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PACKAGING COMPASS:

Evaluating Trends in U.S. Packaging Design Over the Next Decade and Implications for the Future of a Circular Packaging System

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Prepared by:
PMMI Media Group
Custom Research

A collaborative whitepaper between AMERIPEN and PMMI

WHO WE ARE AND WHAT WE DO

PMMI is a trade association for the packaging and processing industry, uniting the industry across the manufacturing supply chain. PMMI members promote business growth in various industries by developing innovative manufacturing solutions to meet evolving consumer demands. Over 980 North American manufacturers and suppliers of equipment, components, and materials are members of PMMI, as are many providers of related equipment and services to the packaging and processing industry.

PMMI Business Drivers provide the industry with various resources such as market research, best-practice tools and reports, technical training, networking opportunities, and more.

PMMI connects consumer goods companies with our members' manufacturing solutions through the world-class PACK EXPO portfolio of trade shows, including PACK EXPO International, PACK EXPO Las Vegas, PACK EXPO East, PACK EXPO Southeast, EXPO PACK México, and EXPO PACK Guadalajara.

PMMI Media Group connects manufacturers to the latest solutions, trends, and innovations in packaging and processing year-round through various print and digital media, including Packaging World, Healthcare Packaging, Contract Packaging, ProFood World, Mundo PMMI, and OEM.

AMERIPEN represents the U.S. packaging value chain, including material suppliers, packaging manufacturers, brand owners, and end-of-life materials managers. AMERIPEN provides public policymakers with fact-based, material-neutral, scientific information. Its primary role is to optimize the value of packaging while minimizing any associated social, environmental, and economic challenges. AMERIPEN is committed to advocating for progressive, proactive, and evidence-based strategies to advance sustainable packaging systems.

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INTRODUCTION

Packaging is ubiquitous. All of us interact with packaging in our daily routines. Packaging safely delivers goods to our homes and stores, protects our food, and keeps our health and personal care products sanitary. Packaging also promotes the product, provides information on proper and safe use, and identifies potential harmful ingredients, including allergens. Without packaging, our modern-day conveniences would be significantly reduced. Despite its omnipresence in our lives, consumers generally have a challenging relationship with packaging. When packaging performs well, consumers are typically ignorant of its value in protecting their products. Yet, when packaging fails to keep our products fresh, safe, or unbroken, consumers quickly note and complain of its inadequacy. Striking that correct balance has long been a challenge in packaging design.

This desire to see packaging for its value in product protection and delivery and to reduce or reuse it is not new. Awareness of packaging waste and its presence in our environment and landfills has driven campaigns to reduce, reuse and recycle for decades. While some materials have a long history of circularity, increasing attention in recent years has been given to packaging design, and its influence on the ability to recycle or compost.

When we follow packaging across the supply chain, a common refrain we hear from the recycling and composting community is that the rapid rate of innovation by the packaging community hinders their ability to match recovery technology, resulting in a disconnect between the packaging placed on the market and what can be recovered to create a circular packaging system. Recyclers often note that, from the time one begins to plan for the development of a materials recovery facility (MRF), it takes an average of ten years to complete. In that time, packaging may have shifted dramatically as converters and brands seek to replace materials, develop new formats, and launch new technologies designed to make packaging more responsive to its role in protection and delivery. Composters bemoan the challenges in identifying compostable versus non-compostable materials or potential concerns regarding inks, coatings or other additive that may be used in packaging.

Although the packaging community seeks circularity, packaging must be designed for more than just recycling or composting. Design must also consider how best to protect from product damage or spoilage, health and safety, and consumer use as it moves across multiple distribution systems. Packaging also serves to help promote and educate. Additionally, any changes made to a package itself must also be coordinated with product filling systems, distribution channel needs and consumer packaging demographics. Any changes to packaging materials or formats can impact all these variables. Finding the right balance will require collaboration at both the design and recovery phases.

This paper attempts to support that dialogue and to help close the gap between design needs and recovery needs by beginning a conversation on trends, forecasting a decade ahead, and recognizing the role of multiple stakeholders in advancing a circular packaging economy. Systematic thinking to understand how changes in packaging design can impact our collection, sortation, and processing of materials at their end of life will help us better target investments as well as legislation to ensure success.

METHODOLOGY

To evaluate packaging trends for the next decade, we analyzed material growth predictions for packaging formats and materials from various public and private data sources. We supplemented this quantitative data with in-depth qualitative interviews and surveys. 645 CPG brands and retailers, packaging machinery OEMs, and packaging material suppliers and converters, were asked for their thoughts on what packaging materials would look like over the next decade. 61% of survey respondents were brands or retailers, 20% were materials suppliers and converters, and 19% of respondents were OEMs.

For this study, we have attempted to examine insights regarding the packaging produced at CPG companies only (excluding pharmaceuticals), as this is the packaging most frequently found in municipal recycling programs. As a result, any quantifiable data on projected packaging trends or design preferences within the report is restricted to responses received from 394 CPGs. Qualitative insights may be drawn from all sector respondents.

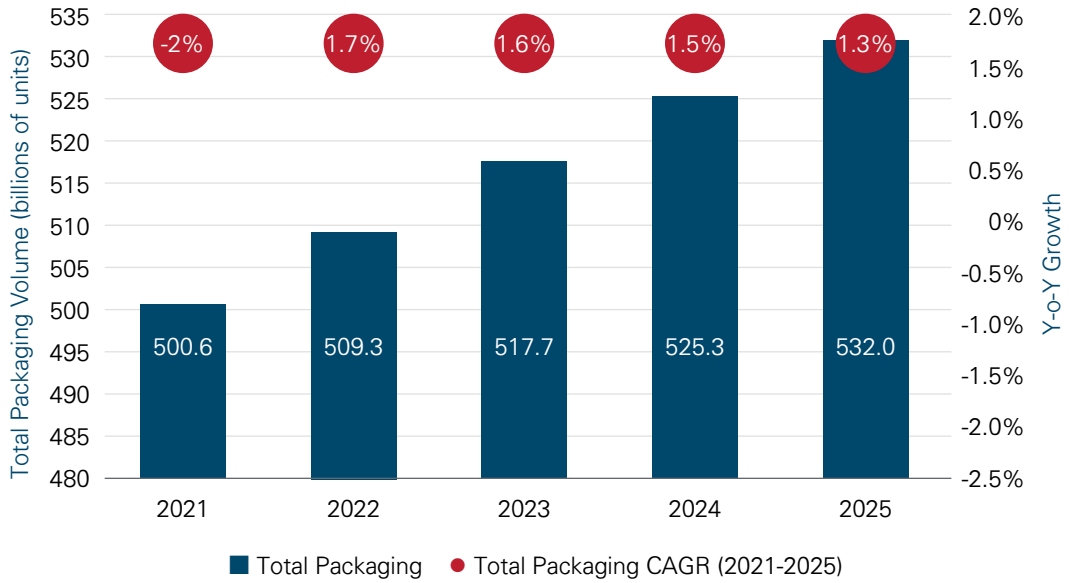
Lastly, data on material and format projections were shared with key constituents, such as trade associations or major packaging manufacturers, to explore their alignment with the qualitative and quantitative projections as well as to discuss investments and legislation opportunities and risks associated with shifting design and related impacts on our collective desire for a circular packaging system.

PART 2

MATERIAL TRENDS

In 2021, the U.S. packaging market volume totaled 500.6 billion units.[1] This includes all packaging segments, fast moving consumer goods, durables, industrial and transit packaging etc. Within the next five years, the U.S. packaging market is expected to grow at an average compound annual growth rate (CAGR) of 1.5%.[2] This number fluctuates with a constant increase in cumulative units but a gradual decrease in CAGR year-over-year. We believe this decrease reflects the movement within omnichannel commerce to design primary packaging for shipping (also referred to as *ships in its own container*—SIOC), eliminating the need for secondary and, in some cases, tertiary packaging as well as, the return to retail we are seeing as consumers return to stores after COVID.

FIGURE 1: Total Packaging Volume, USA 2021-2025

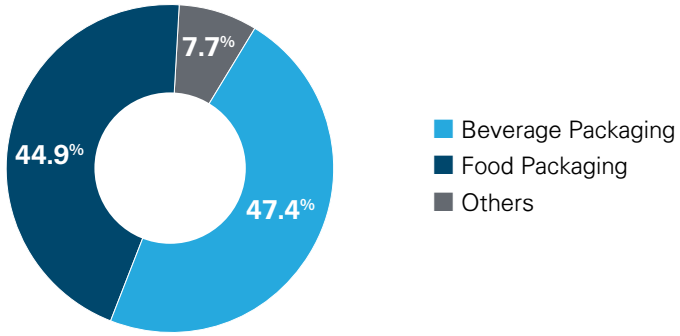


Source: Euromonitor, 2021

[1] *Euromonitor (2021) Private insights provided for this report.*
[2] *IBID*

Since this report is focused on CPG packaging, we broke this sector out by segment to better understand where the volumes of packaging occur and the implications this may have on material and format choices. Per *Figure 2,* we see that the food and beverage sectors are the largest segments, each accounting for a packaging market share of over 40% in 2021. The "other" category includes personal care, household products, and pet food.

Figure 2: Packaging Unit Volume by Product Category, USA 2021 *(share %)*



Source: Euromonitor, 2021

Breaking down CPG packaging by materials and formats, gives us further insight into design trends. Volume tends to follow unit sales demonstrating that those materials in greatest demand (beverage containers) typically demonstrate the greatest growth.

