Co-funded by the European Union

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Implemented by giz

EXPERTISE FRANCE

Rethinking Plastics
Circular Economy Solutions to Marine Litter

Baseline Study on the

MARKET READINESS

for Sustainable packaging in Bacolod City and Iloilo City

Development of Voluntary Guidelines on Sustainable Packaging Towards Reduction of Marine Litter and Promoting Packaging from Alternative Materials Through Market-Based Approach

ACKNOWLEDGEMENT AND DISCLAIMER

This Market Readiness Study was developed by Strategia Development Research Institute, Inc. (SDRI) for the Philippine Center for Environmental Protection and Sustainable Development, Inc. (PCEPSDI) as part of the Sustainable Packaging Towards Marine Litter Reduction Project.

This study was produced with the financial support of the 'Rethinking Plastics – Circular Economy Solutions to Marine Litter' project. 'Rethinking Plastics' is funded by the European Union and the German Federal Ministry for Economic Cooperation and Development (BMZ) and implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and Expertise France.

The contents of this publication are the sole responsibility of PCEPSDI and do not necessarily reflect the views of the European Union, the BMZ, GIZ or Expertise France.

SDRI

Dr. Maria Angela G. Zafra
Dr. Leslie-Anne Chua

PCEPSDI

Ms. Erica Nicole D. Gomez
Ms. Kimberly T. Castillo
Ms. Annabelle S. Selibio
Ms. Paulith Ann H. Aguilar
Ms. Maureen Grace V. Lebria
Mr. June M. Alvarez

November 2021

Philippine Center for Environmental Protection and Sustainable Development, Inc.

Address: 4B Development Academy of the Philippines Building, San Miguel Avenue, Ortigas Center, Pasig City 1600 Philippines
Tel. No.: (02) 8631-2151
Email Address: greenchoicephilippines@pcepsdi.org.ph
Website: www.pcepsdi.org.ph

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

ABA	Australian Bioplastics Association
ASEAN	Association of Southeast Asian Nations
ASTM International Standards	Formerly known as American Society for Testing and Materials, an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services
Bio-based polymers	Bioplastic packaging
BPA	Bisphenol A
BPI	Biodegradable Products Institute
BPS/TC	BPS Technical Committee
BSMED	Bureau of Small and Medium Enterprise Development
CALABARZON	Cavite, Laguna, Batangas, Rizal, and Quezon
CCC	Climate Change Commission
CEC	Chinese Environmental Label
CEN	European Standardization Organizations
CENELEC	European Standardization Organizations
CPU	Central Philippine University
CSR	Corporate Social Responsibility
DENR	Department of Environment and Natural Resources
DIN	Deutsches Institut für Normung e.V. (German Institute for Standardization)
DOST-ITDI	Department of Science and Technology - Industrial Technology Development Institute
DTI	Department of Trade and Industry
DTI-BPS	Department of Trade and Industry - Bureau of Philippine Standards
DTI-ROG	Department of Trade and Industry - Regional Operations Group
EMB	Environment Management Bureau
EN	European Standards
EPR	Extended Producer Responsibility
EPS	Expanded polystyrene
ETSI	European Standardization Organizations
ETV	Environmental Technology Verified
EU	European Union
European EN Standards	European Standard is identified by a unique reference code which contains the letters 'EN'
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration
FGD	Focus Group Discussion
FSC	Forest Stewardship Council
GAIA	Global Alliance for Incinerator Alternatives
GAP	Good Agricultural Practices
GCP	Green Choice Philippines
GECA	Good Environmental Choice Australia
Gen Z	Millennial
GHG	Greenhouse Gas
GHP	Good Handling Practices
GreenPla Japan	Certification for biodegradable plastic of the Japan Bioplastics Association
HACCP	Hazard Analysis Critical Control Point
HDPE	High density polyethylene
HKGLS	Hong Kong Green Label Scheme

ISCC	International Sustainability and Carbon Certification
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LGU	Local Government Unit
LDPE	Low density polyethylene
MOB	My Own Bag
MSDS	Material Safety Data Sheet
MSMEs	Micro, Medium and Small Enterprises
NACI	Nationwide Association of Consumers, Inc.
NCR	National Capital Region
NELP	National Ecolabelling Programme
NELP-GCP	National Ecolabelling Programme – Green Choice Philippines
NGO	Non-Government Organization
NSWMC	National Solid Waste Management Commission
OECD	Organization for Economic Co-operation and Development
PCEPSDI	Philippine Center for Environmental Protection and Sustainable Development, Inc.
PE (packaging)	Polyethylene
PEFC	Programme for the Endorsement of Forest Certification
PET	Polyethylene terephthalate
PH	Philippines
PHBV	Polyhydroxyalkanoate Poly (3-hydroxybutyrate-co-3-hydroxyvalerate)
PIR	Packaging impact ratio
PLA	Polylactic acid
PNS	Philippine National Standards
PP (packaging)	Polypropylene
PPIA	Philippine Plastics Industry Association, Inc.
ProGED	Promotion of the Green Economic Development
PS	Philippine Standard
PVC	Polyvinyl Chloride
PwC	PricewaterhouseCoopers
R&D	Research and Development
RSPO	Roundtable on Sustainable Palm Oil
SFI	Sustainable Forestry Initiative
SGLS	Singapore Green Labelling Scheme
SM	Shoe Mart
SMEs	Small and medium enterprises
SWM	Solid Waste Management
SWMD	Solid Waste Management Division
TBCSD	Thailand Business Council for Sustainable Development
TEI	Thailand Environment Institute
TMECC	Testing Method for the Examination of Composting and Compost
TUV	Technischer Überwachungsverein (Technical Inspection Association)
UN	United Nation (UN)
VOC	Volatile Organic Compounds
WWF	World Wide Fund for Nature

CHAPTER I
INTRODUCTION

1.1 Background

The project "Sustainable Packaging Towards Marine Litter Reduction" aims to reduce marine litter by promoting packaging for reuse and from alternative materials using market-based instruments. One of the market-based instruments that is utilized by the project is the development of ecolabelling criteria for packaging and pilot certification.

Filipinos use about 16.5 billion plastic *labo* bags and 17.5 billion shopping bags per year (Global Alliance for Incinerator Alternatives (GAIA), 2019). However, not all these single-use packaging products are managed properly or effectively at the end of their life cycle which is visibly evident in the country's streets and coastlines. Studies and campaigns such as brand audits highlight the products most polluting marine life by product type and even by brand. With consumer and regulatory pressure, new products are emerging. Alternative product packaging, as well as innovative product distribution, can be seen in the market. This project aims to highlight such successes, provide market incentive, and assure consumers of product claims through a certification process.

To be able to certify through the National Ecolabelling Programme – Green Choice Philippines (NELP-GCP), an ecolabelling criteria must be developed. The criteria need to address key environmental issues while ensuring this is attainable from the industry's perspective. The first set of criteria that the NELP-GCP developed during its launch is for polyethylene (PE) and polypropylene (PP) packaging materials. However, there was no uptake from the industry. Awarding the GCP Seal after the project indicates that the criteria developed is applicable in the Philippine market, attainable for the industry sector, acceptable for consumers, with a stringency level that has co-benefits for businesses and ecology. To arrive at such criteria, a market readiness study is conducted. This includes a supply and demand study of packaging materials.

1.2 Objectives

The market readiness study aims to identify packaging products to be the pilot product category for ecolabelling. To assess the maturity of the market for certification, it is important to determine that the market can provide products and buy products with alternative packaging. The main objective of the study is to recommend three packaging materials, selected based on the readiness of suppliers and consumers. Specifically, the study aims to:

1. Identify product packaging groups and alternatives scope that promotes reduction of material, use of ecological material, reuse, and recycling of packaging products.
2. Assess the readiness of the market and the consumers' willingness and acceptance on the shift to sustainable packaging.
3. Recommend three potential alternative packaging products and features.

1.3 Scope of Work and Limitations

The scope of work for the market readiness study identifies the three prioritized packaging products in the pilot areas (Iloilo City and Bacolod City), and in National Capital Region (NCR) where most head offices of private businesses and government are located. Initial background and data collection is conducted through desk review of secondary sources. Further investigation of the market is through surveys, meetings, and focus group discussions (FGDs) with private and public sector (local suppliers, business associations, manufacturers, importers, general consumers, accreditation/verification bodies when relevant) to develop the market readiness study. The guide report template is based on the UN Environment report on market readiness analysis. This study is presented to the NELP-Technical Committee.

