The MCCI Roadmap for a

Waste Plastic Free Mauritius

MARCH 2022

THE MAURITIUS CHAMBER OF COMMERCE AND INDUSTRY

EXECUTIVE SUMMARY

Mauritius currently generates approximately 116,000 tonnes of waste plastic annually. The quantity of waste plastic recycled is only around 3,000 tonnes per annum (2.5%) while it is estimated that around 71,000 tonnes of waste (61%) is landfilled at Mare Chicose. However, some 42,000 tonnes per annum (36.5%) of waste plastic remains unaccounted for. Littered, dumped, leaked or unaccounted-for waste plastic poses a threat to the environment, especially the lighter fractions which easily find their way to the lagoons and the ocean via rivers and canals.

Efforts to curb usage of single-use plastics, PET bottles, plastic bags and plastic packaging in general have been going on for the past 20 years. In 2020, the Government of the Mauritius passed two regulations namely GN 156 and GN 197 aimed at controlling certain categories of single use plastics and plastic bags respectively. Mauritian business operators could not keep pace with the timelines, exigencies and transition to bio-alternatives imposed by these overdriven regulations. In addition, issues relating to interpretation of the regulations and enforcement were brought up by operators.

It became clear that the prescribed changes would result in major disruptions for importers, exporters, manufacturers and retailers. The implications of going **"plastic free"** should be carefully assessed and was not the option for the time being for Mauritius as it would result in economic chaos. The MCCI decided therefore to commission this high-level roadmap to constructively contribute to the debate and actively take part in achieving the shared vision for a **Waste Plastic-Free Mauritius.**

Projections of waste plastic for the 2030 horizon indicate that some 128,000 tonnes p.a would then be generated. A *Clean & Green Mauritius* scenario for 2030 with zero leakage, 50% recycled and 50% being either landfilled or converted into energy paves the way for the circular approach proposed in this report. Six categories of waste plastic are targeted, ranging from waste plastic packaging, being the most abundant, to microplastics. In line with UNEP's approach, regulatory, economic and information-based instruments are proposed together with set KPIs to achieve a **Waste Plastic-Free Mauritius** by 2030.

Bio-alternatives are slowly making an in road, but the solid waste infrastructure is not ready to accept and treat bio-waste resulting from these optional containers and packaging. Recycling of waste plastic is only at 3% but can be as high 50% by 2030; tipping fees for recyclers, a legal framework to promote material recovery and circularity are among the enabling measures highlighted in this roadmap.

TABLE OF CONTENTS

SHORT FORMS

ASTM	American Society for Testing and Materials
BAU	Business as Usual
CAC	Civic Action Centres
C&G	Clean and Green
COVID	Corona Virus Disease
EPA	Environment Protection Act
EPR	Extended Producer Responsibility
FAQ	Frequently Asked Questions
GN	Government Notice
GWP	Global Warming Potential
HDPE	High density polyethylene
ISO	International Organisation for Standardisation
ICWA	Industrial and Commercial Waste Audit
IWA	Industrial Waste Audit
KPI	Key Performance Indicator
LDPE	Low Density Polyethylene
MCCI	The Mauritius Chamber of Commerce and Industry
MSW	Municipal Solid Waste
p.a	per annum
PA	polyamide
PBAT	polybutylene adipate-co-terephthalate
PBS	Polybutylene succinate
PET	Polyethylene terephthalate
PHA	polyhydroxyalkanoate
PLA	polylactic acid
PP	Polypropylene
PRO	Producer Responsibility Organization
PS	Polystyrene
PTT	polytrimethylene terephthalate
PVC	Polyvinyl chloride
R&D	Research and Development
SIDS	Small Island Developing State
SM	Statistics Mauritius
SUPP	Single Use Plastic Products
SWM	Solid Waste Management
TV	Television
UNEP	United Nations Environment Program
USEPA	United States Environment Protection Agency
WTE	Waste to Energy
WTN	Waste Transfer Note

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 Plastics: the historical perspective

A world without plastics, or synthetic organic polymers, seems inconceivable today, yet the large-scale production and use of plastics only dates to the 1950s. It is generally accepted that a new geological era "The Anthropocene" [1] started in the 1950s when humankind started having a marked impact on the earth's climate and its ecosystems [2]. Mauritius was not spared from the great acceleration of the 1950s which was characterized by the global dramatic post second world war increase in human activity. Malaria was under control in Mauritius and the population had grown to half a million. Also, consumption habits of Mauritians had started to change.

Silk stockings gave way to Nylon, families gathered around their Bakelite radios for evening entertainment, the familiar galvanized metal buckets were slowly replaced by their plastic alternative. The "throwaway living" culture had just begun in Mauritius. Cellophane (biodegradable but not recyclable) made its debut as a food wrapper. Shortly after, plastic bags, invented by the Swedish engineer Sten Gustaf Thulin in 1965 [3], started replacing the 'tente vacoas" as the carrier of choice for grocery shopping at the central markets of Port Louis and other towns and villages. Recycling of waste newspaper into paper bags by the local corner shop owners dwindled to a halt by the 1980s.

In 1973 Nathaniel Wyeth, a DuPont scientist, patented the first PET bottle [4]. It was lightweight, safe, cheap and recyclable. It was also the perfect container to set the stage for the bottle binge that was to follow. Billions of PET bottles were sold globally on the promise that bottled water is good for hair and skin, healthier than soft drinks and safer than tap water. And it didn't take consumers long to buy into the notion that they needed water within reach virtually everywhere they went. By the 1990s, water and soft beverages in PET bottles made their debut in the restaurants of Mauritius; widespread consumption of PET bottled water and beverages ensued as did the eyesore associated to their careless disposal.

Just like in other parts of the world, plastics as the material of choice for making goods started substituting glass and metal, pottery and ceramics, natural fibres, paper and cardboard and organic materials such as wood, while offering very limited or no options for re-use or recycling at its end of life. Single-use packaging in the form of 'take-away' polystyrene boxes appeared in the early 1990s in Mauritius and these convenient and dirt-cheap food boxes were soon recognized as an environmental nuisance.

The waste plastic problem is further complicated in SIDS as these countries rely heavily on food imports where plastic packaging is the wrapping of choice. From a historical perspective, prior to the 1980s, the pollution problems associated with waste plastic in Mauritius did not become apparent for three reasons; (1) waste plastic quantities were relatively small, (2) waste collection in the urban areas of Mauritius was efficient and, in rural areas, (3) households simply burnt their waste in the open. Environmental laws and regulations such as the EPA of 2002 [5] have only partially helped to reduce environmental degradation due to waste plastic. The island urgently needs to improve its waste management capacity. Curbing littering and dumping in all its forms coupled with the collection, transport, treatment, recycling and disposal of 100% of solid waste generated is the only way forward.

1.2 Solid Waste in Mauritius: generation, landfilling, and leakages

Managing waste plastic and solid waste work hand in glove. Management of waste is both a critical and complicated issue for many of the SIDS [6], including Mauritius because of their small land mass, limited availability of other resources and limited markets for recycled goods. Population growth, socio-economic development, and changes in lifestyle as well as in production and consumption patterns have led to an escalation in the quantity and altered the composition of solid waste in SIDS [6]. For example, in 2015, Mauritius imported some 10.6 million tonnes of goods and exported 2.2 million tonnes [7]. Heavy reliance on imported goods and tourism, without much control on upstream processes [8] generally tend to make solid waste generation rates higher in island states; these can range from 0.2 to 5.2 kg per capita per day [6]. In Mauritius, the Statistics Mauritius [9] reported the daily per capita total solid waste disposed at the landfill as 1.2 kg/capita/day for 2019 and as 1.1

kg/capita/day for 2020, the dip is attributed to the effects of the COVID 19 pandemic. A common mistake made in Mauritius is to equate solid waste landfilled to solid waste generated. Such an accounting simplification leaves out the quantity of waste (1) burnt, (2) recycled or exported, and (3) the waste leaked into the environment as a result of littering and dumping.

Until the late 1990s, waste was disposed of in open dumpsites In Mauritius. The dumpsites were often on fire and no records were kept of the incoming wastes. In the early 1990s the Government started efforts to improve the situation by adopting landfill as the disposal method. Operation of the "Mare Chicose" sanitary landfill started in 1997. Five transfer stations were set up across the island to provide for cost effective transportation of waste to the landfill [10]. Despite all these measures and with coverage reaching above 95% of the island, littering and dumping of waste is still rampant in Mauritius even though both practices are illegal and punishable by law. The Environment Protection (Amendment of Schedule) Regulations 2021 recently fixed the penalty for dumping of waste at MUR 25,000, those for littering in natural settings at MUR 5,000 and at MUR 3000 for littering on roads and vacant places. In the absence of enforcement, these penalties have had no observable effect.

1.3 Waste Plastic: composition and mismanagement

Plastics represent a growing international problem due to their post-use long life, high volume, low weight and non-degradable nature. It is estimated that between 4 to 8% of the crude oil produced annually is turned into some 400 million tonnes of plastics every year [10]. Plastics make up on average 8% of solid waste in SIDS [6] while in contrast the plastic portion of waste landfilled in Mauritius is reported to be 14% [5]. As shown in Figure 1, the majority (36%) of plastic produced globally is turned into packaging [11].

From a resource to waste point of view it is important to differentiate the various end-uses of plastics as they tend to have lifetime distributions ranging from 1 year or less (single use packaging) to more than 50 years (plastic in building and construction). Almost 60% of plastic products and parts have a use phase between 1 and 50 years, or even more [12]. This lapse of time determines when they will potentially become waste. Therefore, in a single year, the quantity of collected plastic waste does not match the quantity of production or consumption.

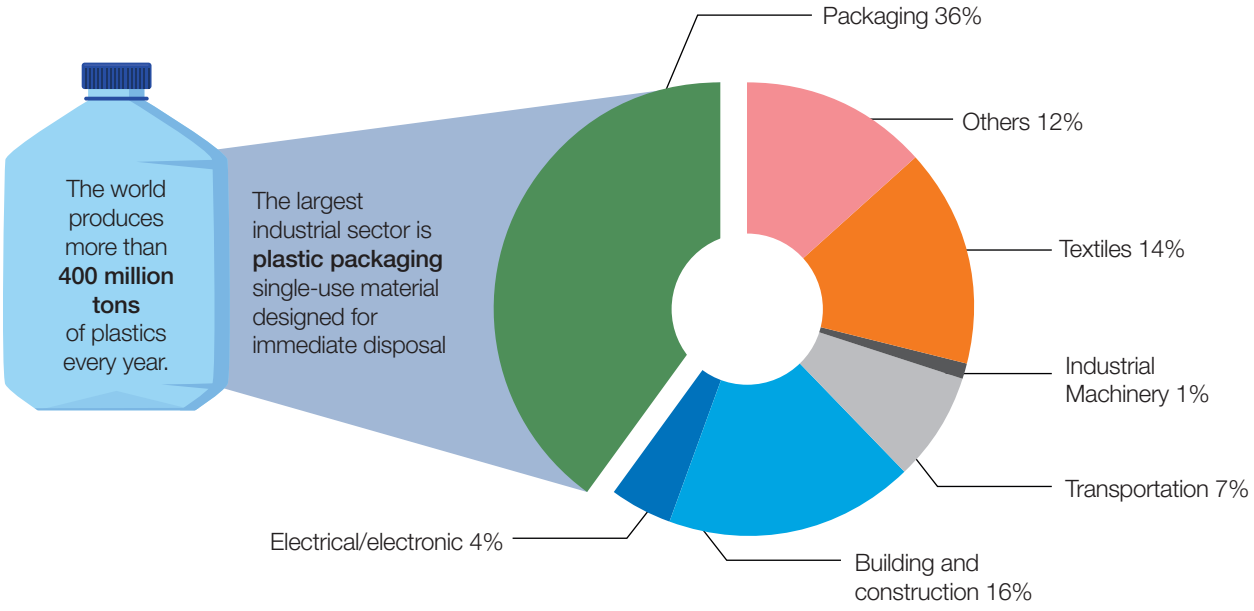


Figure 1: Global Distribution of Plastic End Uses

Plastic pollution is the result of accumulation in the environment of synthetic plastic products to the point where the latter creates problems for wildlife and their habitats as well as for human populations. Many lightweight single-use plastic products and packaging materials [12], are not deposited in "waste bins" for subsequent removal to landfills, recycling centres, or incinerators. Instead, they are improperly disposed of at or near the location where they end their usefulness to the consumer. Dropped on the ground, thrown out of a car or bus window, heaped onto an already full rubbish bin (often at the beach), or inadvertently carried off by a gust of

wind, they immediately begin to pollute the environment. Indeed, landscapes littered by plastic packaging have become common in many parts of the world including Mauritius. Just like the global consumer, the average Mauritian comes into daily contact with all kinds of plastic materials in the form of single use plastic products, durable and non-durable goods, food and consumer goods packaging and electronic goods. While all forms of conventional plastics have common origins (fossil fuels), their uses and fate at their respective end-of-life differ considerably. Hence categorization of waste plastics is an important first step in waste plastic management.

1.4 Regulatory Changes: timeline, purpose and impacts

There's a global battle against single-use plastics, particularly when it comes to plastic bags. A 2018 report [13] found that at least 127 countries (of 192 reviewed) had adopted some form of legislation to regulate plastic bags. These policies range from outright bans in the Marshall Islands to progressive phase-outs in places like Moldova and Uzbekistan to laws in Romania and Vietnam that incentivize the use of reusable bags. Bangladesh was the first country in the world to ban thin plastic bags in 2002 after they were found to be clogging drainage systems amid devastating floods in the late 1980s and '90s [14]. It has been observed that countries where regulations have been successfully applied have systematically used regulatory impact assessments (RIA) as part of their enactment process.

The Regulatory Impact Assessment process identifies possible side effects or hidden costs associated with regulations and helps to quantify the likely costs of compliance on the consumer or business. It also clarifies the costs of enforcement for the implementing authority. RIA was first introduced in Mauritius in 2015 [15] and it was used to analyse the (1) Banning of Plastic Bags and (2) Plastic Bottles regulations. The 2021-2022 budget [16] made provision for:

a). a Regulatory Impact Assessment (RIA) Bill requiring regulatory bodies to submit an impact assessment of upcoming regulations on the business environment.

b). the setting up of an RIA office under the purview of the Prime Minister's Office.

It is not clear whether the RIA process was used to analyse the impacts of GN 156 and GN 197 of 2020 on businesses. Table 1 below contains a review of the regulatory changes that have been enacted in Mauritius since 2001 to better manage waste plastic, namely, PET bottles, plastic banners, plastic bags and single use plastic products. The two regulations promulgated in 2020, the year when the effects of the COVID 19 pandemic started being felt need special mention.

Table 1: Regulatory Framework for Managing Waste Plastic [March 2001 to December 2021			
Regulation	**Gazetted – Effective Dates**	**Purpose**	**Impact**
• Environment Protection (Polyethylene Terephthalate PET Bottle Permit) Regulations 2001 G.N. No. 33 of 2001	19/03/2001 - 01/05/2001	Enterprises carrying out bottling of beverages in PET bottles require PET Bottle Permit	Provides data on the quantity of PET bottles used for bottling of beverages in Mauritius
• The Environment Protection (Banning of Plastic Banners) Regulations, 2008 – Government Notice No. 113 of 2008	09/07/ 2008 – 09/07/2008	The regulation makes provision to ban the use of banners, buntings, flags, barricade tape (with some exemptions) which are made of plastic or similar materials	Plastic banners are no longer used during electoral campaigns
• The Environment Protection (Industrial Waste Audit) Regulations, 2008 – Government Notice No. 255 of 2008	22/11/2008 – 01/04/2009	Requires scheduled industrial activities to conduct and submit industrial waste audits (IWA) once but before 12 months after start of operation	Limited impact on the way industrial waste is managed by industrial operators.
• The Finance (Miscellaneous Provisions) Act 2010	24/12/ 2010 - 04/01/2011	A levy of Rs 2 per plastic bottles	Limited or none
• The Finance (Miscellaneous Provisions) Act 2013 (Act No. 26 of 2013)	21/12/2013 – 09/11/2013	Financial incentive for the exportation of waste PET bottles or PET flakes or waste PET bottles recycled into reusable goods	Currently some 2000 tonnes/year of PET bottles are collected, compacted and exported.
• Environment Protection (Banning of Plastic Bags) Regulations 2015 (G.N. No. 153 of 2015)	06/08/2015-01/01/2016	Prohibition to import, manufacture, sell and supply of plastic bags, other than 'exempted plastic bags.	Controls at port and airport is in place. Un-authorized plastic bags are seized and sent for recycling.
• Environment Protection (Banning of Plastic Bags) (Amendment) Regulations 2015 (G.N. No. 233 of 2015)	04/12/2015 – 01/01/2016	Amendments to the original Environment Protection (Banning of Plastic Bags) Regulations 2015 (G.N. No. 153 of 2015)	Amendments allowed several essential "exempt plastic bags" to enter the country
• Excise (Amendment No. 2) Regulations of 2019 (G.N. No. 161 of 2019)	12/09/2019 – 03/02/2020	A levy of Rs 2 for importation and manufacturing of plastic containers, plates, bowls, cups and trays	No significant effect

Table 1: Regulatory Framework for Managing Waste Plastic [March 2001 to December 2021 (Cont'd)			
Regulation	**Gazetted – Effective Dates**	**Purpose**	**Impact**
• Environment Protection (Control of Single Use Plastic Products) Regulations 2020 (G.N. No. 156 of 2020) *	18/07/2020- -15/04/2021	Prohibition to import, manufacture, possess, sell, supply or use any non-biodegradable single use plastic product.	Successfully caused the shifting away from conventional plastics for items used by food service businesses. Ambiguity for other forms of single use plastics such as containers and packaging.
• Environment Protection (Banning of Plastic Bags) Regulations 2020 (G.N. No. 197 of 2020)	01/09/ 2020- 01/03/2021	Replacement of the Environment Protection (Banning of Plastic Bags) Regulations 2015 (G.N. No. 153 of 2015)	Requires printing of excessive information on exempt plastic bags, ambiguity on definitions (biodegradable, compostable) which are not aligned to the international standards.
• Environment Protection (Extended Producer Responsibility for Beverage Containers) Regulations 2021	MCCI views on draft currently being drafted	A collective EPR scheme for management of post-consumer beverage containers to promote: (1) prevention, reuse and recycling, (2) a circular economy approach, (3) environmental stewardship, (4) internalization of costs	Regulation not Gazetted yet and hence not effective

At its sitting of 10th December 2021, cabinet extended the moratorium for the banning of the following non-biodegradable single use plastic products up to 14th January 2023 – (a) plastic bowls and cups used solely for the packaging of food products such as dairy products; and (b) plastic trays for the Modified Atmosphere Packaging (MAP) of food such as fresh meat and pre-cooked/cooked food products for the purpose of extended shelf life.*

***Operators are in general sceptical about the ability to conform to the provisions of the regulation by 14 January 2023.*

G.N. No. 156 of 2020 or the **Environment Protection (Control of Single Use Plastic Products) Regulations 2020** was made by the Minister on 15/07/2020, gazetted on 18/07/2020 and became effective on: 15/01/2021 and 15/04/2021. Its primary purpose was to curb or even eliminate the usage of non-biodegradable single use plastic products listed in Part 1 of the regulation's Second Schedule. The items listed mainly consisted of food service business related plastic products. As shown in Figure 2, the regulation does not apply to Rodrigues and neither to re-usable plastic products (say toothbrushes). If the item under consideration is made of bio-degradable materials it is permitted after fulfilling certain conditions. Further if the item is made of non-biodegradable material, it is still permitted (for example cotton bud sticks) so long it does not form part of items listed in the Second Schedule. Items listed in Part I of the Second Schedule were prohibited as from 15/01/2021 and items falling in Part II of the Second Schedule were to be prohibited as from 15/04/2021.

