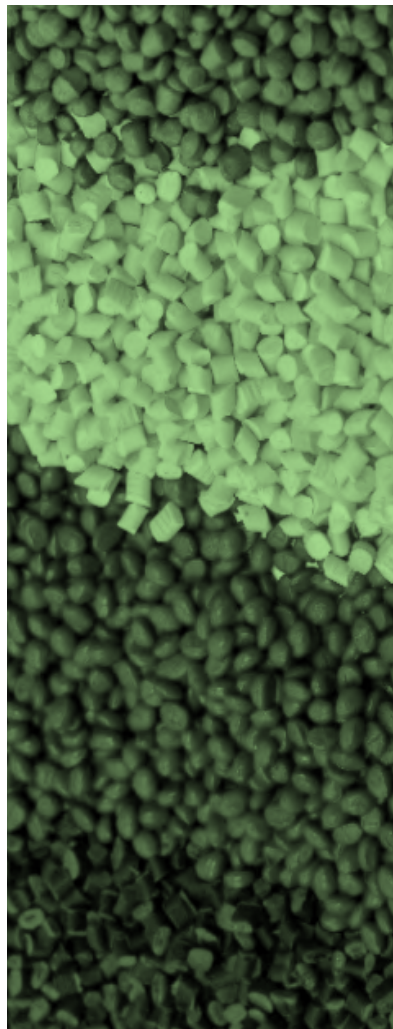


STRATEGIES FOR SUSTAINABLE PLASTIC PACKAGING IN INDIA

A USD 100 Billion Opportunity till 2030

FICCI CIRCULAR ECONOMY SYMPOSIUM 2020

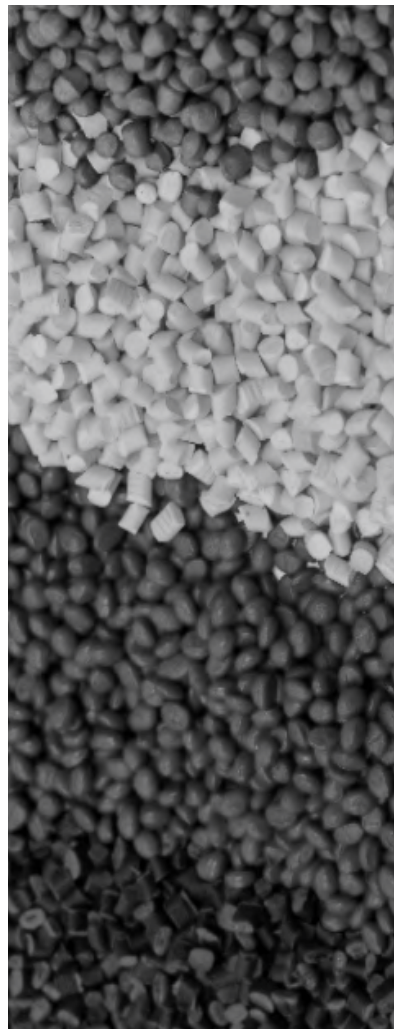




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Foreword

Our economy today is passing through a challenging phase. We are dealing with an unprecedented global pandemic, which threatens to slow down the economic growth in the near-term. According to the estimates recently released by the Ministry of Statistics and Programme Implementation (MoSPI), the nation-wide lock-down resulted in a 23.9 percent drop in India's GDP during the April-June quarter (Q1). The pandemic is also putting new demands and expectations on the industries to reinvent themselves to ensure economic viability and sustainability of their operations.

It is in this context, that this year's National Circular Economy symposium organized by FICCI and the topic for this theme paper (Sustainable Packaging) assumes even greater relevance than ever before. Consider for instance the fact that to combat the COVID challenge, India has emerged as the second largest manufacturer of PPE kits globally. This brings along with it the added responsibility to ensure sustainable disposal of used PPE kits, which includes a large share of plastics waste.

The industry has already embarked several initiatives to adopt sustainable packaging and waste management principles. For instance – under Atmanirbhar Bharat program NITI Aayog launched a challenge for Indian startups and MSMEs to develop alternative food packaging to replace single-use plastics; in June 2020, MoEFCC invited multi-stakeholder comments on the draft Uniform Framework for Extended Producers Responsibility. Given the enormity of the plastic waste challenge, there is a distinct need to scale-up the ongoing efforts and devise innovative mechanisms to address the challenge. While the policy measures provide an enabling environment, the onus is on diverse stakeholders - including Government, businesses, NGOs, and citizens – to co-create sustainable and scalable solutions.

I am happy to introduce this joint knowledge paper released by FICCI and Accenture which outlines a roadmap to transition towards sustainable packaging regime in India. The study identifies an economic value worth ~USD 10bn and several sustainability benefits realizable through sustainable packaging interventions. The study not only quantifies the economic value at stake but also calls out an end-to-end approach and potential interventions to help the industry accelerate its journey towards sustainable packaging.

I would like to congratulate FICCI and Accenture for taking the initiative to develop this well-researched and informative theme paper. I am confident that this study would serve as a good reference document to identify potential interventions with respect to plastics waste management. I would encourage the diverse industry stakeholders to leverage this paper to inform their sustainable packaging strategy and identify potential interventions where they can play a part in accelerating India's Circular Economy agenda through the lens of sustainable packaging principles.



एक कदम स्वच्छता की ओर

(Amitabh Kant)



Dilip Chenoy
Secretary General



PREFACE

FICCI and Accenture have been working together closely for the last three years to strongly emerge out as thought leaders on the topic of circular economy in India. Building on our seminal work on demystifying CE principles and outlining underlying opportunity for India in 2018 and highlighting actionable insights while making plastics circular in 2019, we are pleased to share this year's study on Sustainable plastics packaging.

Despite COVID-19 disruptions, FICCI and Accenture Strategy worked hard closely for over six months under guidance from FICCI's National Circular Economy Committee, comprising of eminent sustainability leaders in this space. The paper provides a toolkit to Indian industry to transition from plastic waste management mindset to a value-chain-based sustainable packaging mindset, focusing on both upstream design and production interventions as well as downstream recycling interventions.

In the proposed Sustainable Plastic Packaging Strategy, we have identified three levers which lend themselves into eight interventions, with potential to reduce value loss from unsustainable choices by almost ~100 bn USD in the next ten years. The quantitative modelling conducted is first-of-its-kind done in the Indian context and I praise applaud the team for setting a data-backed narrative.

To act on these eight interventions, industry needs to work pre-competitively and with policymakers to create the enabling environment. To that end, paper has also articulated five big-ticket system-level accelerators which will go a long way in pacing-up the shift.

The paper also deep-dives into the impact of COVID-19 on plastic packaging and waste management landscape, a very critical topic for all our members in these unprecedented times.

We would like to take this opportunity to thank Accenture Strategy and all the organizations that have contributed to this critical study. We hope their efforts and contributions, as captured through this study, will pave way for the much-needed transformation and impact at scale in the coming years.

Dilip Chenoy

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PREFACE FROM ACCENTURE



Sanjay Dawar
Managing Director
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Vishvesh Prabhakar
Managing Director
Accenture



Sundeep Singh
Principal Director
Accenture

Over the past decade businesses have been operating in an increasingly complex environment, which has been further exacerbated by the ongoing COVID pandemic. There is a growing need to efficiently respond to the rising resource constraints while also responsibly addressing a myriad of social and environmental challenges. Succeeding in such an environment requires businesses to reimagine their business models and find innovative solutions to several intricate and interconnected challenges.

It is in this challenging context that circular business models have gained greater prominence than ever before. These models offer a window of opportunity for businesses to create shareholder value while embracing the principles of responsible business. Accenture's work in the previous editions of Circular Economy Symposium revealed almost half-a-trillion-dollar worth of India's GDP value at risk by 2030, which could be protected through adoption of circular business models. In this edition, we turn our attention to the specific challenge of plastic packaging waste and apply the principles of circular economy to identify viable solutions in the Indian context.

Packaging as an application accounts for a major share of unmanaged plastic waste in India. Traditionally, the actions taken to manage plastic waste in India have largely been focused on post-consumer plastic packaging. This represents just a part of the overall solution. Our analysis reveals that there is almost \$133 bn worth of plastic material value that will be lost in the next 10 years till 2030 due to unsustainable packaging in India. Almost 75% of this, i.e. \$100 bn worth of this value can be recovered through interventions proposed in this paper.

The paper presents a holistic approach to sustainable packaging, one that spans across upstream design & production phase, use-phase, and post-consumer collection & recovery phase. Our endeavor is to equip the organizations with an end-to-end reference framework capturing the wide spectrum of potential interventions along with their impact potential and critical success factors as relevant in the Indian context.

Accenture would like to express its sincere gratitude to all the participating organizations for their valuable contributions and insights during this study. This study couldn't have been completed without their valuable support. We would also like to thank Peter Lacy, our Global Sustainability Lead, for his unwavering commitment to the Circular Economy agenda globally. His recent book "The Circular Economy Handbook: Realizing the Circular Advantage" has been a hugely valuable reference point throughout this study. Peter's work continues to serve as a huge inspiration for us to dive deeper into the Circular Economy opportunities for India.





1

EXECUTIVE SUMMARY

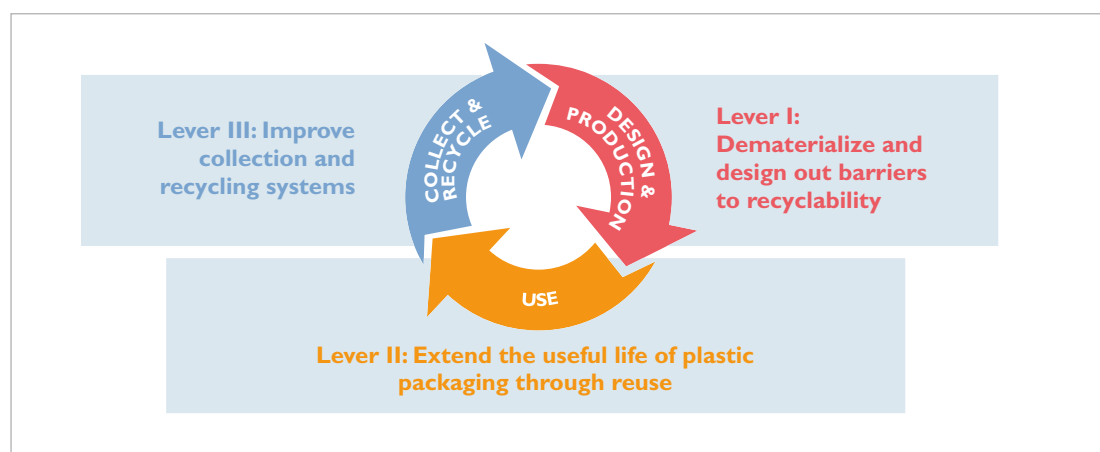
1. EXECUTIVE SUMMARY

Packaging as an application is one of the largest consumers of plastics and accounts for a major share of unmanaged plastic waste in India. Traditionally, the actions taken to manage plastic waste in India have been focused on post-consumer plastic packaging. This is just a part of the overall solution.

Our value assessment of the total plastic packaging material put in the Indian market highlights an estimated \$133 billion worth of material value loss till 2030 in the business-as-usual case

This paper calls for a holistic approach towards sustainable packaging, one that spans across (i) Upstream design and production actions, (ii) Use-phase interventions, and (iii) Post-consumer collection and recovery. The paper recommends a three-pronged approach customized to Indian context that can help us achieve circularity within plastic packaging.

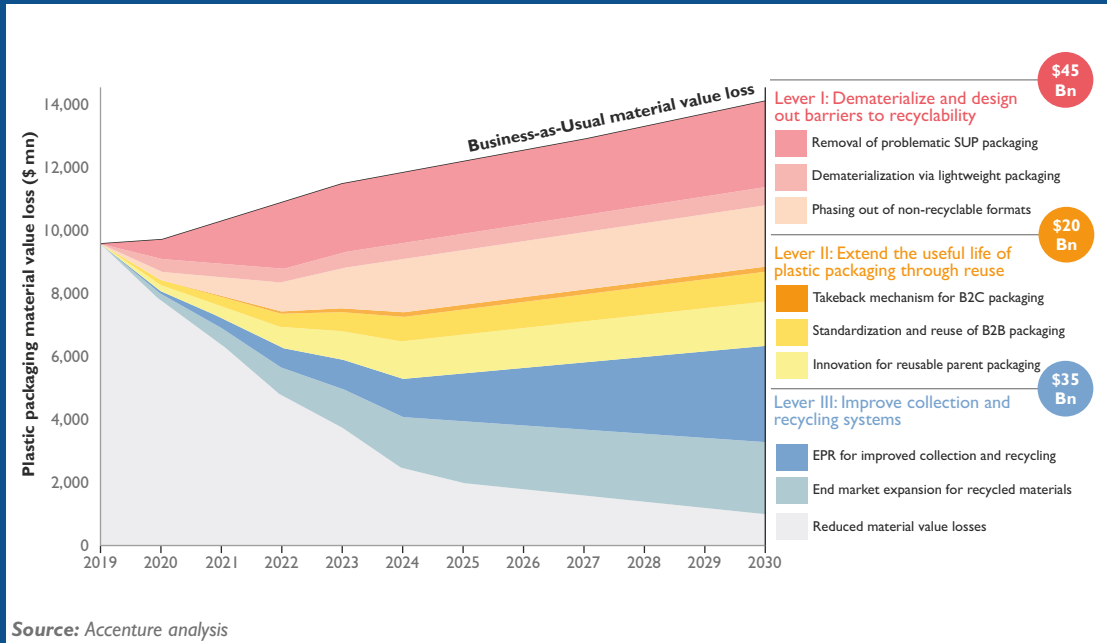
Figure I: Three-pronged approach towards sustainable plastic packaging



Across these three levers, the paper identifies eight high potential interventions that present credible pathways to reduce the current material value loss of \$9.5 billion per year in 2020 to less than \$1 billion per year in 2030, despite the increase in plastic packaging consumption over the next ten years.

