap would be $553,400. Table 4 below details the total cost associated with the initial investment costs for switching to reusable packaging, including the raw materials and manufacturing costs as well as new infrastructure costs.

Table 4: Initial Investment Cost	
What's Included?	**Annual Costs**
300,000 reusable containers (raw materials and manufacturing costs combined)	$194,000
Infrastructure Costs (washers, sanitizers, and return stations)	+ $78,000
Initial Investment	***= $272,000***

As shown by Table 4, the initial investment cost to switch to reusable packaging from single use would be $272,000. Table 5 below details the annual savings after the first year by subtracting total single-use costs from reusable costs.

Table 5: Annual Savings after the First Year	
What's Included?	**Annual Costs**
Total single-use annual costs	$973,000
Total reusable annual costs	- $553,400
Annual savings after the first year	***= $419,600***

According to Table 5, the annual savings after the first year equals $419,600. Table 6 below details the annual first-year savings by subtracting the initial investment costs from the expected annual savings.

Table 6: First-year Savings	
What's Included?	**Annual Costs**
Annual savings	$419,600
Initial Investment	- $272,000
First-year savings	***= $147,600***

According to Table 6, the first-year savings after the initial investment equals $147,600. Table 7 details the rate of return on investment for replacing single-use packaging with reusable packaging.

Table 7: Rate of Return on Investment	
What's Included?	**Annual Costs**
Initial Investment	$272,000
Annual savings	÷ $419,600
Return on Investment	***= .65 years***

According to Table 7, the return on initial expenditures for the reusable bulk containers occurs in .65 years, or approximately 8 months.

Increased Profit of a Reuse Model

So far, the data shows that switching to reusable packaging from single-use packaging for a dish soap company can result in annual savings of $419,600. In addition, these annual savings can translate to increase profit year over year. Table 8 below demonstrates the annual profit of dish soap using single-use packaging at a cost of $3.99 per unit.

Table 8: Profit with Single-use Packaging		
Profit	**What's Included?**	**Annual Costs**
Revenue of Product with Single-use Packaging	2,000,000 units sold at $3.99 each	$7,980,000
Costs of Product with Single-use Packaging	Determined by Table 2	- $973,000
Profit of Dish Soap with Single-use Packaging		***= $7,007,000***

Table 8 showed us how the profit using single-use packaging is approximately $7 million per year. In order to incentivize adoption of reusable packaging, the consumers should receive a price break. With total cost-savings of $567,200 in the first two years, the consumer could potentially receive a 20-cent markdown on the price of the product. Table 9 below shows the total profit on reusable packaging if the price per unit decreases from $3.99 to $3.79.

Table 9: Profit with Reusable Packaging		
Profit	**What's Included?**	**Annual Costs**
Revenue of Product with Reusable Packaging	300,000 reusable bottles, with approximately 8 uses per	$9,096,000

	bottle before refurbishment is needed. Sold at $3.79 each	
Cost of Product with Reusable Packaging	Determined by Table 3	- $553,400
Profit of Dish Soap with Reusable Packaging		***= $8,542,600***

Table 9 showed us that annual profit for dish soap with reusable packaging is approximately $8.5 million. Table 10 below shows the annual profit increase for the dish soap company between the reusable packaging and the single-use, even with the drop in price for the consumer.

Table 10: Annual Profit Increase from Switching to Reusable		
Profit Increase	**What's Included?**	**Annual Costs**
Profit of Dish Soap with Reusable Packaging	Determined by Table 9	$8,542,600
Profit of Dish Soap with Single-use Packaging	Determined by Table 8	- $7,007,000
Annual Profit Increase		***= $1,535,600***

The annual profit increase after switching to reusable packaging from single-use for this FMCG company is approximately $1.5 million.

Discussion

Using this model, a company can carefully compare the costs associated with single-use plastics and reusable plastics in order to determine annual costs and profits of each. The numbers here show that switching to reusables from single-use requires a larger initial investment, but results in cost savings and increased profit across the board when done correctly. If a FMCG

company were to utilize this model, they would be able to determine the return on investment and profit increase from switching to reusable packaging solutions. This would reduce the company's waste output, build brand loyalty, increase customer and operator satisfaction, and most importantly, save the company money overall. Determining the costs and benefits of switching to reusable packaging is not expensive, and can be replicated by most companies to an even greater degree of accuracy.