This study considers the following factors:

1. Most product contributing to marine litter as the main environmental impact
2. Ability of suppliers/products to engage and shift to alternative packaging products and/or willingness to initiate extended producer responsibility (EPR) for packaging
3. Alternative materials for sustainable packaging
4. Regulatory requirements
5. Capacity of retail sector to adapt and promote sustainable packaging
6. Willingness of suppliers for pilot NELP-GCP certification
7. Willingness and acceptance of consumers on the changes or shift to sustainable packaging

1.4 Framework and Approach

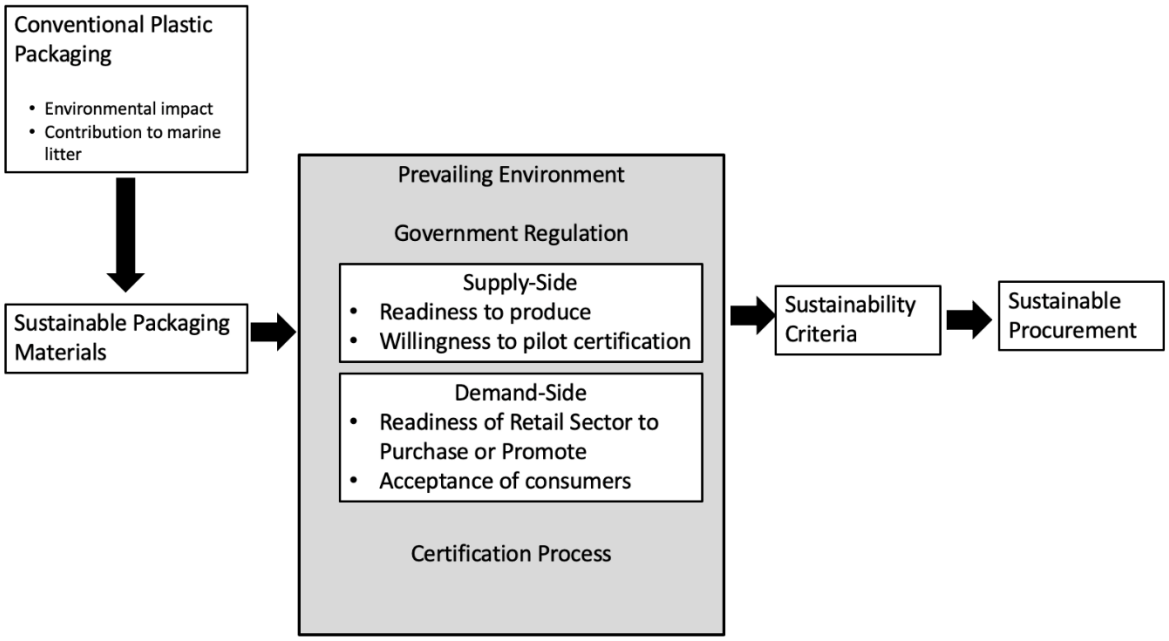


Figure 1.1 Conceptual framework

The selection of conventional packaging to analyze depends on its environmental impact in terms of contribution to marine litter. Alternatives to these packaging categories are identified based on a combination of desk analysis and primary data gathering. The acceptance of these sustainable packaging products depends on several market factors. The first would be the prevailing external environment that helps shape the industry environment. This includes regulation by relevant government agencies such as the Department of Trade and Industry (DTI), the Department of Environment and Natural Resources (DENR) and local government units (LGUs). It also depends on the availability of certifying bodies and the steps involved in the certification process. There is a need to examine the supply side to identify enablers and barriers to suppliers producing more sustainable products and services. However, production also depends on the readiness and willingness of the buyers, in this case, the retail and commercial sector and the sector's end consumers, to purchase sustainable packaging. By studying this complex industry environment, the study can come up with a set of sustainability requirements that will be verified by market players as relevant to the Philippine scenario. This information will feed into the pilot certification for packaging products.

1.5 Data Collection Design

This study uses the triangulation of data sources, among different research participants and of different methods. If done correctly, triangulation results in the gathering of critical factors that are supported by more than a single source of evidence. The following is the mix of methodologies used for this research:

1. *Desk Review*: This included a review and analysis of secondary sources of

data provided by PCEPSDI and retrieved from other sources such as government offices and industry associations.

2. *Online Key Informant Interviews (KIIs)*: In-depth and semi-structured interviews of key supply-side stakeholders such as the manufacturers of the packaging products, chambers of commerce, industry associations, regulatory bodies and certifying bodies for sustainability were conducted.
3. *Site Visits:* Given the COVID-19 global pandemic, the research team did not conduct any site visits. All of the data collection was done online and through other remote means with face-to-face as the last resort.
4. *Online FGD:* FGDs with representatives of the major stakeholder groups fleshed out narratives from both the demand side and the supply side. Supply side focus groups included key employees from the different departments of SM (e.g., operations, purchasing), and business tenants.
5. *Survey:* A survey with consumers assessed current shopping behavior and public perception on switching to more sustainable packaging options. Respondents were customers of SM City Iloilo and SM City Bacolod.
6. *Online Validation Workshop/ Circulation*: Through study circulation and a workshop with representatives from both the demand and supply, sustainability requirements were validated for these three priority products.

See Annex A to Annex F for the full list of participants in the interviews and FGDs.

CHAPTER 2

PRELIMINARY COMPENDIUM OF SUSTAINABILITY REQUIREMENTS AND MEANS OF VERIFICATION FOR THE IDENTIFIED PRIORITIZED PRODUCTS

2.1 Inception Workshop

On April 22, 2021, an inception workshop was held to orient the different stakeholders on the project and to do an initial data gathering for the inception report. The inception workshop started with an introduction of the project on sustainable packaging towards marine litter reduction through a background presentation of the current situation in the Philippine setting. This was conducted to discuss the different viewpoints of the stakeholders from LGUs, SM Malls, DTI, business sectors, packaging industry sectors, academe, and others. The responses of each group were summarized and counted so that they appear in descending order. This means that the first answer was the most frequently cited by the stakeholders, and therefore deemed as the most important. This section summarizes the insights regarding product groups. Other information with respect to the supply and demand of packaging are included in the subsequent sessions.

2.1.1 Description of Sustainable Packaging

Workshop participants describe sustainable packaging as circular packaging that will not end up as waste or has the least environmental impact in its overall life cycle. It is environment friendly while it should perform its function that meets the needs of present times without compromising the future needs. Some keywords mentioned include:

- Reusable
- Environment Friendly
- Recyclable
- Circular
- Compostable
- Zero Waste
- Biodegradable

2.1.2 Reasons for Packaging Ending as Marine Litter

According to the participants, plastics end up as marine litter because of systemic problem that involves people, the government, and the private sectors. People lack discipline. There is weak enforcement of laws and poor infrastructure. Examples are low collection efficiency, ill-sited waste facilities, poor recovery system and even when waste is segregated, it is still disposed of in a single sanitary landfill. The LGUs have not set up a proper place to where it should be disposed of. People do not care or believe in shared destiny on impacts of waste. The piecemeal or *"tingi"* buying habits of Filipinos are also prevalent.

2.1.3 Packaging in the Retail and Commercial Sector

Based on the responses of the inception workshop participants, there are two categories of packaging that contribute to marine litter: first is the essential food packaging and the second is carry and transfer packaging which are thrown after carrying goods. Polybags are given a special mention - packaging made of thin, flexible, plastic film, nonwoven fabric, or plastic textile that are used to contain or transport food and other goods. They can either be food packaging in the form of plastic pouches for dry food, sachets for liquids, packaging for processed food, and bags for fresh produce. Poly bags can also act as carrier bags as *"sando"* shopping bags or trash bags.

2.2 Definition of Sustainable Packaging

The desk research found out that there is no universally accepted definition of sustainable packaging; definitions vary depending on the industry, which are shown in Table 2.1. It can be noted that the eight criteria for sustainable packaging developed by the Sustainable

Packaging Coalition appear most frequently in articles and reports.