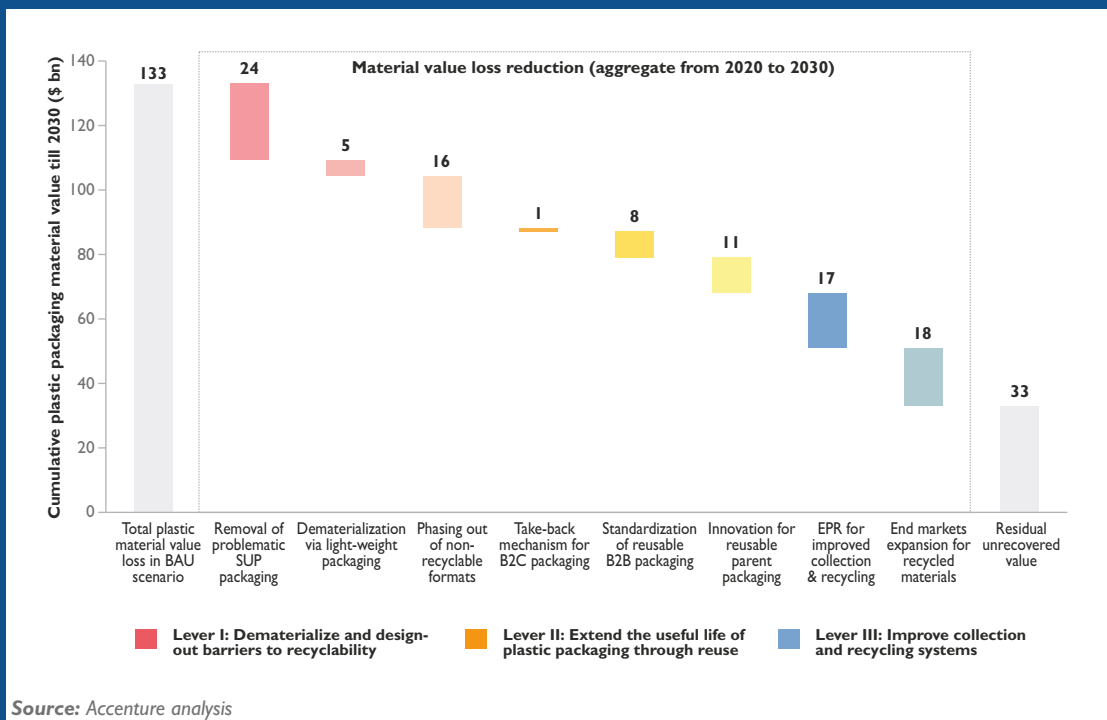
Our modelling based on quantification of the material value loss, a function of input tonnage and output prices, shows that upstream interventions have the highest potential during 2020-2030 horizon. However, it must be emphasized that all interventions are critical to pivot towards sustainable packaging.

Figure 2: Sustainable plastic packaging pathways for India (2020-2030)



At an aggregate level, the interventions highlighted in this report present a potential \$100 billion opportunity to reduce the material value loss over the next ten years till 2030.

Figure 3: Aggregate material value recovery opportunities (2020-30)

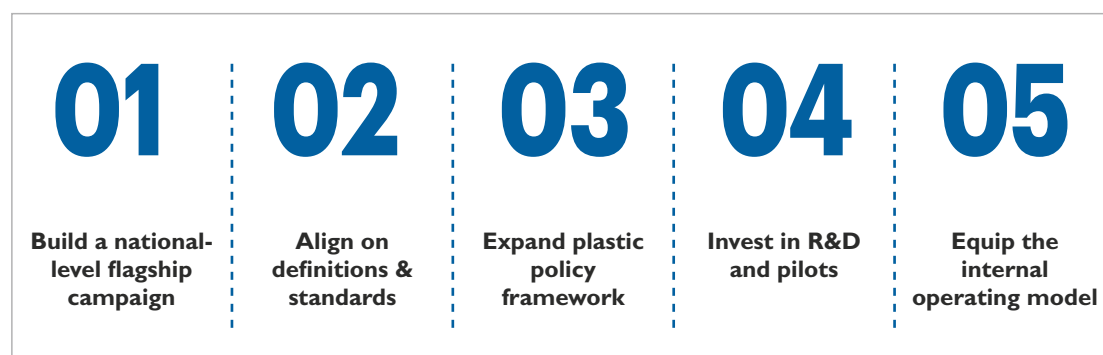


The unprecedented era of disruption caused by the COVID pandemic has impacted all industries in diverse ways and packaging industry is no exception. The paper highlights three key trends that will at least temporarily impact the progress with respect to shift to sustainable packaging. These are:

- ▶ Disruption in plastic recycling economics due to supply-side (resulting from labor and feedstock shortages due to lockdowns) and demand-side (due to dropping virgin plastic prices) shocks.
- ▶ Short-term realignment of private-sector sustainability focus, such as delays in fulfilment of packaging-related public commitments, has created an atmosphere of uncertainty.
- ▶ Shifts in characterization of packaging consumption and plastic waste due to increase in the consumption of packaging used in hygiene products, growth in e-commerce packaging demand, and introduction of new waste streams (e.g. plastic used in PPE kits).

The paper calls out short, medium and long-term action plan for the Indian companies to accelerate the shift to sustainable packaging. While most of these actions will have to be owned by consumer-packaged goods industry, support from upstream polymer manufacturers and converters as well as downstream PROs and plastic recyclers would be critical. The paper also highlights five key accelerators to drive a systemic pivot to sustainable packaging. Many of these will require an ecosystem-led approach underpinned by collaboration across government agencies, businesses and non-profits.

Figure 4: System-level accelerators for sustainable plastic packaging strategy







2

SETTING THE CONTEXT: THE GLOBAL NEED FOR CHANGE

2. SETTING THE CONTEXT: THE GLOBAL NEED FOR CHANGE

Packaging as an application is one of the largest consumers of plastic, given its unique properties as compared to available alternatives

Plastic has several unique properties which makes it the material of choice for the packaging industry as compared to alternatives. For instance, it's a relatively low-cost material which is easily moldable, chemically resistant, lightweight and has a high strength-to-weight ratio. Due to these properties, plastic finds much greater application in the packaging industry vis-à-vis alternatives such as glass, metal and paper. Interestingly, contrary to the general perception plastic also has some environmental benefits. For instance, a life-cycle assessment study revealed that plastic packaging could reduce environmental costs by nearly 4 times as compared to its alternatives.¹ These environmental benefits are attributable the plastic's high strength to weight ratio which allows it to perform similar packaging functions with much smaller material consumption by weight (thereby compensating for its higher environmental cost per kilogram compared to alternate packaging materials).² As a result, packaging applications have emerged as one of the biggest consumers of the plastic produced, contributing to 59% of India's total plastic consumption.³

However, despite these desirable properties, mismanaged plastic packaging leads to negative environmental externalities

- ▶ **Disposal complexities:** Plastic's durability which makes it attractive to use is also the reason for its complicated disposal. Some plastics do not decompose at all while others take up to 450 years to break down. Approximately 70% of plastic packaging (mostly meant for single use) converts into waste in a short span. This implies that before the plastic waste degrades naturally, more plastic waste is introduced creating complexities with respect to waste handling.

Message from Chair, FICCI National Circular Economy Committee

The understanding of possibilities and solutions in circular economy is evolving rapidly. As long as we have reminders like the Pacific plastic patch, plastic refuse on our beaches and clumps of plastic infested garbage in pristine places like the hills, we know we must find a way to live better with the wonder material.

This paper has two major contributions : First, it explores options at the production stage so that the issue is addressed at the root. Shining a light on possibilities creates the opportunity to mainstream ideas faster.

Second, it uses data to depict the relative impact of interventions across the value chain and does not depend on directional statements. Interestingly, big-ticket opportunities exist across the value chain in upstream, use-phase, collection and recycling interventions.

Given the size of the problem we are facing and the fact that the situation is getting worse every minute, we should accelerate the implementation of the interventions that can be done right away! This paper articulates five enablers that could help make responsible production, consumption and recycling of plastics a reality.

The paper is brought to you by FICCI's National Circular Economy Committee and has been made possible by the diligence and insight of its knowledge partner, Accenture.

Anirban Ghosh

Chair, FICCI National CE Committee & Chief Sustainability Officer, Mahindra

- ▶ **Ocean plastic leakage threatening marine and human health:** One of the major impacts of single-use plastic packaging and improper disposal is plastic ocean pollution which threatens marine life, spreads toxins, and threatens human health. Approximately 150 million metric tons of plastic is circulating in oceans and at least 8 million tons of plastics leak into the ocean each year, which is equivalent to dumping the contents of one garbage truck into the ocean every minute. If we fail to act, over 250 million tons of plastic will be circulating in ocean by 2025, with widespread environmental, social and economic implications. A large proportion of this leakage (about 62%)⁴ is estimated to be plastic packaging waste. Subsequent disintegration into microplastics can further lead to plastic entering food chain, thereby adversely affecting human health.
- ▶ **High carbon footprint:** More than 99% of plastic production is reliant on fossil fuel. As a result, plastics have carbon-intense lifecycles as greenhouse gases are emitted at each stage of the plastic lifecycle starting from oil and gas extraction, transport, manufacturing of various forms of plastics, as well as during the end-of-life treatment. In 2019, the production and incineration of plastic resulted in more than 850 million metric tons of greenhouse gases. At the current growth rate, the global emissions from plastic production and incineration could increase by over 3x by 2050.⁵

Given the challenges associated with plastic packaging, there is an urgent need for action. This paper presents an end-to-end approach to help the industry pivot to a sustainable packaging regime. Before we delve into these solutions, we present a view of the state of plastic packaging in India.



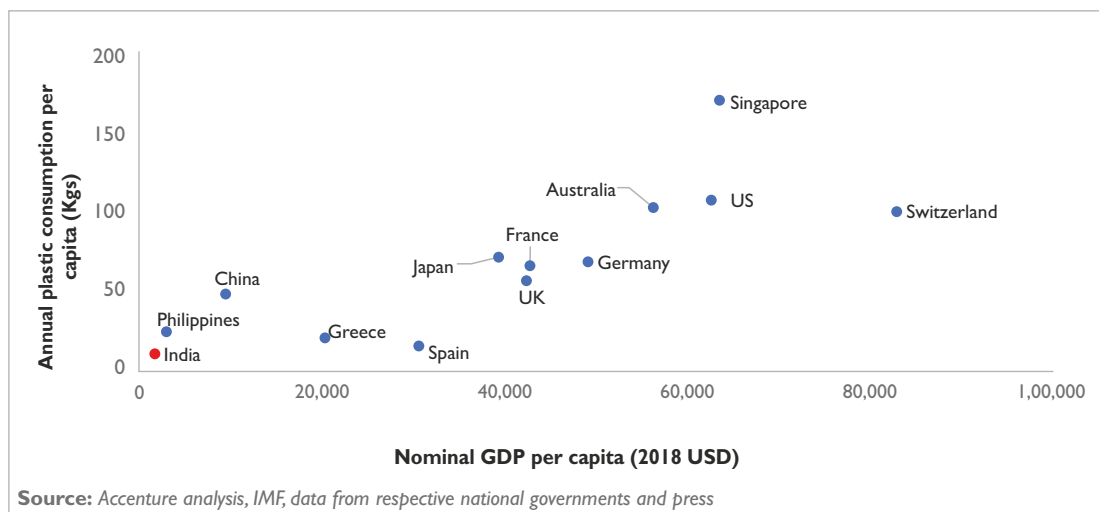
3

PLASTIC PACKAGING IN INDIAN CONTEXT: STATUS QUO

3. PLASTIC PACKAGING IN INDIAN CONTEXT: STATUS QUO

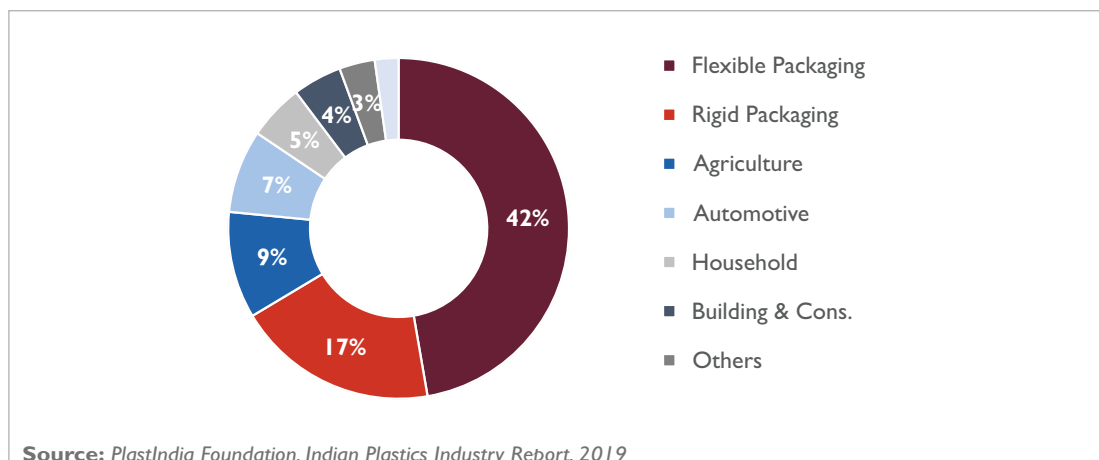
Currently, India has one of the lowest per capita consumption of plastic in the world, much lower than some of the most developed nations. India's per capita per annum consumption is 13.6 Kgs compared to the world's average of about 30 Kgs, about 2 times of India's per capita consumption.⁶

Figure 5: Traditional growth model – Strong linkage between plastic consumption and economic growth



The challenge is that the traditional growth model (i.e. where resource consumption is linked to growth) may result in a rapid increase in the annual plastic consumption. This could have significant implication in terms of the demand for plastic packaging as almost 59% of the total plastic consumed in India is used for packaging. In India, currently, packaging consumes ~10 million tons of plastic every year.⁷ This is estimated to grow in the future, as a result of growth in industries like pharmaceutical, FMCG, retail and others.