Figure 3: Packaging Volume Growth by Material Type 2021-2025
(billions of units)

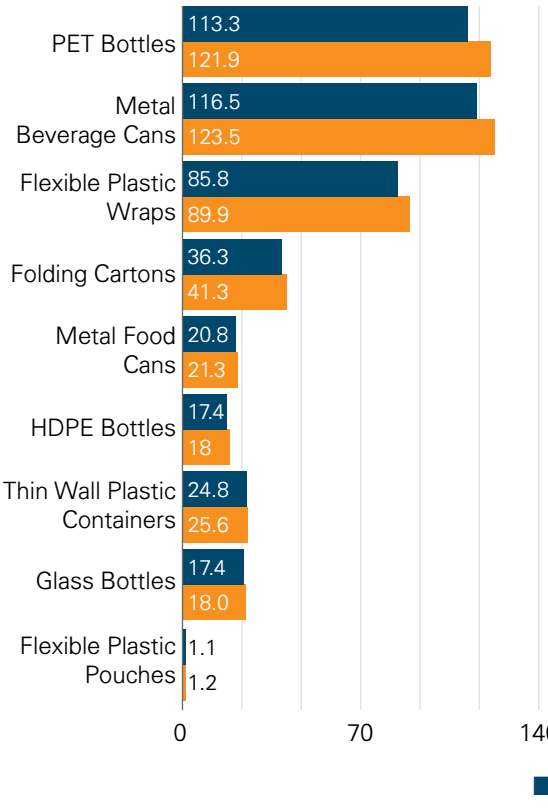
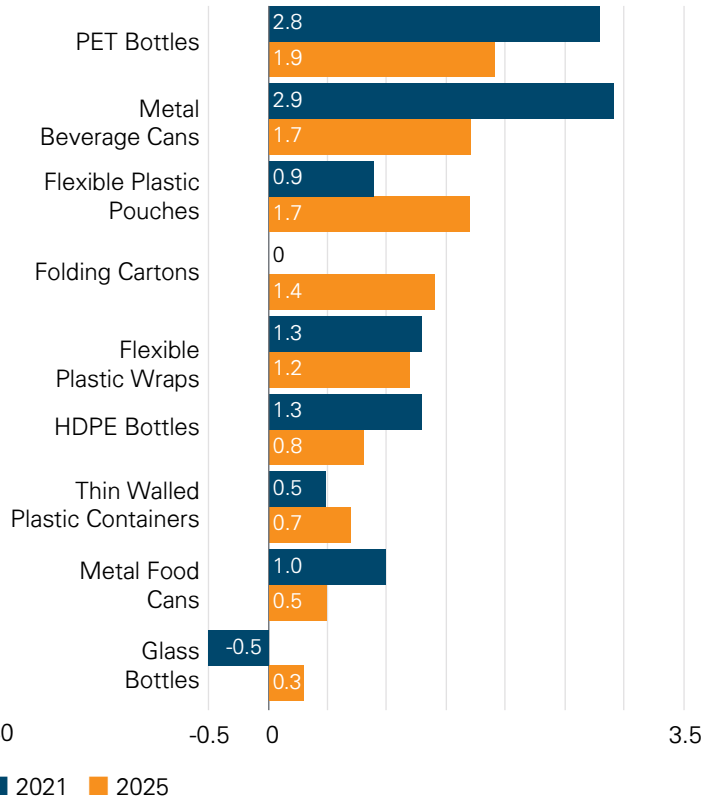


Figure 4: Packaging CAGR Growth by Material Type



Source: Adapted from Euromonitor, 2021

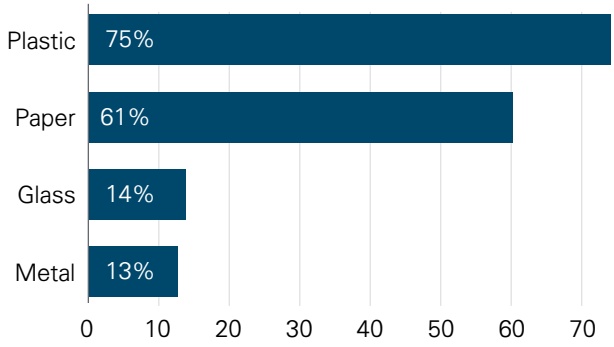
Historically, when we measure volume of units sold against CAGR, it closely matched unit sales, with beverage bottles and cans dominating. However, as we move into 2025, this trend of matching packaging formats to sector growth begins to shift. Although not significant by total units sold, when we look at CAGR, by 2025, flexible pouches match metal beverage cans as the second fastest growing packaging format, just slightly behind PET bottles.

Forecasts into 2025 see glass being adopted more frequently after years of decline, demonstrating a positive CAGR growth from 2021. Folding cartons are also expected to see a significant increase in CAGR from previous years where CAGR growth remained steady. Metal food cans, HDPE and plastic wraps growth slows slightly while thin-walled plastic containers see a slight increase.

While these trends indicate some transition from plastics to other materials, the overall demand for plastics, despite a public dialogue that pushes back against it, still indicates that it is a valuable material for packaging design. In fact, despite slight shifts in growth rates, plastics, as a cumulative of multiple resins and formats, still retains its lead as a packaging material of choice.

When we queried respondents to our survey to identify the types of packaging materials they use in their operations, plastics came out on top by a minimum of 14 percentage points more than other materials.

Figure 5: Materials Used by Survey Respondents



Data shows that plastic packaging is used by

75%

of our CPG respondents. More than those who use paper and significantly more than those who use glass or metal.

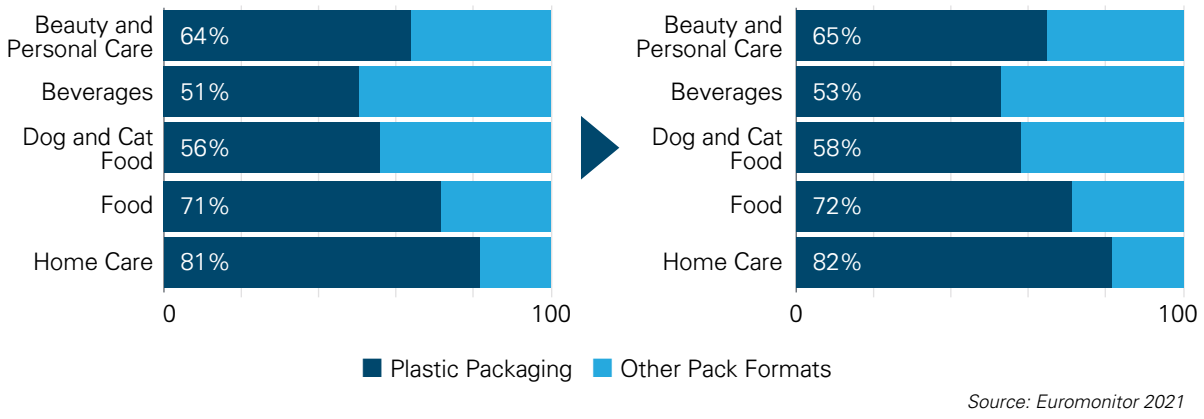
[3]*As noted earlier, Packaging Industry CAGR for 2025 is anticipated at 1.3%*

[4]*Mordor Intelligence (2021) "United States Plastic Packaging Market – Growth, Trends, COVID-19 Impact and Forecasts (2023-2028)"*

Plastic packaging CAGR assessments going into 2028 exceed that of the packaging industry. According to Euromonitor, plastics at large are expected to see a 2.6% CAGR globally going into 2024[3], placing an estimated 80 billion more plastic packaging units into the economy. Mordor Intelligence predicts a more aggressive 3.2% CAGR for plastics packaging until 2028.[4] All data indicates we should expect to see a continued growth in plastic packaging.

In Figure 6: Global Share of Plastic Packaging Market 2020-2030 we try to drill down further into plastic packaging to better understand the sector and formats where plastic packaging may dominate.

Figure 6: Global Share of Plastic Packaging by Industry 2020-2030

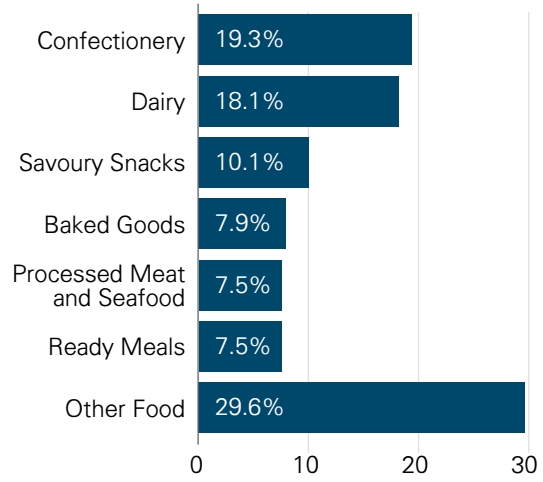


Source: Euromonitor 2021

Home and Beauty care are projected to retain their lead as primary users of plastics. They tend to rely on rigid plastic PET and HDPE as their primary resins and formats. Beverages use primarily rigid PET for their plastics related needs. Dog and Cat Food and Food sectors have begun introducing more diversity with pet food packaging, using multi-material pouches and rigids and mono-material and multi-material formats like heavy paper/plastic bags.

When we drill down into food packaging, it's worth noting that the food packaging market is highly varied. Understanding which categories lead in terms of growth helps provide some insights into packaging materials and formats. While food packaging can include a wide range of frozen and shelf-stable foods such as soup and cereal, breaking food down into subcategories per *Figure 7* gives us more insight into packaging formats and materials that will most typically be used.

Figure 7: Packaging Volume for Key Food Subcategories (USA 2021) ***(share %)***



Confectionery packaging, including chocolate and sugary confectionery and gum, is one of the largest subcategories within the food segment and will include many multi-material and small format packaging films to wrap chocolate, candies, and single-serve treats. Many of these packaging films will be plastic, although there is a small growth in paper films emerging as a potential alternative to plastic wrappers. The same goes for savory snack packaging, which relies on single-serve small-format packaging and flexible and multi-material films. Baked goods and meat and seafood packaging will predominately represent mono-material formats, while ready-made meals will likely leverage a wide range of materials as part of an overall packaging system.