Table 2.1 Definitions of sustainable packaging

Source	Definition of Sustainable Packaging
Industry-Based	
European Organization for Packaging and the Environment (n.d.)[1]	Does not use sustainable packaging but rather "well-designed" packaging that is fit for the product it is protecting, optimizes the climate and environmental footprint of the packaging and packaged product, and uses only as much of the right kind of material as necessary to perform this task.
Henkel (Founding Member of Alliance to End Plastic Waste, n.d.)[2]	Packaging built around the circular economy concept and focuses on including materials from sustainable sources and using a smart design to close the loop – for the benefit of people and the planet.
International Association for Soaps, Detergents and Maintenance Products (2019)	1. It should be manufactured using recycled material to the maximum extent possible. 2. It should be manufactured with the objective to be recyclable to the maximum extent possible. 3. It should be considered that the improvement in its recyclability could have an impact on other phases of its life cycle.
International Union of Food Science and Technology (2018)[3]	Packaging that is eco-friendly, environment-friendly, or green by using the optimum combination of package design and materials to minimize the total cost and environmental impacts of packaging, transportation, and losses, while ensuring food safety and consumer acceptability.
PackCon (2018)[4]	The development and use of packaging which results in improved sustainability. This involves increased use of life cycle inventory (LCI) and life cycle assessment (LCA) to help guide the use of packaging which reduces the environmental impact and ecological footprint.
PwC (2010)[5]	1. Packaging weight and volume considered and effectively reduced. 2. Waste-to-landfill has been reduced through designed-in recyclability, reusability, or degradability of the substrate. 3. Lower environmental footprint in terms of resources used in production as well as emissions to air and water. 4. Effectively reduces waste through extending shelf life and prevents damage or contamination. 5. Able to communicate effectively and engage consumers as to brand attributes and sustainable credentials.
Sustainable Packaging Alliance (2007)[6]	Packaging that meets the following four sustainability principles: 1. Effective - provide social and economic benefits 2. Efficient - provide benefits by using materials, energy, and water as efficiently as possible 3. Cyclic - be recoverable through industrial or natural systems 4. Safe - non-polluting and non-toxic.
Sustainable Packaging Coalition (2011)[7]	Packaging that: 1. Is beneficial, safe & healthy for individuals and communities throughout its life cycle. 2. Meets market criteria for performance and cost 3. Is sourced, manufactured, transported, and recycled using renewable energy 4. Optimizes the use of renewable or recycled source materials 5. Is manufactured using clean production technologies and best practices 6. Is made from materials healthy throughout the life cycle 7. Is physically designed to optimize materials and energy 8. Is effectively recovered and utilized in biological and/or industrial closed loop cycles
Research-Based	
Guillard, et al. (2018)[8]	Packaging that addresses food waste and loss reduction as well as food safety issues and at the same time, address the long-term challenge of environmentally persistent plastic waste accumulation and save on material resources.
Kozik (2020)[9]	Packaging that, compared to conventional packaging, meet higher environmental, economic, and social standards, has better performance and quality features, and at the same time brings new possibilities in the field of the recovery and waste management across the entire life cycle.
Nguyen, et al. (2020)[10]	Consumer-defined eco-friendly package for food products should be visually appealing while satisfying consumers' environmental expectations relating to packaging materials and manufacturing process.

2.3 Packaging Product Groups that Contribute to Marine Litter

This longlist of packaging products for consideration is developed vis-à-vis its contribution to marine litter since the goal of the project is to reduce the volume of marine debris in coasts and oceans. According to the International Union for Conservation of Nature (IUCN)[11], over 300 million tons of plastic are produced every year for use in a wide variety of applications, with 8 million tons of that comprising 80% of marine debris. Plastic products do not decompose but are photodegradable and break down over time into tiny fragments called microplastic. These are ingested by marine life which will have corresponding effects on water quality, ecosystem health, and human health as we eat seafood.

Packaging and single-use or disposable products make up the bulk of marine litter and represent an unsustainable use of resources. A National Geographic article[12] claimed that plastic food packaging now outpaces cigarette butts as most abundant beach trash. This includes food wrappers for processed food such as snacks and chips, bottles and caps, straws and stirrers, cups, lids, take-away containers, and plastic bags. The ascension of plastic packaging to the top of the list is also reflective of the consumer behavior trends such as the popularity of bottled water and beverages as well as the use of plastic carrier bags. IUCN also identifies personal care product packaging as a source of marine debris[13]. Flexible plastic that is used for plastic bags and packaging is especially dangerous for marine life[14].

The Ocean Conservancy[15] annually reports the top ten list of material collected during International Coastal Cleanups. The Philippines is one of the most active countries participating in this event. The data for 2020 is summarized in Table 2.2. Packaging products are highlighted in green.

Table 2.2 Top items retrieved during coastal cleanups

Rank	Item	Quantity (Pieces, Global)	Quantity (Pieces, Philippines)
1	Food wrappers	4,771,602	3,415,438
2	Cigarette butts	4,211,962	1,304,417
3	Plastic beverage bottles	1,885,833	371,529
4	Plastic bottle caps	1,500,523	412,184
5	Straws and stirrers	942,992	315,582
6	Plastic cups and plates	754,969	95,958
7	Plastic grocery bags	740,290	217,682
8	Plastic takeout containers	678,312	234,975
9	Other plastic bags	611,100	236,552
10	Plastic lids	605,778	132,005

SEA Circular, a UN initiative, reported that the Philippines is one of the top countries contributing to marine pollution, primarily due the country being a "sachet economy"[16]. Products in single-use packaging are popular due to its affordability and convenience to a population where more than 20% are below the poverty line[17]. As a socio-economic issue, single-use packaging is prevalent in sari-sari stores where the poor shop in small quantities, known as the *"tingi"* culture. Those who can afford it, buy larger quantities from the supermarket[18]. However, these kinds of packaging are not reusable, expensive for cities to dispose of, and often cannot be recycled. In 2018, Filipinos used 65.8 billion packaging units, with as much as 48% of that packaging composed of plastic as of 2017[19]. The GAIA reported that Filipinos use more than 163 million plastic sachet packets, 48 million shopping bags and 45 million thin film bags each day[20]. Their waster assessment and brand audit revealed that the most common packaging that end up in household trash include glass bottles, corrugated boxes, tin cans, hard plastic, polyethylene terephthalate (PET) bottles, glazed carton, plastic *labo* (poly) bags, plastic/*sando* bag, other plastic packaging, candy and biscuit wrappers, carton boxes, and sachets. Some of these packaging will end up as marine litter.

While food packaging is one of the primary sources of marine litter, it is difficult to identify potential sustainable alternatives. For instance, it is possible that packaging made from recycled materials contain contaminants from the source material, which could then migrate to the food[21]. Any packaging that has direct contact with food needs approval from the Food and Drug Administration (FDA), which regulates how most food is processed, packaged, and labeled. All processed food and food products are required to secure a Certificate of Product Registration before these are sold to comply with Republic Act 9711 (Food and Drug Administration Act) and Administrative Order 2014-0029[22]. The primary and secondary packaging requirements are

included in the FDA Guidelines for Manufacturers and Traders[23]. Given this challenge, this market readiness study will be limited to non-food packaging to come up with feasible options for potential ecolabelling.

2.4 Sustainable Packaging Product Groups in Focus

This section presents the different product groups in focus for this market readiness study which have distinct socio-economic characteristics. In the context of this analysis, sustainable products are those that provide environmental, social, and economic benefits while protecting public health and environment over their whole life cycle, from the extraction of raw materials until the final disposal. The environmental impacts of products and services depend on how they interact with the surrounding socio-economic and technical systems, sectors, and actors along their lifecycles.

Rather than search for individual alternatives to specific packaging products (e.g., plastic bags, sachets), these product groups will instead focus on packaging characteristics for more flexibility. Results of the desk research indicate that that there are very few ecolabels for specific packaging groups, which mostly packaging for food (e.g., Nordic Ecolabelling for liquid food, Nordic labelling for disposables for food, Blue Angel criteria for returnable bottles and glasses for beverages and food). Most of the criteria of these labels are concerned about the safety of packaging (printing, lids, seals, etc.) that has direct contact with food. Packaging that is part of prepacked food products also requires other regulations related to the provision of food information to consumers, which is not part of the scope of this report. In many cases, packaging is not standalone, but one of the criteria for product ecolabelling. For instance, the European Union (EU) Ecolabel Products Catalogue identifies several non-packaging consumer products that have packaging as a criterion – either the type of material used, or the information printed on the package. Instead of having specific sustainable packaging product sub-groups, labelling focuses more on the material (e.g., plastic, paper, wood) or characteristic (e.g., biodegradable, recyclable).

2.4.1 Biodegradable Plastic Packaging

Conventional plastic packaging does not biodegrade. Instead, they slowly break down into microplastics, tiny fragments that are practically invisible to the naked eye. Microplastics are even more challenging to remove from the ocean, which is why most marine debris is made up of this plastic as discussed in Section 2.3.

Biodegradable plastic packaging is plastic that decomposes naturally in the environment. It is made up of different kinds of polymers from different source materials (petrochemical and non-petrochemical); and it has different chemical structures which determine the specific conditions to fully biodegrade[24]. It is broken down by microorganisms into water, carbon dioxide (or methane) and biomass under specified conditions. This type of plastic can be foamed into packing materials, extruded, and injection-molded in modified conventional machines. With the manufacturing process, the resulting packaging can be a completely biodegradable item that is cheaper than conventional plastic materials, completely waterproof, and colored to match conventional plastic materials[25].

It is important to note that biodegradable is not equivalent to compostable. The biodegradability of materials is also different depending on the environment. Humidity, temperature, or concentrations of microorganisms vary in different environments, resulting in different biodegradation rates[26]. For example, in marine environment, such plastics may not biodegrade. One would need to refer to 100% biodegradability, and the related conditions. To turn biodegradable plastic waste into a resource material, the right environmental conditions and the right waste management options need to be in place.

Biodegradable plastic should not be confused with oxo-biodegradable (also known as oxo-degradable) plastic because the latter is quite controversial. Concerns have been raised over the additive being unproven technology which might cause microplastic pollution[27]. Oxo-degradable plastics have been included in the 2019 European Parliament ban on single-use plastics by 2021.