Figure 6: 59% of the total plastic consumed in India goes into packaging applications



India's plastic waste management ecosystem is characterized by its large informal sector and high volumes of low-value plastic packaging waste

In India, approximately 60% of plastic waste is collected for recycling and recovery, which is much higher in comparison to developed countries. The global average of plastic waste being recycled is around 15%, it is estimated to be 30% in most countries in the EU and only about 10% in the US.⁸ India does fairly better in this aspect due to the presence of a large informal sector workforce (comprised of both, individual waste pickers as well as waste traders) making a living by collecting, sorting, recycling, and selling valuable plastic materials recovered.

Roughly 15 lakh workers can be tagged as informal waste pickers and form 10% of the total waste-pickers around the world.⁹ Due to presence of this informal chain of waste-pickers and kabaadiwallas, plastic waste such as bottles, jars and containers find their way back into the reuse and recycling economy. High-value plastic like polyethylene terephthalate (PET) bottles and shampoo bottles, made of high-density polyethylene (HDPE), are sorted by waste pickers before the waste is taken to the dump-yard, but the low-value items like plastic carry bags, candy wrappers, tobacco and pan masala sachets, soap wrappers and shampoo sachets are ignored as they are either too difficult to collect or have very low market value.

Large informal sector dominates the waste management ecosystem in India

A research done by the United Nations Human Settlements Programme indicates that around 150,000 waste-pickers working in Delhi divert more than 25% of all waste generated in the city towards recycling channel, thereby leading to substantial savings for the municipal authorities. The report also indicates that out of approximately 33% of waste processed for either reuse, recycling, or composting, only 7% is attributed to the formal sector.

High-value plastic packaging waste is collected but not channelized through optimal pathways. Our analysis reveals that in business-as-usual case, \$133 bn worth of material value will be lost till 2030 to non-optimal pathways such as open loop recycling and thermal recovery

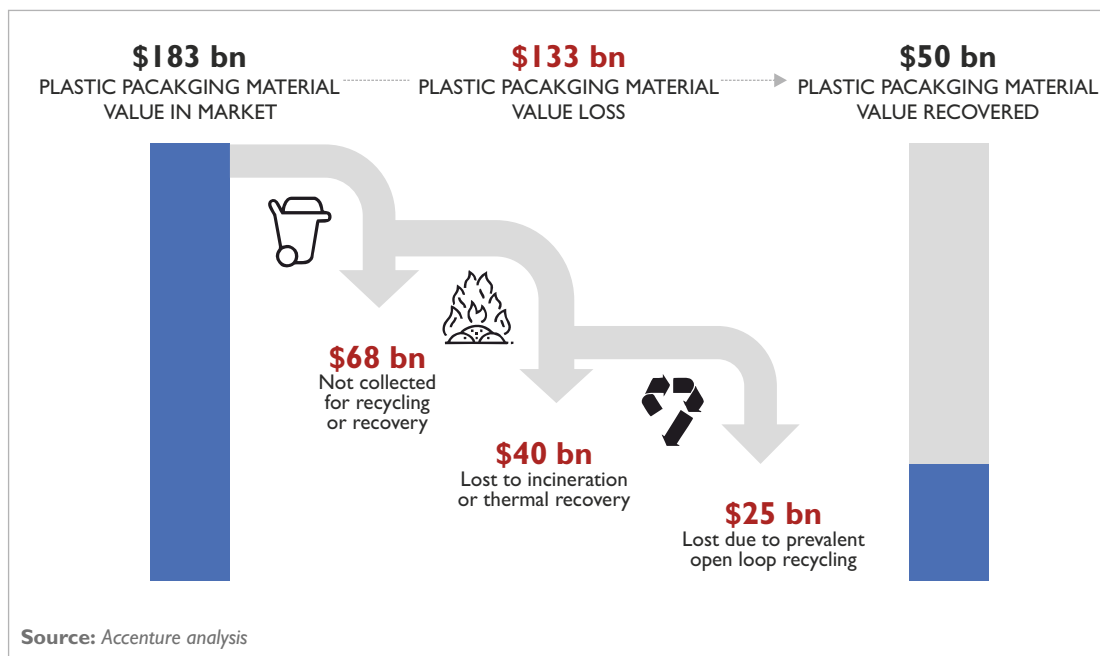
Our research estimates that in the next 10 years till 2030, 73% of the material value used in plastic packaging amounting to \$133 bn will be lost and never recovered.

- ▶ A large part of this loss, \$68 bn (~37% of total value), is attributable to uncollected plastic packaging waste. Often such plastic is dumped, littered, finds its way in the landfills or into nearby water bodies.
- ▶ Of the waste that will be collected for recycling, \$40 bn (~24% of total material value) will be lost due to the packaging being non-recyclable using existing recycling technologies. Such plastic packaging includes formats like multi-layered packaging, nutrient contaminated packaging, and very small formats used in packaging for example sachets. Most often, in India, such packaging items are used in thermal recovery applications for example in waste-to-energy plants, as RDF in cement kilns, or in construction of roads. Absorption of such

packaging by thermal recovery may be a quick win but couldn't be seen as long-term optimal solution.

- ▶ Additionally, our research also highlights that of the plastic packaging that is collected for recycling and is recycled, \$25 bn (~13% of total material value) will be lost due to prevalent open loop recycling (i.e. when the recycled material is used in lower grade plastic applications, for e.g. PET from beverage bottles being used in fibers rather than again in packaging bottles).

Figure 7: Business-as-usual assessment of material value loss from 2020 till 2030 for plastic packaging in India



Actions so far have focused on waste management aspect of plastic, driven by visible negative environmental externalities such as litter and landfills

The Indian government has taken several steps to mitigate the impact of plastic waste. For instance, in 2016, Extended Producer Responsibility (EPR) as a concept was introduced in the Plastic Waste Management Rules in 2016.¹⁰ In June 2020, the Unified framework for EPR proposed three implementation models which are under discussion stage. This includes system of plastic credit, through Producer Responsibility Organizations (PRO) and setting up a fee-based mechanism. The new draft framework also has provisions to impose stringent penalties on producers if they fail to meet their targeted collection. The government is pushing for more evidence-based mechanisms so that authorities can monitor how companies undertake EPR obligations.

In 2018, the Prime Minister pledged to eliminate all single-use plastic in the country by 2022. Post the announcement, local governments in many states had crafted legislation aimed at banning single-use plastic, mostly plastic shopping bags. These measures had mild impact, with some early positive results in few states. For instance, Maharashtra reported a 40% drop in plastic waste in the 7 months of such bans.

Private sector has also been focusing on the collection leg of the plastic waste management value chain, either collectively through PROs or through their own reverse logistics set-up. Priority has been on multi-layered plastics which are primarily being sent by PROs to cement plants for co-processing. But there is a need for coverage of all materials and formats, which can only come from the convergence of resources. To that end, large-scale projects are important. For instance, several beverage players (using PET as primary packaging material) have come together to launch a new entity with a planned investment of ~ \$130 mn.¹¹

Now is the time to take a more holistic view by expanding the focus to also include upstream design and material considerations as well as use-phase product delivery innovations

Sensing the shifts, leading companies have started to take steps upstream. They are making commitments that will fundamentally improve the sustainability of their packaging and push for circular economy.

Table 1: Recent plastic packaging related commitments

Company	Public commitments and targets
Unilever	<ul style="list-style-type: none"> Move to 100% reusable, recyclable or compostable plastic packaging by 2025 Reduce the use of virgin plastic packaging by 50 percent by 2025
Pepsico	<ul style="list-style-type: none"> Reduce the use of virgin plastic across its portfolio by 35% by 2025 Design all packaging to be recoverable or recyclable, and to support increased recycling of plastic waste
Marico	<ul style="list-style-type: none"> Target 100% recyclable plastic usage by 2025 and zero PVC in packaging by 2022 Reduce packaging consumption tons per unit crore revenue by 10% from FY20 base year
Dabur	<ul style="list-style-type: none"> Collect back 100% of the plastic waste that it generates through its product packaging Become a Plastic Waste Neutral company by the end of March 2021
Nestle	<ul style="list-style-type: none"> Target 100% recyclable or reusable packaging and reduce the use of virgin plastics by one third by 2025
ITC	<ul style="list-style-type: none"> Ensure that 100% of product packaging used is reusable, recyclable or compostable within the next decade

In order to meet these commitments, companies have already kicked-off pilots (for instance, to increase recycled content or to eliminate PVC) but there is need for fast scale-up. New ventures have emerged in the space of innovative packaging solutions, but they lack market viability due to weak demand. The need for change will become even stronger as end consumers become more aware. A recent global survey by Accenture found that 83% consumers believe that it's important for companies to design products that are meant to be reused or recycled.¹² Additionally, more than half consumers said they would pay more for sustainable products designed to be reused or recycled.

But moving beyond ad hoc reactionary projects, Indian companies, from polymer manufacturers and convertors to FMCG and retailers, need to take a strategic lens. To enable that, this paper lays out a comprehensive approach to sustainable packaging, one that spans across (i) Upstream design and production actions, (ii) Use-phase interventions, and (iii) Post-consumer collection and recovery. In the following section, we present a three-pronged strategy which can serve as a reference toolkit for industry and policymakers.



4

A THREE-PRONGED SUSTAINABLE PACKAGING STRATEGY

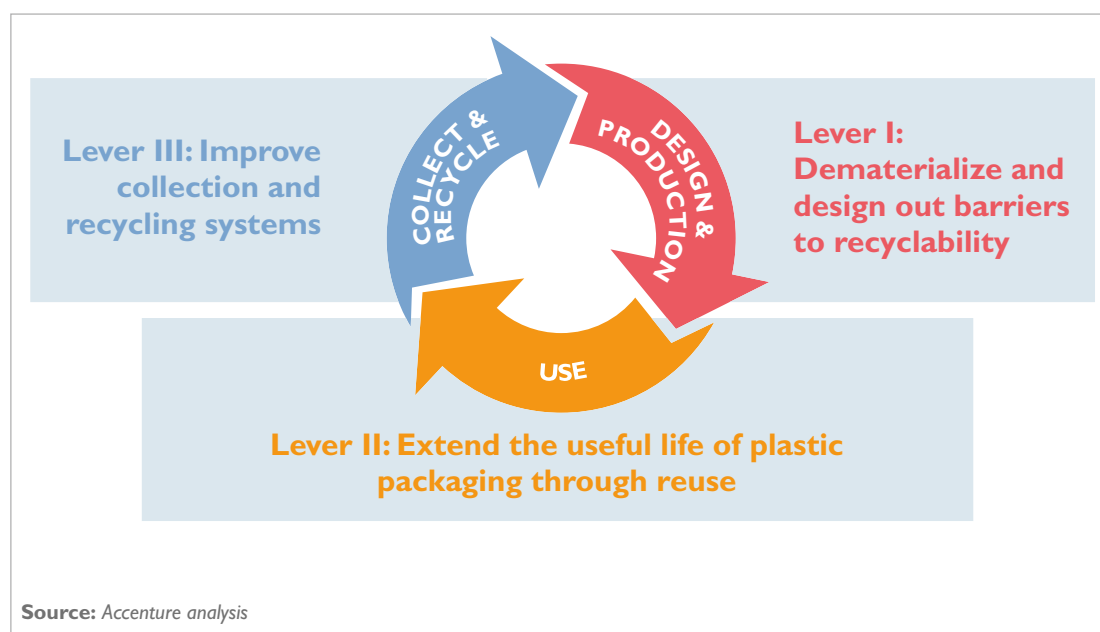
4. A THREE-PRONGED SUSTAINABLE PACKAGING STRATEGY

Traditionally, the actions taken to manage plastic waste in India have largely been focused on post-consumer plastic packaging waste collection. However, this represents just a part of the overall solution. This paper calls for a holistic end-to-end circular approach to sustainable packaging, one that spans across upstream design and production actions, use-phase interventions, and post-consumer collection and recovery.