In summary, we see continued growth in plastic packaging going into 2030. Within plastics, while perhaps not representative of sheer volume but certainly of growth areas, our data indicates we should be paying attention to the growth of plastic pouches and small format packaging.

Overall, we interpret this data to suggest that packaging designers are not designing solely for recycling but may be looking at designing for a variety of attributes—trying to balance the competing demands on packaging to reflect challenges with distribution systems, demographics, and product and environmental protection. Materials that are currently difficult to recycle may still provide increased environmental benefit through reduced material demand, reduced product damage, or lighter-weight shipping. As a packaging system, we need to find a way to balance competing strategies and needs in order desire to increase packaging recovery.

We need strategies in both packaging design and recovery technologies. This shared approach will require much more collaboration and sharing of data than has happened to date in order to drive preferred environmental outcomes.

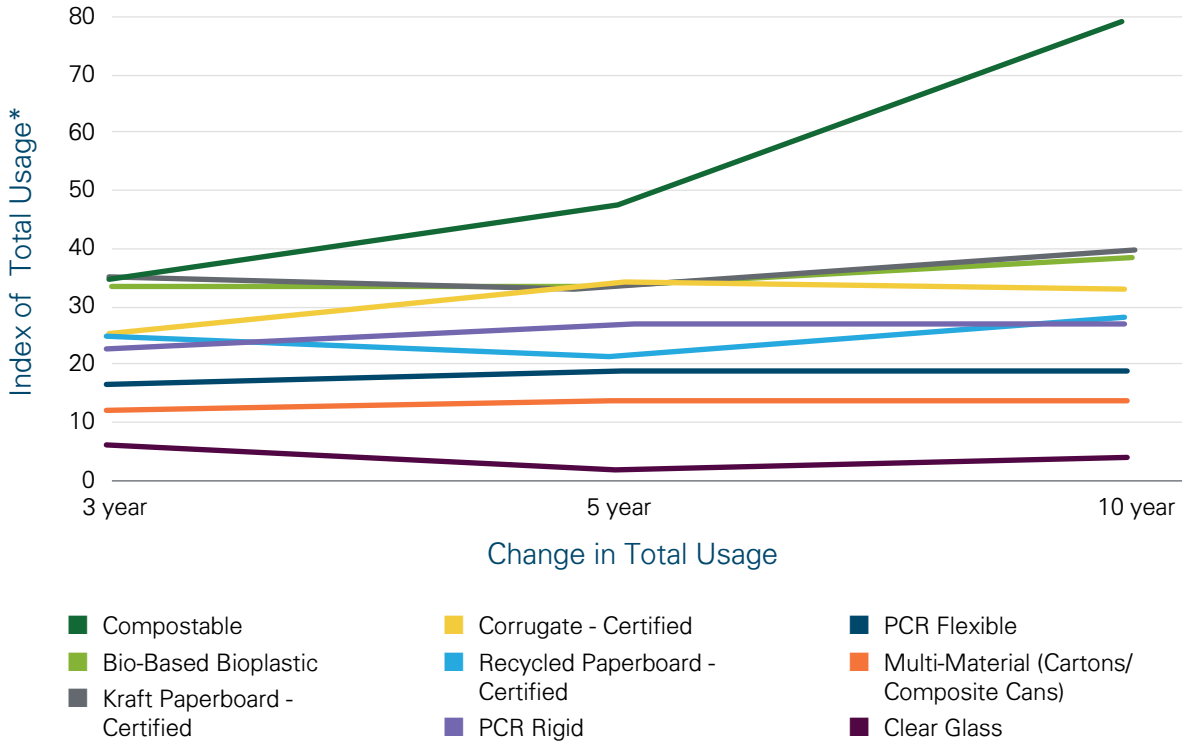
2.2 – DESIGN FORECASTS

While our data to date has focused on quantifiable unit and format projections, we also wanted to survey CPGs to learn what they are planning for packaging material changes over the next decade. Understanding what shifts are anticipated can provide further insights in addition to material projections.

CPG respondents were asked to indicate what materials they currently use, the likelihood of changing those materials over the next three, five, and 10 years and, if changing design, what materials or formats they anticipate transitioning to. It should be noted that this question explored projected, not definitive, trends. Respondents were asked whether usage of a given material would increase, decrease, stay the same, or be eliminated, and if decreased or eliminated, what material would replace it.

Packaging material use is presented in Figure 8, tracing projected rates of increase/decrease in the use of a range of materials. Usage and propensity for replacement scores were then indexed. Current usage and propensity of replacement scores were summed for a score of total usage. Figure 8 represents the total usage index of CPG responses over the next three, five, and ten years.

Figure 8: Projected Packaging Material Usage Over Time



Of note is the relatively steep trajectory identified for compostable paper and plastic materials. While most materials remain relatively stable with small increases or decreases expected, compostable materials see a significant jump around the five-year mark (2027). Since compostable packaging represents a very small share of the packaging this jump will not be significant overall in terms of packaging volume. We do, however, believe that this points to a significant shift in packaging design, material choices, and recovery needs. The significant rise in the use of compostable materials uncovered by our research is congruent with other industry studies predicting a global CAGR of 15.4%.[5] Contrast this to traditional plastics at around 3.5% or paper at 3.8% global CAGR growth.[6]

Examining the total usage index of other materials measured, there are small shifts between materials with minimal rates of increase or decrease.

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[5] *Compostable Plastic Market (2020) Allied Market Research*

[6] *Mordor Intelligence (2021) "Plastic Packaging Market – Growth, Trends, COVID-19 Impact and Forecasts (2023-2028)"*
Mordor Intelligence (2022) "Paper Packaging Market- Growth, Trends, COVID-19 Impact and Forecast (2023-2028)"

Surveyed participants were asked to identify materials they planned to use over the next three, five, and ten years and, if they planned material substitutions, to identify what materials they planned to switch to., The results shown in *Figure 9* indicate a significant increase in recycled and/or certified content rather than in material substitutions per se. This suggests that material demand for post-consumer recycled (PCR) content and certified paperboard should be expected to increase. Finding ways to ensure adequate supply and quality for recycled content in packaging should be a top priority.

Figure 9: Indices of Total Materials Usage

Existing Materials Used in Packaging	Total Materials Usage		
	3 Year	5 Year	10 Year
Compostable	27%	41%	72%
SBS Paperboard - Certified	32%	28%	34%
Kraft Paperboard - Certified	26%	27%	32%
Bio-Based Bioplastic	25%	27%	29%
PCR Rigid	19%	24%	27%
Recycled Paperboard - Certified	18%	21%	24%
Corrugate - Certified	25%	25%	21%
PCR Flexible	14%	16%	16%
PE Flexible	19%	14%	12%
PET Rigid	21%	18%	12%
Molded Pulp	6%	4%	7%
Reusable	-4%	-4%	6%
HDPE Flexible	13%	12%	3%
Aluminum	12%	7%	3%
Colored Glass	6%	3%	3%
Multi-Material Rigid	2%	2%	1%
Multi-Material	-1%	1%	1%
PE Rigid	-3%	-2%	-2%
Recycled Paperboard - Non-Certified	7%	-6%	-3%
Steel	1%	3%	-3%
Clear Glass	6%	2%	-4%
HDPE Rigid	10%	0%	-5%
Laminated Paperboard	-9%	-9%	-5%
PS	-8%	-7%	-9%
LDPE Flexible	8%	1%	-10%
Foams (PU, PS, PE)	-7%	-9%	-12%
Corrugate Non-Certified	8%	7%	-13%
LDPE Rigid	-1%	-10%	-15%
PET Flexible	1%	-6%	-15%
SBS Paperboard - Non-Certified	-6%	-9%	-15%
PP Rigid	-8%	-11%	-16%
PP Flexible	7%	-11%	-16%
Kraft Paperboard - Non-Certified	-5%	-9%	-20%
Multi-Material Flexible	-10%	-5%	-22%
PVC	-18%	-19%	-25%

Increasing Usage

Decreasing Usage

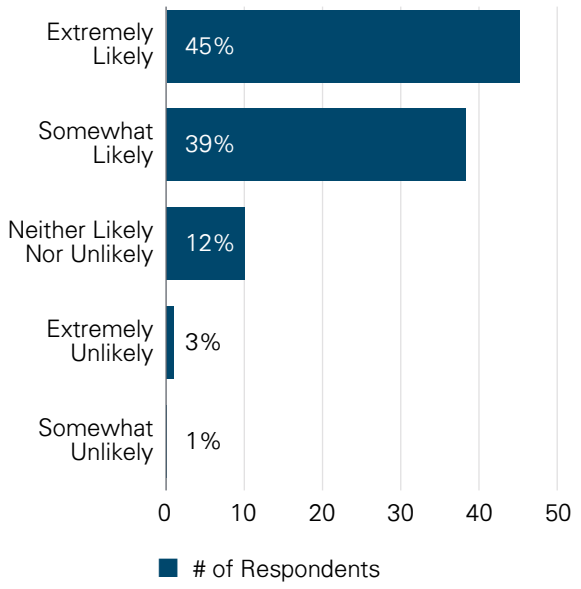
It's also worth noting that many respondents indicated a substitution of some rigid plastics or metals with increased flexible plastic packaging and, where available, that they want to move away from multi-material flexible packaging towards more mono-material flexibles.

We interpret this data to indicate that design for recycling is indeed a motivating factor for packaging designers. Opportunities to simplify packaging for increased recycling is a key strategy they are using; however this specific design objective must still balance with other objectives to consider product protection, distribution etc. There are some packaging formats like flexible pouches which are seen as a valued format and efforts to design for recycling have been focused on simplifying the design from muti-material to mono material—not elimination. This indicates there are areas where we will need innovation in design not just at the packaging phase but across the value chain and towards recovery efforts.