2.4.2 Bio-based (Bioplastic) Packaging

Bioplastic is the popular term used to connote a type of compostable plastic. Technically, it is not a traditional plastic made from petrochemicals but biomass-based compostable biopolymer from all-natural biological materials such as plants or animals. Categories for bioplastics include starch-based, cellulose-based, and protein-based. With bio-based plastic, the material is made from natural sources that does not contain chemical fillers and does not pose the same risk to the environment as traditional plastics[28]. These can include corn oil, orange peels, different starches, mycelium, shrimp shells and sugarcane fiber.

However, depending on the biological source material, bioplastics can pose risk to the environment through other ways, including pressuring land use. It should also be noted that not all bioplastics can be made biodegradable[29]. According to the Australian Bioplastics Association[30], 75% of bioplastics are non-biodegradable. Because of this, seaweed-based packaging is also gaining popularity as it is biodegradable and has the potential to either dissolve in water or be edible[31]. Moreover, seaweed does not need land, irrigation, fertilizers, or other key resources to grow. It also acts as a carbon sink and absorbs carbon dioxide as it grows[32].

==========

Examples: Polylactic acid (PLA), starch-based bioplastic, cellulose-based bioplastic, protein-based bioplastic, organic PE from fermentation

==========

2.4.3 Compostable Packaging

Compostable packaging is a subset of the other types of packaging wherein the materials break down safely into water, biomass and carbon dioxide under controlled composting conditions using industrial composters or home composting[33]. It should be noted that everything that is compostable is biodegradable, but not everything that is biodegradable is compostable. This means that there would be biodegradable and bioplastic packaging that cannot be composted. Some compostable packaging also requires high-temperature industrial composting facility, which might not be readily available[34]. The biggest potential for compostable packaging is if the materials can break down under home composting conditions[35].

==========

Examples: Compressed and molded leaves, cellulose films, starch blends, PLA, poly (butylene adipate-co-terephthalate)

==========

2.4.4 Pulp and Paper Packaging from Sustainably Managed Forests

Certified pulp and paper packaging encompasses a broad range of wood, pulp, cardboard, and paper packaging that are sourced from sustainably managed forests. Examples of packaging types include wooden boxes and pallets, paperboard, corrugated fiber board, paper bags and molded pulp packaging. The principles of the circular economy are aligned to the tenets for sustainably managed forests, which minimize resource use and maximize efficiency. Sustainably managed forests require continuous replanting of trees, and result in a net positive change in forest area. Forest-based products therefore have an important role in the circular economy by providing renewable raw materials[36].

While sourcing might be sustainable, the process of making the different types of pulp and paper packaging might not be. Producing pulp and paper is the fourth most energy-intensive industry in Europe as reported by the European Commission[37], meaning it contributes to greenhouse gas (GHG) emissions. However, this can be resolved by switching to a renewable energy source. The water footprint related to the consumption of paper products may also be significant depending on water efficiency of the different type of wood and the amount of recovered paper used in the packaging[38]. And while these packaging are often biodegradable and recyclable, it might still end up in a landfill with other types of trash, which slows its degradation rate. Furthermore, paper packaging that are lined with other materials makes the packaging non-recyclable and potentially nonbiodegradable[39].

==========

Examples: Wood pulp cellophane, cardboard, and paper packaging

==========

2.4.5 Packaging with Recycled Content

A large amount of both biodegradable and non-biodegradable materials ends up in landfills each day and recycling is one way to utilize or process waste to become input

materials for making new products such as packaging. For instance, paper-based products can be recovered as pulp, which feeds into the paper-making process. Other materials that can be recycled include certain types of plastic, metals, and fibers. Using recycled materials decreases the resource footprint of producing the product including energy, and water. It also lowers the dependence on virgin materials especially for packaging that does not come into direct contact with food and other ingested products.

Using recycled materials can also have some pitfalls. Contamination during the disposal and subsequent recycling process can occur and this can carry over to the manufactured packaging material[40]. Non-recyclables are placed with recyclable which can make the recycling process difficult[41]. This can have effects on health, especially if the packaging is intended for food. Mixing recycled with virgin material may result in the loss of some structural integrity for the packaging, which is an important consideration because packaging protects the product. Using recycled materials can also result in cosmetic changes such as differences in color, texture, and appearance, which can affect consumer perception regarding the product. Some companies have pioneered recycling recovered ocean and beach plastic into new packaging. Processing results in a dark grey product so companies will use dark of black colorants which can later be a problem as materials recovery facilities find it difficult to sort black polymers[42].

==========

Examples: Corrugated fiberboards, cardboard, and paper packaging made from 100% or a mix of recycled and virgin fibers, packaging made from recycled plastic, glass, or metal, bottles made from 100% post-consumer recycled PET, bottles made from ocean plastic (Parley Ocean Plastic)

==========

2.4.6 Recyclable Packaging

Recycling is the process of collecting and processing waste turning them into new products[43]. Recycling provides many benefits such as reducing the quantity of wastes in landfills and conserving natural resources. Recyclable packaging is constructed from glass, metal, wood, paper, and some plastics. Corrugated fiberboard is the most common form of recyclable packaging with as much as 84% of corrugated fiberboard packaging recycled in the United Kingdom. It can also be recycled multiple times before losing structural integrity[44]. The EU's Circular Economy Action Plan aims to increase recycling rates to 70% of all packaging waste by 2030. As of 2018, recycling rates for the EU stands at 66.3% for packaging, broken down into 82.9% for paper and cardboard packaging, 41.8% for plastic packaging, 34.6% for wooden packaging, and 80% for metallic packaging[45]. The recycling rate for plastic is relatively low despite being the largest in terms of volume, one of the reasons it ends up in the ocean.

Packaging made from a single material is often the easiest to recycle. However, many types of packaging are of made up of different types of materials, which can be difficult or impossible to recycle[46]. Contamination, as mentioned in section 2.4.5 can also be a problem during the recycling process. Single-stream recycling, where all recyclables are placed into the same bin, has made the process more convenient for consumers, but leads to 25% loss due to contamination[47]. Recycling works if the rate of effectiveness is above 80% to have a corresponding decrease in the use of natural resources[48]. This might not be the case for developing countries. Recyclable materials continue to end up in landfills and in the ocean, including 91% of plastic, due to the absence of a wide network of materials recovery facilities and recycling centers[49].

While recycling is part of the circular economy, it is considered as a last option when there are no other alternatives for the material. Many companies and governments still think of circularity as getting better at the recycling process. While improved recycling leads to increased recovery of materials, it should not preclude optimizing packaging design and manufacturing process to decrease waste and be more efficient in the resource use[50].

==========

Examples: Recyclable plastic (PET, HDPE), metal (aluminum), glass, wood, or paper packaging, mono-material packaging

==========

2.4.7 Reusable and Long-Lasting Packaging

Reusable packaging, also known as multi-use or returnable packaging, is packaging that is used for the same purpose multiple times with little to no transformation. It can be classified as either refillable by bulk dispenser, refillable parent packaging, returnable, or transport packaging[51]. Unlike recycling, which transforms the packaging into a different material, reusable packaging is designed for durable, ease of repair and maintenance, and can easily be stored. This makes it easy to

return the packaging to the source for reuse. The Ellen Macarthur Foundation[52] also identifies four packaging reuse business models: refills through a subscription service, pick up at home by a logistics service, refilling at a store dispensing system, and returning the packaging to a designated drop-off point.

Reusable packaging can reduce environmental impact since the packaging can be used several times and can last years. For instance, eco-bags or cloth tote bags can be used multiple times compared to single-use plastic bags. There would be less packaging that ends up as waste or being recycled, which enables a more circular model. Aside from lowered environmental footprint, businesses enjoy cost savings from avoided production since they do not have to spend on single-use packaging[53].

Return logistics remain a significant bottleneck for reusable packaging. Businesses need to set up return and recovery procedures to be able to reuse the packaging. However, some consumers cannot be inconvenienced and would continue to throw the packaging into the trash bin rather than return it. Reusable packaging is challenging when the return incurs long travel distance and significant costs. It also requires economies of scale to work, and it would be difficult to justify for low-volume products[54]. Packaging must be used enough times to decrease the environmental impact of producing it[55].

Examples: Reusable glass bottles and containers, reusable metal containers, reusable plastics (HDPE, LDPE, and PP), reusable shopping bags (eco-bags and cloth totes), reusable metal containers, durable cardboard and paper packaging, wooden pallets

2.5 Impact Analysis of Packaging Groups

There are several opportunities to include sustainability practices across the life cycle of packaging. These opportunities have the potential to decrease resource use, minimize GHG emission, decrease the amount of plastic that end up as marine debris, and lower the cost of packaging as a proportion of product cost.