The desired switch from SUPPs to biodegradable options by food service businesses took place and the change was clearly noticeable. Fast food "mine" and "boulette" sellers replaced their plastic cutlery by the wooden equivalents, bagasse-based plates and bowls made their appearance, plastic straws were replaced by their paper-based equivalents, beverage stirrers made of wood became widespread. However, other operators such as dairy manufacturers (yogurt cup), fresh fruit importers (plastic hinged containers), users of MAP for packaging, retailers using plastic films to wrap fruit and vegetable simply could not switch to bio-degradable alternatives; the latter requiring massive investment and time for adaptation. The MCCI reacted by submitting recommendations for amendments to GN 156 of 2020 and subsequently on 17th December 2021, GN 309 of 2021 was promulgated (based on cabinet decision of the 10th of December 2021) to allow affected operators some breathing space.

G.N. No. 197 of 2020 or the **Environment Protection (Banning of Plastic Bags) Regulations 2020** was made by the Minister on 26/08/2020, gazetted on 01/09/ 2020 and became effective on 01/03/2021. This regulation recognises the ubiquitous nature of plastic bags and provides for exempt plastic bags to be used in agriculture, as bin bags for sanitary and medical uses amongst others. Most importantly, plastic bags used as primary packaging are exempt. Further, the regulation provides the conditions under which bio-degradable plastic bags would be allowed to be imported and manufactured. While the regulation refers to standards such as the ISO 17088, definitions used therein for key terms such as 'biodegradable", "compostable" are not aligned to the said international standards and the latter two terms are wrongly used interchangeably. The labelling requirements on exempt and non-exempt plastic bags are excessive and do not reflect those of ASTM standards that are used worldwide.

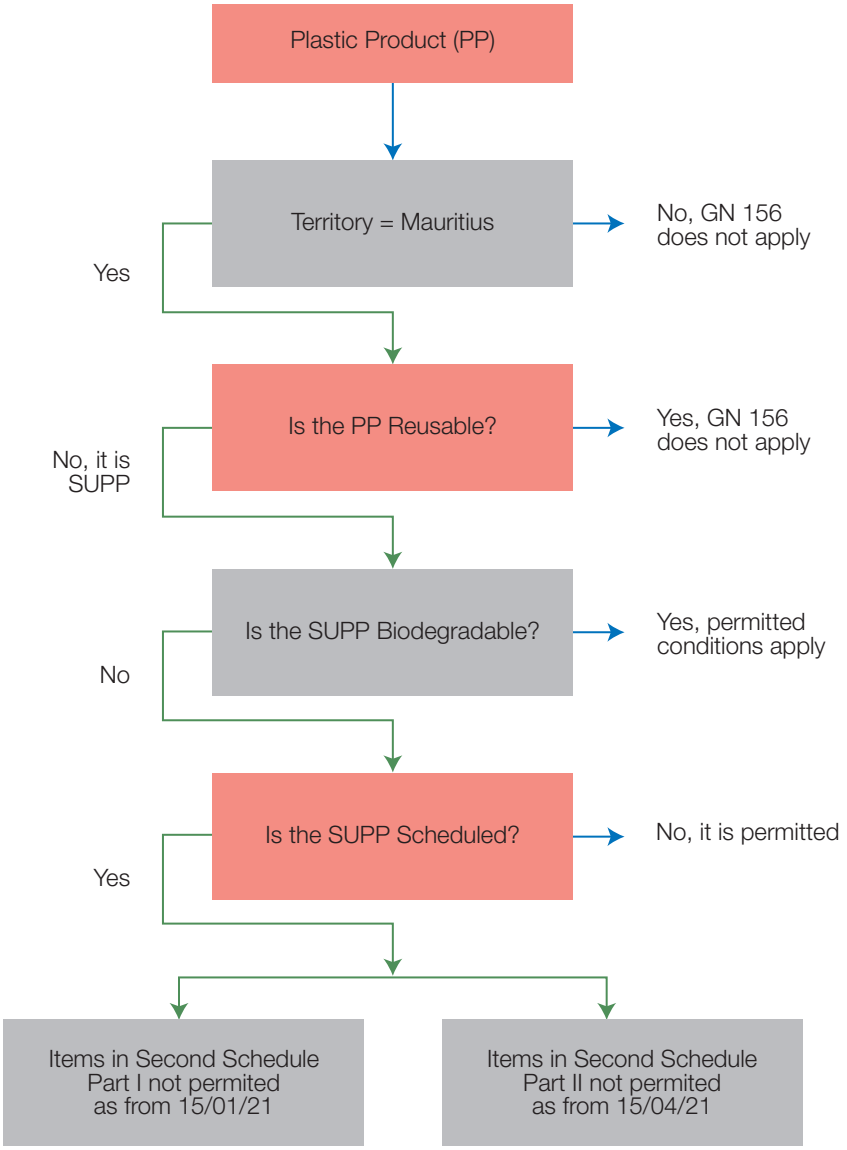


Figure 2 : Original GN 156 of 2020 Flowcharted

Key observations that can be made from the review of the past 20 years of regulating the sector are:

(1). Poor understanding of the dynamics involved for switch over to alternatives and limited view on the ubiquitous nature of plastic packaging gives rise to the need to extend moratoriums,

(2). Usage of levies as a mechanism does not always work; smart usage of levy generated funds to further nudge action by Government should be considered,

(3). Bypass of the regulatory impact assessment phase leads to complications and disruptions that affect operators and the economy as a whole,

(4). Test methods to determine whether imported plastic bags are allowed entry at ports and airports are not based on international standards of the ISO and ASTM.

(5). GN 255 of 2008 (Industrial Waste Audit) needs to be reviewed and extended to commercial activities; data from such reporting will be extremely useful for recyclers and for promoting industrial symbiosis.

(6). GN 156 of 2020 and GN 197 of 2020 contain several flaws which will continue to plague their applicability. Both regulations promote the switch to bio-alternatives but the waste collection infrastructure in place is not ready to accept and treat the biowaste resulting from the end-of-life bio-alternative containers, bags or packages.

1.5 Latest Developments: new directions for solid waste management

On the 13th of August 2021, the Cabinet of Ministers of the Republic of Mauritius [17] were apprised of the recommendations of the feasibility study carried out by Tractebel Engie for the development and implementation of a "Strategy and Action Plan for a new Solid Waste Management and Resource Recovery" system in Mauritius. In order to ensure the successful implementation of the new system, Tractebel Engie recommended the separate collection of organic wastes and dry recyclables (paper, cardboard, **plastics**, glass and metal packaging) at source, that is, from households and commercial areas involving three bins:

(1). one for organic wastes,
(2). one for recyclables and
(3). one for residual wastes.

The setting up and operation of **regional composting plants** and **sorting units** in line with Government's vision of implementing a circular economy in the solid waste management sector were also detailed at the cabinet meeting. Tractebel Engie's recommendation to Government was to pursue these projects through a Public-Private Partnership (PPP) using the Build, Operate, Transfer route, wherein the private sector would design, build, finance and operate the composting plants and the sorting units.

The two-day conference (18th and 19th October 2021) "Plastic Free Mauritius: Defining the Roadmap" organised by the Ministry of Environment, Solid Waste Management and Climate Change was an excellent opportunity for public private sector dialogue on the subject.

1.6 This Report: authorship and coverage

This report and the roadmap contained herein is the result of a consultancy assignment entrusted to ***Sustainable Resource Management Ltd*** by the MCCI in August 2021. Mauritian business operators in general and members of the MCCI could not keep up with the pace of changes that Government wanted to bring about in relation to management of waste plastics. The timelines, exigencies and transition to bio-alternatives that were imposed by regulations, such as Control of Single Use Plastic Products, GN 156 of 2020, simply could not be met. In addition, issues relating to interpretation of the regulations and enforcement were brought up by operators.

It became clear to all that the objectives of transitioning to more environmentally friendly packaging alternatives within the short delays prescribed would cause major disruptions for importers, manufacturers and retailers. A status quo would have entailed major economic repercussions for the food and non-food manufacturing sectors, resulting in huge capital expenditures, job losses and the additional financial burden passed on to the end-consumers. The food manufacturing sector (excluding sugar) employed close to 20,000 in 2020 and contributed around MUR 18 billion as value added. **Annex 1** contains a **qualitative assessment of the impact** a status quo on the original provisions of regulations GN 156 and GN 197 of 2020 could have had on employment and GDP in the country. The hardest hit would have been manufacturing, in particular food manufacturing, imports, distribution and retail.

Consequently, and in order to assist the successful transition that the Government of Mauritius wanted to bring about, the MCCI decided to commission this high-level roadmap to constructively contribute to the debate and actively participate in achieving the shared vision for a **waste plastic free Mauritius.** The methodological framework adopted is based on the UNEP 2018 report titled "Single Use Plastics – A Roadmap for Sustainability" [11] . The 10 main steps (see Box 1) have been reproduced hereunder for ease of reference.

BOX 1: UNEP'S FOR SUPP	
1.	**Target the most problematic single-use** plastics by conducting a baseline assessment to identify the most problematic single use plastics, as well as the current causes, extent and impacts of their mismanagement
2.	**Consider the best actions to tackle the problem** (e.g. through regulatory, economic, awareness, voluntary actions), given the country's socio-economic standing and considering their appropriateness in addressing the specific problems identified.
3.	**Assess the potential social, economic and environmental impacts** (positive and negative) of the preferred short-listed instruments/actions. How will the poor be affected? What impact will the preferred course of action have on different sectors and industries?
4.	**Identify and engage key stakeholder groups** – retailers, consumers, industry representatives, local government, manufacturers, civil society, environmental groups, tourism associations – to ensure broad buy-in. Evidence-based studies are also necessary to defeat opposition from the plastics industry.
5.	**Raise public awareness** about the harm caused by single-used plastics. Clearly explain the decision and any punitive measures that will follow.
6.	**Promote alternatives**. Before the ban or levy comes into force, assess the availability of alternatives. Ensure that the preconditions for their uptake in the market are in place. Provide economic incentives to encourage the uptake of eco-friendly and fit-for-purpose alternatives that do not cause more harm. Support can include tax rebates, research and development funds, technology incubation, public-private partnerships, and support to projects that recycle single-use items and turn waste into a resource that can be used again. Reduce or abolish taxes on the import of materials used to make alternatives.
7.	**Provide incentives to industry** by introducing tax rebates or other conditions to support its transition. Governments will face resistance from the plastics industry, including importers and distributors of plastic packaging. Give them time to adapt.
8.	**Use revenues collected from taxes or levies on single-use plastics to maximize the public good.** Support environmental projects or boost local recycling with the funds. Create jobs in the plastic recycling sector with seed funding.
9.	**Enforce** the measure chosen effectively, by making sure that there is clear allocation of roles and responsibilities.
10.	**Monitor and adjust** the chosen measure if necessary and update the public on progress.

MCCI's approach differs only in scope and the island of Rodrigues is not included in this analysis. The roadmap as proposed in this report pertains to six categories of waste plastic, that is: (1) plastic containers and plastic packaging, (2) durable plastic or plastic containing goods, (3) nondurable plastic or plastics containing goods, (4) single use plastic (food service business), (5) single use plastic (other), and (6) microplastics.

Section 2 of this report contains a review of pollution caused by waste plastic, international responses and lessons learnt. **Section 3.0** of this report contains the outcome of a series of consultations held with MCCI members. **Section 4** contains the prelude to the proposed roadmap. **Section 5** is about quantification of waste plastic and **Section 6** contains the roadmap. Finally, **Section 7** contains the recommendations for the way forward for achieving a **Waste Plastic Free Mauritius** by 2030. The term **plastic free** as applied to a country is utopic, instead the term **waste plastic free** has been used to mean management of 100% of waste plastic generated.

In order to avoid the use of confusing jargon (HDPE, LDPE, PP, PET, PLA, PHA, PBS), the term **"conventional plastic(s)"** as used in this report means fossil fuel derived plastics and the term **"bio-alternative"** has been used throughout to mean **materials** which can be classified as follows:

- Plastics and materials that are both bio-based and biodegradable
- Bio-based or partly bio-based non-biodegradable plastics, known as 'drop-ins'
- Plastics that are based on fossil fuel resources and are biodegradable

2.0 ECOLOGICAL IMPACTS OF WASTE PLASTIC

2.1 The Culprits: macro and microplastics

Plastic pollution was first noticed in the ocean by scientists conducting plankton studies in the late 1960s and early 1970s [18]. Since the ocean is downstream from every terrestrial location, it is the receiving body for much of the plastic waste generated on land. Several million tonnes of debris end up in the world's oceans every year, and much of it is improperly discarded plastic litter. A recent study [19] determined that 44 percent of plastic debris in rivers and oceans, and on shorelines, was made up of bags, bottles, and items related to takeout meals. Inefficient management systems in many countries, especially in Asian countries contribute directly to the ocean pollution problem.

Plastic packaging and in particular single use plastic products have been the subject of much attention since they tend to be lightweight, easily transported by wind and water and constitute the most visible form of the pollution caused by plastic. However, plastic packaging and single use plastic products are not the only culprits as other forms of plastics emanating from discarded durable and non-durable goods (including microplastics) when left unmanaged are equally devastating to the environment.

Footwear, parts of home appliances, cotton-bud sticks, balloon holders, plastic fishing gear are some well-known examples of non-packaging related ocean litter. Microplastics is a generic term for small pieces of plastic under 5 mm, which form part of consumer and industrial products have been found to be highly polluting while their control has often been neglected due to the over-emphasis on single use plastic products [13].

A major part of the problem is the fact that plastic production and marketing are closely linked to the oil industry and the petrochemical sector, which already has a huge installed capacity and constant need to allocate fossil fuels surpluses into other production or products along the value chain [20]. The falling price of fossil fuels and the prospect of falling demand in the future add to this tension. Plastics are a very affordable material now because of a low oil price scenario, and the collection, recycling and disposal cost is not included in the price to other businesses downstream or to consumers.

2.2 Global Responses: continents and selected countries

Governments around the world are increasingly conscious of the scale of plastic pollution. More than 60 countries (including Mauritius) have introduced bans and levies to curb single-use plastic waste. Plastic bags and, to a certain extent, foamed plastic products like Styrofoam have been the focus of government action as these plastic products are often the most visible forms of plastic pollution. It is estimated that one to 5 trillion plastic bags are consumed worldwide each year [11].