We did queried survey participants on their interest in reusable packaging. *Figure 10* indicates there is interest in reusables, particularly amongst those already using some reusable formats. However when taken as a cumulative, there was more caution surrounding resuables than interest. Interview participants typically cited "up gauging" materials to make them reusable, adding production cost and creating a heavier product that some felt would inevitably be thrown out or forgotten, in which case they would acquire another reusable vessel. Another CPG told us: "It's not reasonable to expect that they [consumers] want to reuse your packaging."

The companies we spoke to indicated that the significant investment into redesigning packaging systems, including switching to new filling lines, investing in washing infrastructure, and establishing reverse logistics, made this a much more difficult strategy than material or format substitution. There is a perception that success with reusables will be predicated on ways to make pickup and collection points easy for the consumer and to keep costs low for both consumers and producers.

Figure 10: Likelihood Companies Will Increase the Use of Reusable Packaging within Next Five Years
(% of CPG respondents)



> In summary, based on predicted changes proposed by the consumer-packaged goods community, we foresee growth in lightweight materials like flexible film pouches and food wrappers. These are materials not yet widely recoverable.

> Compostables are also expected to see a significant increase, and similar to flexible films, the lack a significant recovery system to ensure they are composted after use.

> Lastly, recycled content in packaging is expected to grow with a large number of CPGs identifying plans to increase recycled content with in their existing packaging.

All three of these key trends indicate while designers are focused on recovery and reducing environmental impact, our systems are not yet ready to support. Plastics films, although technically recyclable lack a collection infrastructure to scale recycling. Compostables lack both composting and collection infrastructure. While recycled content for some materials, particularly plastics, lack sufficient volume and quality to meet the demand. It's our hope in forecasting these anticipated design trends that we can begin a focused dialogue on the impact of these trends on the recovery system and on the public policy impacting packaging and its recovery.

PART 3

INFRASTRUCTURE NEEDS

With non-traditional materials or formats expected to grow, our recovery systems will be challenged to help increase the collection, sortation, and processing of these emerging packages. Meeting these demands will require additional investment and innovation in infrastructure. Additionally, to meet the highly regulated and high-quality requirements for post-consumer recycled content in packaging, and in particular, in food contact packaging, investments, and infrastructure may also be needed to support packaging's unique safety and hygiene needs. Exploring strategies for each of the packaging trends we have identified can help us begin a more strategic discussion on how best to invest in advancing the U.S. recovery system.

3.1 – FLEXIBLE PLASTIC FILMS

Flexible films are expected to grow at an annual CAGR of 4-6%.[7] With the average CAGR for plastics as a whole coming in at 3-4%,[8] this makes flexibles one of the fastest-growing segments within plastic packaging. Plastic films have significant advantages both in terms of operational needs and sustainability. Their tensile strength permits for greater protection with less material, their lightweight status helps reduce carbon emissions during trucking due to space and weight, and they are highly customizable, and they run efficiently and fast on filling lines reducing overall costs and time in production. Consumers also appreciate the ease of opening, resealable capability, low weight, and small shelf space these packaging formats offer.

Flexible plastic films can be recycled but are typically used in downgraded applications such as plastic "lumber" or polymer asphalt and tend to be collected at drop-off points rather than through curbside systems. These materials are challenging as they can complicate the sortation phase of materials recovery. When flexible films are sorted at a municipal recycling facility, their flexible nature makes it easy for them to get caught in rotators, tangling and wrapping up in the equipment, or being redirected towards paper lines, increasing contamination of that stream. As a result, many community recycling programs have banned the collection of flexible film packaging formats. Since plastic films are expected to continue to increase in market size, we need to begin discussions on how best to collect, sort, and reprocess these materials to ensure a viable end market for their reuse.

Flexible films are expected to grow at an annual CAGR of **4-6%** With the average CAGR for plastics as a whole coming in at **3-4%**

[7] *Mordor Intelligence (2021) "United States Plastic Packaging Market – Growth, Trends, COVID-19 Impact and Forecasts (2023-2028)"*
[8] *Flexible Packaging Association (2022) "State of the U.S. Flexible Packaging Industry Report"*

3.2 – FILMS: EMERGING INFRASTRUCTURE

According to The Recycling Partnership (TRP), only 1.9% of the U.S. public has curbside access to recycling flexible plastics.[9] Rather, most post-consumer flexible plastics recovered in the U.S. are collected via retail drop-off programs, but consumer participation in these programs is low. Close to 95 lbs. of flexible and film plastic (bags, pouches, wrappers) are found annually in the average U.S. home.[10] There is a belief that the U.S. could increase total flexibles recovery volume if municipalities could find a way to incorporate these films into the curbside collection effectively. Finding a way to collect films would improve the economics of recycling as well as access to valuable plastics.

The recycling community is quickly adopting artificial intelligence (AI) technology. AI includes using robotic arms and other technologies to help sort and identify flexible films (amongst other materials) quickly and early in the sorting process to prevent damage to existing equipment and ensure recovery. This could help reduce concerns with the sortation of flexibles from curbside materials.

Chemical recycling may help increase the quality of resin for reuse and permit the increased collection and reduced sortation requirements. Chemical recycling is also believed to help increase access to U.S. Food & Drug Administration (FDA) approved recyclable content for food contact use—permitting the increased opportunity to reuse films for circular reuse rather than directing it to downgraded products.

Investments in the collection, sortation, and processing of flexible films are emerging. The next few years will help provide an increased understanding of the potential impact of these technologies as well as opportunities and investments needed to improve collection and sortation. But progress will happen faster if we align these investments with the regulatory and legislative environment to support progress.

[9] *The Recycling Partnership (2021) Addressing the Challenge of Film and Flexible Packaging Data*

[10] *Ibid*

3.3 – COMPOSTABLE PACKAGING

According to our research, compostable packaging material usage is poised to increase significantly over the next decade, which is congruent with other industry studies predicting a CAGR of about 15-16%.[11]

Compostable packaging material is poised to increase

15-16%
over the next decade

Some see compostable packaging as the ideal circular economy story. Products are created from natural materials and returned to the earth via degradation back into the soil and basic elements. Compostable packaging can provide a simple one-step collection process, eliminating the need for consumers to wash and clean food contact packaging before disposal.

The promise of compostable packaging is hindered by the lack of infrastructure in the U.S. to meet both food and organic waste needs. According to the Sustainable Packaging Coalition (SPC), only 27% of the U.S. population has access to food waste composting programs, and even less (11%) can direct compostable packaging away from the landfill to composting.[12] Very few retailers or event outlets have composting collection programs. To realize the full circular potential of compostable packaging, the U.S. needs to increase consumer access to composting by investing both in expanded access to composting facilities that accept food scraps plus packaging and in the collection of compostable materials. As the U.S. looks at investments into the necessary collection and processing infrastructure, there may be a need to consider where compostable packaging collection could be most effective, i.e. stadiums, food service outlets, and cafeterias e.g., versus households per se, so stakeholders can invest with the greatest immediate impact.

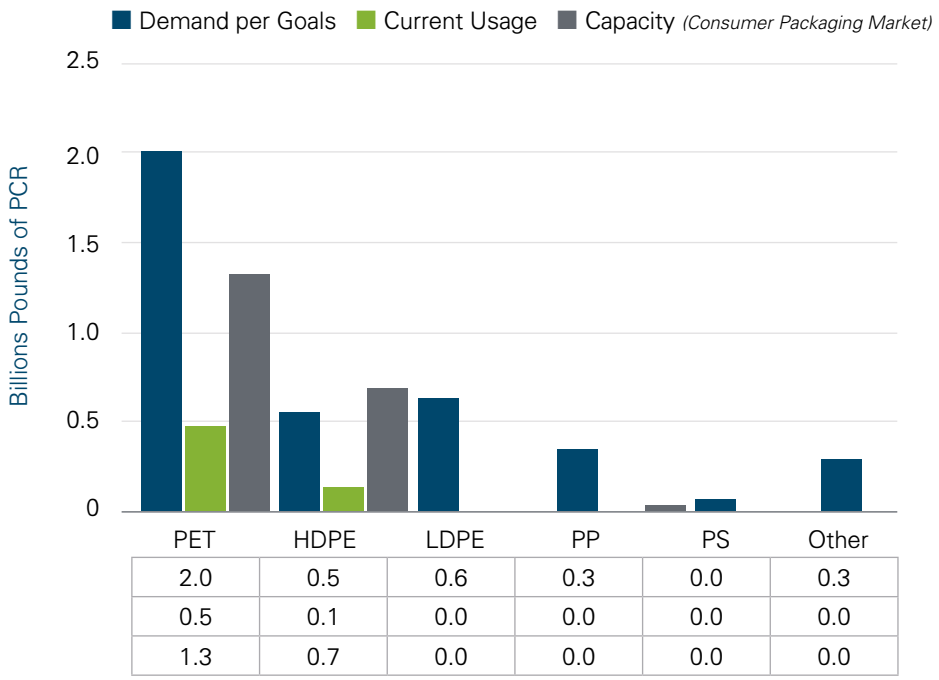
[11]Compostable Plastic Market (2020) Allied Market Research
[12]SPC "Understanding the Role of Compostable Packaging in North America"

3.4 – RECYCLED CONTENT

Many survey participants indicated that within the next decade, they foresee a significant increase in using PCR content within their packaging. This interest in PCR aligns with an increase in state mandates for recycled content in packaging as well as voluntary goals signed by numerous companies to increase recycled content in packaging 25-30% by 2025.[13]

While access to and use of recycled content varies by material, a previous study by AMERIPEN examined corporate goals for PCR content in plastic packaging against available supply and capacity. The study found, for almost all plastic resins, demand for PCR content far exceeded available supply and also demonstrate that, in some cases, we lack sufficient infrastructure capacity to meet potential demand.[14]

Figure 11: US Annual Production Capacity, Current Usage and Future Committed Use (Goals) for Consumer Packaging PCR



	PET	HDPE	LDPE	PP	PS	Other
Demand per Goals	2.0	0.5	0.6	0.3	0.0	0.3
Current Usage	0.5	0.1	0.0	0.0	0.0	0.0
Capacity (Consumer Packaging Market)	1.3	0.7	0.0	0.0	0.0	0.0

Source: AMERIPEN (2021) "US Company Recycled Plastic Content Goals Analysis: Supply & Demand."