Table 2.3 Sustainability-related opportunities across the life cycle of packaging

Life Cycle Stage	Environmental Opportunities	Socio-Economic Opportunities
Extraction of raw materials	• Use of sustainable or renewable feedstock • Sourcing from sustainably managed forests • Sustainable agriculture in the case of bio-based feedstock • Use of partial or 100% recycled content to decrease extraction of virgin materials • Choice of mono-material which does not need separation at end-of-life stage	• Due diligence in choosing raw material suppliers that pay the right wages and have safety protocols in place • Inclusive business models – working directly with poor farmers as suppliers • Gender equality in production of raw materials • Development of healthier and safer materials and methods of extraction
Design	• Optimal packaging design which uses the minimum amount of material but maintains purpose of packaging • Frustration-free packaging that simplifies the packaging experience • Redesigning products to use less single-use plastic in packaging • Multipurpose packaging that have different functionalities • Designing for durability to extend packaging lifespan	• Research and development (R&D) of new packaging materials that can be safely reused, recycled, or composted • Nurturing innovative startups that can lead to employment generation • Lowers packaging costs, which can be enjoyed by the consumer
Production and assembly	• Environmental management systems • Possible use of degradable additives that do not harm or compromise currently acceptable recycling practices • Use of renewable energy in production of materials • Optimization of water use • Management of emissions and treatment of effluents	• Proper training and safety measures for workers • Gender inclusivity in manufacturing • Fair wages • Using manufacturing partners with sustainable practices
Transport and distribution	• Use of modular packaging to optimize space during transport • Use of non-plastic material for fillers and shock packaging	• Fair wages for logistics providers • Occupational safety for loading, unloading, and transport

Life Cycle Stage	Environmental Opportunities	Socio-Economic Opportunities
	• Reusable transport packaging • Shortened transportation routes • Choice of transportation for lowered carbon footprint	• Lowers logistics cost which can as much as 50% of product cost; savings can be passed on to the consumer
Sales and use	• Choosing alternative packaging or consider refusing packaging. • Purchasing in bulk rather than single-serve to minimize packaging	• Plastic bans for certain single-use products • Shifting practices on waste management to source reduction • Business opportunities for sale of alternative products • Packaging deposit fees at purchase • Education of consumers to increase demand for sustainable packaging • Subscription business models that can give opportunities for micro, small and medium enterprises (MSMEs)
Disposal	• Disposal stream for single-use materials • Collection or return for reuse • Buy-back programs • Recycling and composting programs specific for specific kinds of materials • Recycling of sachets by recovering the plastic from the sachet and reusing in the manufacturing process • Producer end-of-life responsibility and investment into recycling facility • Upcycling to other useful objects such as plastic chairs, clothing, recycled plastics asphalt	• Business models for manufacturer-led or outsourced packaging return, reuse, and refill • Employment and fair wages in recovery and recycling • Community-based composting and recycling • Business opportunities for composting bio-based polymers and selling as inputs to agriculture as long as microplastics are absent and possible additives are not harmful • Incentive schemes for proper end-of-life-disposal

An impact assessment of the different packaging product groups identified a number of advantages and disadvantages for each sustainable option. Several environmental and socio-economic opportunities are available for the various sustainable packaging groups. These opportunities can be considered in creating the list of sustainability requirements. The specific environmental and socio-economic impacts of the identified packaging product groups are enumerated in the table below:

Table 2.4 Environmental and socio-economic impacts of packaging groups

Product Attribute	Environmental Impact	Socio-Economic Impact
Biodegradable plastic packaging	***Positive:*** • Biodegradable – will break down over time ***Negative:*** • Some biodegradable packaging still have high carbon footprint • Requires specific conditions to biodegrade properly (e.g., what is biodegradable in "natural EU conditions" may not be in the "natural PH conditions") ***Neutral:*** • Options can be petrochemical or non-petrochemical with additives • Choice of additive will determine rate of biodegradability	***Positive:*** • Aesthetic impact from less garbage of litter
Bio-based plastic (bioplastic) packaging	***Positive:*** • Convert all parts of a harvested crop, maximizing the crop's total value • Uses waste biomass from the production of other bio-based goods such as pulp and paper • Carbon emissions from feedstock has to be accounted but produce fewer GHG emissions over its lifetime • Some options such as seaweeds are less resource intensive and promotes carbon sequestration • Potential as edible packaging	***Positive:*** • Promotes farming to the youth as a viable means of livelihood (average age of a farmer in the Philippines is 57) • Generates another income stream for rural / agricultural areas and income for farmers • Enables coastal communities to participate in the supply chain

Product Attribute	Environmental Impact	Socio-Economic Impact
	• Some manufacturers embed seeds to make it plantable packaging ***Negative:*** • Production relies on weather and climatic conditions, which have inherent risks • Possible pollutants due to fertilizers and pesticides used in growing the crops and chemical processing needed to turn organic material into plastic • Avoiding petrochemical intensive agriculture is essential • Some bioplastics are non-biodegradable and non-compostable, and may not decompose in the ocean because of the water temperature • Can contaminate recycling streams	
Compostable packaging	***Positive:*** • Composting will provide organic material for the renewable feedstock ***Negative:*** • Majority of packaging requires industrial composting and cannot be composted under home conditions • Can be compostable but only if separate from other materials (requires source separation)	***Positive:*** • Livelihood opportunities for selling or using the compost for farming • Can indirectly help in improving nutrition in communities

Pulp and paper packaging from sustainably managed forests	***Positive:***
	• Net forest growth
	• Carbon sequestration of trees
	• Biodegradable and/or compostable depending on the composition and avoidance of multilayers
	Negative:
	• Energy and water requirements to produce paper
		Positive:
		• When sourced from well-managed forests, provide:
		  ○ sustainable livelihood
		  ○ health and wellness benefits to surrounding communities

Packaging with recycled content	***Positive:*** • Saves non-renewable resources • Making products from recyclables results in energy savings and lowered water usage • Pulp and paper materials are the easiest to recover and recycle	***Positive:*** • Livelihood opportunities from the recycling stream • Manufacturers can engage consumers through buy-back programs
Recyclable packaging	***Positive:*** • Less waste enters landfills • Mono-material can make recycling easier • Reduced emissions as long as the recycling process has a low carbon footprint • Glass bottles and jars may be recycled endlessly without loss of quality ***Negative:*** • Recycling may lead to continuous use of plastics because “it can be recycled” • Contamination with other material may make the material difficult to separate or unrecyclable	***Positive:*** • Can be turned into an infinite number of consumer products (not just packaging) • Livelihood and business opportunities for curbside collection • Creates more jobs compared to landfills and incinerators because it is more labor-intensive • Proper collection and processing protect workers from hazardous materials • Manufacturers can engage consumers through buy-back programs
Reusable and long-lasting alternatives	***Positive:*** • Sustainable sourcing of material • Reusable – last long - less garbage • Refilling produces less garbage • Some options are biodegradable • Source container might still be plastic, but it would most likely be a single recyclable plastic container	***Positive:*** • Initial cost of purchase will be higher but total lifetime cost will even it out. Innovative business models for return or refill can offset cost • New jobs in repair, rental, delivery, return refilling stations • Promoting a mindset on sustainable resource use (just take what you need)

2.6 Identification of Available of Verification for the Sustainability Requirements Means

This section presents the available means of verification for the sustainability requirements for packaging such as existing internationally recognized ecolabels, voluntary sustainability standards, basic information required by law, laboratory tests, and product declarations, which can serve to verify the sustainability attributes of the selected sub-categories of products and services. This may also include references to the national ecolabels.

ASTM International Standards[56] (ASTM) is an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services. The **Australian Bioplastics Association** (ABA), an industry association, administers a voluntary verification scheme, for companies or individuals wishing to have their claims of compliance with Australian Standard 4736-2006, compostable and biodegradable plastics verified.

B Corp Certification[57] is the only certification that measures a company's entire social and environmental performance.

Biodegradable Product Institute[58] (BPI) certification provides technically and scientifically credible certifications for materials that biodegrade in biologically active environments

The **Blue Angel**[59] is the ecolabel of the federal government of Germany since 1978. The Blue Angel sets high standards for environmentally friendly product design and has proven itself over the past 40 years as a reliable guide for a more sustainable consumption.

The **Chinese Environmental Label**[60] (CEC) is a certification mark that indicates that the products approved to use the mark are not only qualified in quality, but also meet environmental protection requirements during production, use, and disposal

Cedar Grove Composting[61] offers a program of technical review and testing for compostable products to determine if they will compost in their facility. Products are tested on site in Cedar Grove's composting process.

CERES offers certification for organic farming and food processing, for good agricultural and good manufacturing practices in the food industry, and for organic textiles and biofuels.

Deutsches Institut für Normung e.V.[62] (DIN, German Institute for Standardization) develops norms and standards for rationalization, quality assurance, environmental protection, safety and communication in industry, technology, science, and government, as well as the public domain.

Environmental Choice New Zealand[63] is New Zealand's official ecolabel. The Type I ecolabel offers strong, independent proof of environmental best practice for those products and services that bear the mark.