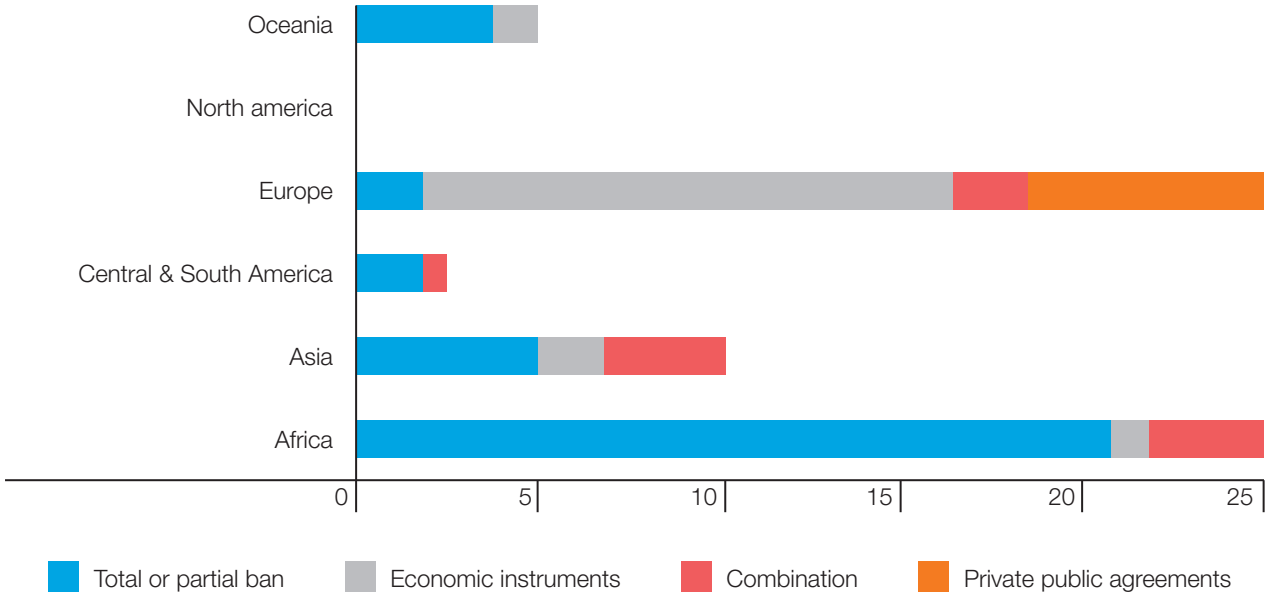


Figure 3 : Types of National Policies on Plastic Bags by Continent

The x-axis of Figure 3 [11] above represents the number of countries that have introduced national policies to control pollution caused by plastic bags in some form or the other. In Africa, most countries opted for total or partial ban while European countries have favoured economic and private-public agreements. Early movers such as Bangladesh are still struggling to contain the problem caused by plastic bags due to poor enforcement while countries like Japan have successfully controlled the waste plastic bag issue without resorting to bans. Japan has a waste management system with literally no leakage and the high degree of civic sense prevailing in the country have helped to keep it free from littered waste single use plastic bags.

Waste is nothing else but valuable material resource at the wrong place. Many countries have recognised this fact and have geared their waste strategy accordingly. Table 2 contains a summarised review of the instruments used by the world's top five countries with solid waste recycling rates above 50% [21]. Instruments that work in one country may or may not work in another; level of affluence, culture and the level of social consciousness are strong determinants.

Table 2: Countries with Recycling Rates of 50% and Above		
Country	**Recycling [%]**	**Instruments Used**
Germany	56.1	• Industry funded Green Dot System for waste collection from households and businesses. Waste costs paid by companies linked to weight of products made. • German Packaging Act of 2019 to prevent or reduce the impact of packaging waste on the environment make retailers more responsible for promoting the use of eco-friendly products • Restricted single-use products and banned the destruction of unsold durable goods
Austria	53.8	• Blanket ban on certain waste types going to landfill • Any product that has a total organic carbon emission rate of more than 5% is banned, which in effect prevents any packaging from ending up in the ground
South Korea	53.7	• Privately-run companies collect the waste and sell it for profit (impacted negatively by China ban on waste imports) • Implemented policies that include the banning of both coloured plastic bottles and PVC since 2020 • Improve the domestic recycling plastic bottles by collecting them separately from other recyclables • Phase-out disposable cups and plastic screws completely by 2027 • General policy to reduce wastepaper imports • Target to collect 100,000 tonnes of plastic bottles per year by the beginning of 2022.
Wales	52.2	• Recycling in Wales is operated by local administrations • People and businesses have similar rules on what can and can't be recycled across the country • Set out in 2010 aim is for a 70% recycling rate nationwide by 2025 • Welsh government launched a consultation on plans to ban a range of single-use plastic items in 2020. • A range of single-use, hard-to-recycle and commonly littered plastic items – such as straws, cotton buds, polystyrene food and drinks – banned from 2021.
Switzerland	49.7	• "Polluter pays" policy – households and businesses pay for any non-recycling waste they produce • Bin bags for landfill waste are taxed • Commonly used household goods including tin and aluminium cans, light bulbs, paper and electronic products taken to recycling points across the country typically found at supermarkets

2.3 Lessons Learnt: national and international

Lessons that can be learnt from the global responses [22] to the approaches adopted to curb or eliminate the pollution caused by waste plastic are reviewed below:

1. In general instruments that work in one country may or may not work in another; level of affluence, culture and the level of social consciousness are strong determinants.

2. Countries which have been successful in controlling pollution caused by waste plastic have extremely efficient waste collection and management systems with zero leakage.

3. It does not matter whether the end-of-life treatment of waste plastic involves landfilling or incineration of a combination of both, so long the waste management system is highly efficient.

4. Very often, initiatives to control waste plastic require a bundle of measures, that is, combinations of economic, regulatory and voluntary actions.

5. Voluntary or public-private agreements involving producers, importers, retailers and the public have been successful in many parts of the world and such initiatives should be encouraged. Dialogue is key for achieving circularity.

6. Measures put in place (bans, levies, etc.) to promote the transition from conventional plastics to bio-alternatives (as applied to packaging and single use plastics) should a priori be accompanied by waste collection systems that allow these bio-alternatives to be either composted or bio-treated at their end-of-life to take full advantage of their biodegradability.

7. Economic operators, that is, importers, manufacturers, retailers and recyclers should be considered as part of the solution, and they should be regularly consulted be it on an informal basis or as part of regulatory impact assessments. The cornerstone of a circular economy is built on dialogue between policy makers, business operators, recyclers and most importantly, consumers.

8. Most countries fail to regulate plastic through its lifecycle. The end-of-life treatment of waste plastic should be shelved in favour of lifecycle approach starting with products design to its disassembly and re-use.
9. Countries favour partial bans over full bans.

10. Virtually no countries restrict plastic bag manufacturing/production.

11. Exemptions are numerous.

12. Incentives are not offered for alternatives to single-use plastic bags.

3.0 CONSULTATIONS

3.1. The MCCI: mission and purpose

The MCCI was established in 1850 and is the oldest non-profit making institution representing the private sector in Mauritius today. It took on its present name in 1965, when the country was moving towards independence and was contemplating the diversification of its economy through appropriate forms of industrial activities. The MCCI has evolved from a purely representative and consultative body to a dynamic actor in the socio-economic development of the country. Throughout its years of existence, it has constantly striven to carry out its fundamental mission of promoting economic development policies while taking into consideration the point of view of its members (see Figure 4). It has also set up and developed the organizational structures capable of providing a wide range of highly professional services. As the main voice of the Mauritian business community, it has always maintained close links with Government and increasingly contributed to the development process of the country. And just as importantly, it has set up links and affiliations at international level with inter-governmental and private organizations aimed at widening its scope of activities and better promoting Mauritius on the world scene. As for matters relating to the development of commercial and industrial activities, the MCCI is regularly solicited and makes submissions directly to representatives of the Government ministries and departments concerned [23].

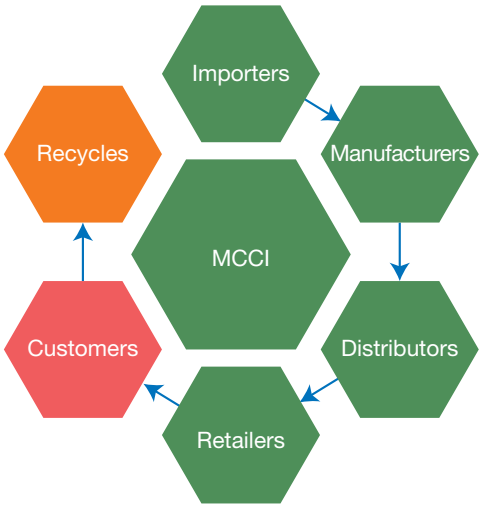


Figure 4 : Map of Key Stakeholders for Waste Plastic Management

3.2. The Need for Consultations: race against time and technical challenges

Members of the MCCI, importers and suppliers of plastic packaging, food importers, food manufacturers, non-food manufacturers and retailers came under intense pressure to switch to bio-alternatives as a result of GN 156 and GN 197 of 2020. While operators approved the transition to bio-alternatives for containers, packaging and single use plastic products, implementing the government-imposed timelines were in most cases challenging and often impossible to meet. The nature of the challenges posed for each of the sub-sectors concerned differed considerably; hence the sectoral approach for holding the consultation sessions (see Annex 2). The outcome of the consultations held is presented in Table 3 in the next sub-section.

3.3 Outcome of Consultations: face to face and online

The outcome of the 6 consultations sessions held have been summarized in Table 3 below. In 2019, there were 119 large enterprises engaged in the manufacturing of food and beverage products in Mauritius representing 21% of the total number of large manufacturing establishments in Mauritius and employing nearly 14,500 people. According to Statistics Mauritius, the provisional estimated value added for large dairy products manufacturing establishments for year 2019 was at Rs 388 Million. Unfortunately, Statistics Mauritius does not provide similar categorization in terms of activities for SMEs. As per Table 3, the regulations and ban of SUPPs can have major repercussions on the ability of the local food manufacturing industry to manufacture and supply of food to the country. For some products such as dairy and meat products, enterprises have highlighted the difficulties in meeting the timeline given by the authorities. Given the large number of variables that have to be considered including financial costs, technology options, investment and impact on prices, the tight deadline cannot be met.

Table 3: Summary of Outcome from Consultation Workshops			
Date	**Group Consulted**	**No. Enterprises Present**	**Outcome**
3rd September 2021	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	19 Enterprises	• Some products should be excluded from the definition of 'single-use' plastics. • G.N. No. 156 of 2020 should be applicable to the food service businesses only. • Allow other food operators a transition period to look for and test alternative (biodegradable) packaging options.
9th September 2021	Local food manufacturers	15 Enterprises	• Alternative (biodegradable) options are costly and require huge investment. • A transition period is required. • Banning of Modified Atmospheric Plastic (MAP) packaging should be reviewed.
16th September 2021	Other local manufacturing industries (chemicals, detergents, pains, etc.)	8 Enterprises	• Unfair competition with importers. • No alternatives for some water-based chemicals.
29th September 2021	Importers/Distributors/ Retailers of finished products with single-use plastic products as part of the primary packaging	9 Enterprises	• Shelf-life of products is reduced with bio-alternatives
16th November 2021	Consultation with the Plastic Committee Group	Sub-committee of the MCCI on Plastics	• Members of the plastics sub-committee provided key insight on the draft roadmap and made key suggestions for the final
6th December 2021	Validation Workshop	23 Enterprises	• Circular economy (recycling) approach highly desirable. • Aggressive recycling targets of 50% by 2030 for waste plastic

3.4 Key Findings from Consultations: the 10 main points

1. Finding alternatives to conventional plastic packaging has been restricted as international travel to attend international fairs or visits to suppliers has been curtailed due to the pandemic.

2. As shown in Table 4, the main issues with bio-alternatives are availability, costs, know-how and time. Bio-alternatives for packaging, in most cases, are irregular or not easily available from international suppliers. They are also not yet available for commercial deployment. For example, PLA is more expensive, becomes brittle at low temperatures, is not naturally biodegradable and requires special environmental conditions which are not supported by the current solid waste management infrastructure in Mauritius.

Table 4: Matrix of Issues Related to Transition to Bio-alternatives

Issues	Importers	Manufacturers	Distributors	Retailers	Recyclers
Availability	•	•		•	•
Cost	•	•	•	•	•
Know-how	•	•		•	•
Time	•	•		•	•

3. Economic operators in Mauritius as well as international suppliers have been caught off-guard. The changes taking place worldwide in terms of packaging and SUPPs will make the transition possible, but this will take some time and will be subject to technological developments worldwide The moratorium of 1 year for the application of GN 156 of 2020 is not sufficient as innovation and availability of bio-alternatives will hardly be different in one years' time.

4. Process changes (especially for manufacturers) are capital intensive and slow to implement. Given more time, several alternatives can be investigated and adopted.

5. Consumer acceptance for carton-based alternatives has been trialled by one operator. The plastic (PE) lined carton option costs more and is difficult to source. Changeover to large scale usage of plastic lined carton containers would require massive investments (>100 million Mauritian Rupees per operator), time for implementation exceeding 2years and also requiring price hikes of 20% or more.

6. Regulations, as currently drafted, confer an unfair advantage to importers of plastic packaged goods as opposed to locally manufactured products.

7. Labelling of locally made plastic packaging should follow international norms (such as those of the ASTM D7611M-20 [24])

8. A holistic approach to manage waste plastic, as opposed to piecemeal, is favoured by all operators.

9. Carbon neutrality, ecotoxicity and human health parameters as determined using LCA should be considered when making choices between alternatives to conventional plastics. Instead of outright bans, it might make more sense to instead make plastics better. Innovation is key.

10. Economic operators and institutions such as the MSB need time to fully grasp standards, tests and compliance requirements; some countries have allowed 10-15 years for the transition to take place.

4.0 THE ABC OF WASTE PLASTIC MANAGEMENT

4.1 Production and Consumption in Loops: lifecycle, circularity and insularity

An important factor when considering transition to bio-alternatives is to compare the performance of the bio-alternative to the conventional plastic from an environment and resource utilization point of view. Key indicators that are used in life cycle assessments (LCA) to compare alternatives (paper versus plastic single use beverage cups for example) include Global Warming Potential (GWP), eco-toxicity and carcinogenic propensity. The geographical context, that is, the source of energy used for the manufacture of the cups, the end-of-life fate of the discarded cups (incinerated or landfilled) has a strong bearing on the results of the comparison. Nevertheless, LCAs when conducted properly can provide insightful information to decision makers. Also, the life cycle approach when applied to waste management system enables the "big picture approach" which if neglected by policy makers could lead to unsustainable solutions.

The lifecycle approach when applied to the management of waste plastic in the context of a circular economy can be represented as shown in Figure 5 below [25]. In the case of plastic and plastic products say PET beverage containers, the **extraction** and **processing** stage is directly linked to the petroleum industry [10]. The **design** stage is about the product design (consumable plus primary and secondary packaging). It is important to point out that this stage is critical as innovation in packaging solutions can yield drastically eco-friendly solutions. Eco-design or design for recycling are extremely important concepts which need to be taken on-board not only in R&D but also in tertiary education and research organisations in Mauritius. Packaging weight reduction or shift to RICs which lend themselves for recycling are concrete examples of what can be achieved at this stage.

The **manufacturing** stage involves the production of the packaged products, followed by the **retail** and **use** stage after which the PET container reaches its useful life and is discarded by the consumer. In an ideal situation, the **disposal** stage consists of the collection, sorting, and treatment of the waste plastic container according to the hierarchy options available with reuse being the most preferred option and landfill being the least preferred.

In the case of Mauritius, most products (food and non-food) are imported, and this means that decision makers, business operators (importers, distributors), consumers and waste contractors do not have any control on the extraction, processing and manufacturing stages (upstream processes). In cases where the products are manufactured locally, the additional stages that can be influenced are design and manufacturing; however, if the said product is manufactured under an international licensing agreement, changes can hardly be made. As shown in Figure 5, the life cycle approach provides insight on the whole value chain and points to the limits of intervention.

A circular economy is restorative, regenerative by design and seeks to move the waste management strategy up in the hierarchy. This means materials constantly flow around a 'closed loop' system, rather than being used once and then discarded. In the case of plastic, this means simultaneously keeping the value of plastics in the economy, without leakage into the natural environment.

As shown in Figure 5, circularity can be achieved by: (1) recycling, (2) re-manufacturing, (3) re-use, (4) repair, (5) sharing, (6) industrial symbiosis, and (7) the use of renewable or bio-based inputs at the design stage [25]. Concrete examples of these options as they relate to PET are given in Table 5 below.

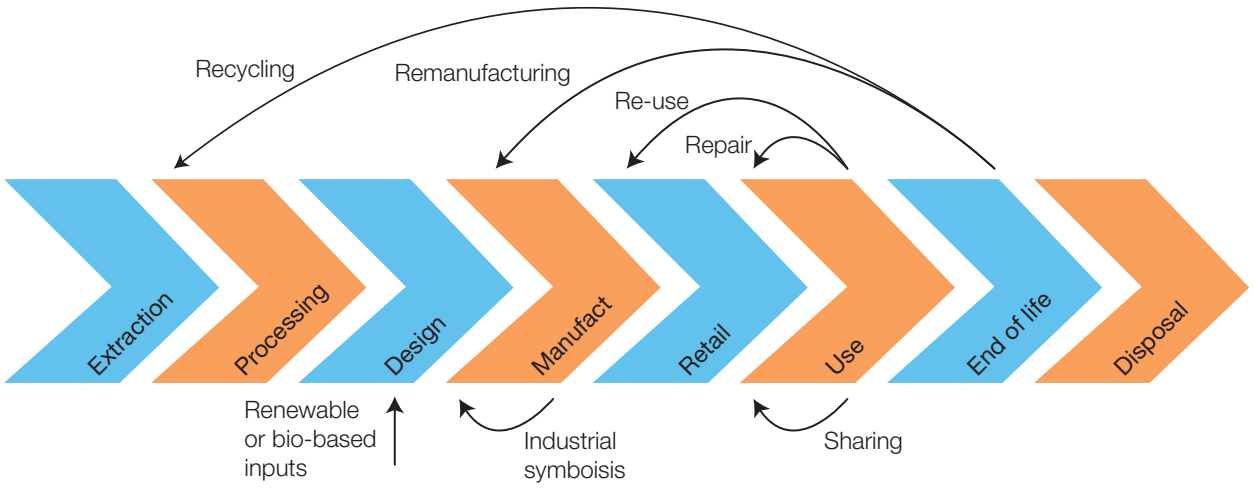


Figure 5 : Lifecycle and Waste Management in a Circular Economy

Table 5: Circular Options for Plastic from PET	
Discarded PET	**Concrete Example**
Recycled	Waste plastic from PET can be turned into jars, carpet, clothing, industrial strapping, rope, automotive part for example.
Remanufactured	Turned into pellets and used to remanufacture PET containers.
Re-Used	Re-Use of PET bottles is possible if the latter is designed for reuse
Repaired	PET bottles if conceived for reuse can be repaired
Shared	Replacement of 1 Litre PET water bottles by a pool 25 Litre containers which are continually refilled and distributed
Industrial Symbiosis	Use of waste PET bottles from an industrial activity to make spectacle frames; waste from one industrial activity is a resource for another
Renewable or bio-based inputs	Use of renewable energy in processes or switch over to bio-alternatives which are compostable.