In line with the principles of circular economy, the study outlines a three-pronged approach - (i) Dematerialize & design out barriers to recyclability, (ii) Extend the useful life of plastic packaging through reuse, (iii) Improve collection and recycling systems.

Our study shows that targeted interventions across these three levers can help recover almost 75% of the projected packaging material value loss in India till 2030. This aggregates to approximately \$100 bn worth of material value the industry can realize through sustainable packaging interventions

Figure 8: Three-pronged approach towards sustainable plastic packaging



4.1 DEMATERIALIZE AND DESIGN-OUT BARRIERS TO RECYCLABILITY

The plastic packaging industry is highly reliant on oil and gas - a non-renewable fossil-based feedstock. Only 0.8% of the plastic packaging is manufactured using renewable bio-based feedstock.¹³ From a resource conservation perspective to avoid material value loss, especially of non-renewable resources, the first step is to reduce their consumption at source and remove any barriers that prevent material recovery at later stages.

- ▶ Dematerialization is the act of optimizing, reducing or even eliminating plastic packaging use while maintaining the same utility. Lower material consumption in turn leads to lower material loss of non-renewable resources.
- ▶ Designing out non-recyclable packaging elements helps improve the quality of packaging waste stream thereby enhancing the recovery of material value at the recycling stage. Additionally, while transitioning to renewable feedstock might not always be any better in closing the loop and avoiding material value loss, there are some specific packaging applications - for e.g. packaging contaminated with organic materials during use - where material value recovery can be enhanced.

Dematerialization efforts can reduce plastic packaging consumption at source thereby mitigating \$29 bn (or ~22%) of material value loss

Intervention 1.1: Remove problematic and unnecessary single use packaging applications

The amount of plastic packaging material in the system can be specifically reduced by eliminating problematic and unnecessary single-use plastic packaging items that are frequently littered. This type of waste has a low residual economic value within current systems due to which it is not collected and/or recycled at scale. According to EU and WRAP, there are four problematic and unnecessary plastic packaging items:

Table 2: Problematic and unnecessary packaging applications

Problematic and unnecessary packaging items that are not recycled at scale	
1. Plastic grocery bags	3. Expanded polystyrene (EPS) food containers
2. Plastic cups and lids	4. PVC-based packaging

Critical success factors: Sizeable portion of these packaging items are manufactured by small-to-medium sized producers, for whom sustainability might not be as important. Therefore, elimination of such packaging items would require regulatory action in the form of production bans or consumption taxes. There is evidence that effectiveness of such actions improves by:

- ▶ Proactively garnering judicial support as it can help avoid stay orders on implementation due to local manufacturer appeals in court.
- ▶ Recommending alternatives - for instance, the Tamil Nadu government listed suitable locally available SUP alternatives such as cloth bags and banana leaves.

Material value loss analysis: Our analysis estimates that there is a potential to reduce \$24 bn (or 18%) material value loss by eliminating the production and consumption of these four packaging formats.

Intervention 1.2: Dematerialize packaging through light-weighting

Light weighting has been leveraged in packaging applications for more than 40 years and has delivered significant material and cost savings. For example, in Europe, the average weight of plastic packaging used in products reduced by 28% over a course of last 10 years.¹⁴ Similarly, the average packaging material used in a 0.5 liter PET water bottle is 46% lesser than in early 2000s, that has resulted in savings of more than 2.8 million tons of PET.¹⁵

Although an old concept, light-weighting is still relevant in today's modern economy due to two factors. First, due the rise of e-commerce within the food, beverage, personal care and household categories, packaging made with less material is attractive as it helps reduce shipping costs due to light weight. Second, as more countries implement EPR laws based on packaging weight-based fee models, lower packaging weight in products drives regulatory cost savings for businesses.

Critical success factors: While light weighting is necessary and beneficial, it could also have undesirable consequences from a system's perspective due to two potential reasons:

- ▶ Any drop in the amount of plastic material in one unit of packaging also reduces its value per unit in after-use systems. This is especially relevant in India, as a significant portion of plastic waste is managed by informal sector, and their likelihood of collecting and recycling plastic packaging is highly correlated to the after-use value of the packaging waste.
- ▶ Light weighting tends to reduce the after-use value of the packaging waste by compromising recycling economics of packaging material - an extreme example is when

Amcor: Light weighting of PET bottle

Amcor recently enabled The Coca-Cola Company's Vitaminwater brand to use extremely light-weight PET bottles. Using PowerStrap technology, that strengthens structure and increases vacuum absorption, and ActiveHinge technology, that further improves the rigidity of bottle sidewalls, company was able to produce the bottle with 16% less PET, while delivering same functional properties.

multi-material formats are chosen over mono-material packaging formats as they deliver the same functional benefits at lower packaging weights, albeit the former being a technically non-recyclable format.

Hence, the efforts that significantly reduce the material value of plastic packaging in after-use systems can aggravate material value loss due to non-collection and/or non-recycling. A detailed LCA comparison with the existing packaging should therefore be a precursor to any light weighting effort and should be used to help understand tradeoffs while considering systems perspective.

Material value loss analysis: Based on an analysis of more than 100 case studies, we estimate that \$5 bn (or 4%) of plastic packaging material value loss can be avoided by light-weighting efforts.

Transitioning from non-recyclable multi-layered packaging to recyclable format can prevent \$16 bn (or 12%) material value loss

Intervention 1.3: Gradually design-out use of non-recyclable formats like multi-layered packaging

Multi-material packaging refers to the type of packaging that consists of multiple material types bound together as a packaging such that they cannot be easily separated. Packaging may consist of blends of plastics layered with either one or more of the following materials - another type of plastic, thin metal foils, and/or paper or cardboard. Multi-material packaging is advantageous as it combines the unique properties of different materials to provide high barrier strength at much lower amount of packaging material than alternatives like mono-material packaging. Over the years, these properties have led to significant increase in the use of multilayered plastic. It is typically used in applications like chips bags, stand-up pouches, toothpaste and many more. As per a waste composition study in Pune, more than 16% of the plastic waste collected from households was found to be multi-material packaging.¹⁶ However, one of the biggest disadvantages of such a packaging format is that to date it is not possible to separate the different materials economically, and mechanical recycling is not possible. As a result, multi-material packaging is often either incinerated or co-processed, used in roads, or simply landfilled/dumped.

Borealis and Borouge: Mono-material pouch solution with high barrier strength

Through collaboration with value chain partners, the company recently launched new and fully recyclable mono material pouch solutions for both PE and PP based materials. These solutions include pouch concepts fully made of PP and PE laminates with high barrier properties, and a PE laminate containing 35% post consumer recycled material.

Critical success factors: Given that the multi-material packaging is usually designed for specific applications and has been optimized over the years, finding a single replacement may not be possible and each potential application will have to be evaluated on case-by-case basis to find suitable recyclable alternatives that deliver the same packaging properties. Research is underway to find suitable recyclable mono-material alternatives and several global packaging converters have made breakthroughs.

As the technology around suitable recyclable alternatives for multi-layered packaging advances,

in the near-term retailers and brand owners should analyze the shelf life of their products and their inventory turnover ratio to reconsider the need for multi-layered packaging in their products.¹⁷ Given today's highly interconnected logistics network, maintaining desired inventory levels for high inventory turnover products might not be a huge challenge. Brand owners and retailers for specific products can have a potential to move away from traditionally used multi-layered packaging to existing recyclable packaging formats.

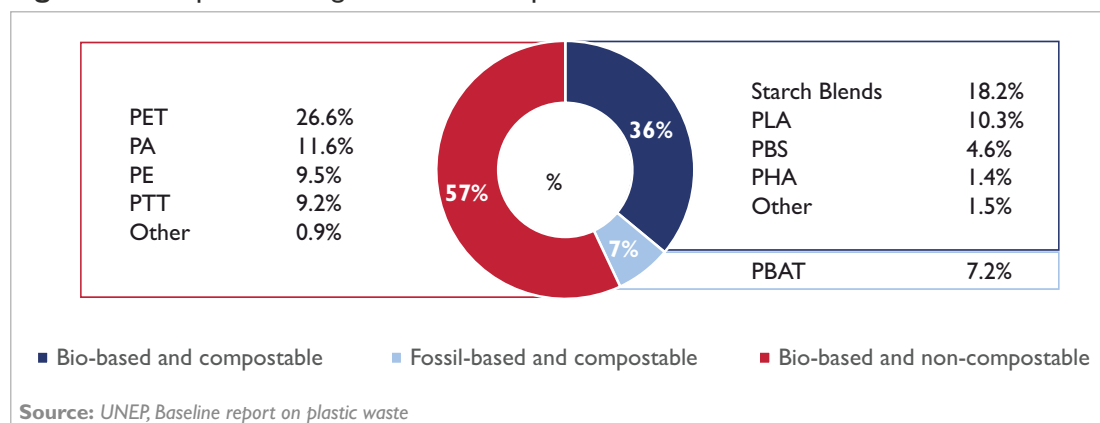
Material value loss analysis: Our estimate suggests that \$16 bn (or 12%) material value can be saved by transitioning away from non-recyclable multi-layered plastics format to recyclable formats. Of this 12%, ~1.2% can be saved due to better product to packaging weight ratio of innovative recyclable barrier packaging¹⁸, whereas 10.8% can be saved due to transition from non-recyclable to recyclable format.

Other related interventions

Replacing traditional plastics with bio-based compostable (or bio-degradable) alternatives for nutrient-contaminated packaging can reduce material value loss by ~0.2%

'Bioplastic' can refer to bio-based plastic, bio-degradable plastic, or both. Bio-based plastics is a term used for plastics that are completely or partially manufactured using biomass or other renewable resources. On the other hand, bio-degradable or compostable plastic refers to plastics that can be broken down into its constituents by microorganisms in industrial and/or home composting facilities. It is important to note that not all bio-based plastics are compostable - for example bio-PET is a frequently used bio-based plastic that is chemically and structurally identical to fossil-based PET and are therefore recyclable but not compostable. Some bio-based plastics like PLA, PHA and others are technically both recyclable and compostable. Additionally, there are also fossil-based plastics that are technically compostable, for example PBAT, but these represent very small portion of the entire bioplastic market (as shown in the figure below).

Figure 9: Composition of global bio-based plastics market



To reduce the material value loss, replacing nutrient contamination-prone packaging applications with bio-based compostable packaging presents a viable opportunity. Such packaging is not recycled due to challenges in cleaning and low value of the recycled output. Additionally, composting packaging contaminated with organic waste can also support closing the biological cycle as organic contents that are stuck to the packaging and/or content that is not completely consumed can be brought back to the soil. Two specific applications - food delivery/take-away containers and garbage bags present sizeable opportunity.

Use bio-based compostable packaging for food delivery/take-away containers and garbage bags

There are two key trends that indicate a potential increase in the amount of food delivery and garbage packaging waste generated in the future.

- ▶ Around 22,000 tons of plastic waste is created every month through orders on food delivery platforms, a significant portion of which is plastic packaging waste.¹⁹ The customer base of online food delivery industry in India is projected to expand 1.5 times that of current levels to 311 million users in 2024.²⁰
- ▶ Additionally, garbage bags account for ~8% of the plastic waste generated per day.²¹ Currently 62 million tons of municipal solid waste is generated per year. This is steadily growing at 4% CAGR and so is the need for garbage bags.²²

Given that plastic packaging used in food delivery and garbage are both contaminated with organic content, they are most likely to be seen ending up in landfills. Therefore, transitioning to bio-based compostable plastic packaging for these applications presents a viable opportunity.

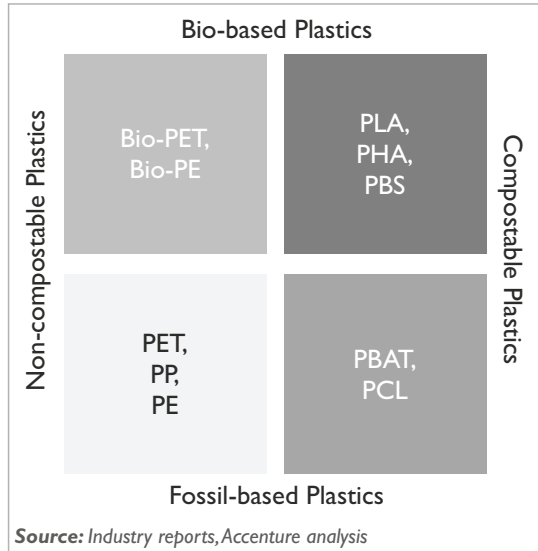
Critical success factors: Non-compostable plastic packaging entering the composting facilities can significantly contaminate the end-product - compost or fertilizer. It is therefore imperative to clearly identify and segregate compostable plastic packaging items from other types of plastic packaging. Segregation of compostable plastic packaging can be facilitated by either industry-wide standardized adoption of compostable plastic material in specific applications, and/or clearly defined and identifiable markers on compostable packaging items. Given that organic fertilizers typically sell at 20% premium over synthetic fertilizers, composters may be hesitant in accepting organic waste mixed with compostable plastic with the fear of losing the organic fertilizer market.²³

Material value loss analysis: Transitioning all the food delivery/takeaway containers and garbage bags to bio-based compostable packaging, supported by availability of adequate composting capacity can reduce material value loss by ~0.2%. The relative size of the opportunity may seem small but its potential in managing the landfills is extremely high.