This cost-savings model is a clear example of how a company can take tangible steps to evaluate the changes in operations necessary to implement a circular economy into their overall strategy. In fact, many companies are already doing it. Clorox, a popular cleaning brand, has launched a multi-purpose refillable cleaner that comes in concentrated refills with a reusable spray bottle. Clorox must have done some cost-savings analysis in order to determine that the refillable containers are more profitable in the long run, as it would not have switched to refillable if it did not believe it would save money or increase profit. The idea is not so much the numbers themselves, but the exercise of completing this analysis.

Although completing cost-savings to implement circular economy is incredibly useful for most, it certainly has its limitations in the real world. In the next section, I will discuss limitations to this model as well as challenges to the circular economy overall.

V. Key Obstacles and Challenges

What is Standing in the Way?

In the previous chapter, I applied circular economy theory to a FMCG dish soap company by demonstrating cost-savings and profit increase associated with reusable packaging. However, there are key obstacles and challenges to establishing a circular economy in real-world applications that stands in the way of full implementation. This chapter will explore those restrictions and make suggestions to mitigate such setbacks.

Challenges and Limitations to the Circular Economy

Although the circular economy has gained traction in recent years for its goal of repairing previous environmental damage, it is certainly not a perfect model. Economists have argued that although the circular economy is based on the idea of a closed loop, where materials and energy cycle through the system, it is not necessarily how nature tends to operate. Earth operates as an open system, continuously changing according to human activity. Relying on nature to serve as the basis for the circular economy is difficult because sufficiency of resources cannot be assessed without energy flows. Energy flows pose a great threat to the planet, and the circular economy often fails to account for loss of energy or heat. Recycling creates yet more energy waste, as degradation requires energy to restore the materials. Thermodynamic considerations are not represented in the circular economy, but the only way to do this would be to reduce energy expenditure overall. This typically occurs when ceilings in nature are reached, such as population size or ecological succession; however, it is not realistic to expect degrowth from human civilization. The circular economy avoids challenging the incumbent economic system that is based on rapid growth and excessive consumerism, and therefore can never truly be a perfect

model for utilitarian environmental and social sustainability. However, for the purposes of this thesis, the circular economy is assumed to be the best and most accessible economic model alternative to the traditional, linear economy, because of its emphasis on material recovery and reuse.[51]

Circular economy theory is far more difficult in practice than it is to understand. In reality, ownership of end-of-life materials is exceedingly rare, as most supply chains lose track of products and raw materials after their point of sale. Regaining them from the consumer is extremely difficult, but leasing and subscription models make it easier because the product is recollected by the organization. If there is a large quantity of materials, it can be difficult to centralize end-of-life products for easy processing. Manufacturers will need to create systems for collecting products at the end of the service agreement or useful life; otherwise, repair, reuse, or remanufacturing is simply impossible. Supply chain organizations tend to collaborate with waste management companies and reverse logistics providers to regain materials, but almost always leave behind products with low residual value. High complexity makes a product harder and more expensive to reprocess. There arises a need for improved collection systems to reuse raw materials, which can be made easier utilizing digital technology and AI software. Supply chain digitization allows reusable packaging to work with automated systems to provide inventory visibility and data sharing. In order to establish a more circular economy and move away from the traditional linear economy, digital integration is critical to end-of-life management, as poorly designed products with complex or cheap materials are costly to process without the help of technology.[52]

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[51] Skene, Keith Ronald. "Circles, Spirals, Pyramids and Cubes: Why the Circular Economy Cannot Work." *Sustainability Science* 13, no. 2 (2017): 479–92. https://doi.org/10.1007/s11625-017-0443-3.

[52] McCrea, Bridget. "Four Challenges Standing in the Way of a Circular Economy." StackPath, September 28, 2020.