The insularity of SIDS like Mauritius provides both the challenge and opportunities for the circular economy approach to solve waste issues including waste plastic. Local resources are scarce, markets for recycled products are limited, dependence on imports and on the tourism industry is high. But improved waste management practices and financial incentives to change the habits of consumers, retailers and manufacturers and enacting strong policies that push for a more circular model of design and production of plastics have started to give positive results in many SIDS. Bans and levies are not the only instruments that work, voluntary actions and most importantly, material recovery, innovative approaches such as industrial symbiosis have proved to be highly effective in many SIDS [11]. For example, in Mauritius, waste plastic hangers from large retailers are converted into poly-pipe (plastic conduit) and waste plastic containers are converted into flowerpots by local recyclers. Around 2,000 tonnes of PET bottles are retrieved and recycled every year [26]. Dialogue between waste producers, recyclers and consumers of recycled goods is gaining traction; more and more economic operators in Mauritius do not regard waste as waste but more as a resource. A clearly defined policy framework providing incentives to promote material would yield positive results for the country at large.

4.2 Classification: resin type, recycling and labels

The Society of the Plastics Industry created the RIC codes in an effort to develop consistency in plastics manufacturing and recycled plastics reprocessing. Each Resin Identification Code (RIC) corresponds to a specific type of resin used in a plastic product. By recycling according to a product's RIC, the product could be properly recycled and have its value preserved.

The ASTM D7611M-20 Standard [24] - Practice for Coding Plastic Manufactured Articles for Resin Identification (see Figure 6) is the most updated standard and is meant to provide guidance to **recyclers** on the predominant resin type used to produce specific plastic packaging/bottles/containers.

The previous version of these RICs had a triangle that closely resembled the Universal Recycling Symbol. This was misleading as consumers interpreted the symbol as a mark of certainty that the said waste plastic would be recycled. However, this is no longer the appearance of RIC as per the revised version. As an example, Figure 7 shows the change that was enacted to limit any misplaced associations of RICs with recycling codes. The ASTM D7611M-20 standard provides the globally accepted basis for labelling of plastics meant for recycling. The RIC code is meant for recyclers and once again should not be confused with information that needs to be imparted to consumers.

Labels on packaging are used to convey information to consumers about:

1. Bio-alternatives
2. Compostability and biodegradability,
3. Recycling guidance,
4. Recycled content,
5. Recycling financing.

Printing the packaging manufacturers name, address and any other information on the material does not serve any purpose other than to track dubious operators who lend themselves to malpractices such as falls claims about biodegradability.

Resin	Resin Identification Code-Option A	Resin Identification Code-Option B
Poly(ethylene terephalate)	1 PETE	01 PET
High densityPolyethylene	2 HDPE	02 PE-HE
Poly(vinyl chloride)	3 V	03 PVC
Low density polyethylene	4 LDPE	04 PE-LD
Polypropylene	5 PP	05 PP
Polystyrene	6 PS	06 PS
Other resins	7 OTHER	07 0

Figure 6: RIC as per ASTM D7611/ASTMD7611M-20

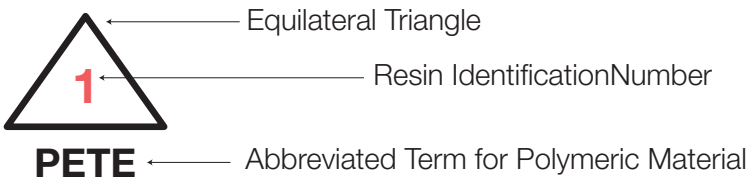


Figure 7: Interpretation of the RIC Code as per ASTM D7611M-20

4.3 Categorization: usage time and waste plastic

The proposed six categories of waste plastic (see Table 6 below) have been inspired from the work done on the subject by the USEPA [27] for the first 3 categories. It was deemed necessary to differentiate between the two categories of single use plastic products and the sixth category has been added to complete the range of waste plastic that need to be managed in the Mauritian context. The usage time referred to in Table 6 below is the lapse of time that the plastic item or product is in the hands of the user or consumer. For example, a family size ice cream pack whose container is made of plastic would be bought from a retailer and kept in the refrigerator say for 2 months and then discarded once it is empty. Similarly, durable plastics are in use for periods exceeding 3 years.

Table 6: Categorization of Waste Plastic

Category	Usage Time	Example
1. Plastic Containers* and Plastic Packaging	< 1 year	Food containers
2. Durable Plastic or Plastic Containing Goods	> 3 years	Discarded e-waste
3. Nondurable Plastic or Plastics Containing Goods	< 3 years	Disposable diapers
4. Single Use Plastic (Food Service Business)	Immediate	Drinking straws
5. Single Use Plastic (Other)	Immediate	Cotton buds
6. Microplastics	Released upon usage	Beads in laundry detergent

*Plastic containers contaminated with hazardous substances such as pesticides should be treated as hazardous waste

4.4 The Waste Plastic Management Hierarchy: the Mauritian context

The waste plastic management hierarchy in the Mauritian context is shown in Figure 8. While options to reduce or prevent the occurrence of waste plastic do exist, these are often confronted with hygiene considerations. The same goes for re-use of waste plastic. Very often, the switch to bio-alternatives, while applicable to containers and packaging, is difficult to implement as the alternatives are not available; they involve major technological changes and generally require large investments. Regulations pertaining to single use plastics as applied to the food service business have successfully seen the switch to wooden or paper-based items which were previously made from conventional plastics. Recycling of waste plastic is on the rise in Mauritius as there are at least 12 [28] recyclers of waste plastic registered with the authorities.

At present, there is no Waste to Energy (WTE) recovery in Mauritius (this option is contemplated for 2030); most of the waste plastic (61%) is landfilled at Mare Chicose. The Mare Chicose landfill will undergo vertical expansion (wall construction) and the authorities are busy planning its horizontal expansion by the acquisition of some additional 40 hectares of adjacent land. It is important to note that the choice between landfilling and WTE has an important bearing on the ecological footprint of bio-alternatives when the latter are compared to their conventional counterparts (see next section). Leakages of waste plastic (~36.5%) into the environment is common in Mauritius and is the results of littering and dumping.

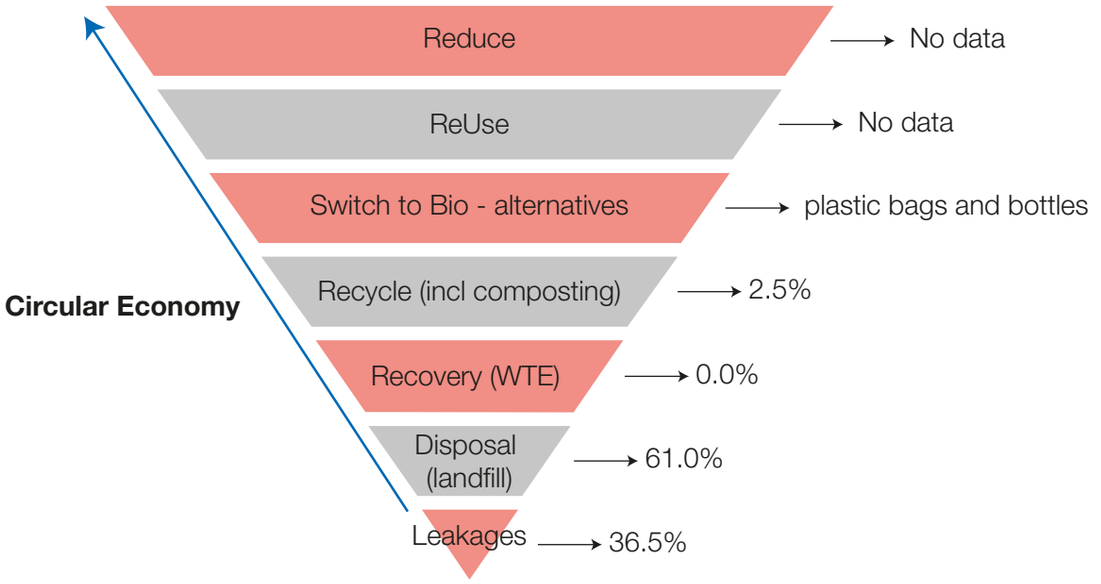


Figure 8: The Waste Plastic Management Hierarchy in the Mauritius Context

4.5 Transition to Bio-alternatives

The transition from conventional plastics and composites to bio-alternatives [29] is likely to be arduous, lengthy and requiring major changes in upstream and downstream production processes relating to containers, packaging, single use plastic products, durable goods and non-durable goods. As shown in Figure 9, the options for transitioning to bio-alternatives can be towards:

- Group 1: Bio-alternatives that are both bio-based and biodegradable and can include carton or paper packaging lined with Chitosan for example,
- Group 2: Bio-based or partly bio-based non-biodegradable plastics, known as 'drop-ins' and can include paper or carton (cellulosic) lined with PE,
- Group 3: Plastics that are based on fossil fuel resources and are biodegradable.

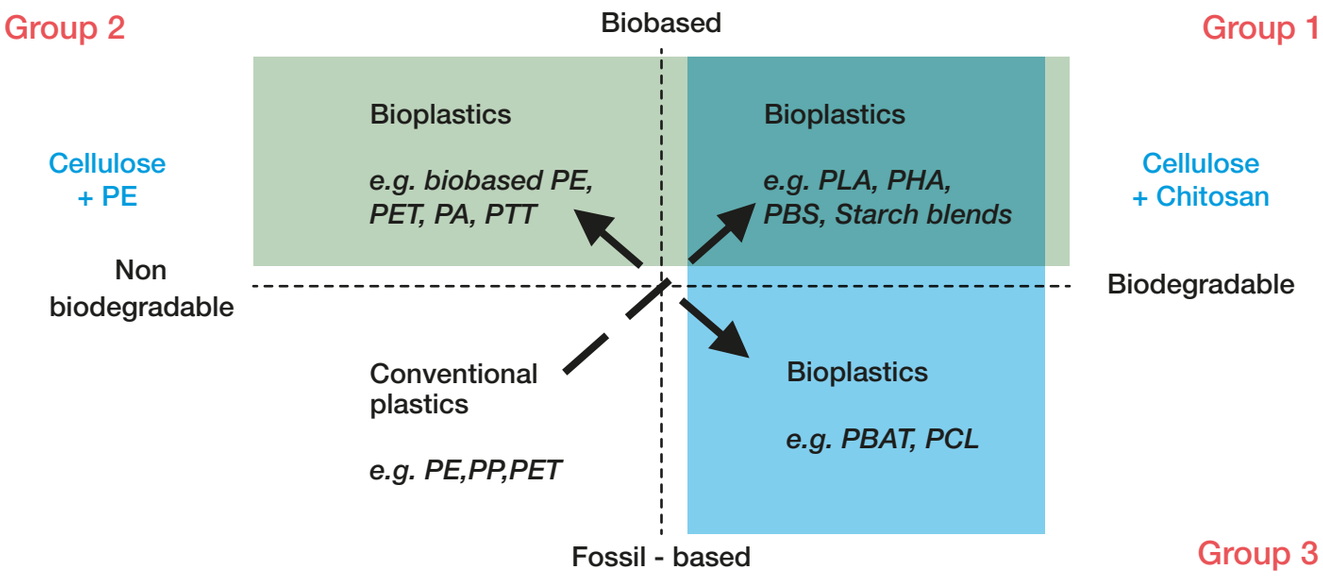


Figure 9: Transitioning to Bio-alternatives

Group 1 [30] consists of materials that are both bio-based and biodegradable; examples include polylactic acid (PLA) and polyhydroxalkanoate (PHA). Derived from the starch of natural and renewable resources such as corn, wheat or potatoes, polylactic acid, also known as polylactide and commonly referred to as PLA they are currently one of the most popular and promising 'green' plastic alternatives on the market. On an industrial scale lactic acid is made to undergo polymerisation to cause the molecules to link up into long chains or polymers. This is turned into sheets of flat plastic or pellets, which can then be moulded into a variety of different forms including containers. The characteristics of PLA are like those of conventional petrochemical plastics (such as PET), while another benefit is its ability to be processed on existing plastic production equipment. One of PLA's strong environmental selling points is its ability to completely biodegrade. However, if placed in a backyard compost bin or sent to landfill, it will behave just as any regular conventional plastic; it will take many decades to disappear. To fulfil its biodegradable potential, PLA requires specific compost conditions. Unfortunately, these can only be found in industrial composting facilities. PLA's increasing popularity has seen its uses expand from primarily food packaging to encompass a wide range of fields including medical, textile, automotive, cosmetic and household applications. Another **'Group 1** bio-alternative is polyhydroxalkanoate, or PHA. PHAs are naturally occurring polymers that can be produced in different ways by specific strains of bacteria. PHAs are not ready for commercialisation yet as the large-scale production still requires research and development. PHA is fully biodegradable under the right conditions, non-toxic, and can be used in a wide range of applications, from food packaging to medical implants.

Group 2 [30] are **bio-based or partially bio-based non-biodegradable** materials also known as 'drop-ins'; examples include bio-polyethylene (PE), bio-polypropylene (PP) and bio-polyethylene terephalate (PET). Drop-ins are bio-alternatives that are bio-based or partly bio-based but are not biodegradable. Put simply, 'drop-in' solutions are hybrid versions of traditional plastics. They differ from their conventional counterparts only in terms of their partly renewable raw material base, while retaining the same functionality. Leading the field is partially bio-based PET, which is already accounting for approximately 40 per cent of the global bio-alternatives production capacity. Many conventional plastic types such as polyethylene (PE), polypropylene (PP) and polyvinyl chloride (PVC) can in fact be made from renewable resources, such as bioethanol. A popular example of a drop-in plastic is the 'Plant Bottle' currently used by one of the world's leading soft-drink manufacturers. The bottle uses 30 per cent plant-based materials in its manufacture, while retaining the same characteristics as the traditional bottle, and being fully recyclable. Over time, it is hoped that the renewable component of the bottle will increase, while the fossil fuel-based materials will decrease. Drop-ins are the fastest growing bio-alternative group. Industry interest is based around two main selling points:

1. Drop-ins feature the same properties and functionality as their petrochemical counterparts, meaning they can be processed, used and recycled in existing facilities and following the same routes as conventional plastics. This reduces the need for new or additional infrastructure and reduces costs across all levels.
2. The renewable (or partly renewable) basis of these products reduces their carbon footprint while also lowering production costs.

Group 3 [30] are fossil **fuel-based** materials that are **biodegradable**; examples include polybutyrate (PBAT) and polycaprolactone (PCL). They are based on fossil fuels but are still biodegradable and include products such as polybutyrate adipate terephthalate (PBAT). It is fully biodegradable under correct composting conditions and contains many properties which are like low-density polyethylene such as high elasticity, fracture resilience and flexibility. This makes it a viable alternative for use in products such as bags, wraps and other packaging. It is particularly suited to rubbish bags or disposable packaging due to its ability to decompose in compost within several weeks.

Currently, bio-alternatives (mainly bioplastics) represent about one per cent (1%) of the ~368 million tonnes of plastic produced annually [31]; demand is rising and with more sophisticated materials, applications, and products emerging, the market is poised to grow. According to the 2020 market data compiled by European Bioplastics [31], global production capacity of bioplastics is predicted to grow by 36 percent in the medium term, from around 2.11 million tonnes in 2020 to approximately 2.8 million tonnes in 2025. As shown in Table 7, when bio-alternatives are compared to their conventional counterpart, several parameters such as availability, technology status, standards, labelling and terminology are yet to reach the equivalence of conventional plastics. The comparison of bio-alternatives with the conventional using the steps of the waste hierarchy differs only slightly but for the lack of separate streams for bio-waste.

Table 7: Comparison of Conventional Plastics to Bio-alternatives		
Parameter	**Conventional Plastics**	**Bio-alternatives**
Global Production [tonne p.a]	368×10^6	2.11×10^6
Availability	unlimited	limited
Application	widespread	packaging mostly
Technology	mature	R&D
Standards	well established	upcoming
Labelling	well established	development stage
Terminology	well established	development stage
Prevention and Reduction	✓	✓
Reuse	✓	✓
Organic Recycling/Composting	x	✓[a]
Mechanical Recycling	✓	✓[a]
Feedstock Recovery	✓	✓[a]
Energy Recovery	✓	✓
Landfilling	✓	✓

a : requires separate collection stream for the bio-waste

4.6 Standards and Definitions

Dialogue between policy makers, economic operators, recyclers, and consumers is key and constructive dialogue can only be based on consistency in definitions and in the application of technical standards. The currently used method for testing biodegradability in Mauritius [32] is the Fourier Transform Infrared Spectroscopy, also known as FTIR Analysis or FTIR Spectroscopy, which is an analytical technique used to identify organic, polymeric, and, in some cases, inorganic materials. The FTIR analysis method uses infrared light to scan test samples and observe chemical properties. However, the method is neither referred to in international regulations nor is it a recognized method for determining biodegradability in Mauritian regulations. Several international standards exist (such as ISO 17088:2012) and their use and application would help towards bringing about uniformization and consistency.

There are three primary standard-setting bodies that govern the relevant standards for sustainable packaging claims:

1. The International Organization for Standardization (ISO; standards begin with “ISO”),
2. ASTM International (ASTM; standards begin with “ASTM”), and
3. The European Committee for Standardization (CEN, standards begin with “EN”).