Consider use of non-compostable bio-based plastic in packaging where after use recycling systems for their fossil-based counterparts are mature

Transitioning to bio-based non-compostable packaging, although not value adding in terms of reducing the material value loss, will still play a role in the overall transition towards circularity by decoupling the plastic packaging growth from finite fossil-based resources

Figure 10: Family of materials within bioplastics



Bioplastics have a smaller carbon footprint, with lower cradle-to-grave carbon emissions than their fossil fuel-based counterparts. For example, Polyamide 410 made from castor bean oil is known to be net carbon neutral as the amount of carbon emissions from manufacturing are offset by the carbon capture during the growth of castor bean plant.²⁴

Non-compostable bioplastics are of two types: first the non-compostable bioplastics that are identical in their properties to traditional fossil-based plastics (for example bio-PET, bio-PE), and second the non-

compostable bioplastics that have significantly different properties than any existing fossil-based plastic (for example PA, PTT). The former type can be used by manufacturers without significantly having to change their processes and can also be recycled together with their fossil-based counterparts. They present an easy and low capital-intensive pathway to reduce carbon emissions from plastic packaging. In India, PET and PE represent ~50% of the plastic consumption in the packaging applications and their recycling streams are fairly well established.²⁵ This represents a significant potential to explore transition towards bio-based PET and bio-based PE to decouple plastic usage from fossil-based resources and decarbonize the packaging industry. A high-level estimate for India suggests 8.5 million tons of CO₂e savings per year.²⁶

Critical success factors: Since bio-plastic production largely relies on crops produced on agricultural land, the impact of increase in demand for bioplastic on agricultural land use and food prices needs to be carefully considered. Studies have indicated that requirement of arable land to support bioplastic production is not very high - for example, the global production of 2.1 MTPA of bioplastic in 2019 required only 0.016% of total arable land and is projected to increase to 0.021% by 2024.²⁷ However, there is lack of evidence on the impact of crop production for bioplastic on food prices in India. There is a need to carefully study this in the Indian context.

Material value loss analysis: This intervention is not anticipated to result in sizeable material value savings as the use of non-compostable bioplastics like bio-PET and bio-PE instead of their fossil-based counterparts does not technically alter recyclability. However, it is still important given the potential to deliver environmental benefits.

4.2 EXTEND THE USEFUL LIFE OF PLASTIC PACKAGING THROUGH REUSE

An overwhelming 50% of the plastic packaging is produced for single use purpose.²⁸ Since it is not always possible to eliminate plastic packaging due to their undeniable benefits, the useful life of the packaging material needs to be extended beyond a single use. When viewed from the lens of circular economy, reusing packaging means reapplying the packaging for the same purpose in its original form without any major chemical or mechanical alterations.

Reusing plastic packaging helps reduce the overall material value loss, by reducing overall consumption and preventing the packaging from being downcycled or being disposed-off in landfills. While reusable packaging might require more material than a single use packaging due to sturdier design, the amount of packaging material required per consumption cycle is significantly lower. For example, a reusable 1 liter PET bottle weights more than 3 times the average single serve PET bottle.²⁹ However reusable PET bottle can be reused for as many as 25 cycles, reducing the amount of packaging material used per consumption cycle to 13% of that of single serve packaging.³⁰

In addition to material savings, reusable packaging can also lead to reduced carbon footprint. The exact carbon footprint depends on several factors like type and quantity of material used, number of reuse cycles, transportation emissions etc. thereby making it difficult to compare it with recycling. But generally, reusable packaging is found to be better than single use packaging and disposable alternative packaging materials. For example, RePack that provides packaging-as-a-service for online retailers and web stores, found that their reusable plastic based packaging reduces CO₂ emissions by up to 80% when compared to single-use plastic bags and cardboard boxes.^{31,32}

Coca Cola: Dedicated PET reuse model for carbonated beverages

Coca-Cola in Brazil has invested \$425 mn in creating a reverse logistics infrastructure for their reusable PET bottles and unifying the packaging design across its different brands. Customers pay a deposit when purchasing soda in a refillable bottle and receive a discount on their next purchase when they return the empty bottle to the store. This reward system has ensured a return rate of above 90%.

Models that enable transition towards sustainable packaging through reuse of packaging can be classified in two categories: reuse by return and reuse without return.³³ The two models differ based on their refill strategy. In the first model, the contents or product is refilled by the producer and therefore the packaging must be returned to the producer. In the second model, the contents are refilled by the consumers themselves at home or at a designated refill center. These models are discussed in greater detail in this chapter.

In the 'Reuse by return' model, the ownership of the packaging, and thereby the responsibility to collect, refill and resell, is retained by the producer. Traditionally such a model has been extensively

used in reusing glass packaging. Today the model is becoming increasingly relevant for plastic packaging as well - both across B2C and B2B packaging. The adoption of this model for plastic packaging depends on efficient reverse logistics. There are four key elements that determine the viability of this model: (i) Cost of input packaging material, (ii) Relative cost of take-back (transport distance, cleaning cost etc.), (iii) Achievable level of standardization across packaging items to be reused, (iv) Volume of addressable reuse packaging material in a particular geography.

Reuse by return

Reuse by return in B2C and B2B product packaging can reduce material value loss by \$9 bn (or 7%)

Intervention 2.1: Setup take-back mechanism for B2C reusable packaging in dense areas

In this model customers return empty packaging that is cleaned and refilled for future use by the producer. Given the high cost of reverse logistics, reusing packaging by return is generally economically attractive for rigid packaging consumed in beverages, beauty and personal care and home care products in densely populated regions where packaging consumption is relatively high.³⁴

Typically return of packaging in this model is incentivized through deposits. Customer pays an upfront deposit while purchasing the product which is refunded either in cash or in-kind once the empty packaging is returned. The packaging return can be managed through either one or a combination of the following takeback channels: takeback through local retailers, dedicated drop-off points, reverse vending machines, and/or direct pick-up service from home.

Reuse by return systems are attractive for a company in B2C packaging as it allows them to retain complete ownership of their packaging, increase their capability to build strong brand loyalty through customized reward and return schemes, and enhance their ability to gather granular customer level data specific to their brand. Company can choose to implement such a model by either setting up an independent collection system (dedicated and owned reverse logistics system) - for example Coca-Cola in Brazil, or through a subscription-based reuse system operated by a third-party pool operator offered as a service to all companies - for example Loop.

Loop: Reuse as a service

Loop is a circular shipping platform that works as a subscription-based e-commerce model for consumer goods companies. The ownership of the packaging is retained by the brand. After delivery and use of the product by the consumer, the packaging is picked up, cleaned and refilled by Loop before being resold. At 5 reuse cycles, Loop model has a 50% lower carbon impact than traditional single use models.

Critical success factors: This model requires a careful evaluation and design of the model economics. There are several factors that need to be considered to work out an economically viable model. For instance:

- ▶ Companies should look to maximize standardization of reusable packaging. While in B2C segment, inter-company packaging standardization may be hard to achieve as packaging is seen as product differentiator, companies should look to maximize

standardization of reusable packaging across their own product portfolio. Differentiation can be maintained through removable sleeves.

- ▶ Design modifications for the reusable packaging should look at optimizing the number of reuse cycles in the system. Certain tradeoffs need to be carefully considered here - for e.g. factors such as increase in packaging weight and durability vs. packaging cost, choice of plastic packaging material vs. alternate material.
- ▶ Distances between point of consumption and refill should be kept short. Such models might only be economically attractive in geographies with high sales density that are near the dedicated cleaning and refilling stations.
- ▶ Careful modulation of deposit levels is required to optimize the tradeoff between the increase in product price and maximizing the return rates. In principle, the packaging need not be necessarily returned by the end consumer. Products with relatively lower value of packaging where returns can also be managed through informal waste pickers can have lower deposit levels. On the other hand, models where packaging is preferred to be returned by the consumer themselves (for e.g. high value packaging items, when company is looking to build brand loyalty) can have relatively higher levels of deposit to incentivize returns.

Material value loss: Our analysis suggests that takeback mechanisms for packaging in beverages, homecare, and beauty and personal care products targeted in high-density urban areas can help reduce \$1 bn (or 0.7%) of the material value loss.

Intervention 2.2: Standardize reusable B2B transit packaging for efficient reuse by return

Euro Pool System: Reusable trays and pallets as a service

Euro Pool System is a fully outsourced pooling service for players in the fresh food and packaged food supply chain. After the use, the company collects back the HDPE-based trays and returns them to the nearest service center. At these centers, collected trays are checked, washed and repaired before they are reused in another rotation. The company has 73 service centers in 18 countries and manages 1,161 million tray movements every year. For customers, it means lower costs and lesser direct CO₂ emissions.

The B2B transit packaging refers to rigid packaging used in transport of perishables or non-perishables - for example tray, crates, pallets and drums. In many cases for such applications, reusable plastic packaging often enables a sizeable business opportunity. Additionally for such applications, plastic packaging is found to be economically and environmentally more beneficial than alternatives like single use cardboard or wood if reused for more than 20 times - on average reusable rigid plastic transit packaging is used for more than 90 cycles before being recycled.³⁵

Critical success factors: Viability of such a return system depends on the cost of take-back when trays, crates, pallets, and drums are returned empty for cleaning and reuse. To bring

down the per unit cost of reverse logistics, standardization and scale will play a big role. But at the moment, the landscape is fragmented in terms of reusable versus non-reusable transit packaging as well as in terms of own reverse logistics versus third party logistics service providers within each industry. Through a wider collaboration within each industry, players can overcome these limitations to capture efficiency gains and reduce the overall cost through scale.

Material value loss analysis: Reuse of B2B transit packaging can save \$8 bn (or 6%) of the material value loss.

Reuse without return

New innovative business models are providing greater opportunity for increasing overall reusability of the packaging. These models do not rely on traditional reverse logistics and are, therefore, more suitable for categories where a take-back mechanism is impractical or uneconomical. "Reuse without return" models rely on reusing and refill packaging close to the point of consumption by the consumers themselves. In these models the ownership of the packaging is transferred to the consumer, and the producer is only responsible for providing refills to consumers.

Intervention 2.3: Innovate product design by using ultra-concentration of active ingredients

Liquid, or semi-liquid based beauty and personal care products like shampoos, home care products like liquid detergents, and beverage products like flavored water are largely water based. For example, a shampoo typically has only 10%-25% active ingredients.³⁶ Therefore, today, we are not only packaging and transporting the cleansing agents used in a shampoo but also a sizable portion of water along with it. Companies can leverage the willingness of consumers to refill at home by providing reusable containers (parent packaging) and ultra-concentrating the active ingredients in refill pods that can be used in the reusable containers. The amount of packaging used in refill pods is much lesser, thereby reducing the cost of packaging and distribution for a company.

Humankind: Ultra-concentrated personal care products

Tablet mouthwash that can be dissolved in water and used as regular mouthwash by the consumers. Similar concept available for shampoos and deodorants. Consumers are provided a durable, refillable and luxurious packaging on their first purchase designed to be kept for a lifetime. Subsequent tablets are delivered in compostable packaging using a subscription-based model. A single user can save 2.2 kg of plastic packaging every year.

Critical success factors: Success of this model depends on consumer acceptability of the change in how some of their day-to-day products can be used or consumed. While environmentally conscious green consumers might be readily willing to make such changes, to drive adoption at a wider scale companies can look to transfer some of the packaging and transportation cost savings to the consumer in the form of discounts or lower prices. Educating the consumer on benefits of such a model will drive long term acceptability and change.

Material value loss analysis: Ultra-concentration of active ingredients applied to appropriate homecare and beauty and personal care products can save \$11 bn (or 8%) of the material value loss. This intervention might be more attractive than reuse by return models in B2C packaging as its applicability is not dependent on population density.

Other related interventions

Explore distributed "refill at retailer" strategy

The Ecoindian: A zero waste store

The store has on-boarded brands and sellers which deliver products with reusable packaging and minimal branding. The products are sold in cotton bags of different sizes. The customers are also given a 5% discount if they bring back the used jars for a refill. Ecoindian is saving 8-10% of the costs incurred through packaging, and are able to share this profit with customers with reduced pricing of organic products.

In this model customers use their own packaging or brand's/retailer's refillable packaging in-store or at a mobile truck, to refill their products and reuse the parent packaging. This model presents a low-cost economical alternative to reuse by return systems due to avoided reverse logistics costs, while also providing flexibility to the consumer to purchase product in desired quantity. Historically, traditional retailers in India have used such models for selling products like cereals, grains, oil and milk wherein consumers would bring their own containers to stores and get it refilled.

Critical success factors: Consumer acceptability is critical to determine the success of the model as consumers own the responsibility to appropriately use the reusable packaging. Providing incentives in terms of lower price or discounts can help - for example, Mother Dairy encourages consumers to use their 'token or loose milk' from its automated vending machines by selling it cheaper by Rs. 4 per liter than the packed milk. Additionally such concept is typically applicable for only products that have high shelf life in ambient conditions, or have high inventory turnover rate, or are unbranded/retailer-branded products (private label brands).

Some challenges need to be overcome when applying such a concept to branded products. For example, there is a need to consider factors such as potential shrinking of brand margins¹ and how that gets shared with retailers, impact on sales volume due to change in consumer journey and lastly, liability for product handling and quality.

Material value loss analysis: Our analysis suggests that refill at retailer strategy applied at organized retail stores for their private label products like milk, staples (rice, wheat), and oil can save ~0.4% material value loss.