This indicates that we need to consider what investment is needed to ensure that we can match industry demand for PCR content within packaging. Higher quality and regulatory requirements mean that the use of PCR content for food packaging can be more restrictive than using PCR content from packaging in other applications. Quality of materials is one of the biggest challenges for packaging grade PCR content. Contamination from food, scents and co-mingling of materials can limit the reuse of certain materials, rendering it difficult to produce a smooth paperboard, a resin free of scent, or to meet color qualifications. Until we can resolve quality challenges, demand and supply pressure may remain tight.

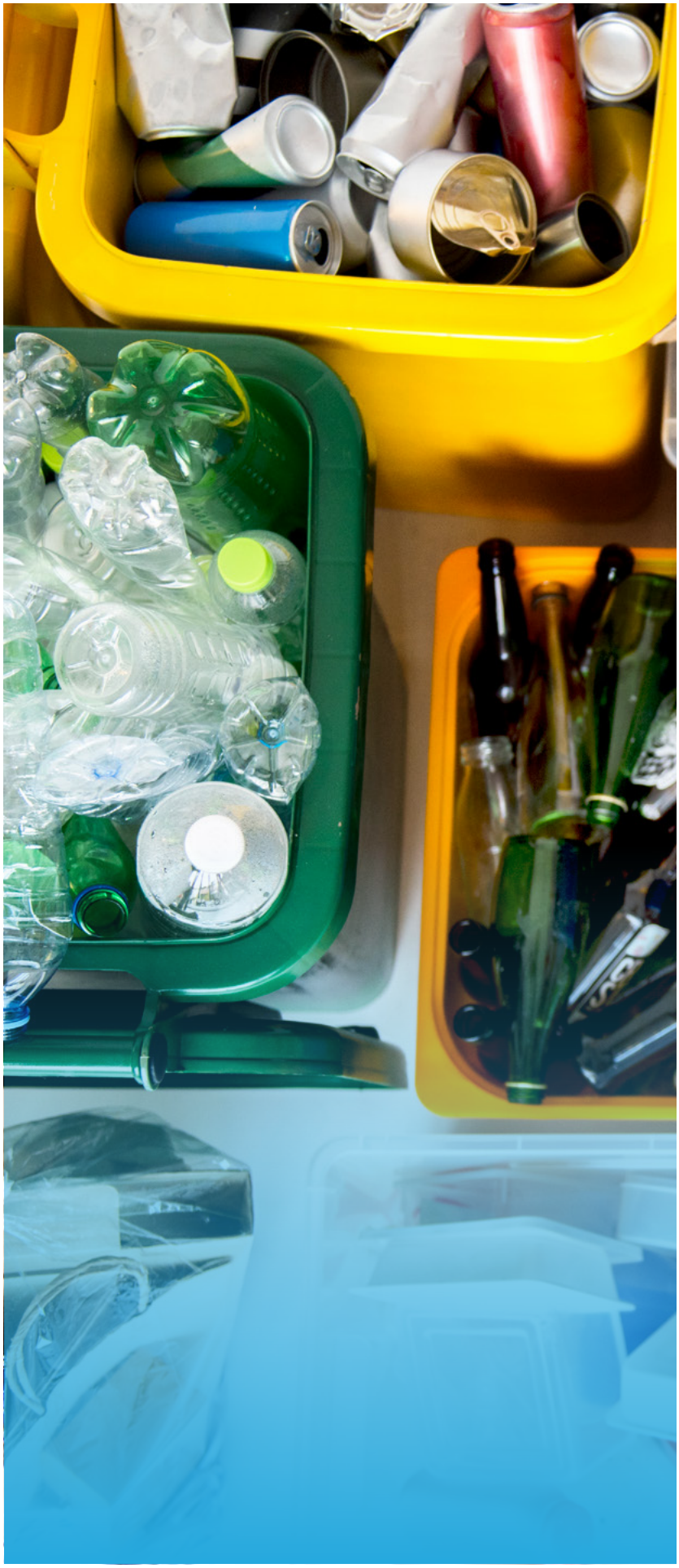
[13] *Ellen MacArthur Foundation Global Commitment*
[14] *AMERIPEN (2021) "US Company Recycled Plastic Content Goals Analysis: Supply & Demand."*

Finding ways to better sort materials so that different materials are directed to the correct end market is valuable. Flexible films may be inadvertently directed to paper lines, while multi-material cartons may be sorted with rigid plastics. Investments such as optical sorters, robotic arms, and air jets are becoming priority investments for new MRFs. However, there's still a need to help finance upgrades to existing but older facilities.

Chemical recycling is an emerging technology that could help reduce color or scent concerns in plastic resins. Reverting materials to their original monomers could also simplify the regulatory process to obtain FDA-approved food contact resins for use in food contact packaging—currently a challenge for many packaging producers due to a limited number of approved facilities.

Design for recycling guidelines has emerged within the packaging industry to help ensure that labels, additives, and chemicals used in packaging are beneficial to recycling and do not hinder a package's recyclability. These strategies, when adopted, help reduce the risk of contamination from packaging designs. Companies are making investments to change suppliers or products to ensure recyclability.

We hope that by providing some insight into material and packaging projections, we can help reassure investors that it's worth investing in some of these solutions and advise them where their investments may have the greatest impact. While many of these investments will require private-sector funding, efforts to increase collection and improve consumer awareness will also require public resources. This is where legislation may be of value.



PART 4

IMPLICATIONS OF THESE FINDINGS FOR PACKAGING AND WASTE LEGISLATION

Legislation is a tool that can advance goals and support systems that need assistance. When legislation is effective many benefit. However, legislation is a political act that can sometimes overlook the systemic nature of changes. Creating circular systems is one area where interventions in one area of the system can have inadvertent impacts at a different stage of that system. By exploring legislation related to packaging and its recovery, we hope to offer insights into how we can better direct or inform legislation to minimize unintended consequences.

Providing insight into the design and recovery helps advance the dialogue around packaging circularity so we can direct limited resources toward the most impactful and efficient interventions.

4.1 – EXTENDED PRODUCER RESPONSIBILITY

Extended Producer Responsibility (EPR) is a policy mechanism designed to shift the financial and sometimes operational responsibility of the end-of-life management of products from consumers and the government to the producers of those products. It is argued that when companies seek recycled inputs and can control the process to obtain these inputs from design to end-of-life, the product design will be improved, and necessary investments for recycling success will follow.

As of January 2023, extended producer responsibility for packaging (EPR) laws have been passed in four states (California, Colorado, Maine, and Oregon). Many more states are anticipated to consider and potentially adopt similar legislation. EPR has been executed in five provinces in Canada and across Europe, with varying program designs and variable impacts on packaging design. Given the trajectory of EPR in the U.S. it is likely that the adoption of multiple programs and different rules (as found in Canada and Europe) is likely to create unintended consequences as states develop varying EPR rules. Early in the development of an EPR program, dialogue with the packaging value chain to understand design trends and potential restrictions or trade-offs on changing packaging design may help ensure that investments made into packaging recovery reflect what the future of packaging will be. By advancing a dialogue on the future of packaging and engaging stakeholders across the packaging value chain, EPR proponents can help ensure these systems are proactive and set up to influence the design and match the needs of both packaging designers and recyclers. Leveraging EPR legislation to plan for the future can help ensure we avoid unintended consequences by failing to plan for change.

Based on the research within this study, EPR programs would benefit if they considered ways to improve the quality and quantity of recycled materials. Key considerations should explore how best to invest in the composting infrastructure, including packaging, and address how to handle hard-to-recycle materials by investing in collection and sortation technology and supporting end-market development. The data within this study indicates that attempts to restrict packaging design simply for recycling needs to be revised. The multiple demands on packaging require that designers consider recycling as one of many variables they must balance. Leveraging EPR to help strike this balance should create benefits for all stakeholders.

4.2 – UNIVERSAL ACCESS LAWS

Universal waste access laws seek to provide all households with convenient and consistent access to recycling and composting services. Recycling or composting may look different in urban versus rural communities or single versus multi-family dwellings. Recycling can even look different between household collection services and what is available in businesses or on-the-go collections. Ensuring all consumers access a convenient program to collect recyclables, compostables, and waste provides environmental equity. To provide universal access, there is merit in identifying effective ways to collect materials from different communities and what are the necessary infrastructure needs to accomplish this goal. There is a benefit to determining how best to support and equalize access to material recovery services. A discrepancy between what materials can be recycled in one community versus another creates consumer confusion and increases recycling system contamination.

Finding the right balance to help provide universal access with system effectiveness will require dialogue and system planning. As more states explore ways to harmonize recycling between municipalities, evaluating how to make these efforts work efficiently may be warranted.

4.3 – REGULATING STANDARDIZED DEFINITIONS

There are numerous and conflicting state and federal definitions of recycling and composting across the U.S. Inconsistency in how we define recycling, composting, or other recovery technologies drives consumer and packaging designer confusion. For example, flexible films are technically recyclable and often produce high yields when recycled. But suppose a state definition of recycling is dependent on available end-market sales, in that case, films may be deemed unrecyclable simply because a community needs more supply to collect, bale and sell the material, or bans these materials from curbside collection systems, or is geographically restricted from economical access to a nearby reprocessor. Working together to agree on these definitions will help set goalposts that packaging producers and recyclers can cross.

Standardized definitions will also help reduce consumer confusion. Common definitions provide clear direction on what to do and how to do it, easing the process of recycling or composting for consumers.