Unfortunately, most plastic waste collected for recycling is downcycled into materials with a lower value than the original material. This is caused by the contamination of organic and inorganic matter, such as when a recycled tub still contains food residue, or when the design contains multiple different polymer types. From a product design perspective, a diverse mix of plastic types and additives can inhibit technically feasible pathways for plastic-waste recycling. The diversity of polymers in the waste stream can be attributed to the product design of short-lifespan products and single-use plastic packaging, making recycling difficult both technically and economically. Because of this, there arises a need to study and modify the full value chain of plastics in order to improve the recovery and prevention of plastic waste, particularly in the design phase of the product life cycle.[53]

Greenwashing

Despite claims by major FMCG conglomerates that they are doing everything they can to mitigate the environmental impact of their businesses, many environmental groups believe their claims to be a result of greenwashing, a marketing strategy meant to make customers believe a product is more environmentally-friendly than it actually is. This term was first coined in 1986 by environmentalist Jay Westerveld upon finding little evidence that a hotelier was working towards energy savings, despite their public claims. Westerveld concluded that this initiative, and many others like it, were far more interested in generating profit than in creating environmental benefit. Apart from ESG standards, there lacks a framework to bring together disparate standards from the government and NGOs that may contradict each other. There are many characteristics that can help one identify greenwashing. For example, companies

[53] Johansen, Mathilde et al. "A Review of the Plastic Value Chain from a Circular Economy Perspective." Journal of Environmental Management. Academic Press, October 23, 2021. https://www.sciencedirect.com/science/article/pii/S0301479721020375.

occasionally claim "green" practices in the manufacturing of their products while willfully ignoring harmful environmental practices in other aspects of their business. Even more, these claims are often given broadly and vaguely, without easily accessible supporting evidence or materials. Greenwashing can also include irrelevant information meant to mislead customers, and on occasion, include straight lies or falsehoods. In order to prevent greenwashing, which is difficult to monitor, marketing departments must increase transparency at each stage of product development, from manufacturing to end-of-life. While it would be difficult to eliminate greenwashing in its entirety, reducing exaggerated claims by instilling sustainability values and increasing transparency in companies would subsequently help businesses move closer to sustainability goals.[54]

Many FMCG companies have been accused of greenwashing in recent years. Environmental groups such as Greenpeace have argued that Unilever has a poor overall record of environmental conservation that has led to deforestation, despite the public announcement of their zero-deforestation policy. Even more, Unilever and Nestle have both been criticized for their partnerships with the cement industry in various countries, which is using a technology called Refuse Derived Fuel (RDF). RDF takes mixtures of plastic, biomass, and paper to incinerate and process as fuel pellets, allowing Unilever and Nestle to claim plastic neutrality. This can seem beneficial on the surface, but in actuality, incinerating plastics releases hazardous substances into the air, including dioxins, which can cause environmental harm and health problems. Even more, utilizing waste-to-energy initiatives allows for the multinationals to

[54] "Greenwashing - What Is It and How Transparency Can Beat IT - RTS." Recycle Track Systems, January 21, 2021. https://www.rts.com/blog/green-washing-what-is-it-and-how-can-transparency-can-beat-it/.

continue creating plastic waste, and makes it far more difficult for recycling to be successful.[55] Like Unilever, Procter & Gamble faces claims of greenwashing, particularly by youth activists on Tik Tok who are raising concerns about forest destruction and Indigenous sovereignty. Procter & Gamble promotes tree planting initiatives, while at the same time, destroying the boreal forest in Canada to make Charmin toilet paper. These youth activists claim that P&G's new environmental commitments do not stop suppliers from destroying primary forests, allowing the company to continue making paper-related products from critical forests yet run advertisements on endangered forests and species habitats.[56] Unilever's marketers fight against claims of greenwashing by attempting to strengthen the integration of its climate action plan with its brands as well as maintaining simplicity and ease-of-use of their products.[57] However, according to a report in 2019 by the Break Free from Plastics Coalition, Unilever remains the fourth largest producer of plastic polluting the planet, behind Coca-Cola, Nestle, and Pepsico. Greenpeace claims that Unilever's entire business model is based on environmental destruction, yet is being praised internationally for their so-called action on sustainability.[58]

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[55] "Nestlé and Unilever Greenwashing Tricks." Plastic Soup Foundation, February 9, 2022. https://www.plasticsoupfoundation.org/en/2021/11/new-greenwashing-trick-by-unilever-and-nestle-plastic-waste-for-cement-kilns/.