Annex 3 contains a non-exhaustive review of **standards** that are applicable to plastics, bio-alternatives, labelling and other key parameters that should be taken into consideration when regulations are drafted and enacted. The increasing number of bio-alternatives available on the market, combined with unregulated use of terminology such as ***‘biodegradable, compostable, natural, bio-based and plastic free’***, make it challenging for businesses and consumers to procure responsibly and for business operators to effectively and responsibly manage the variety of waste material produced. It has been noted that the terms ***biodegradable*** and ***compostable*** have been used interchangeably in certain regulations (GN 197 of 2020) in Mauritius. While biodegradable items refer to just any material which breaks down and decomposes in the environment, compostable goods are specifically organic matter which breaks down, the end-product having many beneficial uses which include fertilizing and improving soil health. All **compostable** materials are **biodegradable**, but the converse is not always true. The usage of terminology in regulations should be aligned to technical standards to avoid ambiguity. **Annex 4** contains a non-exhaustive list of **definitions** of key terms related to plastics drawn from technical standards.

5.0 WASTE PLASTIC QUANTIFICATION

5.1 Quantification: measure to manage

"If you can't measure it, you can't improve it". Quantification of waste plastic flows is crucial if the latter is to be effectively managed. The quantities of waste plastic generated, landfilled, recycled and unaccounted for has been estimated and the results are presented in Table 8 below (see footnotes for the calculation procedure adopted). The waste generation rate of 1.8 kg/cap/day (see Figure 10 [11]) has been retained in the subsequent analysis for Mauritius for the base year for the following reasons:

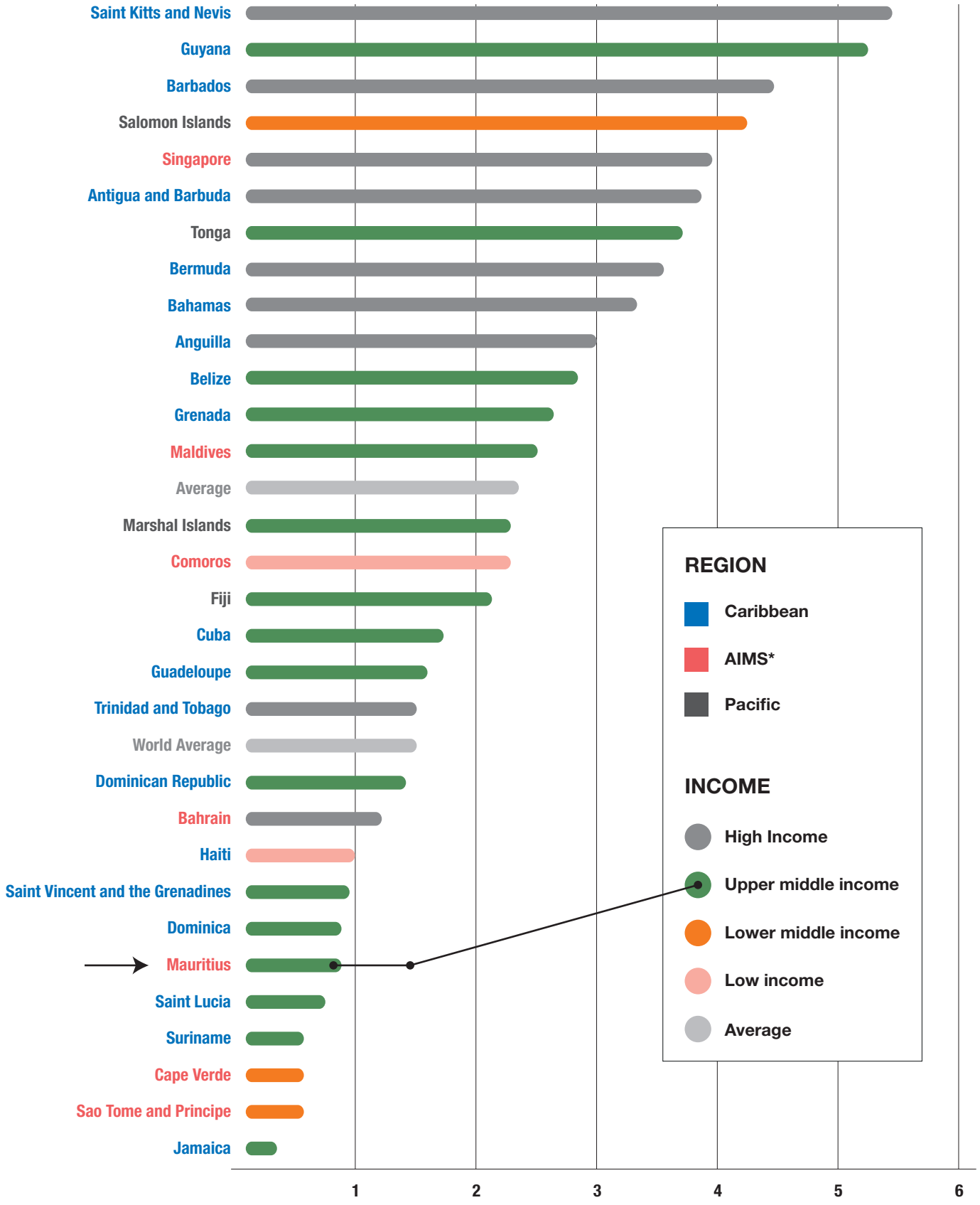
1. Municipal Solid Waste (MSW) in Mauritius includes not only household waste but also commercial, industrial waste, construction, and institutional waste streams.

2. Mauritius is an upper middle-income country [11] and is also a small island developing state where solid waste generation rates tend to be higher compared to non-SIDS with similar income levels. The solid waste **landfilled** per capita per day is reported as 1.2 by the SM for the year 2019 [9].

3. In addition, the following have been adopted for the calculations:

4. The plastic percent of solid waste of 14% (measured in 2013/2014) has been retained and are based on results of waste characterization [32].

5. Solid waste recycling rate of 8% instead of 5% [26] has been used to account for the **unreported** recycling activities that occur within inter-related companies and other commercial and industrial companies.



*Aims: The Atlantic Indian Ocean, Mediterraean, and South China region

[67]United Nations Statistics Division (2017)

Figure 10: Solid Waste Generation Rates in Selected SIDS and Mauritius

Table 8: Estimation of Waste Plastic Generated Landfilled Recycled and Unaccounted-for								
Parameter [Base Year 2019/2020]	Units	Solid Waste Generation Rates[a]						
	[kg/ capita/ day]	1.2	1.4	1.6	1.8	2.0	2.2	2.4
Population[b]		1,265,740	1,265,740	1,265,740	1,265,740	1,265,740	1,265,740	1,265,740
Solid Waste Generated	tonne/year	554,394	646,793	739,192	831,591	923,990	1,016,389	1,108,788
Solid Waste Landfilled[c]	tonne/year	509,094	509,094	509,094	509,094	509,094	509,094	509,094
Solid Waste Recycled[d]	tonne/year	45,300	52,850	60,400	67,950	75,500	83,050	90,600
Solid Waste Leaked or Un-accounted-for[e]	tonne/year	0	84,849	169,698	254,547	339,396	424,245	509,094
Solid Waste Managed	%	100	87	77	69	63	58	54
Plastic Portion of Solid Waste[f]	%	14	14	14	14	14	14	14
Waste Plastic Generated[g]	tonne/year	77,615	90,551	103,487	116,423[h]	129,359	142,294	155,230
Waste Plastic Landfilled	tonne/year	71,273	71,273	71,273	71,273	71,273	71,273	71,273
Waste Plastic Recycled[h]	tonne/year	3,000	3,000	3,000	3,000	3,000	3,000	3,001
Waste Plastic Leaked or Un-accounted-for[e]	tonne/year	3,342	16,278	29,214	42,150	55,085	68,021	80,956

a: range of values from 1.2 to 2.4

b: [9]

c: [9]

d: Assumed rate of 8.2%

e: Computed by difference

f: Data from 2013/2014 characterization study from two transfer stations, new study commissioned in September 2019, results awaited [32].

g: [32]; This is equal to equal to 0.25 kg/cap/day

h: 2.5% of total waste plastic

Given the above assumptions, the results of computations indicate that only 69% of the country's solid waste is managed (see Table 8), giving rise to an estimated 42,150 tonnes/year of waste plastic that is unaccounted for or leaked into the environment.

The complete picture is shown in Figure 11 below. With an estimated annual waste plastic generation rate of 116,000 tonnes, Mauritius is comparable (see Table 9) to countries like Namibia, Slovenia, Qatar and Cyprus [33].

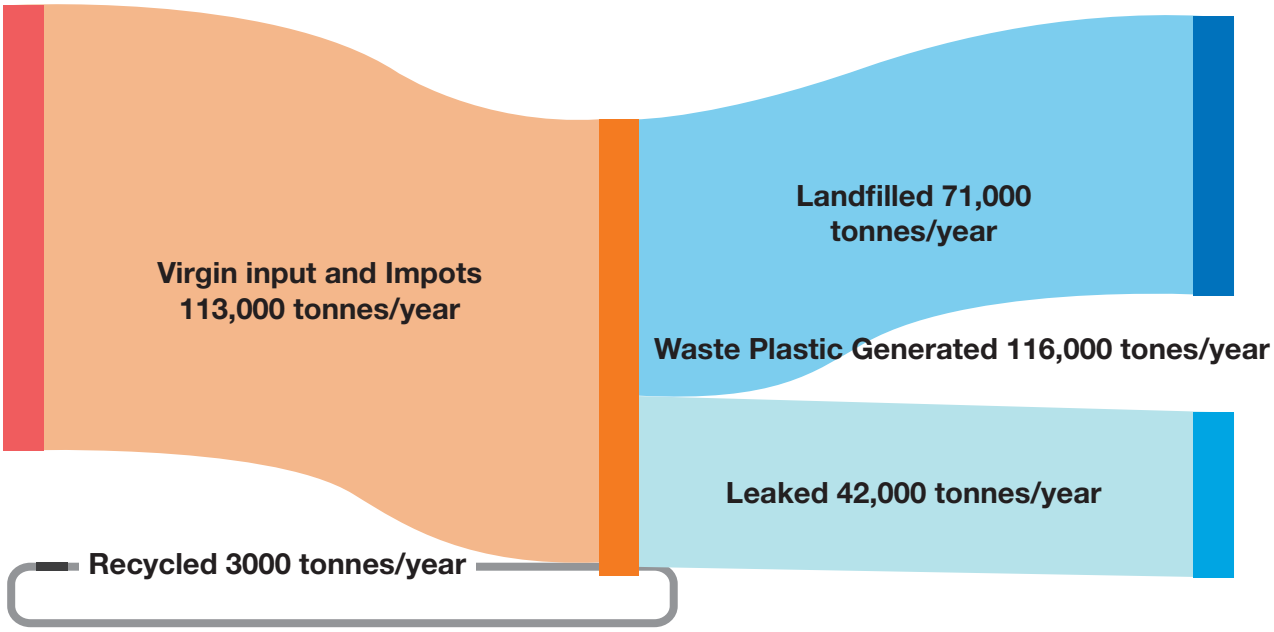


Figure 11: Sankey Diagram of Plastic Flows for Mauritius in Base Year

Table 9: Country Comparison of Estimated Waste Plastic Generated [2021]				
Country	**Waste Plastic Generated [tonne/year]**	**Population**	**Waste Plastic Generated [kg/cap/day]**	**Data Source**
Namibia	114,222	2,587,344	0.12	[33]
Slovenia	108,421	2,078,724	0.14	[33]
Mauritius	104,971	1,273,433	0.23	[33]
Qatar	103,933	2,939,528	0.10	[33]
Cyprus*	100,713	1,215,584	0.23	[33]

*Cyprus must meet a 55% waste plastic recycling target by 2030 as per EU Directive

In the absence of data for the six categories for Mauritius, global averages from Table 10 [11] have been used (see Figure 1) to allocate waste plastic generated to each category as shown in Table 11 below.

Table 10: Percentages Adopted for Waste Plastic per Category in Mauritius		
Category	**End Use Type***	**Waste Plastic [%]**
1. Plastic Containers and Plastic Packaging	Packaging	36
2. Durable Plastic or Plastic Containing Goods	Building and Construction, Transportation, Electrical and Electronics, Industrial Machinery	28
3. Nondurable Plastic or Plastics Containing Goods	Textile and Others	26
4. Single Use Plastic (Food Service Business)	Consumer and Institutional Products	5
5. Single Use Plastic (Other)	Consumer and Institutional Products	5

*see Figure 1

Table 11: Estimates of Categorized Waste Plastic Quantities in the Base Year				
Category of Waste Plastic	Generated	Landfilled [tonne/ year]	Recycled	Leaked
1. Plastic Containers and Plastic Packaging	41,912	25,658	1,080	15,174
2. Durable Plastic or Plastic Containing Goods	32,598	19,956	840	11,802
3. Nondurable Plastic or Plastics Containing Goods	30,270	18,531	780	12,007
4. Single Use Plastic (Food Service Business)	5,821	3,564	150	2,107
5. Single Use Plastic (Other)	5,821	3,564	150	2,107
6. Microplastics	NQ	NQ	NQ	NQ

NQ: Not Quantifiable

5.2 Crystal-balling: business as usual and the clean & green Mauritius scenario

As shown in Table 12, the population of Mauritius [34] is projected to decrease by 2030 compared to the base year. However, given the effect of economic development and changing lifestyles, the solid waste generation per capita per day is likely to grow to 2.0, the plastic percent in solid waste generated is projected to remain at 14%.

Under the **Business as Usual** (BAU) Scenario for 2030, waste plastic generated would grow from 116,324 tonnes in the base year to reach 127,557 tonnes p.a by 2030. Waste plastic landfilled would remain at 61%.

In line with Government's vision for enhanced material recovery and recycling, the **Clean & Green Mauritius (CGM)** scenario (see Table 12) is based on the **bold** objective of achieving:

1. *Zero leakage of waste plastic generated by 2030,*
2. *50% of waste plastic generated getting recycled by 2030,*
3. *50% of waste plastic landfilled compared to 61% currently or 0% landfilled if WTE adopted by 2030.*

Table 12: Business as Usual and the Clean & Green Mauritius Scenarios for 2030				
Mauritius		Baseline 2020	BAU 2030	CGM 2030
Population		1,265,740	1,248,110	1,248,110
Solid Waste Generation Rate	kg/cap/day	1.8	2.0	2.0
Plastic Percent of Solid Waste	%	14	14	14
Waste Plastic Generated	tonne/year	116,423	127,557	127,557
Waste Plastic Landfilled/WTE	tonne/year	71,273	78,089	63,778
Waste Plastic Recycled	tonne/year	3,000	3,287	63,778
Waste Plastic Leaked or Unaccounted-for	tonne/year	42,150	46,181	0

Table 13 contains the estimates of waste plastic likely to be generated, landfilled, recycled and leaked or unaccounted for under a **Business as Usual** (BAU) scenario for the year 2030. Table 14 contains the estimates of waste plastic likely to be generated, landfilled, recycled and leaked or unaccounted for under a **Clean & Green Mauritius (CGM)** scenario for the year 2030. The proposed roadmap is about achieving the objectives of the **CGM** scenario by 2030.

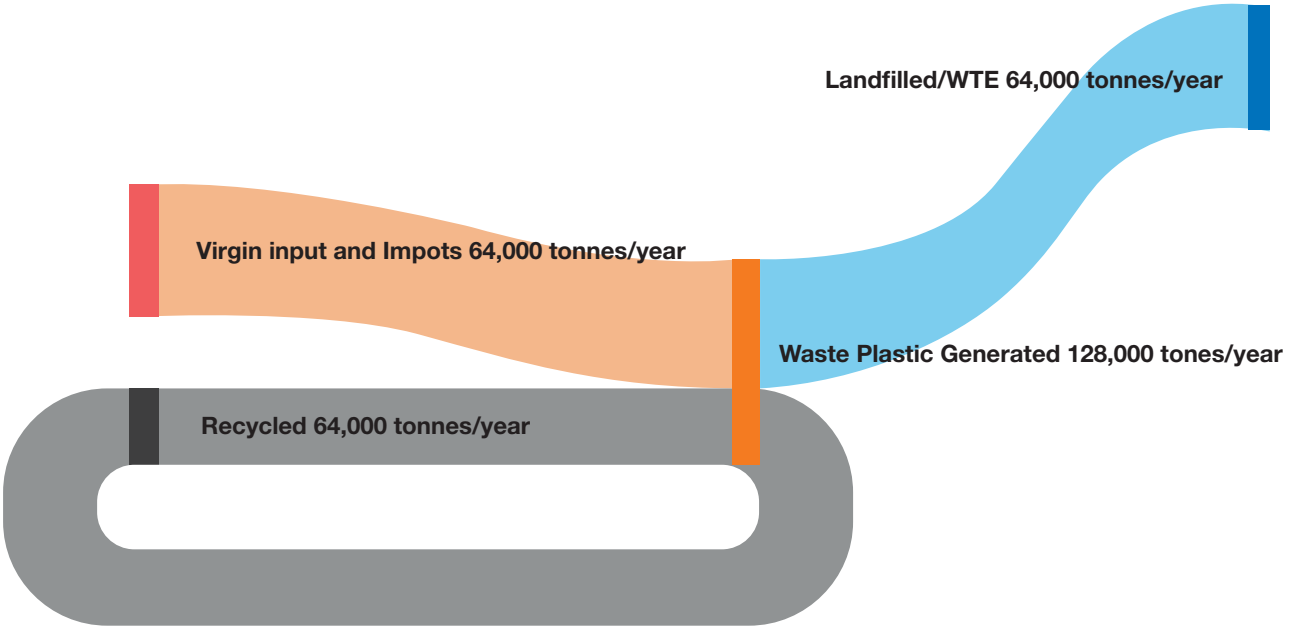


Figure 12: Sankey Diagram of Plastic Flows CGM Scenario for 2030

Figure 12 above should be interpreted as follows:

(1). Leaked or Unaccounted-for waste plastic is brought to zero by 2030, hence is not shown,

(2). 50% of waste plastic generated is either landfilled or converted to energy (WTE),

(3). the virgin input and imports is calculated as the difference between the projected waste plastic generated in year 2030, that is ~128,000 tonne p.a. minus the set objective of achieving the 50% recycled target or 64,000 tonne p.a,

(4). there is no export and the recycled plastic displaces virgin and imports,

(5). the recycling process is 100% efficient, that is there is no process loss.