¹ Additional retail cost can be compensated by packaging cost savings, but this needs to be investigated on a case-by-case basis

4.3 IMPROVE COLLECTION AND RECYCLING SYSTEMS

In India, ~40% of the plastic waste is never collected.³⁸ For packaging applications, this aggregates to ~4 million tons of uncollected plastic packaging each year. The number reflects the economic challenges of collecting and processing plastic waste. Although the economics are better for some packaging applications, such as PET beverage bottles, on average the cost of collection, sorting and recycling exceeds the generated revenues. A detailed analysis by Accenture and Ocean Conservancy reveals that this results in funding gap of \$28-40 per ton of mixed plastic waste collected.³⁹

Some typical challenges that contribute to unattractive economics include - fragmented collection and recycling systems, lack of consistent quality feedstock for recyclers, lower demand for recycled material, and volatile virgin and recycled plastic prices. Improving the overall economics of collection and recycling is critical to reduce material value loss in the form of plastic waste that would otherwise remain uncollected.

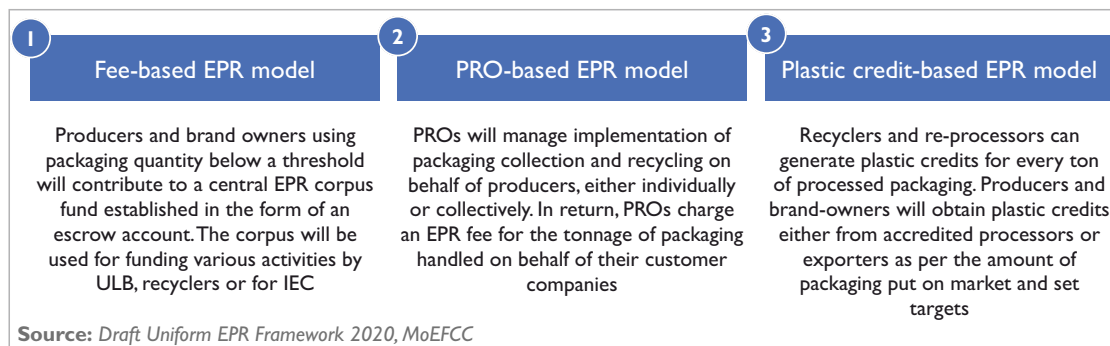
Collecting and recycling uncollected plastic waste through robust EPR program can reduce material value loss by \$17 bn (or 13%)

Intervention 3.1: Extended producer responsibility for scaling plastic collection and recycling

EPR, in principle, refers to the shift in the responsibility over the product lifecycle (especially after the product is consumed) from government to the producers. Over 65 packaging EPR legislations are currently in operation across the world and have led to an improvement in plastic waste collection and recycling in these countries. For example, packaging EPR legislations in the EU countries have led to an increase in overall plastic collection and recycling rate by ~25% from the pre-EPR levels.⁴⁰

Under the Plastic Waste Management Rules 2016, the Ministry of Environment, Forest and Climate Change has recently proposed a Uniform framework for EPR implementation in India. The framework outlines three models of EPR implementation in India.

Figure 11: Three models for EPR implementation in India



Critical success factors: While the draft framework is a step in the right direction to unify the EPR implementation regime, but there are many improvement areas. In recent past, intensive deliberations have happened on the draft language or the operational considerations but not so much on making EPR work for long-term sustainable plastic packaging and circular economy. Here are certain nuances which need to be carefully analyzed in the India context:

- ▶ **Prioritizing recycling over recovery:** Currently the draft framework recommends setting EPR target as "a single consolidated recycling and recovery target for all obligated plastic packaging types". It contradicts the circular economy principles and could potentially have an adverse impact on the recycling sector. Recovery of plastic is much cheaper than recycling - a study estimates that if one-ton plastic were collected just for incineration, the total cost is a meagre 10% of the cost required to collect, sort and recycle the same amount of plastic. Even if we consider the opportunity cost of generating revenue by selling recycled material, incinerating one-ton plastic would be 26% cheaper than recycling.⁴¹ This means that generating one plastic credit from incineration would be cheaper than generating the same through recycling. This could potentially lead to incineration favored over recycling even for recyclable plastic. To avoid this, the credits generated through recycling and recovery should be separate, and there should be a defined upper cap on the amount of credits that can be met through recovery. The upper cap for recovery credits should then be reduced in a phased manner over years to push the industry towards more recycling.
- ▶ **Ensuring full-cost principle in practice:** The framework currently relies on recycling and treatment companies to generate and sell plastic credits either directly to producers and brand owners or to the PROs. This model is very similar to the UK Packaging Recovery Note (PRN) system. Due to inherent market mechanics of a competitive scheme where PROs compete, prices of credits are driven down to the minimum possible. In UK, recyclers, in order to avoid higher cost of domestic recycling, preferred credits that were generated for plastic that was exported and recycled somewhere else. In Indian context, problem may manifest itself in different forms such as lower expenditure on infrastructure upgradation or on workplace safety norms, as recyclers and PROs attempt to minimize the cost. One way to circumvent this would be the mandatory application of full-cost principle. In a full cost system, plastic credit price or EPR fees should cover all costs related to plastic waste management and additional cost for comprehensive data collection and reporting, as well as cost for IEC. Key would be regular monitoring and evaluation that ensures that plastic credit prices reflect the true costs incurred as per certain minimum requirements and don't fall below a certain threshold.
- ▶ **Complementing EPR with circular policies:** In many European markets, upstream design changes have been driven by eco-modulation of EPR fees (see case study below). The principle of eco-modulation means adjustment of the fees paid towards EPR compliance to reward producers for their efforts in designing environmentally friendly packaging (bonus) or to provide disincentives for making less environment-friendly packaging (malus). While the set EPR targets will help improve waste collection and recycling, eco-modulation of EPR fees can incentivize upstream changes in product material and design supporting and accelerating the overall transition towards

sustainable packaging. India has adopted a competitive PRO system as opposed to a non-profit monopolistic PRO system prevalent in most European countries. Therefore, implementing eco-modulation on EPR fees might not be feasible in India given that EPR fees (or price of plastic credit) would be set by multiple PROs or recyclers and treatment companies based on their individual economics. Alternatively, India will have to push for complementary national level policies in a phased manner that would achieve same purpose. Focus should be on the following: eco-design standards to identify and ban unnecessary and non-recyclable packaging elements, eco-labelling standards that can facilitate segregation or sortation at source, and recycled content standards to increase use of recycled plastic in packaging applications.

CITEO, France : Eco-modulation of EPR fee

The scheme charges a basic fee based on the weight, type of packaging material (e.g. plastic, paper, glass, cardboard) and the number of packaging units. It also incorporates an eco-modulation of fees based on a bonus system (as shown below) depending on specific design criteria.

Sample “bonus” initiatives

Iso-material and iso-functionality weight reduction	8% reduction in EPR fee
Display of sorting guidelines on the packaging	8% reduction in EPR fee
Atleast 50% post-consumer recycled plastic content	50% reduction in EPR fee

Sample “malus” initiatives

Dark rigid plastic packaging not detectable by optical sorting	10% increase in EPR fee
Disruptive packaging (e.g. colored PET with aluminum, PVC or silicone)	50% increase in EPR fee
PET packaging with mineral opacifiers	100% increase in EPR fee

Based on public information made available by CITEO, the national PRO of France

Material value loss analysis: Our analysis suggests that EPR, in addition to complementing the existing recycling progress in the country could help reduce the material value loss by \$17 bn (or 13%) due to additional plastic packaging collection and recycling.

Increasing the demand for recycled output coupled with improvements in technology that can enable recycled plastic usage in packaging applications can reduce material value loss by \$18 bn (or 14%)

Intervention 3.2(a): Expand end markets by increasing post-consumer recycled content

While EPR will push for improvements in packaging collection and recycling rates, a well-functioning secondary market for recycled materials is critical to support the overall economics. As the EPR guidelines suggest a gradual increase recycling targets from 30% to 90% in a phased timeline over the next 5 years till 2025, development of simultaneous secondary materials marketplace will create a pull effect complementing the efforts at collection and recycling stages.

Critical success factors: Currently there are technical and regulatory constraints that limit

the use of recycled material in some applications, especially in food and pharmaceutical packaging.

For food-grade packaging, for instance bottle-to-bottle PET recycling, there is need to conduct extensive studies from food safety point of view as chemicals can migrate from the materials into food. In Europe, the food safety authority has evaluated and approved plastic recycling processes that produce food-grade rPET and rHDPE.⁴⁴ In India, organizations such as FSSAI should work towards development of a safety evaluation framework to promote the market of food-grade recycled plastics in absence of which large volume packaging applications such as PET in beverage bottles will continue to use virgin.

For non-food-grade packaging, recycled plastic in less sensitive applications, such as rigid packaging in home care and personal care categories (made of resins such as PP, HDPE, and PET) present an immediate opportunity. However, for these applications currently using recycled plastic is not financially attractive due to comparatively lower virgin plastic prices. Taking PET for example, traditionally for around 10 years till 2018, rPET enjoyed a 18% discount over virgin PET.⁴² However since then till the onset of COVID, due to the falling oil prices food grade rPET on average commanded ~35% premium over virgin PET prices.⁴³ The price gap has further exacerbated due to the recent COVID-led oil price shock. In the short run, despite these poor economics, the demand for recycled plastic may sustain driven by the existing recycled content integration commitments by large producers. However, it is important to realize that in the medium-to-long run - (i) small producers are likely to switch away from expensive rPET due to lower sustainability ambitions, (ii) for large producers it might not be economically sustainable if these price dynamics continue primarily due to the opportunity cost savings forgone by switching to lower priced virgin plastic.

To sustain and increase the use of recycled plastic in the longer run, following could be the potential opportunities to prioritize:

- ▶ **Recycled content standards:** Introduce a mandatory scheme requiring minimum recycled content in defined product packaging categories coupled with a tax on non-compliance. In such an approach, tax applied on the amount of plastic for which recycling content standards that could not be met can act as a protection against the potential volatilities in recycled material prices.
- ▶ **Financial incentivization:** Keep the tax (GST) on recycled plastic to near-zero slabs while increasing the tax levels on use of virgin plastic. Such incentives will also drive demand for recycled plastic in non-packaging applications like fibers and automobile sector. In addition to this, large-scale recycling capacities can also be supported with tax breaks, access to cheaper credit and direct CAPEX support.
- ▶ **Materials marketplace:** Given the fragmented nature of recycling in India, sourcing of required type and quality of recycled plastic is often a challenge. For such an ecosystem, a secondary materials marketplace bringing together suppliers and buyers of recycled plastic could help reduce sourcing barriers. An example is the Material Marketplace in the US, which has created a well-functioning recycled plastic market in 5 states.

Intervention 3.2(b): Innovate in end-of-life reprocessing technologies

The collected plastic waste streams reaching the recyclers will never be 100% pure either due to the low source segregation levels, contamination with food/organic waste and presence of undesirable additives and fragments not completely removed during sorting. Due to these challenges, currently a large fraction of the plastic waste in India is downcycled in open loop

recycling. Developments in reprocessing technologies could be critical to enable recycling of otherwise non-recyclable waste fragments and to improve the quality of the recycled materials.

Critical success factors: Two factors could play a critical role here - (i) improvements in the quality of mechanical recycling, (ii) development of environment friendly and economical chemical recycling technologies

For mechanical recycling the key would be to build the ability to cost-effectively clean all contaminants, and efficiently separate polymers into mono-material streams so that the recycled material is fit for any plastic or packaging application. Banyan Nation, for example, has developed their proprietary cleaning technology that helps completely remove contaminants like metals, labels, auto paints, inks, dirt, oils, adhesives, etc. from plastics making the recycled product fit for any application, including packaging.

Banyan Nation: Bottle-to-bottle shampoo recycling

Banyan Nation through their proprietary plastics cleaning technology is enabling brands to replace virgin plastic with virgin quality recycled granules in their products and packaging. The company has partnered with players such as L'Oreal and Unilever to supply virgin grade recycled HDPE that can be used in new shampoo bottles and other personal care products.

Several chemical recycling technologies have been developed over the years - for e.g. depolymerization, catalytic cracking, and pyrolysis. These technologies have traditionally been associated with negative environmental impact. Additionally, they require significantly high upfront capital investment as compared to mechanical recycling and therefore require continuous supply of plastic waste for operational sustainability - thus competing with

SABIC: Circular polymers from mixed plastic waste

Using Tacoil feedstock, a pyrolysis product from feedstock derived from low-quality mixed-use plastic waste, SABIC can develop certified circular polymers that can be used even in food grade packaging. The company will be supplying these polymers to Unilever, Vinventions and Walki Group where they will be used to develop consumer packaging for food, beverage, personal and home-care products.

mechanical recycling for feedstock. But there is need to start a fresh narrative given the lack of alternative solution and the recent technological advances. While mechanical recycling should remain the preferred option due to its ability to preserve the same material value with lower energy and cost, there may be plastic waste that cannot be mechanically recycled into a valuable product - for e.g. due to low quality mixed plastic waste streams or for applications such as recycled plastic usage in sensitive packaging applications like food packaging. In such cases, chemical recycling could play an important role. Besides that, new pyrolysis technologies have

been developed which have lower impact on environment, proven to be viable at a capacity as low as of 0.5-1 tons per day per plant (a volume that can be easily aggregated locally) and marketable output (e.g. oil). To that end, Indian recyclers need to scan the emerging pyrolysis technologies and work with government to evaluate them for India-specific use cases.