[56] Cleaveland, Virginia. "Procter & Gamble's Environmental Controversy Escalates with Protest in Company's Hometown." Stand.earth, March 31, 2021. https://www.stand.earth/latest/markets-vs-climate/charmin-toilet-paper/procter-gamble-environmental-controversy-escalates.

[57] Kelly, Chris. "How Unilever and Other Marketers Work to Avoid Greenwashing." Marketing Dive, October 21, 2021. https://www.marketingdive.com/news/how-unilever-marketers-avoid-greenwashing-advertising-week/608662/.

[58] "Unilever's Makeover: 'Woke-Washing' or the Real Thing?" The Economic Times, October 18, 2020. https://economictimes.indiatimes.com/news/international/business/unilevers-makeover-woke-washing-or-the-real-thing/articleshow/78728995.cms.

Another Greenpeace report states that giant FMCGs are actually ramping up their production of plastics in the coming years, which threatens ecosystems around the world. The report also claims that FMCGs are working with oil and gas companies in order to oppose regulations on single-use plastic packaging. These companies' lack of transparency around plastic emissions reporting and their failure to reduce the use of single-use plastic packaging clarifies the irony between their public commitments to reduce emissions and their active contributions to the climate crisis. Greenpeace is urging FMCG companies to move toward reuse models and package-free products and move away from single use plastics for the sake of the planet and public health.[59]

Resistance to Change

Resistance to change can be defined as the unwillingness to adapt to altered circumstances in an organization. This is due to social and psychological barriers from a number of different factors, including lack of commitment or trust in management, lack of know-how or conviction, or lack of motivation. Resistance to change in this case can be divided into two categories: internal and external resistance. Internal resistance pertains more to company culture and employee satisfaction, whereas external resistance pertains to consumer acceptance of new packaging norms.

Internal resistance is faced with almost every organizational or operational change, as a change can often cause unforeseen disruption. Dramatic changes in the workplace are especially difficult to implement when the changes affect the day-to-day responsibilities of the employees.

[59] "FMCGS Fuelling Massive Plastic Expansion: Greenpeace." The Economic Times, September 14, 2021. https://economictimes.indiatimes.com/news/india/fmcgs-fuelling-massive-plastic-expansion-greenpeace/articleshow/86194332.cms.

In order to mitigate this lack of commitment, being open to feedback about the changes switching to reusable has brought onto the organization can help management determine how to address their employees' concerns. Even more, lack of incentives or support systems when implementing large operational changes in an organization has proven to have a negative impact on performance. Finally, proper communication and clear training regarding the changes will make the transition far more seamless. A trustworthy and reliable manager with an open-door policy can make all the difference in reducing internal resistance to change.[60]

External resistance from the consumer can also make or break a transition to reusable packaging. Sustainable packaging efforts are indeed popular with consumers, but research shows that it is marketed poorly to consumers. Misconceptions about total sustainability can be affected by greenwashing, but it also stems from the fact that few consumers know all the operational details of the products they are buying. Therefore, without proper implementation and instruction, few consumers would be willing to switch to reusable packaging as they would not understand its benefits. Proper customer incentivization such as price reduction or ease of delivery can help mediate this, as well as educational programs on the environmental benefits of reusable packaging over single-use.

Other barriers to sustainable behaviors are reflected by a person's area of interest or priorities. If the consumer does not value sustainability, they may not be interested in sacrificing the habit of using single-use for reusable packaging. However, when tradeoffs are absent, the consumer is more inclined to prefer environmentally-friendly products. On average, consumers are valuing sustainability more highly in the products they purchase. However, consumers may demonstrate what is called a value-action gap: they may not purchase the more sustainable

[60] Sinha, Rahul. "How to Deal with Resistance to Change in the Workplace?" LinkedIn, March 7, 2018. https://www.linkedin.com/pulse/20140717111252-169955770-resistance-to-change-how-to-counter-it-at-workplace/.

product, even if they indicated preference during surveys. Social desirability bias, when respondents describe themselves according to social norms, can exacerbate this and affect the legitimacy of the survey. Specific behaviors are influenced by a person's own attitude, cultural norms, and the level of difficulty to engage in a specific sustainable behavior.[61] Further research is necessary to determine how to mitigate survey bias in reusable packaging in order for reusable packaging to become more mainstream.