Table 13: Estimated Categorized Waste Plastic under the BAU 2030 Scenario

Category of Waste Plastic	Units	Generated	Landfilled/ WTE	Recycled	Leaked
1. Plastic Containers and Plastic Packaging	tonne/year	45,920	28,112	1,183	16,625
2. Durable Plastic or Plastic Containing Goods	tonne/year	35,716	21,865	920	12,931
3. Nondurable Plastic or Plastics Containing Goods	tonne/year	33,165	20,303	855	12,007
4. Single Use Plastic (Food Service Business)	tonne/year	6,378	3,904	164	2,309
5. Single Use Plastic (Other)	tonne/year	6,378	3,904	164	2,309
6. Microplastics	tonne/year	NQ	NQ	NQ	NQ

Table 14: Estimated Categorized Waste Plastic under the C&G 2030 Scenario					
Category of Waste Plastic	**Units**	**Generated**	**Landfilled/ WTE**	**Recycled**	**Leaked**
1. Plastic Containers and Plastic Packaging	tonne/year	45,920	22,960	22,960	-
2. Durable Plastic or Plastic Containing Goods	tonne/year	35,716	17,858	17,858	-
3. Nondurable Plastic or Plastics Containing Goods	tonne/year	33,165	16,582	16,582	-
4. Single Use Plastic (Food Service Business)	tonne/year	6,378	3,189	3,189	-
5. Single Use Plastic (Other)	tonne/year	6,378	3,189	3,189	-
6. Microplastics	tonne/year	NQ	NQ	NQ	NQ

6.0 TOWARDS A WASTE PLASTIC FREE MAURITIUS

The roadmap proposed herein is a high-level document which seeks to influence intervention pertaining to six categories of waste plastic in the form of regulations, economic and information instruments to achieve: (1) zero leakage of waste plastic, (2) at least 50% recycling of waste plastic by 2030, and (3) voluntary transition bio-alternatives wherever applicable. The roadmap also provides for the management of waste microplastics; an often-neglected form of plastic which can have significant impact on human health.

6.1 Plastic Containers and Plastic Packaging

The characteristic usage time of items falling in this category (see Table 6) is generally less than1 year and this category includes spent wrapping (packaging) to protect imported and locally manufactured goods, including food, beverages, medications and cosmetic products and paints. It is important to distinguish between primary and secondary packaging. Primary packaging is the packaging which is in direct contact with the product itself. It forms an integral part of the product as it guarantees food safety and preservation. Any attempt to ban, switch, alter primary packaging has a direct impact on the product itself. Secondary packaging provides supplementary protection to help maintain the integrity of the primary packaging.

Also, the Plastic Containers and Plastic Packaging category includes polyethylene terephthalate (PET) soft drink and water bottles, high-density polyethylene (HDPE) milk and water jugs, film products (including plastic bags and sacks) made of low-density polyethylene (LDPE) and other containers and packaging (including clamshells, trays, egg cartons, loose fill, produce baskets, coatings and closures) made up of polyvinyl chloride (PVC), polystyrene (PS), polypropylene (PP) and other resins. The roadmap for this category is summarized in Table 15. It is estimated that some 42,000 tonnes of waste plastic belonging to this category is generated every year, ~26,000 tonnes are landfilled and approximately 1000 tonnes are recycled. The quantity of leaked or unaccounted for waste plastic in this category amounts to ~15,000 tonnes p.a.

Priority actions should obviously be directed at suppressing leakages of waste plastic containers and plastic packaging, promotion of recycling and voluntary switch to bio-alternatives wherever possible and practical. As per the annual report [32], a new system consisting of segregation of wastes at the national level will be implemented only when composting plants and sorting units are commissioned and operational and this is expected to be by 2023/2024. Any biodegradable and compostable waste plastic container or packaging material generated as waste plastic before the implementation of the new system would simply end up landfilled together with their conventional plastic counterparts or leaked (or unaccounted-for) into the environment if leakage of solid waste is not brought to a stop. It is envisaged that by 2025 bio-alternatives would have made a modest inroad followed by more significant substitution of conventional plastics by 2030. Lessons learnt (such as the use of correct labelling and the right standards) from the voluntary switch to bio-alternatives would be of great value for future regulations should the latter be deemed necessary. Primary plastic packaging which ensures wholesomeness and guarantees shelf life should generally be excluded from controls such as bans.
An important factor when considering the transition to bio-alternatives is whether the waste management infrastructure can treat the resulting biowaste effectively. *What is the point of replacing conventional yogurt cups with a Group 1 bio-alternative if the waste management system in place is not able to differentiate and ensure suitable end-of-life option for the correct disposal of the waste product?* Careful planning and phasing of actions in line with the availability of supporting infrastructure is crucial.

Mauritius is not ready yet for a regulation driven transition to bio-alternatives (related to containers and packaging) for the following reasons:

1. Availability of bio-alternatives as an alternative is limited or at best costly,
2. The SWM infrastructure is not ready to accept and treat biowaste originating from bio-alternatives,
3. Standards and test facilities related to bio-alternatives are yet to be implemented,
4. Consumers are not aware of end-of-life options for biowaste from bio-alternative packaging.
5. Composite packaging is widely used and is also a challenge to the recycling process since they contain multiple layers of metals, plastics, or papers combined with wax or resins. Current recycling facilities in Mauritius are not equipped to handle composite packaging.

Table 15: Roadmap for Plastic Containers and Plastic Packaging								
						Base Year	2025*	2030
Waste Plastic	End of Life Responsibility	Policy Target	Regulatory	Economic	Information	KPI	KPI	KPI
		Leakage Prevention	Anti-littering/ dumping regulation with severe penalties and enforcement	Support for NGOs fighting littering/marine littering/land pollution	Aggressive anti littering campaign on all media (billboards, TV, Social, etc)	~15,000 tonne/year leakage	Leakage reduction by half	Zero leakage
~40,000 tonnes/ year generated, ~25,000 tonne/ year landfilled, ~1000 tonnes recycled, and ~15,000 tonnes/ year leaked or unaccounted for	Mainly households plus commercial operators	***Promotion of Recycling***	Waste segregation at source (3 bins), Exempt containers**, EPR regulation (where applicable), Revisit IWA regulation	(1) review tipping fee for recyclers collecting from Civic Amenity Centres (2) PRO promotion	Benefits of buying recycled on all media (billboards, TV, Radio, Social, etc)	~1,000 tonnes currently recycled	25% of waste containers and packaging	50% of waste containers and packaging, ~20,000 tonne/year
		Bio -alternatives	Measures to support voluntary switch to bio-alternatives by operators	Incentive scheme to promote voluntary switch	Consumer awareness to promote acceptance	Limited to plastic bags	Target for 2030 can be set as part of Regulation supporting transition	Quantities achievable would depend on many factors

*the new system for SWM with a 3-bin system implemented in household and commercial sector by end of 2024

**containers that can be re-used/recycled should be exempted from regulations; recyclable containers or recyclable plastic product as an option should to be given due consideration.

6.2 Durable Plastic or Plastics Containing Goods

The characteristic holding time for items in this category is more than 3 years; this implies that these items are in use for time periods of more than 3 years (some can be in use for periods exceeding 50 years) after which they reach their end-of-life. Typical plastic goods in this category include oversized and bulky items such as TV sets, white goods, vehicle parts, carpets and rugs, used vehicles, e-waste, and plastic containing construction waste that have reached their end of life. The roadmap for this category is presented in Table 16. Almost 31,000 tonne/year of waste plastic belonging to the durable plastic or plastics containing goods category is generated, ~18,000 tonnes/year is landfilled, ~1000 tonnes/year is recycled but ~12,000 tonnes/year is leaked or unaccounted for.

Figure 13: Disassembly for Valorisation

Priority action should be directed to quash illegal dumping of durable plastic or plastic-containing goods. Fortunately, recyclers can play a significant role in the management of waste emanating from this category as the collection of such bulky items are generally more efficient. When such waste plastic-containing goods are sorted and disassembled (see Figure 13), the value of the different components (plastic, rare metals) of the resulting waste generally goes up and these become an attractive business for recyclers. Thus, closing the loop with the advent of 11 CACs, 2 sorting facilities on the island by 2023/2024 [26] and re-adjustment of tipping fees for recyclers who collect such waste from CACs is the way forward. Recycling works if there is a market for recycled products; information campaigns to promote the use of recycled products would help to increase demand for the latter and in turn drive the closure of the loop.

Table 16: Roadmap for Durable Plastic or Plastic Containing Goods								
						Base Year	202(	2030
Waste Plastic	**End of Life Responsibility**	**Policy Target**	**Regulatory**	**Economic**	**Information**	**KPI**	**KPI**	**KPI**
		Leakage Prevention	Impose stricter penalties for illegal dumping	Set up dedicated collection points (CACs),	Greater emphasis on eyesore abatement	Leakages =~11,000 tonne p.a	Reduce by 50%	Zero Leakage
~32,000 tonnes/year is generated, ~20,000 tonnes/year is landfilled, ~1000 tonnes are recycled but ~11,000 tonnes are leaked or unaccounted for.	Households, commercial and construction industry	***Promotion of Recycling***	New regulatory framework for recyclers with attractive tipping fees, Revisit IWA regulation	Concessions for scrapyard for used vehicles sand used tyre recycling	Campaign to promote use of recycled products	Recycled = ~840 tonne p.a	Recycle at least 25%	Recycle at least 50%
		Bio -alternatives	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

6.3 Nondurable Plastic or Plastic-Containing Goods

The characteristic holding time for items in this category is less than 3 years (see Table 6); such items are in use for time periods of less than 3 years. Generally, goods in this category (see Figure 14) are smaller household items such as toothbrushes, razors, plastic plates and food containers, disposable diapers, clothing (textile), footwear, shower curtains and disposable medical supplies. Fishing gear also forms part of this category and requires special attention as waste plastic from fishing is a common ocean litter. The roadmap for this category is summarized in Table 17. It is estimated that ~30,000 tonnes/year of waste plastic belonging to this category is generated, 18,000 tonnes/year is landfilled, around 800 tonnes p.a is recycled and almost 12,000 tonnes p.a is leaked or unaccounted for. Just like for the previous category, leakage prevention should be a priority and actions should be targeted towards households and institutions. If waste plastic belonging to this category is to be recycled, it must be collected as segregated waste upstream making the Mauritian a crucial link in the circular economy. Some form of incentive provided to households who consistently sort their waste (the 3-bin system) would help to boost citizen engagement.

Figure 14: Nondurable Household Plastic Goods

Announcements by Government [26] for the creation of 5 Civic Action Centres (CACs), 2 Sorting Facilities, payment of tipping fees to recyclers who collect waste from the CACs will be enabling measures when successfully implemented. Indeed, recyclers are likely to play a crucial role if 50% of the waste generated in this category is to be achieved by 2030. Barriers, such as the requirement for EIA or PER licenses before recyclers gain registration, should be removed. Incentives and loan facilities extended to SMEs should be de-facto extended to recyclers while the latter need to be regularly audited and rated to avoid malpractices which occur especially when financial incentive schemes are involved. The potential to transition away from conventional plastics towards bio-alternatives for this category is limited.

Table 17: Roadmap for Nondurable Plastic or Plastic Containing Goods								
						Base Year	202(	2030
Waste Plastic	**End of Life Responsibility**	**Policy Target**	**Regulatory**	**Economic**	**Information**	**KPI**	**KPI**	**KPI**
		Leakage Prevention	Anti-dumping/ anti littering regulation with severe penalties and enforcement	Attractive incentives schemes for households participating in segregation at source	Anti-littering campaign on all media (billboards, TV, Radio, Social, etc)	Leakage ~12,000 tonnes p.a.	Leakage reduction by half	Zero leakage
~30,000 tonnes/ year generated, ~18,000 tonnes/ year is landfilled, around 800 tonnes p.a is recycled and almost 12,000 tonnes p.a is leaked or unaccounted for	Households including Institutions (such as medical)	***Promotion of Recycling***	Review Local Government (Registration of Recycler and Exporter) Regulation 2013 and remove EIA/ PER	(1) Extend all SME incentives to Recyclers, (2) Incentives for Dis-assemblers	Recyclers audited, star-rated and showcased on govmu.org website	Currently ~780 tonnes/year	25% recycled	50% recycled
		Bio -alternatives	Limited Potential	Limited Potential	Limited Potential	Limited Potential	Limited Potential	Limited Potential

6.4 Single Use Plastics (Food Service Business)

Also referred to as disposable plastics (see Figure 15), these are commonly used items intended to be used only once by food service businesses before they are thrown away or recycled. These include grocery bags, food packaging, straws, containers, cups and cutlery commonly used for packaging or serving “take away’ food.

Figure 15: Typical SUPPs related to the Food Service Business

The regulation known as Environment Protection (Control of Single Use Plastic Products) Regulations 2020 (G.N. No. 156 of 2020) was Gazetted on18/07/2020 and became effective on 15/04/2021. While the regulation could be implemented with relative ease by food service businesses (see Table 18), other operators such as those involved in imports, manufacture and retail of food and non-food products were not able to cope with the exigencies. This led the MCCI to request the authorities to reconsider the said regulation to clearly differentiate between SUPPs meant for food service businesses and SUPPs relating to containers and packaging. Governments response to this issue has been two pronged: (1) a moratorium has been granted on the ban for certain forms of packaging (see Table 1) and (2) the draft terms of reference currently being envisaged for a national roadmap for waste plastic was circulated in October 2021.

Table 18: Roadmap for Single Use Plastics (Food Service Business)								
						Base Year	2025	2030
Waste Plastic	**End of Life Responsibility**	**Policy Target**	**Regulatory**	**Economic**	**Information**	**KPI**	**KPI**	**KPI**
5800 tonnes p.a. is generated, 3500 tonnes/year is landfilled	Consumers and Operators of Food Service Businesses	***Leakage Prevention***	Anti-littering regulation with severe penalties and enforcement	Smart usage of Government levies to support and maintain switch to bio-alternatives	Campaign to maintain the success of the switch from SUPP	Leakage = 2000 tonnes p.a	50% reduction	Leakage = 0
		Promotion of Recycling	Switch to bio-alternatives has been observed as a result of GN 156 of 2020*					
		Bio -alternatives	Review GN 156 and GN 197 considering consistent definitions and applicability of standards	Subsidised testing facilities for determining biodegradability				

*Containers that can be re-used/recycled should be exempted. To consider recyclable containers or recyclable plastic product as an option

6.5 Single Use Plastics (Other)

Single use plastics termed as “other” refer to non-food service business related disposable plastic items which are used only once before they are thrown away. Examples include plastic cotton buds, cigarette filters, balloon sticks, wet wipes and sanitary items, face masks (see Figure 16) and some items relating to fishing gear, plastic flags, thermocol for decoration and plastic banners. The roadmap for this category is presented in Table 19. It is estimated that almost 6,000 tonnes of waste plastic falling in this category are generated each year in Mauritius with almost 3,500 tonnes being landfilled and the remainder of almost 2,000 tonnes are leaked or are unaccounted for.

Figure 16: Discarded Face Mask

A very common form of waste from this category are cigarette butts. They are small and tend to go unnoticed. Contrary to popular belief cigarette butts are not harmless. They are made of cellulose acetate, a man-made plastic material, and contain hundreds of toxic chemicals. While cigarette filters, or the plastic part of butts, can take up to 10 years to completely degrade, the chemicals they release can remain in the environment for many more years beyond the life of the cigarette butt itself. Another culprit in this category is the plastic stem of cotton buds. Plastic cotton buds are one of the most problematic litter items found on beaches across the world. Almost 1.5 billion single-use plastic cotton buds are produced each day. Many end up in waterways and oceans. Plastic cotton buds break down into microplastics which can be ingested by the smallest phytoplankton through to the biggest whale. Microplastics can block digestive tracts of marine life and reduce their urge to eat, causing some species to starve and die. Mauritius urgently needs to address the issue related to this category of single use plastic products.

Table 19: Roadmap for Single Use Plastics (Other)								
						Base Year	2025	2030
Waste Plastic	**End of Life Responsibility**	**Policy Target**	**Regulatory**	**Economic**	**Information**	**KPI**	**KPI**	**KPI**
~5800 tonnes p.a. is generated, almost ~3500 tonnes p.a is landfilled.	Households and consumers	***Leakage Prevention***	Anti-littering regulation with severe penalties and enforcement	Incentives and support schemes to encourage voluntary switch plus bans in the longer term	Campaign to create awareness on negative impacts of SUPPs on the environment	Leakage estimated at 2000 tonnes p.a	At least halved	Zero Leakage
		Promotion of Recycling	Generally recycling of these small items is problematic					
		Bio -alternatives	Regulations to push towards bio-alternatives on a case by case* basis					

*for example, cotton buds, cigarette butts, disposable diapers, sanitary products, disposable wipes

6.6 Microplastics

Microplastics include microbeads (see Figure 17) that are found in detergents and personal care products, plastic pellets (or nurdles) used in industrial manufacturing, and in plastic fibres used in synthetic textiles. Primary microplastics [35] enter the environment directly through detergents being washed into wastewater systems from households, unintentional loss from spills during manufacturing or transport, or abrasion during washing (laundering of clothing made with synthetic textiles). Secondary microplastics [35] are formed from the breakdown of larger plastics which typically happens when larger plastics undergo weathering, through exposure to, for example, wave action, wind abrasion, and ultraviolet radiation from sunlight. The roadmap for this category is presented in Table 20. While recycling as an option is not applicable, regulations and switch to bio-alternatives can have significant impact on reducing or even eliminating the threat paused by this category of waste plastic.