4.4 – MATERIAL BAN LEGISLATION

While circularity is a key design strategy, packaging producers must consider aspects like safety during distribution and storage, material efficiency, product filling, and consumer preference. The multiple demands on packaging make it difficult to design singularity for recyclability or composability. Bans on materials or packaging formats, while well-intentioned, may have unintended consequences.

With a consistent growth projection anticipated for plastics, particularly flexible plastics, it may be time to shift the dialogue from restricting materials to realizing the best way to collect, sort, and reprocess these materials to reduce environmental impact.

4.5 – LEGISLATIVE FUNDING FOR RECOVERY INNOVATION

Increasing the recovery of those materials expected to grow will require increased investment into the recycling and composting systems from collection to end markets. Private investment and sound extended producer responsibility for packaging may be two strategies to help meet funding needs, but limiting innovation based on private investment and enterprise may hinder the ability to leverage the actual value of a circular

economy. Federal investment into programs like REMADE[15] and BOTTLE[16] is instrumental in uncovering the emerging science and data we need to drive efficiencies across packaging design and waste management. A collaborative dialogue based on understanding packaging trends to explore how we can better support innovations to advance the circular economy may be beneficial in directing research and development funding for packaging recovery.

Recent legislation such as Save Our Seas 2.0[17] and the RECOVER[18] Act also provide funding for increased recycling. The EPA's SWIFFER grant funding[19] is an outcome of these efforts. Linking research into packaging trends with funding for recovery could help ensure funds are directed towards opportunities to support the shifts in packaging rather than funding recycling as it exists today.

While composting legislation has been introduced, more legislation still needs to be passed to support investment into growing this infrastructure.

With an increased recognition of the value domestic recovery can have on our environmental and economic impacts in the US, linking funding with proactive insights into the future of material use can help ensure limited resources are directed towards proactive solutions.

4.6 – IMPROVED DATA COLLECTION

The intent of a circular packaging economy is to reduce environmental impact and increase efficiency through material reuse. To understand the impact of interventions toward this goal, consistent data collection is needed to effectively measure and benchmark performance. At the current time, differences in definitions, variability in services, different measurement tools or timelines, and a lack of standard infrastructure hinder our ability to assess the impact and benchmark performance. Legislation to help provide a common framework of data through which stakeholders could evaluate and determine impact could significantly advance system effectiveness.

The U.S. Environmental Protection Agency (EPA), through its sustainable materials management (SMM) division, has attempted to quantify the waste US consumers and industry produce, recycle, compost, or incinerate, but discrepancies exist between state reporting. Additionally, private versus public facilities and the challenges mentioned above have made this report difficult to standardize and produce in a timely manner. The last update to the SMM waste study was based on 2018 data, providing us with a backward look at packaging and recovery success.[20] Better systems to collect and share data could significantly impact timely interventions.

4.7 – REUSABLES INFRASTRUCTURE

There is significant interest from policymakers and the environmental community in leveraging reusable packaging as a strategy to reduce cumulative packaging and material demand. Reusables are a disruptive innovation that will significantly impact the packaging system and require considerable new infrastructure. Success in leveraging reusable packaging will require investments to redesign distribution systems, more dialogue on how we can provide safe and hygienic drop-off or pick-up collection points that are convenient to consumers, and frank discussions on who finances and how to provide the infrastructure and funding needed for industrial cleaning and product-refilling. Currently, the costs and development of new systems make this a daunting challenge for many packaging companies to scale at the level required to have a significant impact.

A collaborative strategy that incentivizes innovation in this area while at the same time planning for the development of a new system of infrastructure is needed. Understanding the challenges and opportunities will require a wide range of stakeholders to avoid unintended consequences.

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[15]Reducing Embodied Energy and Decreasing Emission (REMADE) is a research institute funded by a public private partnership under the leadership of the Department of Energy. REMADE seeks to support research into new technologies and processes to increase the recovery of materials.

[16]The Bio-Optimized Technologies to keep Thermoplastics out of Landfills and the Environment (BOTTLE™) consortium is another Department of Energy initiative design to advance research into how we can use catalytic and biocatalytic processes to increase plastic recycling.

[17]Save our Seas 2.0 was passed in 2020. The Bill aims to reduce and clean up plastics in marine systems. Funding is available for domestic recycling infrastructure and research on waste management and mitigation.

[18]The RECOVER Act provide funding to establish a recycling infrastructure program within the US Environmental Protection Agency (EPA) with the intend

[19]The EPA's Solid Waste Infrastructure for Recycling (SWIFER) Grant program (offers funding to recycling programs to support infrastructure investment as well as data collection on recycling.

[20]Advancing Sustainable Materials Management: Facts and Figures Report (2020) EPA

CONCLUSION

Packaging design is a complex process that requires balancing various processes, attributes, and systems. While our data demonstrates that packaging designers are acutely interested in sustainable packaging, and want to support circularity, they must balance these objectives against multiple variables such as price, safety, distribution requirements, material availability, and overall environmental impact.

Based on our ten-year forecast and materials sales projections, plastic packaging, particularly flexible plastic pouch formats, will continue to grow and represent an increasing portion of the packaging waste stream. Although technically recyclable, flexible packaging is not widely recyclable in practice because very few Americans have access to convenient and consistent recycling for flexibles due to the challenges in sorting flexibles within municipal recycling facilities. Innovation and investment are needed to help improve this process as well as to help expand the available end markets where these materials can be sold. This is an area where the benefits of design with flexible packaging need to be balanced with innovation in recovery.

Our survey indicates that demand for recycled content, particularly in paper and plastic packaging, will continue to grow. Packaging designers understand the environmental value of recycled content offers and want to use this material. Their biggest challenge is gaining access to sufficient materials of high enough quality to meet both packaging and, where applicable, food contact requirements. In addition to applying design strategies to simplify packaging for increased recycling, improving the collection, sortation, and reprocessing technologies for these materials could also significantly impact supporting corporate goals for recycled content and stimulating a domestic recycling community.

The promise of compostable packaging is enticing, and while demand for this material appears to be high, the size of the compostable packaging market versus other materials remains small. However, the potential for compostable packaging to help divert food waste from landfill and into composting, which has a significantly decreased environmental impact, should be reason enough to conclude that the value of compostable packaging comes both in its use and its end of life. Investments in the compostable packaging collection and processing infrastructure are lacking and must be addressed if we want to realize the potential of this format.

Overall, these three trends may point to different design strategies and materials, but when we examine their collective needs for recovery and accompanying legislation, we find they all share common needs. By focusing on how best to invest in recycling and composting infrastructure across the U.S. and tying that dialogue into what is happening with packaging design and the multiple variables packaging designers must balance, we can create a more effective system. If we can get packaging designers and recyclers to share their challenges and opportunities, we can collectively design systems that incorporate an understanding between all parties in the packaging value chain. Changes in one area of that chain can impact others downstream; for example, changes to packaging design can alter how packaging machinery supports the new format, changes in distribution may impact how we design for protection, and changes in materials might help or hinder how we recover. Collaboration across the value chain will help us innovate for success.

It is our hope that starting a dialogue on packaging design trends will help packaging stakeholders with the foresight to identify the most effective legislative and investment strategies to support our shared goal for packaging circularity. As EPR for packaging is adopted in the U.S., and the federal government has begun a national dialogue on recycling, suggesting that this is the right time to push the need for dialogue on design needs, so we can create a circular packaging system that meets all our goals.

PART 5

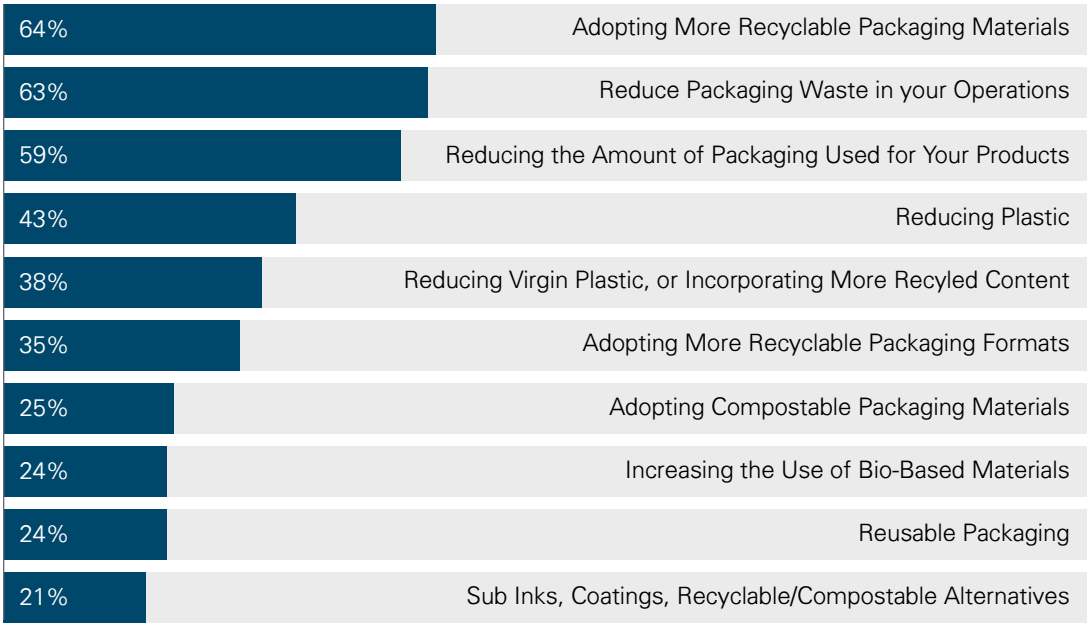
APPENDIX

The following charts show the raw numbers from the survey. There is no additional statistical analysis done to these charts other than show the number of responses provided per question.