[61] Boz, Ziynet, Virpi Korhonen, and Claire Koelsch Sand. "Consumer Considerations for the Implementation of Sustainable Packaging: A Review." *MDPI* 12, no. 6 (March 12, 2020). https://doi.org/10.3390/su12062192.

VI. Review and Conclusion

The preconceived notion is that reusable packaging is far more expensive than single-use. This might have been true 20 years ago, but increases in digitization, AI, and supply chain technologies have made reusable packaging much more affordable in recent years. Even further, reusable packaging assists with reducing overall costs, including raw materials, transport, and damage costs, and saving time in the global supply chain. Making the switch can also lead to increased customer satisfaction, better inventory management, increased profits, and many more operational benefits.

In the first chapter, I evaluated the threats that massive waste streams present, including contributions to climate change and implications for public health. I focused particularly on plastic waste, as it presents exorbitant threats to marine life as it degrades into microplastics. The production of plastic, which boomed in the years following World War II, has played a central role in the development of modern technologies and comforts. Plastic packaging in particular has helped companies market their products effectively and keep products protected during transit and from contaminants. As the long-term environmental costs of plastic come to the public's attention, more people are claiming that the producers themselves should take responsibility for collecting their plastic waste. In the fast-moving consumer goods industry, plastic is commonly used in packaging for its benefits as a marketing tool, but improved product design is needed to reduce its use. This can be done through the circular economy.

In the second chapter, I clarified that although many companies are taking on extended product responsibility for their products, few of them have scaled these efforts into their company strategy. The circular economy, defined as "restorative or regenerative by design", is one way that they would be able to do this. The circular economy is meant to eliminate the

creation of waste through the improved design of products, materials, and systems, and also presents opportunities for huge economic growth and profits. The Ellen MacArthur Foundation serves to enable conditions for a circular economy by setting universal goals for policy around the globe. Although Europe has passed some circular economy legislation over the years, few of them pertain to product design or reuse/repair/refurbishment. Effective product design is critical to circular economy because involved decisions about a product's manufacturing and collection can vastly limit the creation of waste. Reuse models can help fast-moving consumer goods companies conceptualize changing the packaging product design from single-use to reusable.

In the third chapter, I explored the four reuse models: refill at home, refill on-the-go, return from home, and return on-the-go. Refill at home consists of consumers refilling a reusable container utilizing refills delivered via a subscription service. Refill on-the-go consists of users refilling their container at an in-store dispensing system. Return from home occurs when reusable containers are picked up from a user's home using a pick-up service for cleaning and refurbishment. Return on-the-go consists of the consumer returning reusable containers to a store or drop-off point. These reuse models can save businesses money by cutting supply chain costs and improve consumer relations through increased support for sustainability, not to mention the environmental benefits.

In the fourth chapter, I evaluate how a FMCG company can compare the costs between reusable and single-use packaging in order to determine how much money they can save by switching to reusable packaging. The data is based on industry averages, which can fluctuate based on external and internal factors. From the cost-savings analysis, we determined that the costs of raw materials and manufacturing would drop, but the costs to return the packaging as well as investment in new infrastructure would increase. However, the increases were not

significant as reusable packaging has a return on investment of .65 years, or approximately 8 months. Switching to reusable packaging can lead to a profit increase of approximately $1.5 million, when done correctly.

In the fifth and final chapter, I discussed the key obstacles and challenges associated withthe circular economy, including its theoretical limitations. The difficulty of gaining ownership ofend-of-life materials serves as a major obstacle to collecting products from the consumer after point of sale. However, digital technology and artificial intelligence can help improve collection systems and providing inventory visibility. Even more, I clarified how greenwashing damages transparency on environmental actions and allows large conglomerates to leave their fundamental business models unchanged. Finally, I discussed how resistance to change, both internal and external, leads to some unwillingness to adopt reusable packaging or disinterest in sustainability initiatives overall.

In order to overcome the limitations of a circular economy, this cost-savings model can be applied before initial investment in order to determine rate of return on investment and profitincreases. The primary finding of this thesis is that any fast-moving consumer goods company can implement this cost-savings model to switch to reusable packaging and reap the benefits. There are many companies that would like to be considered “green” but lack the know-how or resources to implement change. Despite the challenges, the future of the circular economy is bright, and more and more applications of reusable packaging will likely be seen in the next century.

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Biography

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