Material value loss analysis: Increasing the use of recycled content in non-sensitive packaging applications (all packaging except for food and pharmaceutical packaging) to 25%, coupled with improvements in reprocessing technologies which can enable this, can reduce \$18 bn (or 14%) of the existing material value loss.





5

IMPACT OF COVID-19



5. IMPACT OF COVID-19

The unprecedented era of disruption caused by the COVID pandemic has impacted all industries in diverse ways - packaging industry is no exception. There are several trends that have at least temporarily impacted the progress with respect to shift to sustainable packaging.

During the COVID-19, plastic recycling industry is deeply impacted by both demand-side and supply-side shocks

- ▶ **Labor and feedstock shortage at MRFs and recyclers due to abrupt lockdowns:** Door-to-door collection and sorting activities at MRFs have been adversely affected by labor shortage. As a result, volume of materials collected and quality of sorting fell, leading to increased flow of recyclable plastic to landfills and incinerators. To address health and safety issues concerning COVID-19, waste management companies provided PPEs to workers and introduced social distancing norms as they resumed operations, albeit at low capacity. Resulting lower collection volumes and higher operating expenses have negatively impacted waste management companies' bottom-lines.
- ▶ **Cheap virgin plastics have negatively impacted recycling viability:** The plastic recycling value chain has been impacted by lower virgin plastic prices, a result of falling crude oil prices, which has led to weakening of the recycled plastic demand and thus downward pricing pressure. According to a recent report, of the 47 PET recyclers in India, 15 are closed and the remaining 32 are operating at 25-30% of capacity.⁴⁶ At an aggregate level there has been an ~50% fall in demand for recycled plastic.⁴⁷

In short term, brands and producers must support PROs and recyclers, and reaffirm their commitments

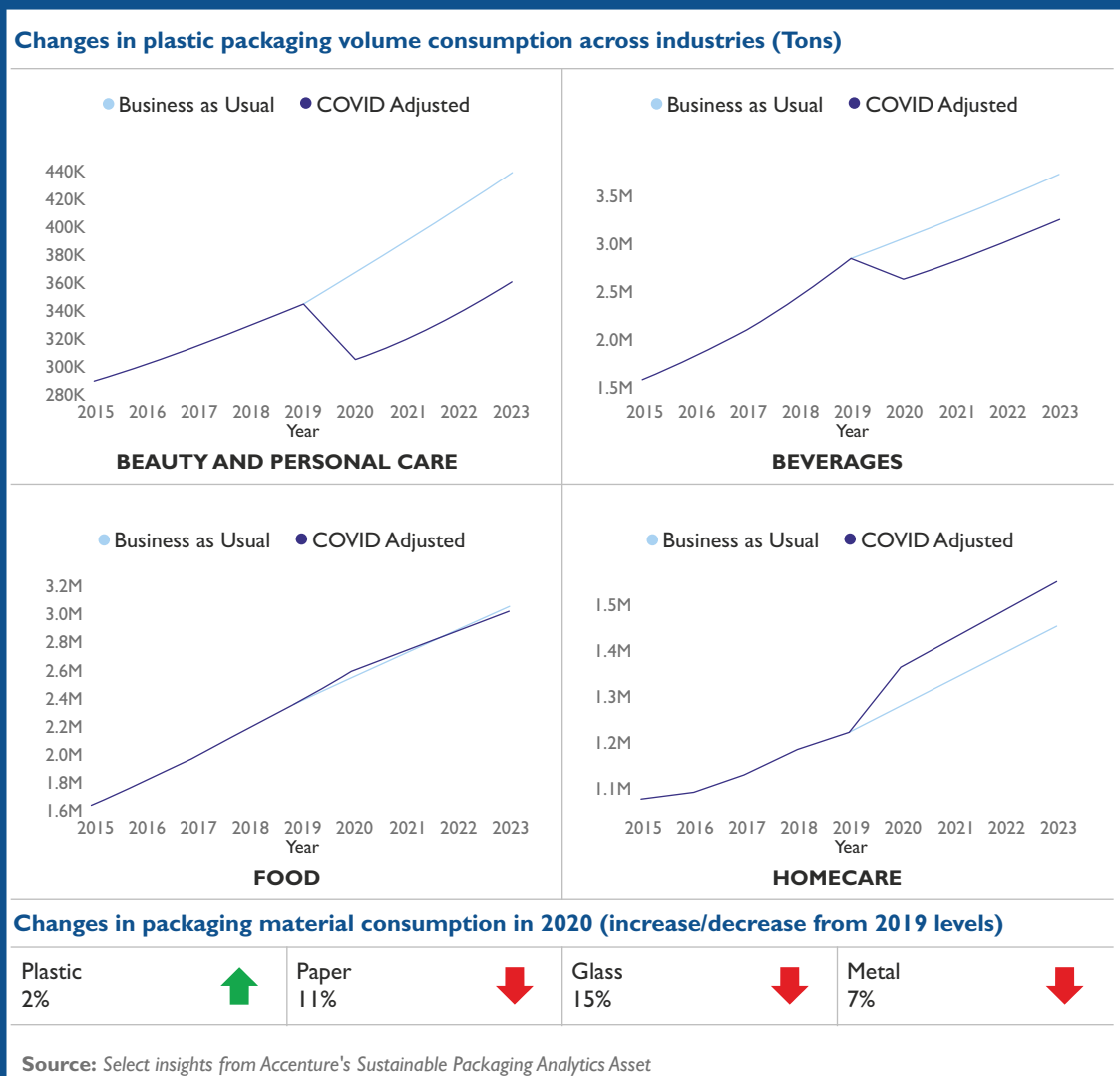
- ▶ **PROs and recyclers need urgent support from producers and brands:** To support the cash-strapped PROs and plastic recyclers, brand owners and producers must commit to continue with EPR volumes and provide minimum material offtake guarantee. The brand owners and producers must not only honor the contracts already signed but also raise the ambition by signing-up for higher volume and longer duration. Upholding the recycled content targets will inspire confidence in the recycling industry to invest in large-scale capacities in near future.
- ▶ **Sustainability initiatives are delayed but need to reaffirm commitments:** Several companies have deprioritized their immediate plans as the focus has shifted to ensuring business continuity. For instance, many ongoing pilots on reusable cups/straws have been stalled. In fact, in many parts of the world, industry associations used COVID-19 as an opportunity to build a business case for continued use of single-use plastics. Similarly, imminent plastic regulations were delayed providing relief to the industry. For instance, the introduction of deposit refund system in UK was pushed forward by two years and in India the implementation of SUP bans was loosened in

many cities. But recovery in consumer-packaged goods industry has been faster than other industries. Therefore, it is imperative for producers and brand owners to reaffirm their public commitments.

Due to COVID-19, characterization of packaging consumption and plastic waste has altered

- ▶ **Packaging demand in home care and food categories evaded the impact:** The pandemic has had varied impact on packaging consumption across industries and packaging material types. An analysis of the food, beverages, beauty and personal care, and homecare industries reveals that while the pandemic has had a negative impact on packaging consumption in beauty and personal care, and beverages industries, the packaging consumption in food industry and homecare industry has spiked. Among all the different packaging materials, the pandemic is found to have the least impact on plastic.

Figure 12: Impact of COVID-19 on packaging demand across industries and packaging materials



- ▶ **Growth in e-commerce sales has led to additional packaging demand:** As online deliveries became popular, consumption of relevant applications such as paper-based tertiary packaging or plastic-based air cushions grew. This calls for increased attention from online retailers towards e-commerce specific interventions. For example, use of paper-based cushions instead of plastic, or "fit for e-commerce" packaging which combines primary and secondary packs to minimize total packaging weight.
- ▶ **New plastic packaging waste streams have been introduced in the system (e.g. in bio-medical waste):** Several components of the PPE kits are made of plastic resins - including their packaging. For instance, body coveralls and masks use PP or PET as raw materials and are usually sold in flexible packaging.





6

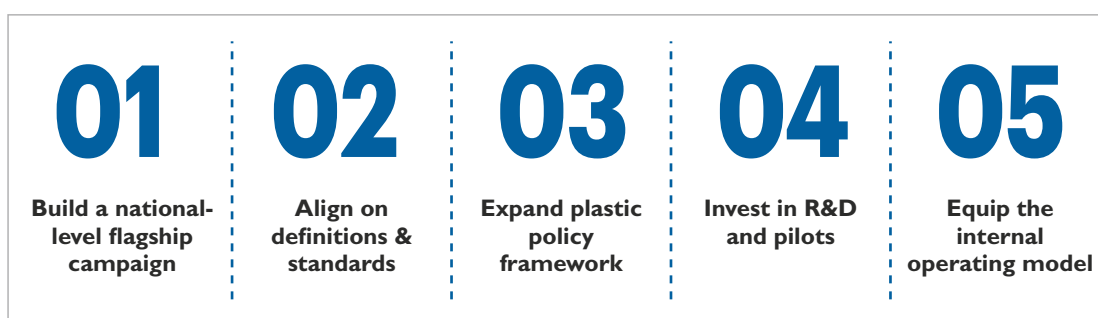
CALL TO ACTION

6. CALL TO ACTION

We have identified five system-level accelerators which will enable India's sustainable plastic packaging movement

Individual businesses can act in isolation but can sustain the above-mentioned interventions only if provided with enablement through the five system-level accelerators below.

Figure 13: System-level accelerators for sustainable plastic packaging strategy in India



Accelerator 1: Build a national-level flagship campaign

Plastics Pacts have emerged as key platforms to bring together stakeholders behind a common vision and ambitious targets in both developed (such as the US and UK) and developing (such as Malaysia and South Africa) markets. In India, we need a similar cross-industry steering group to improve dialogue and cooperation. The companies within the group agree to commit to certain sustainable packaging related targets, participate in various work streams (for instance, refillable models) by contributing technical knowledge, manpower, financial resources, and report their progress on regular basis. Such a campaign can be led by a non-profit and steered by a government agency such as MoEFCC or CPCB.

Accelerator 2: Align on definitions and standards

There are several rapidly evolving technical issues such as what constitutes single-use-plastics (SUP) or how to evaluate the recyclability of a particular SKU's packaging. Advanced markets have put in place eco-design standards across resin and format combinations and harmonized rules on defining compostable and biodegradable plastics. Similarly, downstream players such as PROs and processors will benefit from the introduction of standard operating procedure for quality assurance of materials, and safety standards for

European PET Bottle Platform: Design for recyclability guidelines

European PET Bottle Platform is a voluntary industry initiative that provides PET bottle design guidelines for recycling, evaluates PET bottle packaging solutions and technologies and facilitates understanding of the effects of new PET bottle innovations on recycling processes. It has established several test procedures and the products that pass the tests should not cause any problems during recycling.

integration of recycled content in food-grade packaging applications. Government and industry associations can take a lead on developing these shared rules and specifications. If implemented well, they will go a long way in minimizing policy unpredictability and maximizing collaboration.

Accelerator 3: Expand plastic policy framework

In India, policymakers should start to think about expanding the scope of plastic policy framework to include upstream interventions. For instance, there is merit in evaluating the concept of eco-modulation on top of EPR that incentivizes good packaging design choices and penalizes bad ones. Similarly, a deposit refund system (DRS), particularly for beverage bottles, may also be explored. In countries where DRS has been implemented, not only has the load on municipal solid waste management system come down but also the availability of high-quality raw materials for production of food-grade rPET has increased. Financial incentivization of large-scale plastic recycling capacities should also be evaluated in order to build a vibrant secondary materials market.

Accelerator 4: Invest in R&D and pilots

As the demand from consumer-packaged goods industry shifts, new threats and opportunities will arise for polymer producers as well as converters in India. For instance, demand for monolayer packaging solutions and rPolymer (recycled virgin-like polymers) will grow. At the same time, certain resins or additives and formats will lose market relevance. Old technologies such as pyrolysis of mixed plastic waste are making a come-back as global petrochemical companies invest heavily in them. Similarly, FMCG companies and retailers across the world are looking at outside-in innovation for solutions such as reusable and refillable models, beginning with personal care, home care and pet food categories. Domestic players must prepare for this disruption by spending more on in-house R&D and ambitious pilots.

Danone : Strong governance through Plastic Cycle

European multinational food-products major has created cross-divisional Strategic Resource Cycles teams that consist of the procurement, technical, quality and business transformation capabilities. This new transversal organization includes three cycles, plastics being one of them. All cycles have dedicated resources at Senior Vice President levels and aggressive KPIs and deliverables across the business units, in line with Danone's circular economy commitments.

Accelerator 5: Equip the internal operating model

Letting brands take a lead and exploiting packaging sustainability as a differentiator is a powerful approach. But many proposed interventions will require collaboration across multiple organizational functions like design, procurement, manufacturing, marketing and others. To enable this, embedding sustainability lens for packaging within internal business functions is key. Companies could benefit by introducing robust governance structure (for e.g. a new cross-functional taskforce led by senior leadership), tweaking of procurement-related decision-making processes and introducing new key performance indicators (for instance,

percentage of recycled content used, or number of reusable packaging pilots launched) to professionally drive their sustainable packaging agenda.