The **EU Ecolabel**[64] is awarded to products and services meeting high environmental standards throughout their life-cycle: from raw material extraction, to production, distribution and disposal. The EU Ecolabel promotes the circular economy by encouraging producers to generate less waste and carbon dioxide (CO_2) during the manufacturing process. The EU Ecolabel criteria also encourages companies to develop products that are durable, easy to repair and recycle.

European Bioplastics[65] is the association representing the interests of the thriving bioplastics industry in Europe.

European Standards[66] (EN) have been adopted by one of the three recognized European Standardization Organizations: CEN, CENELEC or ETSI. It is produced by all interested parties through a transparent, open and consensus-based process. There are no specific standards for packaging products but there are standards for the different materials.

Forest Stewardship Council[67] (FSC) Certification is a label that provides a credible link between responsible production and consumption of forest products, enabling consumers and businesses to make purchasing decisions that benefit people and the environment as well as providing ongoing business value.

Good Environmental Choice Australia[68] (GECA) is a purpose driven, not for profit that provides solutions for sustainable consumption and production. It runs Australia's only not-for-profit multisectoral ecolabelling program and advisory.

The **Green Mark**[69] is administered by the Environmental Protection Administrations of R.O.C (Taiwan). In the long term, the

promotion of Green Mark's products aims to promote green consumerism among consumers to select recyclable, low-polluting, resource-saving products.

GreenPla Japan[70] is the certification for biodegradable plastic of the Japan Bioplastics Association.

The **Hong Kong Green Label Scheme** (HKGLS) is an independent, nonprofit-making and voluntary scheme for the certification of environmentally preferable products launched in December 2000 by Green Council. The scheme sets environmental standards and awards its "Green Label" to products that are qualified regarding their environment attributes and/or performance.

The **International Sustainability and Carbon Certification** (ISCC) is a certification system that offers solutions for the implementation and certification of sustainable, deforestation-free and traceable supply chains of agricultural, forestry, waste and residue raw materials, non-bio renewables and recycled carbon materials and fuels.

The **Korea Eco-Products Institute**[71] carries out various operations related to Korea Eco-label including improvement in eco-products and product environmental friendliness by setting up the eco-product standards, building an evaluation system, offering eco-products and environmental trend information to the public, facilitating production of eco-products, and constructing the eco-product consumption system.

The **Nordic Swan**[72] is the official ecolabel of Nordic countries and works to reduce the environmental impact from production and consumption of goods – and to make it easy for consumers and professional buyers to choose the environmentally best goods and services.

The **Programme for the Endorsement of Forest Certification**[73] (PEFC) promotes sustainable forest management through independent third-party certification. It is considered the certification system of choice for small forest owners.

The **Rainforest Alliance 2020 Certification Program**[74] uses the Sustainable Agriculture Standard, to drive more sustainable agricultural production and responsible supply chains.

The **Singapore Green Labelling Scheme**[75] (SGLS) endorses industrial and consumer products that have less undesirable effects on our environment. Administered by the Singapore Environment Council, the SGLS is the region's most established ecolabelling scheme with over 3,000 unique products certified across 28 countries.

The **Sustainable Forestry Initiative**[76] (SFI) advances sustainability through forest-focused collaboration. SFI's work includes organizations across the supply chain — from forest managers to manufacturers to distributors to printers. Once certified, organizations can apply to use SFI on-product labels.

The **Thai Green Label**[77] is an environmental certification awarded to specific products that are shown to have minimum detrimental impact on the environment, in comparison with other products serving the same function. This was initiated by the Thailand Business Council for Sustainable Development (TBCSD) and formally launched in August 1994 by The Thailand Environment Institute (TEI) in as-sociation with the Ministry of Industry.

TUV Austria Belgium NV/SA[78] has several certification schemes related to biodegradable and bio-based material.

The **US Composting Council**[79] advances compost manufacturing, compost utilization, and organics recycling to benefit members, society, and the environment.

The **USDA Biopreferred**[80] program catalog assists users in identifying products that qualify for mandatory federal purchasing, are certified through the voluntary labeling initiative, or both. The USDA Certified Biobased Product label is designed to provide useful information to consumers about the biobased content of the product.

Verus Carbon Neutral[81] specializes in the measurement and reduction of energy use and environmental impact to create affordable ways to enable businesses to understand and control their life-cycle energy use and resulting GHG generated from product manufacturing and services.

Table 2.5 Sustainability requirements for biodegradable plastic packaging

Means of Verification	Indicators
ABA Verification	• Comply with all criteria of the Australian Standard AS 4736-2006 for biodegradable plastic
ASTM	• ASTM D5338 test method for determining aerobic biodegradation of plastic materials • ASTM D6002 guide for assessing the compostability of environmentally degradable plastics • ASTM D6866 test methods for determining the biobased content of solid, liquid, and gaseous samples using radiocarbon analysis • ASTM D5511 and ISODIS15985 for anaerobic biodegradability
BPI	• Meet ASTM D6400 or ASTM D6868
European EN Standards	• EN 14046:2003 Method by analysis of released carbon dioxide
GreenPla	• Pass ISO 16929 or ASTM D5338 tests for biodegradability • Pass oral acute toxicity tests (Organization for Economic Co-operation and Development (OECD) standards) • Pass environmental safety tests (OECD 201, 202, 203) • Biomass carbon measurement tests
TUV Seedling	• Comply with European Standard EN 13432 requirements for packaging recoverable through composting and biodegradation

Table 2.6 Sustainability requirements for bio-based plastic (bioplastic) packaging

Means of Verification	Indicators
European Committee for Standardization	• CEN/TS 16137:2011- Determination of biobased carbon specifies the calculation method for determining the biobased carbon content in monomers, polymers and plastic materials and products, based on the 14C content measurement.
Nordic Swan	• At least 90% of the weight must be bio-based or made from recycled plastic • Sugar-cane bioplastic must be Bonsucro-certified • Palm oil bioplastic must be RSPO certified • Soy oil must be RTRS certified • Produce of bio-based polymer or suppliers of raw materials must be chain of custody certified • Use of genetically modified agricultural raw materials is prohibited • Manufacturer of polymer must be ISO 50001 certified • Energy consumed in production of bio-based polymers must not exceed 50MJ/kg polymer
TUV OK Bio-based	• Percentage of renewable raw materials (% bio-based)
TUV NEN Bio-based	• Based on European Standard EN 16785-1 on biomass content
USDA Biopreferred	• Calculation of the amount of renewable biological ingredients based on ASTM D6866

Table 2.7 Sustainability requirements for compostable packaging

Means of Verification	Indicators
ASTM	• ASTM D6002, D6400, or D6868 guide for assessing compostability
ABA Verification	• Industrial compostable test based on Australian Standard AS4736 • Home compostable test based on Australian Standard AS 5810-2010
BPI Certification	• Pass ASTM D6400 or EN 13432 industrial compostability test
Cedar Grove Composting Approved	• ASTM D6400 or EN 13432 standards for bioplastics, co-polymers, PLA coated paperboard and paper, and other similar items • Meet ASTM D6868 requirements for plastics used as coatings on compostable substrates and fibrous material
DIN	• Pass DIN V 54900 testing of the compostability of plastics
European Bioplastics	• Chemical test: Disclosure of all constituents, threshold values for heavy metals are to be adhered to. • Biodegradability in controlled composting conditions (oxygen consumption and production of CO_2): Proof must be made that at least 90 percent of the organic material is converted into CO_2 within six months. • Disintegration: After 3 months' composting and subsequent sifting through a 2 mm sieve, no more than 10 percent residue may remain, as compared to the original mass. • Practical test of compostability in a semi-industrial (or industrial) composting facility: No negative influence on the composting process is permitted. • Ecotoxicity test: Examination of the effect of resultant compost on plant growth (agronomic test)
European EN Standards	• EN 13432 test scheme for packaging recoverable through composting and biodegradation based on biodegradability, disintegration during biological

Means of Verification	Indicators
	treatment, effect on the biological treatment process and effect on the quality of the resulting compost
ISO 17088:2012	• Standard covers biodegradation, disintegration during composting, negative effects on the composting process and facility, negative effects on the quality of the resulting compost, including the presence of high levels of regulated metals and other harmful components.
TUV OK Compost HOME	• Pass quantitative and qualitative disintegration test for home compostability
TUV OK Compost INDUSTRIAL	• Meet EN 13432:2000 standard for compostability in an industrial plant
US Composting Council STA certified compost	• Pass testing method for the examination of composting and compost (TMECC) based on ASTM standards

Table 2.8 Sustainability requirements for pulp and paper packaging from sustainably managed forests