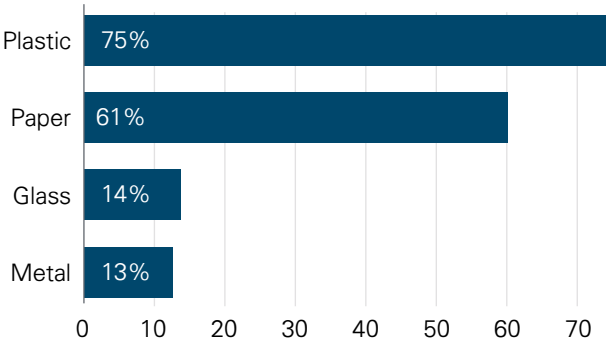
Not of all these questions were included in the report write-up but they all informed our findings.

A total of 394 CPG brands or retailers responded. Survey participants had the opportunity to skip questions or only respond to a few elements within a question. This means not all answers will reflect the sum of all participants.

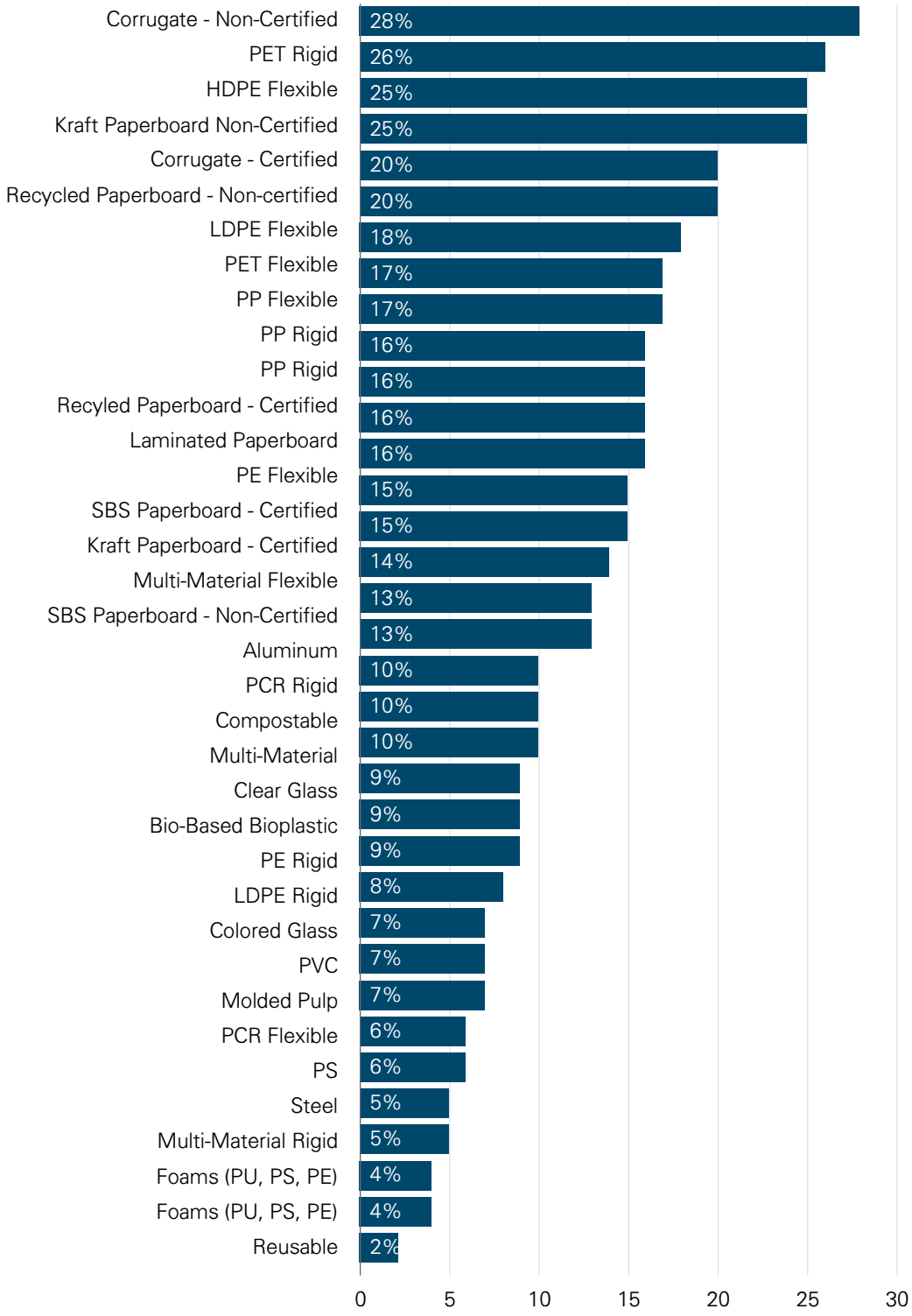
Please rank in order of importance the packaging sustainability design strategies chosen by your company?



What materials do you mostly use in your packaging operations? (select all that apply)



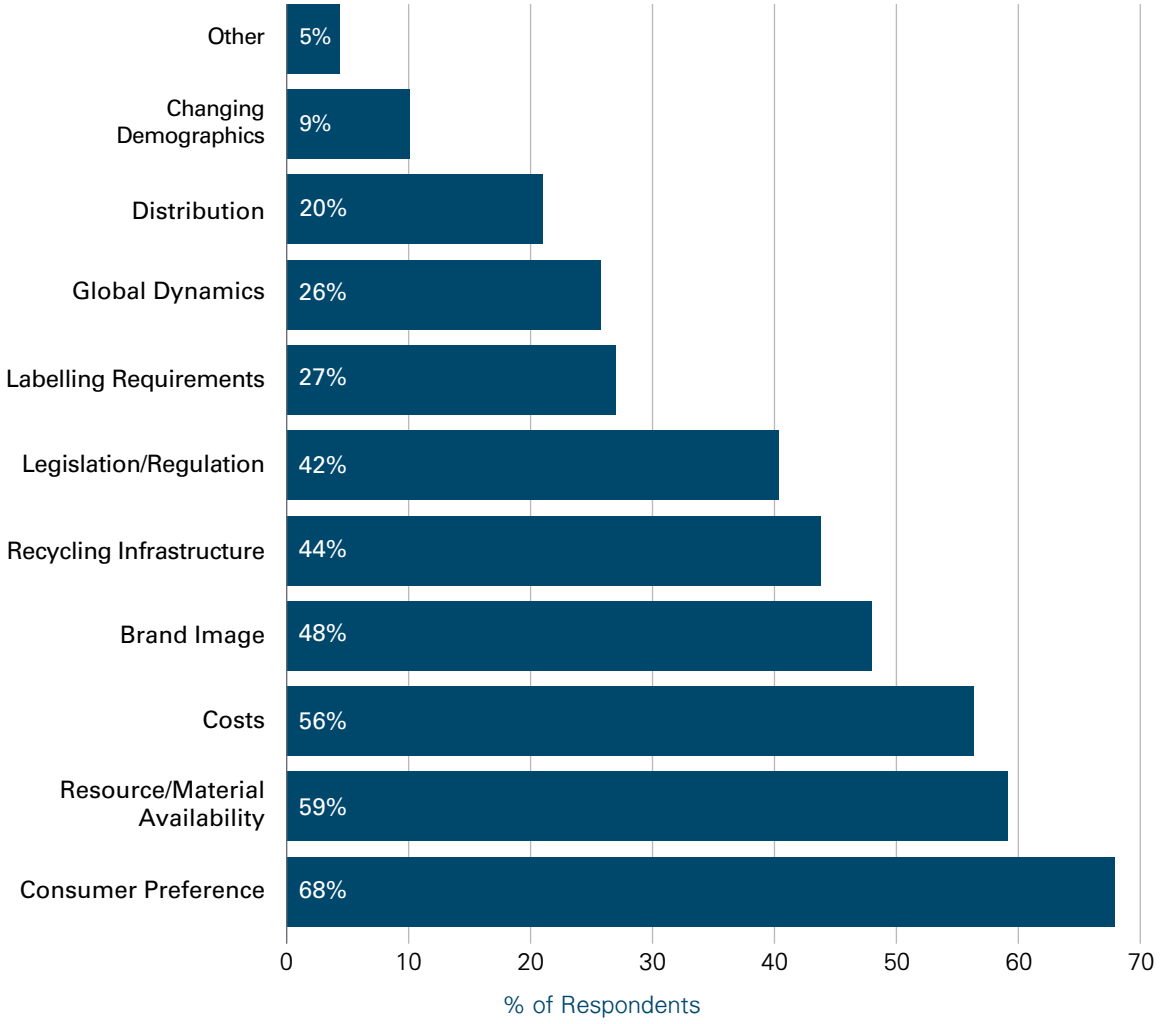
What materials are you currently using or planning on using in the future?