Figure 17: Microplastics in Common Household Products

Countries that have established microbead bans are Canada, France, Italy, the Republic of Korea, New Zealand, Sweden, the UK and the US. Among these countries, New Zealand's regulations go beyond a ban on microbeads in personal products by also regulating abrasive household, car and industrial cleaning products. In addition, Belgium, Brazil, India and Ireland have proposed new regulations or laws banning microbeads at the national level, and the EU has started a process to restrict the addition of microplastics to consumer and professional use products. Voluntary approaches to tackle microbeads are also emerging, with governments, companies and civil society organizations promoting voluntary phase-outs and ecolabeling [36]. Mauritius needs to urgently address the issue of microplastics.

Table 20: Roadmap Microplastics								
						Base Year	2025	2030
Waste Plastic	**End of Life Responsibility**	**Policy Target**	**Regulatory**	**Economic**	**Information**	**KPI**	**KPI**	**KPI**
Not Quantifiable	Households, commercial (laundromats), Industrial (textile washing)	***Leakage Prevention***	Regulatory framework for both primary and secondary microplastics	Incentives to encourage switch to options without microplastics or bio-degradable microbeads	Specific campaigns to create awareness about the negative ecological impacts of microplastics	No data	No data	No data
		Promotion of Recycling	Not Applicable (N/a)	Not Applicable (N/a)	Not Applicable (N/a)	No data	No data	No data
		Bio -alternatives	Switch to biodegradable cellulose microbeads that replace harmful plastic microbeads	Incentives to manufacturers and importers	Promote consumer awareness on benefits of biodegradable cellulose microbeads	No data	No data	No data

6.7 The Roadmap in a Nutshell

Figure 18 depicts the MCCI Waste Plastic Free Mauritius Roadmap in a nutshell. The base year (2022) conditions are the following:

- Almost 36% of waste plastic generated is un-accounted for,
- Only 3% of waste plastic generated is recycled,
- The balance, that is 61% of waste plastic is landfilled.

> Actions taken during the period 2022 to 2025 would reduce waste plastic leakage to 18% and drastically increase recycling rate to 25%. These bold actions would require the implementation of the 3-bin system in both households, commercial and light industries as well as in the hospitality industry and institutions. It is expected that by 2027, bio-alternative packaging would have been tried and tested as part of a voluntary switch scheme. Bio-waste from bio-alternatives could form part of the organic portions of solid waste diverted for industrial composting. Microplastics would be regulated by 2025.

> Sorted waste plastic, attractive tipping fees for recyclers, incentives schemes for operators and clear visibility on quantities and RICs as a result of ICWA would kick start and project the waste plastic recycling industry on a path to achieve the desired 50% recycling rate by 2030. The launch of the MMRF and effective dialogue between government and private sector would be critical.

> Severe anti-littering laws, equally severe anti-dumping laws would curb leakage and enable the target of zero leakage of waste plastic to be achieved by 2030.

> The Solid Waste Management National Knowledge Attitude and Awareness study launched in 2022 would provide key insights for gearing the information strategy necessary for achieving the objectives of a clean and green Mauritius by 2030.

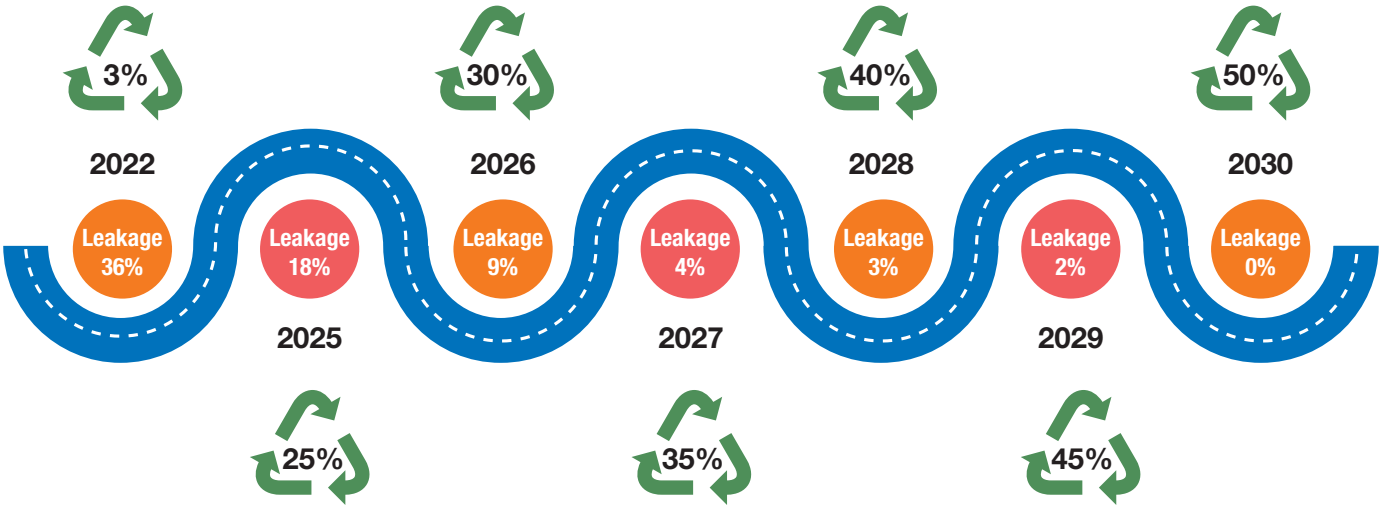
> Regulations and incentive schemes are like the two faces of the same coin. Monitoring of the effectiveness of the “carrot” and the “stick” need to be carried out all though starting in 2022. Characterisation of waste landfilled should become an integral part of monitoring, reporting on waste generated, landfilled or recycled by operators as a result of ICWA would help to transform waste plastic into recovered materials.

> By 2030, 50% out of the 128,000 tonne per year of waste plastic generated then would be recycled and the balance would either be landfilled or converted into energy. Mauritius can then boast that it has not only become “Waste Plastic Free” but also that its contribution to ocean litter is ZERO.

- Waste plastic recycling schemes operational
- 3 Bin System implemented (household and commercial)
- Sorting/CAC/Composting Centers Operational
- National testing facilities (ISO ASTM) ready
- **Mauritius Material recovery Forum** launched
- Microplastics regulated

- **Monitoring and Evaluation**
- Review effectiveness of Regulations and Incentive Schemes

- **Monitoring and Evaluation**
- Review effectiveness of Regulations and Incentive Schemes



- Anti-littering/dumping regulation (revised), ICWA implemented, Recycling incentives implemented
- Voluntary transition to bioplastic packaging schemes launched
- SWN national knowledge, attitudes, awareness study launched

- **Monitoring and Evaluation**
- Review effectiveness of Regulations and Incentive Schemes

- **Monitoring and Evaluation**
- Review effectiveness of Regulations and Incentive Schemes

- **Monitoring and Evaluation**
- Review effectiveness of Regulations, Incentive Schemes, evaluate WTE versus landfilling

Figure 18: The MCCI Waste Plastic Free Roadmap in a Nutshell

7.0 RECOMMENDATIONS FOR THE WAY FORWARD

7.1 Country Strategy

1) **Solid waste management and waste plastic management are hand in glove.** Any effort to better manage waste plastic should be part of the overall solid waste management strategy of the country. The three most important areas requiring intervention are:
   - littering and dumping prevention,
   - aggressive promotion of recycling of waste plastic and
   - smooth and phased transition to bio-alternatives in phase with the supporting solid waste management infrastructure.

2) **Dialogue** between Government and stakeholders (including MMRF) is key to achieving the objectives of the Clean and Green Mauritius scenario that is zero-waste plastic leakage, 50% recycling of all waste plastic generated by 2030 and a substantial transition towards bio-alternatives. Consultations between parties will be purpose-driven and regular. The two-day conference (18th and 19th October 2021) "Plastic Free Mauritius: Defining the Roadmap" organised by the Ministry of Environment, Solid Waste Management and Climate Change was an excellent opportunity for public private sector dialogue on the subject. There should be more of these.

3) Instead of only focusing on transition from conventional plastics to bio-alternatives, regulators, business operators and recyclers should encourage **shift towards resin types that are recyclable,** and for which recycled goods markets exist. RIC 1 and 2 are easily recycled compared to RIC 3,4,5 and 6.

4) **Pollution caused by microplastics** is a genuine issue that needs immediate attention of the authorities.

5) Government would have a clear policy for **procuring recycled plastic goods** such as bins, trash bags and other goods commonly given out for free to households by local authorities.

6) **Innovation** at the design can be a game changer. Eco-design or designed-for-recycling packaging options for example can yield drastically different eco-friendly solutions. These concepts need to be taken on-board not only in R&D but also in tertiary education and research organisations in Mauritius.

7) Whether **landfilling or WTE** should be adopted as a future waste plastic management option was not within the scope of this analysis, hence the MCCI does not have any recommendation for or against these options.

8) The MCCI will facilitate the launch of the **Mauritius Material Recovery Forum** (MMRF) whose purpose would be to act as the permanent apex private sector body for promoting waste (including plastic) recycling and circularity in the Mauritian economy. The MMRF would draw representatives from importers, exporters, distributors, manufacturers, retailers, recyclers and PROs. The MMRF would help to coordinate and support government action and private sector initiatives for recyclables such as metal, plastic, paper, wood and other materials such as bio-alternatives and packaging. The MMRF would champion voluntary transition from conventional plastics to bio-alternatives and will join the Ellen Macarthur Foundation network.

7.2 Regulatory Framework

1) A **Resource Recovery and Circular Economy Act** should be promulgated to promote material efficiency and recovery throughout the Mauritian economy. Countries to be inspired from are Denmark, Netherlands Sweden, Scotland and Japan.

2) **Definitions of key terms** as they relate to waste plastic regulations should be based on international standards. The increasing number of bio-alternatives available on the market, combined with unregulated use of terminology such as 'biodegradable, compostable, natural, bio-based and plastic free', make it challenging for businesses and consumers to procure responsibly and for business operators to effectively and responsibly manage the variety of waste material produced.

3) The **six categories of waste plastic** as proposed to cover the full range of waste plastics would be adopted. Categorization of waste plastic ensures that control and circularity measures that are applied take into consideration the respective sources of waste plastic, their quantities, their types and RIC.

4) Regulations would be aligned to relevant **International Technical Standards** (such as ISO and ASTM) as they guarantee consistency and are regularly updated.

5) **Life Cycle Assessment** (LCA) would be adopted as a tool for designing and managing the solid waste (including waste plastic) management system in Mauritius. LCA does not only help in making the right choices between alternatives but also helps to see the bigger picture of the value chain. Business operators in the Mauritian context have limited control on the packaging choices made by their international suppliers; recognizing this fact in the quest for a waste plastic free Mauritius is important.

6) **EPR regulation** should not be limited to PET bottles but should be inclusive of other packaging forms such as glass, aluminium and carton and should include all operators in the value chain.

7) The Industrial Waste Audit regulations (GN 255 of 2008) should be reviewed and extended to commercial activities and re-styled as **"Industrial and Commercial Waste Audit Regulations"** (ICWA). Regular ICWA reporting should be made mandatory. The concept of waste transfer note (WTN), a document that details the transfer of waste from one entity to another should be emphasized in the new ICWA. Data on waste generation (including plastic) by type from ICWAs should be compiled and made available to operators of listed activities and recyclers. This itself would be a "treasure trove" for the promotion of circularity in the economy.

8) **Regulatory Impact Assessment** (RIA) should be carried out systematically for all changes in regulations to avoid panic and disruptions. Government will come forward the RIA bill and create the RIA office. The EPR regulation currently being drafted would be subject to a full RIA preferably by an independent assessor.

7.3 Information Strategy

1) **Labelling of plastic products** would follow international norms such as ASTM's D7611M-20. Printing the manufacturers name and address on the plastic container or packaging (including bags) will not guarantee recycling or traceability; conveying the right information in a clear and concise manner to consumers is key for proper end of life treatment of waste plastic.

2) **Traceability of waste** (including waste plastic) would be enforced by making waste transfer notes (WTN) mandatory as per the re-styled ICWA.

3) Over and above a manned information desk, the Ministry responsible for environment will maintain an **FAQ on waste plastic, regulations** and **incentive schemes on its website.**

4) Judging by the quantity of litter found on roadsides of Mauritius, education **and awareness to curb and eliminate littering has failed miserably.** It is common for Mauritians to toss out their junk from moving cars, vans, trucks and buses. In addition, waste carriers regularly dump their load of waste in sugarcane fields, forested areas or any vacant plot found outside public view. These are among the many reasons why almost 31% of solid waste is un-managed in Mauritius, giving rise to some 42,000 tonne per year of un-accounted-for waste plastic. It is high time for authorities to wipe the board clean and start all over. A national study on the knowledge, attitudes, awareness status and behaviour concerning solid waste management would provide the right direction for basing a revamped information and national awareness campaign on the subject.

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Annex 1: SUPP Regulations and Impact on Employment and GDP						
Sector	Employment March 2020			Impact of SUPP Regulations (GN 156 and 197)	Value added (Millions)	Contribution to GDP (%)
	Male	Female	Both Sexes			
Agriculture, forestry and fishing	**7,344**	**1,828**	**9,172**	**Medium**	**14,645**	**4%**
Sugarcane	4,188	719	4,907	Medium		
Tobacco	0	0	0			
Flower growing	55	70	125	Medium		
Tea	109	122	231	Medium		
Other crop production	183	125	308	Medium		
Raising of poultry	341	109	450	Medium		
Other animal production	627	54	681	Medium		
Forestry, logging, fishing and aquaculture	599	159	758	High		
Support activities to agriculture, forestry and fishing	1,242	470	1,712	High		
Mining and quarrying	**872**	**118**	**990**	**Low**	**975**	**0%**
Quarrying of stone and sand	845	101	946	Low		
Extraction of salt (including refining by producer)	27	17	44	Low		
Manufacturing Food	**37,777**	**24,704**	**62,481**		**46,026**	**12%**
Processing and preserving of meat	1,374	405	1,779	High		
Processing and preserving of fish and other seafood	1,981	3,060	5,041	High		
Processing and preserving of fruits and vegetables	198	220	418	High		

Annex 1: SUPP Regulations and Impact on Employment and GDP (Cont'd)						
Sector	Employment March 2020			Impact of SUPP Regulations (GN 156 and 197)	Value added (Millions)	Contribution to GDP (%)
	Male	Female	Both Sexes			
Dairy products	240	105	345	High		
Vegetable and animal oils and fats and grain mill products	436	69	505	High		
Bakery products						
Bread	519	136	655	High		
Pastries and cakes	80	71	151	High		
Biscuits and other dry bakery products	88	104	192	High		
Sugar	692	19	711	High		
Cocoa, chocolate and sugar confectionery	34	207	241	High		
Macaroni, noodles, couscous and similar farinaceous products	167	156	323	High		
Other food products	705	457	1,162	High		
Distilled potable alcoholic beverages	266	49	315	Low		
Other beverages	2,226	289	2,515	High		
Textiles	3,876	832	4,708	Medium		
Wearing apparel	14,587	12,662	27,249	Medium		
Leather products	137	458	595	Low		
Footwear and parts of footwear	36	30	66	Medium		
Other products of wood, cork, straw and plaiting materials	167	260	427	Low		

Annex 1: SUPP Regulations and Impact on Employment and GDP (Cont'd)						
Sector	Employment March 2020			Impact of SUPP Regulations (GN 156 and 197)	Value added (Millions)	Contribution to GDP (%)
	Male	Female	Both Sexes			
Paper and paper product	378	167	545	Low		
Printing and reproduction of recorded media	1,056	491	1,547	Medium		
Basic chemicals, fertilizers and nitrogen compounds, plastics and synthetic rubber in primary forms	447	83	530	High		
Pharmaceuticals, medicinal and other chemical products	1,256	433	1,689	Medium		
Rubber products	72	36	108	High		
Plastic products	868	281	1,149	High		
Glass and other non metallic mineral products	728	86	814	Low		
Structural metal products, tanks, reservoirs and steam generators	946	153	1,099	Low		
Other fabricated metal products; metal working service activities	582	191	773	Low		
Computer, electronic and optical goods	535	652	1,187	Low		
Electrical equipment	305	172	477	Low		
Motor vehicles, trailers and other transport equipment	237	39	276	Low		
Furniture	637	90	727	Low		
Jewellery, bijouterie and related articles	496	706	1,202	Low		
Other manufacturing n.e.c	409	1,420	1,829	Low		