Means of Verification	Indicators
Enhanced SGLS	• Applies to pulp and paper products • Standards available only to applicants
EU Ecolabel	• Meet Commission Decision 2014/256/EU criteria for converted paper products where virgin fibers shall be covered by valid sustainable forest management and chain of custody certificates issued by an independent third-party certification scheme, such as FSC, PEFC or equivalent. Uncertified virgin material (maximum 30%) shall be covered by a verification system which ensures that it is legally sourced.
FSC Certified	• Forest management certification (source) • Chain of custody certification (manufacturer or seller of forest product) • % FSC = % quantity of claim contributing inputs / total quantity of forest-based inputs • Legal employment and safe working conditions based on ILO standards
HKGLS	• Packaging material using virgin wood fiber should have certification on chain of custody • Bleached with chlorine free agents
PEFC	• Sustainable forest management standards PEFC ST 1003 • Chain of custody standards PEFC ST 2002:2020
SFI	• SFI forest management standard with 15 requirements • SFI fiber sourcing standard with 13 requirements for procuring fiber from non-certified forestland • SFI chain of custody standard for tracking fiber content through production, to manufacturing to end product

Table 2.9 Sustainability requirements for packaging with recycled content

Means of Verification	Indicators
Blue Angel (Plastic packaging)	• At least 80% recycled plastic
Blue Angel (Pulp and paper packaging)	• 100% sourced from recovered paper • Recovered paper must be processed without the use of chlorine and halogenated bleaching agents • Content of diisopropylnaphthalene in paper and cardboard should be as low as possible
EU Ecolabel (Pulp and paper packaging)	• Meet Commission Decision 2014/256/EU criteria for converted paper products where fiber can be made from recycled or virgin fiber.
FSC Certified (Pulp and paper packaging)	• FSC Recycled standards – 100% recycled content • FSC Mix standards – FSC-certified forests, recycled materials, and/or FSC controlled wood
Green Dot	• Manufacturer is a member of the packaging recovery scheme and pays a contribution one of the two eco-organizations specialized in packaging: Éco-Emballages or Adelphe
Green Mark (Paper packaging)	• Recycled paper content: packaging paper and paper bags (>40%); paper boards, corrugated boxes, and paper pallets (>80%); pulp molded products (100%). Only FSC or PEFC certified virgin pulp shall be used.
Green Mark (Glass Packaging)	• The recycled glass used in the products shall all be sourced from domestic consumption, usage, construction, production, and processing activities; and shall have the blending (weight) ratio of at least 50%, not counting pre-consumer (on-site recycling) materials.
Green Mark (Plastic packaging)	• The content of recycled plastics in the product's plastic materials shall be above 50%.

Means of Verification	Indicators
HKGLS (Plastic packaging)	• At least 50% by weight of recycled plastic content for plastic bags (non-food)
HKGLS (Paper Packaging)	• Packaging paper and paper bag should be 50% recycled content • Paper box, board and plate should be 100% recycled content • Source of raw material, country of origin, and recycled content ratio should be clearly stated
Korea Ecolabel (Pulp and paper packaging)	• Meet EL723 standards for recycled wood products including usage rate of wood, usage rate of disposed wood, formaldehyde, Volatile Organic Compounds (VOC) and toluene emission • Usage rate of wastepaper use in % usage rate of waste material weight and % usage rate of post-consumer waste material weight (variable depending on packaging type)
Nordic Ecolabel (Recycled content)	• The sum of lead, cadmium, mercury, and hexavalent chromium contained in a package material should be 100 mg/kg or below.
SGLS (Recycled content)	• Applies to glass, metal, plastics, rubber, waste material • Standards available only to applicants
Thai Green Label (Plastic packaging)	• Proportion of the post-consumer waste plastic range from 30-50% depending on product category
Verus Carbon Neutral (Recycled content)	• Recycled content is expressed quantitatively as a percentage. Total proportion of recycled materials is considered by mass for the product and or product packaging.

Table 2.10 Sustainability requirements for recyclable packaging

Means of Verification	Indicators
CEC Type II environmental label	• Packaging materials need to be easily recyclable.
EU Ecolabel	• Meet Commission Decision 2014/256/EU criteria for that guarantee converted paper products and printed paper products are recyclable. The printed paper product shall be recyclable and de-inkable. Non-paper components of the printed paper product shall be easily removable. • Plastic packaging shall be designed to facilitate effective recycling by avoiding potential contaminants and incompatible materials that are known to impede separation or reprocessing or to reduce the quality of recyclate.
ISO 18604:2013 Packaging and the environment — Material recycling	• Packaging assessment and declaration of percentage recyclable

Table 2.11 Sustainability requirements for reusable and long-lasting packaging

Means of Verification	Indicators
Blue Angel Returnable Packaging	• Number of times packaging can be reused • Collapsible or stackable
Environmental Choice New Zealand Reusable Plastic Products	• Proven life expectancy, plastic content, recycled content, Polyvinyl Chloride (PVC) content, packaging should be made of plastic that can be recycled
ISO 18604:2013 Packaging and the environment - Reuse	• Packaging assessment

Table 2.12 Sustainability requirements for the packaging manufacturing process

Sustainability Requirements	Means of Verification	Indicators
Efficient design and fulfillment	ISO 18602:2013 Packaging and the environment — Optimization of the packaging system	• Packaging assessment of achievement of a minimum adequate weight or volume of the packaging
	EU Ecolabel	• Packaging impact ratio (PIR) in terms of grams of packaging per gram of product for each of the packaging in which the product is sold.
Local fabrication	No certification	• Self-declaration of manufacturing facility location
Responsible employment	EU Ecolabel	• Fundamental principles and rights at work shall be observed by production sites
	GECA	• Requirements for workplace safety, fair pay and equal opportunity, lawful conduct and environmental compliance
Sustainable manufacturing	Cradle-to-Cradle certification 4.0	• Meet Gold or Platinum requirements of the Cradle-to-Cradle product standards

Sustainability Requirements	Means of Verification	Indicators
	EU Ecolabel	• Low air and water pollution during production, energy management, hazardous substances restricted, implementation of waste management systems
	Global Sustainable Enterprise System certifications	• CO_2 emissions based on ISO 50001 and ISO 16064-1 circular economy based on BIS 8001
	ISCC Plus	• Compliance with ISCC EU system documents 102, 103, 201, 201-1, 202, 203, 204, 205, and 206
	ISO 14001:2015	• Maps out a framework that a company or organization can follow to set up an effective environmental management system
Sustainable organization and supply chains	B Corp	• Pass the B Impact Assessment which evaluates how the company's operations and business model impact workers, community, environment, and customers
	Rainforest Alliance for bio-based and agricultural production	• Meet 2020 sustainable agriculture standards covering climate-smart agriculture, deforestation, conserving biodiversity, human rights, shared responsibility, living wage, continuous improvement, living income, risk-based assurance, and gender equality

CHAPTER 3
ANALYSIS OF SUPPLY

This chapter aims to assess the capabilities of the local and the national market to supply the packaging materials and products in focus at a competitive price. It includes identification of the level of availability and the market share of the conventional and alternative packaging products in focus in the country. It discusses description on the market players involved in the market segments considered and identification of the advantages, disadvantages and main obstacles limiting the supply of the packaging products in focus from life cycle and circular economy perspectives. This chapter also contains analysis of the potential threats and opportunities for the local production and processes that could arise from the introduction of these criteria. The interview participants whose insights contributed to the supply analysis were composed of the LGUs of Iloilo City and Bacolod City including the relevant government agencies not limited to the roles and functions: in the coordination of all scientific and technological activities, and of formulating policies, programs and projects to support national development; research and development institution; in the coordination and implementation of all policies, plans, projects and activities relative to the prevention and control of pollution as well as the management and enhancement of environment; in expanding economic opportunities in industry and services and increasing the access particularly of MSMEs. Included also were the following: an industry association of local downstream plastic companies, local organization of businesses and companies; conventional and alternative packaging business owners, sellers, distributors, and manufacturers; and other stakeholders in the academe and marine organization.

3.1 Regulatory Environment

There are several government agencies that regulate the manufacture, use, and eventual disposal of packaging. The DTI – Bureau of Philippine Standards (BPS) supports the packaging industry through the development of voluntary Philippine National Standards (PNS) for various packaging specifications. As the national standards body of the Philippines, DTI-BPS is actively participating in the international standardization activities on packaging. The agency uses ISO/IEC Guide 41 on Packaging addressing consumer needs. Subsequently, this document has been adopted as PNS ISO/IEC Guide 41:2020 by the National Mirror Committee, DTI-BPS Technical Committee on Consumer Policy (BPS/TC 81). All standards referenced in the technical regulations under the DTI-BPS mandatory certification Schemes do not require submission of an LCA or an environmental and social impact analysis across the importers' or manufacturers' supply chain. There are no penalties imposed on manufacturers for violation of sustainability-related standards since these standards are not used in the certification schemes. PNS ISO 9001:2015 and the relevant product standards are the only standards used to determine manufacturer's compliance for the issuance of Philippine Standard (PS) Mark License.

Packaging technology is one of the priority research areas of the Department of Science and Technology - Industrial Technology Development Institute (DOST-ITDI). The Institute is also the national agency for tests and analyses, ensuring that the standards developed by DTI-BPS are met (e.g., testing packaging for possible food contaminants). DOST-ITDI is currently building two laboratories: The Simulation Packaging Testing Laboratory to serve as a hub for testing the performance of transport packaging and the Green Packaging Laboratory which will focus on the development of sustainable packaging technology using indigenous and renewable materials and processes that reduce carbon footprints.