Eight interventions and five system-level accelerators need to translate into specific actions across stakeholders

Transition towards sustainable plastic packaging paradigm requires a well-thought out implementation roadmap - one that can only be designed and implemented through collaboration across diverse stakeholders. While most of the interventions will have to be owned by consumer-packaged goods and retail sector, supported by upstream and downstream players, governments and NGOs have a role to play by enabling system-level accelerators. These will lend themselves into specific action items as mapped across stakeholder groups in the table below. The action items are immediate next steps required to set in motion the interventions and system-level accelerators.

Table 3: Action plan across three stakeholder groups – businesses, government, and non-profits – in short, medium, and long term

	BUSINESSES	GOVERNMENTS	NON-PROFITS
Lever I: Dematerialize and design-out barriers to recyclability	<ul style="list-style-type: none"> • Analyze packaging footprint and identify areas for improvement: Evaluate collectability, sortability and recyclability of primary packaging across SKUs, identify opportunities across the eight interventions proposed 	<ul style="list-style-type: none"> • Define problematic and unnecessary single use packaging: Work with the industry to identify packaging elements that are non-functional, non-recyclable and can be “phased out” 	<ul style="list-style-type: none"> • Initiate a national-level campaign: Identify partners and develop a common minimum program along the lines of Plastic Pact
	<ul style="list-style-type: none"> • Collaborate with suppliers and vendors: Work with existing packaging suppliers to pilot quick-wins (e.g. transparent PET beverage bottles) and identify potential long-term initiatives (e.g. 100% elimination of MLPs) 	<ul style="list-style-type: none"> • Provide guidance on eco-design standards: Sponsor studies on existing resins & formats and alternatives, develop and launch eco-design standards and definitions of bio- based alternatives 	<ul style="list-style-type: none"> • Sponsor research studies: Commission studies on LCA of various alternatives and facilitate alignment meetings • Build technical capacity: Organize expert-driven workshops for upskilling of packaging decision-makers and government officials
Lever II: Extend the useful life of plastic packaging through reuse	<ul style="list-style-type: none"> • Evaluate reuse potential: Map products and categories that can be served through reusable and refillable models, evaluate various models proposed for economic feasibility and emissions footprint 	<ul style="list-style-type: none"> • Mobilize startup funding: Set-up an innovation fund or accelerator program to encourage entrepreneurial ventures in reusable and refillable packaging space; support from urban authorities may be needed to facilitate these pilots 	<ul style="list-style-type: none"> • Coordinate to de-risk pilots: Partner with the private sector in developing relevant proof of concepts to de-risk innovative approaches and make them more investible
	<ul style="list-style-type: none"> • Launch local pilots and scale: Identify high population density areas and launch pilots in collaboration with retailers or third-party service providers to build proof of concept 		<ul style="list-style-type: none"> • Organize and support consumer behavioral change campaigns: Partner with business to drive behavioral change among consumer required to facilitate success of reuse models
Lever III: Improve collection and recycling economics	<ul style="list-style-type: none"> • Commit to recycled content integration targets: Set ambitious targets and deliver on the use of recycled plastic in packaging applications wherever possible (e.g. mix of 30% rPET with 70% virgin PET in beverage bottles) 	<ul style="list-style-type: none"> • Strengthen EPR: Set-up a national packaging register or database and monitor key indicators; publish yearly reports on industry EPR performance 	<ul style="list-style-type: none"> • Evaluate impact: Conduct impact assessment of EPR funds spent through various PROs; deliver annual material flow analysis reports
	<ul style="list-style-type: none"> • Set-up large-scale recycling capacities: Players (including brand-owners) should invest in large-scale mechanical and chemical recycling capacities based on new technologies 	<ul style="list-style-type: none"> • Explore complementary packaging regulations: Evaluate additional regulations and incentivization mechanisms to promote circularity in packaging (e.g. deposit return scheme or mandatory recycled content standards etc.) 	<ul style="list-style-type: none"> • Push for informal sector integration: Given the unclear direction of current EPR guidelines on informal sector integration, NGOs will play a crucial role to ensure that this sector does not get marginalized
	<ul style="list-style-type: none"> • Ensure EPR compliance and support to PROs: Ensure 100% compliance with the set targets, commit minimum volume guarantee to PROs and recyclers 		<ul style="list-style-type: none"> • Study requirement of new labelling system: Organize discussions on a new labelling system to help consumers segregate better

Priority of specific action item

Short term

Medium term

Long term

METHODOLOGY FOR QUANTITATIVE MODELLING

Our aim is to provide facts-based decision support to businesses and policymakers, helping them understand the relative impact potential and trade-offs. The modelling followed a three-step approach as described below.

STEP 1: USING MATERIAL VALUE LOSS AS A DECISION-MAKING VARIABLE

Most traditional modelling approaches are based on material flow analysis (in tons). While the volume data is useful for waste management companies and municipalities, it does not account for the output side (e.g. price of power generated in a waste-to-energy plant or price of recycled PET). To address this, we have adopted a novel indicator called "material value loss" which is the product of input volume (tonnage) and output prices (depending on the nature of the particular activity). For example, material value of a PET bottle that is recycled but the recycled output is used in fibers is calculated as the weight of PET times the average price of non-food grade rPET.

STEP 2: ESTIMATING BUSINESS-AS-USUAL VALUE LOSS

For four different categories of plastic packaging specifically rigid, flexible, multilayered and others (small format, organic contaminated packaging), we studied the post-consumer material flow. We analyzed the collection rates, recycling rates, and incineration rates (including plastic in waste-to-energy, RDF in cement kilns, and plastic in roads) in each of these categories. The data was collected through various secondary sources and validated by industry subject matter experts. The material flow was then coupled with price yields at each stage as shown in the calculation formula shown in the figure 14 below.

Figure 14: Material value recovery/loss streams and calculation approach

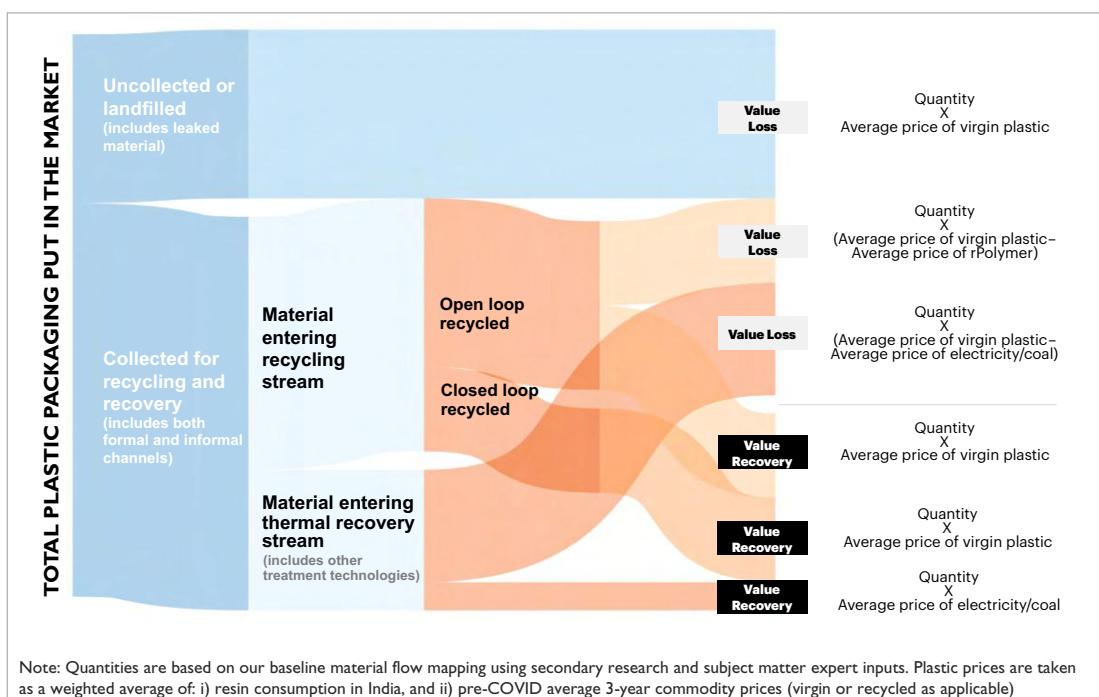
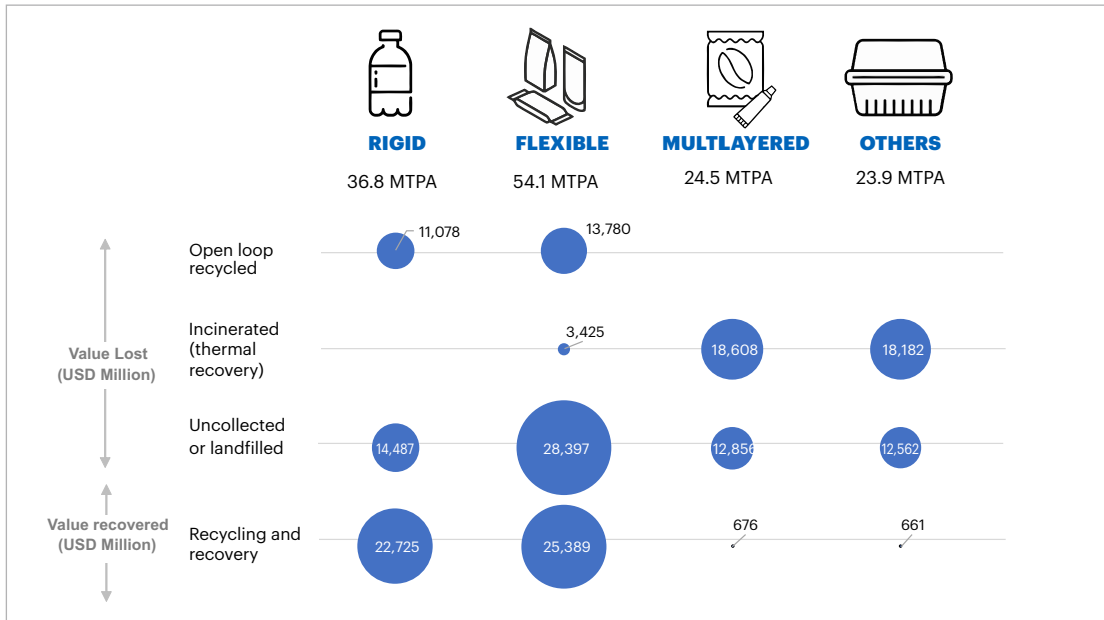


Figure 15 : Business-as-usual material value loss/recovery projections for 2020-2030



Keeping the material flow (collection rates, recycling rates and incineration rates) same till 2030, while projecting the increase in plastic packaging consumption, we calculated the 10-year material value loss in the business-as-usual scenario. Our baseline shows that the estimated material value loss in this scenario will be highest for flexible packaging that goes uncollected, followed by material lost in thermal recovery of multi-layered packaging and other formats. In terms of material value recovered, the opportunity for rigid and flexible are approximately of the same sizes.

STEP 3: ESTIMATING IMPACT OF PROPOSED INTERVENTIONS

To estimate the impact of proposed intervention, we compared the material value losses in the improved scenario with the business-as-usual scenario. In the improved scenario, across the three levers a) Dematerialize and design-out barriers to recyclability b) Extend the useful life of plastic packaging through reuse c) Improve collection and recycling systems, we shortlisted eight interventions which we found to be most applicable in the Indian context. For each of these interventions, we conducted a customized analysis to compute the "avoidable material value loss" till 2030 from the implementation of the intervention. Following steps were adopted:

- i. Identified the products or type of plastic packaging which is most applicable to the intervention and calculated the volumetric packaging consumption and business-as-usual material flow
- ii. Using improvements in relevant KPIs like collection rates, recycling rates, material value retention etc. (based on experiences of other countries and contexts), we calculated the avoidable material value loss by applying the observed improvement in KPIs to business-as-usual scenario
- iii. Assumed a benefits realization schedule from 2020 to 2030 by taking into account a graded increase in targets, which is driven by factors such as public commitments, targets set in policies such as EPR and SUP ban and lastly, learning from mature markets
- iv. Compared the business-as-usual material value loss with losses in improved scenario from 2020 till 2030 to compute the aggregate impact of each intervention

The comparison of the two scenarios is shown in the executive summary, both over the ten years duration as well as at an aggregate level for the eight interventions.

GLOSSARY

CPCB	Central Pollution Control Board
EPS	Expanded polystyrene
EPR	Extended producer responsibility
FMCG	Fast-moving consumer goods
FSSAI	Food Safety and Standards Authority of India
HDPE	High-density polyethylene
HDPE	High-density polyethylene
IEC	Information, education and communication
LCA	Life-cycle assessment
LDPE	Low-density polyethylene
Material value	Product of quantity and price of the material in consideration
MFA	Material flow analysis
MTPA	Million tonnes per annum
MoEFCC	Ministry of Environment, Forest and Climate Change
MLP	Multi-layered plastics
PPE	Personal protective equipment
PBT	Polybutylene terephthalate
PET	Polyethylene terephthalate
PLA	Polylactic acid
PP	Polypropylene
PTT	Polytrimethylene terephthalate
PVC	Polyvinyl chloride
rPolymer (e.g. rPET)	Post-consumer recycled polymer
PRO	Producer responsibility organization
SUP	Single-use plastics
ULB	Urban local body
Material value loss	Difference between value of material originally put in market and that of recovered
MRF	Material recovery facility

ACKNOWLEDGEMENTS

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