Annex 1: SUPP Regulations and Impact on Employment and GDP (Cont'd)						
Sector	Employment March 2020			Impact of SUPP Regulations (GN 156 and 197)	Value added (Millions)	Contribution to GDP (%)
	Male	Female	Both Sexes			
Repair and installation of machinery and equipment	679	56	735	Low		
Electricity, Gas, Steam and Air Conditioning Supply	**2,346**	**217**	**2,563**	**Low**	**6,198**	**2%**
Water Supply, Sewerage, Waste Management and Remediation Activities	**1,815**	**409**	**2,224**	**High**	**1,594**	**0%**
Water supply, sewerage and waste management	1,754	350	2,104	High		
Materials recovery	61	59	120	High		
Construction	**17,132**	**984**	**18,116**	**Low**	**16,656**	**4%**
Construction of buildings	11,025	509	11,534	Low		
Civil engineering	2,764	138	2,902	Low		
Specialised construction activities	3,343	337	3,680	Low		
Wholesale and retail trade; Repair of Motor Vehicles and Motorcycles	**17,884**	**13,078**	**30,962**	**Low**	**49,191**	**13%**
Sale of motor vehicles and motorcycles	1,669	528	2,197	LOw		
Maintenance and repair of motor vehicles	281	56	337	Low		
Sale of motor vehicles parts and accessories	576	201	777	Low		
Wholesale on a fee or contract basis of agricultural raw materials	328	217	545	Medium		
Wholesale of food, beverages and tobacco	3,699	1,262	4,961	High		
Wholesale of textiles, clothing and footwear	164	333	497	Medium		

Annex 1: SUPP Regulations and Impact on Employment and GDP (Cont'd)						
Sector	Employment March 2020			Impact of SUPP Regulations (GN 156 and 197)	Value added (Millions)	Contribution to GDP (%)
	Male	Female	Both Sexes			
Wholesale of other household goods	1,105	825	1,930	High		
Wholesale of machine equipment and supplies	979	352	1,331	Medium		
Other specialised and non specialised wholesale	1,377	519	1,896	Medium		
Retail sale in non-specialised stores with food, beverages or tobacco predominating	3,348	5,241	8,589	Medium		
Retail sale of information and communications equipment in specialised stores	452	233	685	Low		
Other retail sale	3,818	3,299	7,117	Low		
Transport and Storage	**12,670**	**3,086**	**15,756**	**Low**	**21,248**	**6%**
Passenger land transport	4,959	499	5,458	Low		
Freight transport by road	639	34	673	Low		
Water and air transport	1,541	773	2,314	Low		
Warehousing and storage	883	145	1,028	Medium		
Support activities for transportation	3,747	1,073	4,820	Low		
Postal and courier activities	901	562	1,463	Low		
Accommodation and Food Service Activities	**18,407**	**10,746**	**29,153**	**High**	**10,953**	**3%**
Accommodation	16,291	8,915	25,206	High		
Food and beverage service activities	2,116	1,831	3,947	High		

Annex 1: SUPP Regulations and Impact on Employment and GDP (Cont'd)						
Sector	Employment March 2020			Impact of SUPP Regulations (GN 156 and 197)	Value added (Millions)	Contribution to GDP (%)
	Male	Female	Both Sexes			
Information and Communication	**6,798**	**5,293**	**12,091**	**Low**	**19,549**	**5%**
Publishing activities	652	406	1,058	Low		
Motion picture, video and television programme production; programming and broadcasting activities	558	308	866	Low		
Telecommunications	1,946	1,012	2,958	Low		
Computer programming, consultancy and related activities	2,958	2,708	5,666	Low		
Information service activities	684	859	1,543	Low		
Financial and Insurance Activities	**6,261**	**7,847**	**14,108**	**Low**	**49,263**	**13%**
Monetary intermediation	4,078	4,657	8,735	Low		
Other financial services activities	640	998	1,638	Low		
Insurance, reinsurance and pension funding	1,145	1,659	2,804	Low		
Activities auxiliary to financial service and insurance activities	398	533	931	Low		
Real Estate Activities	**768**	**467**	**1,235**	**Low**	**25,288**	**7%**
Professional, Scientific and Technical Activities	**5,913**	**5,495**	**11,408**	**Low**	**19,654**	**5%**
Legal activities	146	205	351	Low		
Accounting, book-keeping and auditing activities; tax consultancy	891	1,011	1,902	Low		

Annex 1: SUPP Regulations and Impact on Employment and GDP (Cont'd)						
Sector	Employment March 2020			Impact of SUPP Regulations (GN 156 and 197)	Value added (Millions)	Contribution to GDP (%)
	Male	Female	Both Sexes			
Activities of head offices; management consultancy activities	2,470	2,928	5,398	Low		
Scientific research and development	909	272	1,181	Low		
Advertising and market research	427	506	933	Low		
Other professional, scientific and technical activities	313	244	557	Medium		
Administrative and Support Service Activities	**10,390**	**8,488**	**18,878**	**Low**	**11,563**	**3%**
Rental, leasing activities and employment activities	311	39	350	Low		
Travel agency activities	152	294	446	Low		
Tour operator activities	323	349	672	Low		
Security and investigation activities	3,563	731	4,294	Low		
Services to building and landscape activities	2,783	3,279	6,062	Medium		
Activities of call centres	2,696	3,257	5,953	Low		
Business support service activities n.e.c.	562	539	1,101	Medium		
Public Administration and Defence; Compulsory Social Security	**30,835**	**13,919**	**44,754**	**Low**	**28,475**	**8%**
Education	**9,784**	**17,506**	**27,290**	**Low**	**20,621**	**5%**
Human Health and Social Work Activities	**7,917**	**10,210**	**18,127**	**Medium to High**	**20,582**	**5%**
Human health activities	7,040	8,603	15,643	High		

Annex 1: SUPP Regulations and Impact on Employment and GDP (Cont'd)						
Sector	Employment March 2020			Impact of SUPP Regulations (GN 156 and 197)	Value added (Millions)	Contribution to GDP (%)
	Male	Female	Both Sexes			
Residential care and social work activities without accomodation	877	1,607	2,484	Medium		
Arts, Entertainment and Recreation	**2,942**	**1,401**	**4,343**	**Low**	**11,493**	**3%**
Librairies, archives, museums and other cultural activities	359	225	584	Low		
Gambling and betting activities	946	656	1,602	Low		
Sports activities and amusement and recreation activities	1,637	520	2,157	Low		
Other Service Activities	**893**	**807**	**1,700**	**Low**	**5,337**	**1%**
Activities of membership organisations	343	428	771	Low		
Other personal service activities	550	379	929	Low		
	198,748	**126,603**	**325,351**		**379,311**	**100%**

Annex 2: Members' Participation in the Consultation Workshops						
	Enterprise	Sector	Sessions Dates			
			03/09/2021	09/09/2021	16/09/2021	29/09/2021
1.	a.b.e Industrial Products (IO) Ltd	Chemical Manufacturing			•	
2.	Archemics and MCFI and Chemco	Chemical Manufacturing			•	
3.	AVIPRO CO LTD	Local Food Manufacturer		•		
4.	B.D.C (PLASTIC INDUSTRY) LTD	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			
5.	Bavarian Packaging Solution Ltd	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			
6.	Beachcomber Catering	Local Food Manufacturer		•		
7.	BrandActiv	Local Food Manufacturer		•		
8.	CERNOL CHEMICALS LTD	Chemical Manufacturing			•	
9.	Chue Wing & Co. Ltd	Importers/ Distributors/Retailers of finished products with single-use plastic products as part of the primary packaging				•
10	Deramann Ltd	Chemical Manufacturing Industry			•	
11.	Eclosia Group	Local Food Manufacturer	•	•		
12.	Edendale Distributors Ltd	Food Distributor		•		•
13.	ESKO & CO LTD	Local Food Manufacturer		•		
14.	Fast Foods Ltd	Local Food Manufacturer	•	•		
15.	Food Canners Ltd	Local Food Manufacturer		•		•
16.	Golden Foods International Ltd	Local Food Manufacturer		•		

Annex 2: Members' Participation in the Consultation Workshops (Cont'd)						
	Enterprise	Sector	Sessions Dates			
			03/09/2021	09/09/2021	16/09/2021	29/09/2021
17.	Head of Operational Excellence	Local Food Manufacturer		•		
18.	Innodis Ltd	Local Food Manufacturer		•		•
19.	Innodis Ltd - Dairy Business Unit	Local Food Manufacturer		•		
20.	INNODIS POULTRY LTD	Local Food Manufacturer		•		
21.	IPAC Ltd	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			
22.	Lampotang & Co Ltd	Non-Food Products Manufacturer			•	
23.	Les Moulins de la Concorde Ltee	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			
24.	LFL	Local Food Manufacturer		•		
25.	Maurilait Production Ltee	Local Food Manufacturer	•	•		•
26.	Mauritius Oil Refineries Ltd	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			•
27.	MEDINE DISTILLERY CO LTD	Local Food Manufacturer		•		
28.	Meeshy Plastic Bags Company Ltd	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			
29.	Metal Can Manufacturers Ltd	Non-Food Products Manufacturer			•	
30.	NEW MAURIFOODS LIMITED	Local Food Manufacturer		•		
31	Nidomac & Co Ltd	Chemical Manufacturing Industry			•	

Annex 2: Members' Participation in the Consultation Workshops (Cont'd)						
	Enterprise	Sector	Sessions Dates			
			03/09/2021	09/09/2021	16/09/2021	29/09/2021
32.	Pasta & Pasta	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			
33.	PERFORMANCE PLASTICS LTD	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			
34.	Pick N Eat	Local Food Manufacturer		•		
35.	PIM Limited	Local Manufacturer/ Importer of re-usable and single-use plastic products	•			
36.	Plaspak Ltd	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			
37.	PRINCE INDUSTRIES LTD	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•		•	•
38.	Quality Beverages Ltd	Local Food Manufacturer		•		•
39.	SKC Surat & Co Ltd	Importers/ Distributors/Retailers of finished products with single-use plastic products as part of the primary packaging				•
40.	Soap & Allied Industries Ltd	Chemical Manufacturing Industry			•	•
41.	SOFAP LTD	Paint Manufacturing Industry			•	
42.	SONIC TRADING LTD	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			

Annex 2: Members' Participation in the Consultation Workshops (Cont'd)						
	Enterprise	Sector	Sessions Dates			
			03/09/2021	09/09/2021	16/09/2021	29/09/2021
43.	Speedfreight Ltd	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			
44.	Tea Blenders Ltd	Importers/ Distributors/Retailers of finished products with single-use plastic products as part of the primary packaging				•
45.	Udis Ltee	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			
46.	VIC LUX PLASTICS PACKING LTD	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			
47.	YIP TONG & SONS LTD	Local Manufacturers/ Importers/ Distributors of single-use plastic products and plastic bags	•			
48.	Kulfidream Co. Ltd	Local Food Manufacturer				•
49.	Panagora	Importers/ Distributors/Retailers of finished products with single-use plastic products as part of the primary packaging				•

Annex 3: Relevant Standards	
Standards	**Purpose**
ISO 18606:2013(E): Packaging and the Environment-Organic Recycling	This International Standard specifies procedures and requirements for packaging that are suitable for organic recycling. This group of ISO standards and supporting reports provides a set of procedures which aim to: • Reduce environmental impact. • Support innovation in product, packaging and the supply chain. • Avoid undue restrictions on the use of packaging. • Prevent barriers and restrictions to trade.
ISO 17088:2021(E): Plastic-Organic Recycling-Specifications for Compostable Plastics	This International Standard specifies procedures and requirements for plastics and products made from plastics, which are suitable for recovery through organic recycling. The following four aspects: • Disintegration during composting. • Ultimate aerobic biodegradation. • No adverse effects of compost on terrestrial organisms. • Control of constituents. These four aspects are suitable to assess the effects on the industrial composting process. This document is the basis for systems of labelling and claims for compostable plastics materials and products.
BS EN 13432:2000: Packaging-Requirements for packaging recoverable through composting and biodegradation-Test scheme and evaluation criteria for the final acceptance of packaging	This European Standard specifies requirements and procedures to determine the compostability and anaerobic treatability of packaging and packaging materials by addressing four characteristics: • Biodegradability. • Disintegration during biological treatment. • Effect on the biological treatment process and. • Effect on the quality of the resulting compost.
ASTM D6400 – 19: Standard specification for labelling of plastics designed to be aerobically composted in Municipal or Industrial facilities.	This specification covers plastics and products made from plastics that are meant to be composted under aerobic conditions in municipal and industrial aerobic composting facilities, where thermophilic conditions are achieved. The purpose of this specification is to establish requirements for identifying items made from plastics or polymers so that they do not interfere with their satisfactorily composting in commercial and municipal aerobic composting facilities.
ASTM D5511 – 18: Standard test method for determining anaerobic biodegradation of plastic materials under high-solids anaerobic-digestion conditions	This test method covers the determination of the degree and rate of anaerobic biodegradation of plastic materials in high-solids anaerobic conditions. This test method is designed to yield a percentage of conversion of carbon in the sample to carbon in the gaseous form under conditions found in high-solids anaerobic digesters, treating municipal solid waste. This test method is designed to be applicable to all plastic materials that are not inhibitory to the microorganisms present in the anaerobic digesters operating on household waste.

Annex 4: Glossary of Terms		
Terms	**Definitions**	**Source**
Biodegradable Plastic	A degradable plastic in which the degradation results from the action of naturally occurring micro-organisms such as bacteria, fungi and algae	[37]
Composite	A solid product consisting of two or more distinct phases, including a binding material (matrix) and a particulate or fibrous material.	[37]
Compost	The product of composting.	[37]
Compostable plastic	A plastic that undergoes biological degradation during composting to yield carbon dioxide, water, inorganic compounds and biomass at a rate consistent with other known compostable materials and leaves not visually distinguishable or toxic residues.	[37]
Degradable plastic	A plastic designed to undergo a significant change in its chemical structure under specific environmental conditions resulting in a loss of properties as measured by standard test methods appropriate to the plastic and the application of a period that determines its classification.	[37]
Degradation	A deleterious change in the chemical structure, physical properties, or appearance of a plastic.	[37]
High density polyethylene plastic (HDPE)	Those linear polyethylene plastics having a standard density of 0.941 g/cm3 or greater.	[37]
Hydrocarbon plastics	Plastics based on resins made by the polymerization of monomers composed of carbon and hydrogen only.	[37]
Hydrolytically degradable plastic	A degradable plastic in which the degradation results from hydrolysis.	[37]
Low density polyethylene plastics (LDPE)	Those branched polyethylene plastics having a standard density of 0.910 to 0.925 g/cm3.	[37]
Monomer	A low molecular weight substance consisting of molecules capable of reacting with like or unlike molecules to form a polymer.	[37]
Oxidatively degradable plastic	A degradable plastic in which the degradation results from oxidation.	[37]
Photodegradable plastic	A degradable plastic in which the degradation results from the action of natural daylight.	[37]
Plastics	A material that contains as an essential ingredient one or more organic polymeric substances of large molecular weight, is solid in its finished state and at some stage in its manufacture or processing into finished articles can be shaped by flow.	[37]
Plastic composite	A material consisting of two or more distinct immiscible materials, at least one of which is plastic.	[37]
Recycled plastic	Those plastic composed of post-consumer material or recovered material only, or both, that may or may not have been subject to additional processing steps of the types used to make products such as recycled-regrind or reprocessed or reconstituted plastics.	[37]

Annex 4: Glossary of Terms (Cont'd)		
Terms	**Definitions**	**Source**
Resin	A solid or pseudo-solid organic material often of high molecular weight, which exhibits a tendency to flow when subjected to stress, usually has a softening or melting range and usually fractures conchoidally.	[37]
Virgin plastic	A plastic material in the form of pellets, granules, powder, floc or liquid that has not been subjected to use or processing other than that required for its initial manufacture.	[37]
Biodegradable	Packaging in which the waste shall be of such a nature that it can undergo physical, chemical, thermal or biological decomposition such that most of the finished compost ultimately decomposes into carbon dioxide, biomass and water.	[38]
Compostable	Packaging waste that can be recycled through a process of organic recovery comprised of composting and anaerobic digestion.	[38]
Extended Producer Responsibility	An environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle. It has two related features: (1) the shifting of responsibility, physically and/or economically (fully or partially), upstream toward the producer and away from municipalities for the treatment or disposal of post-consumer products; and (2) providing incentives to producers to incorporate environmental considerations in the design of their products.	[38]
Lightweight plastic carrier bags	Plastic bags with a wall thickness below 50 microns.	[38]
Plastic Carrier Bags	Carrier bags, with or without handle, made of plastic, which are supplied to consumers at the point of sale of goods or products.	[38]
Recyclable packaging	Packaging, including plastic bags, that can be reprocessed in a production process of the waste materials for the original purpose or for other purposes including organic recycling but excluding energy recovery.	[38]
Reusable packaging	Packaging, including plastic bags, that are conceived and designed to accomplish within its life cycle a minimum number of uses for the same purpose for which it was conceived.	[38]
Very lightweight plastic carrier bags	Plastic bags with a wall thickness below 15 microns which are required for hygiene purposes or provided as primary packaging for loose food when this helps to prevent food wastage.	[38]
Deposit-Refund System	A system that combines a tax on product consumption with a rebate when the product or its packaging is returned for recycling.	[38]
Packaging	All products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw materials to processed goods, from the producer to the user or the consumer. 'Non-returnable' items used for the same purposes shall also be considered to constitute packaging.	[38]

Annex 4: Glossary of Terms (Cont'd)		
Terms	**Definitions**	**Source**
Single-use plastics	Often also referred to as disposable plastics, are commonly used plastic packaging including items intended to be used only once before they are thrown away or recycled, e.g., grocery bags, food packaging, bottles, straws, containers, cups cutlery, etc.	[38]
Microbeads	Manmade plastic particles intentionally added to consumer products, typically less than or equal to 5 mm in size. Microbeads can vary in chemical composition, size, share and density.	[38]
Microplastics	Generic terms for small pieces of plastic under 5 mm.	[38]
Primary microplastics	Typically used to refer to microplastics originally manufactured to be that size. Primary microplastics can include but are not limited to microbeads as they can also refer to industrial plastic powders and pellets.	[38]
Secondary microplastics	Small particle pieces that have resulted from the fragmentation and weathering of larger plastic items.	[38]

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