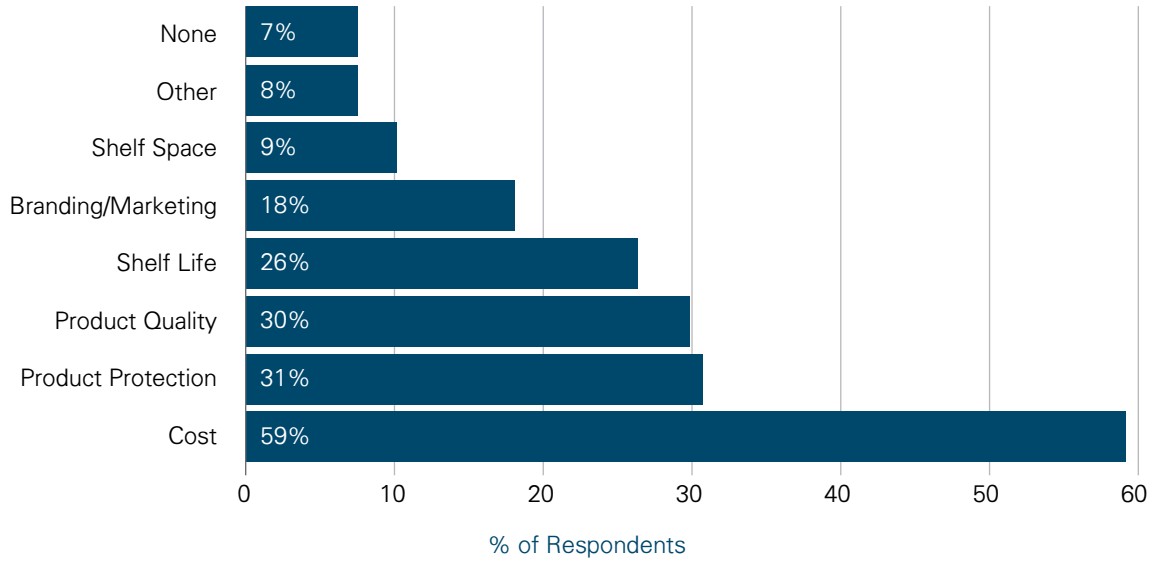
Which, if any, of your selected materials are you planning on replacing, and how will this material be replaced over the next three, five, or 10 years?

Existing Materials Used in Packaging	Total Materials Usage		
	3 Year	5 Year	10 Year
Compostable	27%	41%	72%
SBS Paperboard - Certified	32%	28%	34%
Kraft Paperboard - Certified	26%	27%	32%
Bio-Based Bioplastic	25%	27%	29%
PCR Rigid	19%	24%	27%
Recycled Paperboard - Certified	18%	21%	24%
Corrugate - Certified	25%	25%	21%
PCR Flexible	14%	16%	16%
PE Flexible	19%	14%	12%
PET Rigid	21%	18%	12%
Molded Pulp	6%	4%	7%
Reusable	-4%	-4%	6%
HDPE Flexible	13%	12%	3%
Aluminum	12%	7%	3%
Colored Glass	6%	3%	3%
Multi-Material Rigid	2%	2%	1%
Multi-Material	-1%	1%	1%
PE Rigid	-3%	-2%	-2%
Recycled Paperboard - Non-Certified	7%	-6%	-3%
Steel	1%	3%	-3%
Clear Glass	6%	2%	-4%
HDPE Rigid	10%	0%	-5%
Laminated Paperboard	-9%	-9%	-5%
PS	-8%	-7%	-9%
LDPE Flexible	8%	1%	-10%
Foams (PU, PS, PE)	-7%	-9%	-12%
Corrugate Non-Certified	8%	7%	-13%
LDPE Rigid	-1%	-10%	-15%
PET Flexible	1%	-6%	-15%
SBS Paperboard - Non-Certified	-6%	-9%	-15%
PP Rigid	-8%	-11%	-16%
PP Flexible	7%	-11%	-16%
Kraft Paperboard - Non-Certified	-5%	-9%	-20%
Multi-Material Flexible	-10%	-5%	-22%
PVC	-18%	-19%	-25%

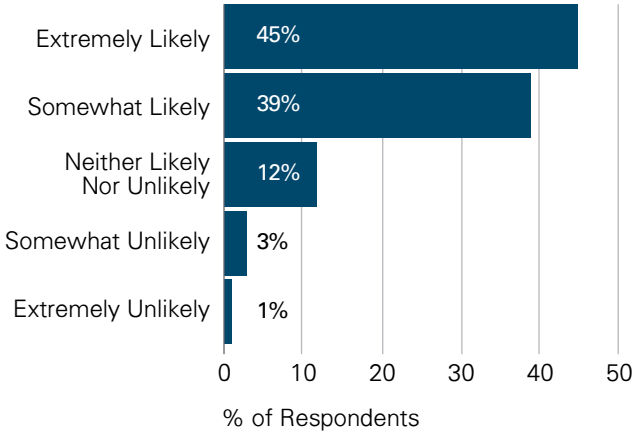
What are some of the key factors that are influencing your 10 year outlook (select all that apply)



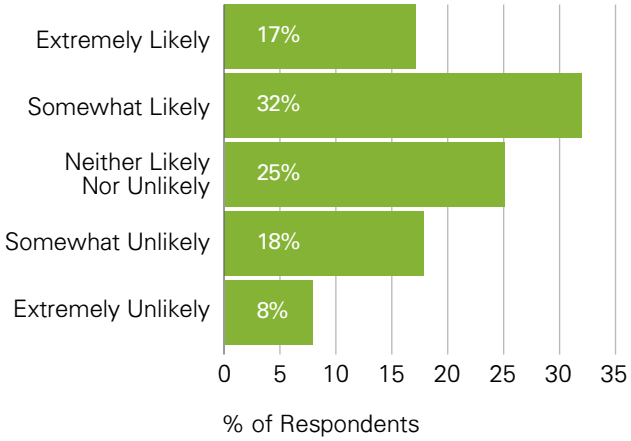
In adopting sustainable packaging, what trade-offs, if any, do you see the most?



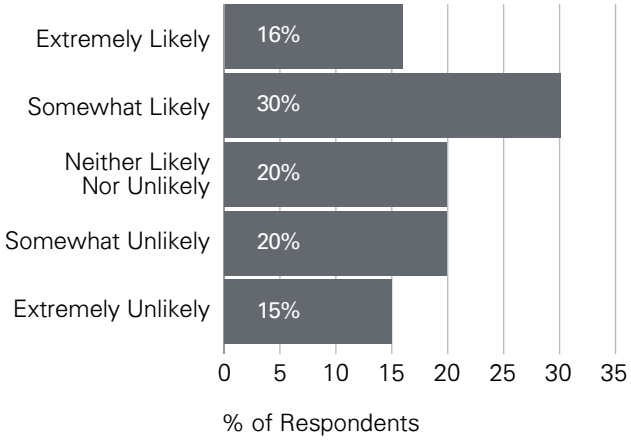
What is the likelihood that your company will increase the use of *recyclable packaging* material within the next five years?



What is the likelihood that your brand will increase the use of *compostable packaging* within the next five years?

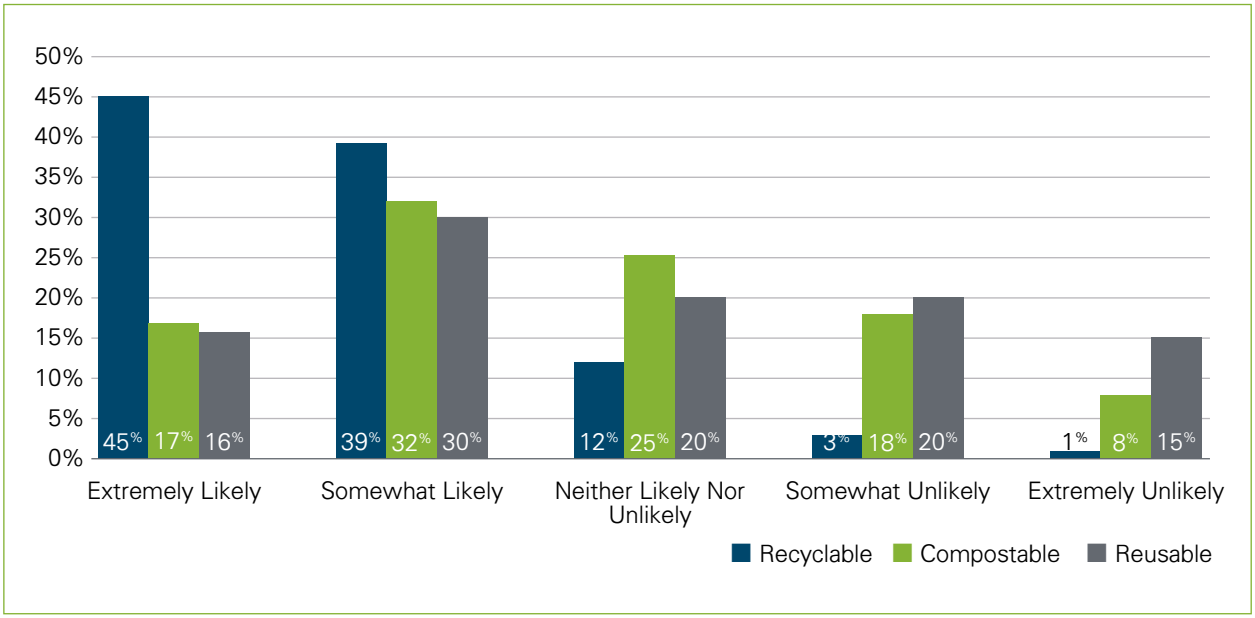


What is the likelihood that your brand will increase the use of *reusable packaging* within the next five years?



To help compare between packaging strategies, we blended data from all three packaging formats into one chart to better compare against one another

What is the likelihood of applying recyclable, compostable or resusable strategies within 5 years



MATERIAL DEFINITIONS

Respondents to this study were provided definitions to help provide clarification on how we define materials or attributes. The following definitions were provided in our survey:

Recyclable: Recyclable refers to the series of activities by which discarded materials are collected, sorted, processed, and converted into raw material and returned to the economic mainstream by being used in the production of new products. Does not include the use of these materials as a fuel substitute or for energy production.

Reusable: The claim that a product or packaging is reusable or refillable shall only be made where: 1. A program exists for collecting the used product or packaging and reusing or refilling it; or 2. Facilities or products exist that allow the purchaser to reuse or refill the product or package.

Bio-based: Biobased materials refer to products that mainly consist of a substance (or substances) derived from living matter (biomass) and either occur naturally or are synthesized, or it may refer to products made by processes that use biomass.

Compostable: Compostable refers to the series of activities by which discarded materials are collected, processed, and converted into usable compost in a safe and timely manner. Additionally, materials/products meet applicable compostability standards.

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