DTI - Bureau of Small and Medium Enterprise Development (BSMED) ensures that small and medium enterprises (SMEs) adhere to the provisions of Republic Act 9003 (Ecological Solid Waste Management Act), which prohibits non-environmentally acceptable packaging. As one of the implementing agencies of the legislation, DTI is actively encouraging its network to patronize and endorse sustainable packaging and cascade that to the regional offices. BSMED also serves as the secretariat of the Promotion of the Green Economic Development (ProGED) program, which mainstreams green growth and green economic development in SMEs by using the value chain approach. The DTI - Regional Operations Group (ROG) is also the

supporting body for ProPak, a processing and packaging trade event which showcases the latest developments in environment friendly packaging.

Packaging as a waste material can contribute to achieving the objectives of Republic Act 9003, which adopts a systematic, comprehensive, and ecological solid waste management (SWM) program through:

- Setting targets for solid waste avoidance and volume reduction through source reduction and waste minimization measures, including composting, recycling, reuse, recovery, green charcoal process, and others, before collection, treatment, and disposal in appropriate and environmentally-sound SWM facilities in accordance with ecologically sustainable development principles
- Encouraging greater private participation in SWM
- Encouraging cooperation and self-regulation among waste generators through the application of market-based instruments.

The Environment Management Bureau (EMB) – Solid Waste Management Division (SWMD) of the DENR monitors the compliance of LGUs based on their ten-year SWM plans. The LGUs correspondingly issue SWM certificates to businesses as part of the requirements for a business permit. A unit of the EMB also issues environmental compliance certificates based on compliance with certain environmental conditions such as waste management.

Several cities and municipalities have issued local ordinances banning or regulating single-use plastics. House Bill No. 9147, or the Single-Use Plastic Products Regulation Act consolidates individual LGU efforts into a national policy that aims to reduce the dangerous effects of unnecessary plastics on people's health, the environment, and climate. The bill has already been approved by Congress on its second reading and if enacted into law, can accelerate the shift to sustainable packaging. The bill seeks to phase out several single-use plastic items, including packaging, within four years. Moreover, producers and importers of single-use plastics will also be required to implement EPR programs. The bill also sets out fines and penalties ranging from P50,000 to P1,000,000 and revocation of the business permit.

3.2 Supply Analysis of Conventional Packaging

3.2.1 Level of Availability

Many multinational consumer goods companies produce their goods in other Southeast Asian countries such as Indonesia, Thailand, and Malaysia or outsource from factories in China. These goods are already packaged in the factories and shipped to the Philippines. While this lowers the cost of good production, it increases the carbon footprint of products due to transport and logistics. These goods also require additional packaging for transport by sea or air.

The Philippine downstream plastics industry refers to the plastic fabricators and manufacturers which convert plastic resins to industrial and consumer finished products. Majority of the plastics companies are situated in Metro Manila and in CALABARZON (Cavite, Laguna, Batangas, Rizal, and Quezon) area, where many export processing zones are located. There are also a few manufacturing facilities in Iloilo, Cebu, and Davao.

The figure below, from the DTI's Philippine Plastics Industry roadmap, provides data on the plastic raw material consumption of the Philippines' plastic downstream industry. DTI's data does not disaggregate by purpose or use and there is no specific data for conventional plastic packaging. PE is the most common plastic used in packaging. It comprised 50% of the overall raw material consumption of the downstream industry. Both PE and PP are the most used plastic types to make sachets and other forms of packaging. Plastic raw material consumption has shown an increasing trend, which also means that the production of packaging has also experienced an uptrend.

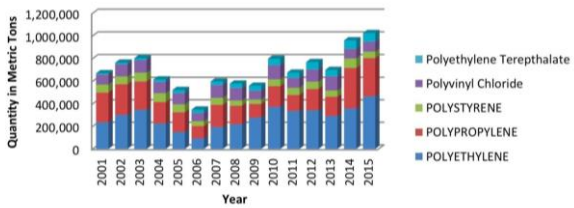


Figure 3.1 Philippine Plastic Raw Material Consumption (2001-2015)
Source: DTI, Philippine Plastics Industry Roadmap

3.2.2 Market Players

According to the Philippine Plastics Industry Association, Inc. (PPIA), there are more than 1,000 plastic fabricators and converters nationwide. The labor force in the industry is estimated at 600,000 direct and indirect workers as production of plastic products is labor intensive. The raw materials consumed by the downstream plastic industry are mostly imported as local midstream petrochemical companies are still unable to meet their requirements.

Some manufacturers buy plastic films, laminate and print based on their client's requirements for either mono-material or multilayer packaging materials. They also worked with companies in their action plans and roadmaps for their own packaging. Multilayer plastic is critical for protecting the product and prolonging its shelf life. Virgin raw material is often required for food packaging. Unless necessary, manufacturers minimize the use of a third layer of packaging to cut the cost. Materials such as aluminum have been previously used as an inner layer of a multilayer packaging but have now been replaced by nylon or PET which makes the packaging lighter and cheaper.

Conventional plastic packaging has many advantages over alternative materials, making it the preferred choice of the market. Plastic is often the cheapest type of packaging material and is widely and readily available. It comes in multiple variations and customers can easily find the type of plastic packaging that fits the purpose. It protects the products very well and its durability is unmatched.

3.2.3 Opportunities, Obstacles and Threats Affecting Supply

As it currently stands, conventional products are still largely preferred due to the high cost associated with shifting towards more sustainable options. The supply is also readily available. A rapid scan of packaging products sold online verifies that conventional plastic packaging products are cheaper compared to other materials. Paper comes closest to the price of plastic, but it is the least durable option. Plastic is more expensive when it comes to reusable packaging, but it is more durable and can be reused more times. A sampling of online packaging products is presented in Table 3.1, with products highlighted in blue considered to be conventional packaging products.

Table 3.1 Sample pricelist for selected packaging products

Items	Dimension	Price / Piece (PHP)	Source
Food Containers			
Plastic microwaveable bowl	450ml	3.80	Lazada
Cornstarch bowl	250ml	29.00	Lazada
Aluminum foil bowl (plastic lid)	700ml	10.80	Lazada
Kraft paper bowl (plastic lid)	500ml	11.00	Lazada
Sugarcane (bagasse) container	450ml	7.60	The Good Trade
Laminated paper box	400ml	6.00	Lazada
Biodegradable (bio-additive) bowl	750ml	5.28	Happy Green
Pouch / Sachet			
Plastic pouch	7x10 in	1.25	Lazada
Plastic *labo* bag	10x14 in	0.18	Lazada
Aluminum foil pouch	9x13 in	2.22	Lazada
Kraft paper pouch (with plastic window)	9x13 in	1.85	Lazada
Carrier Packaging			
Plastic sando bag	Medium	0.74	Lazada
Reusable canvas tote bag	Medium	55.00	Lazada
Reusable PP green bag	One size	40.00	SM Supermalls
Corn bag	Medium	22.08	EcoNest
Reusable non-woven eco-bag	Medium	11.30	Lazada
Cassava sando bag	Medium	10.50	EcoNest
Kraft paper shopping bag with handles	Medium	8.00	Lazada
Brown paper bag without handles	Medium	1.58	Happy Green
Liquids Packaging			
PET plastic bottle	500ml	11.95	Lazada
Amber glass bottle	500ml	49.00	Shopee
Clear glass juice bottle	350ml	22.00	Shopee
Reusable and Refillable Containers			
Clear glass dispenser with pump	500ml	160.00	Lazada
PET plastic bottle dispenser with pump	500ml	158.00	Lazada

Items	Dimension	Price / Piece (PHP)	Source
Amber glass dispenser with pump	500ml	120.00	Lazada
Transport Packaging			
Plywood shipping crate	-	970.00	Alibaba
Reusable plastic turnover box	60x40x36 cm	1,960.00	Lazada
Reusable plastic crate	60x40x29 cm	801.00	Lazada
Cardboard *balikbayan* box	20x20x20 in	190.00	Lazada

Source: Consolidated from online marketplaces
Note: Does not include any shipping fees

Suppliers note that the market opts for more eco-friendly options when local legislation requires them to do so. As plastic packaging and its disposal have become an environmental concern, several legislations have been created to either ban or regulate single-use plastic including various types of plastic packaging. From 2017-2019, several cities and provinces have approved regulations on plastic and plastic packaging in the Visayas. In 2017, Iloilo City started enforcing Regulation Ordinance No. 2013-403 which prohibited the use of non-biodegradable plastic bags. This has been expanded across Iloilo province through Provincial Ordinance 2019-193, which regulates the use of single-use plastics and expanded polystyrene (EPS) foam for goods and commodities and promotes the use of native baskets and other biodegradable materials. The island province of Siquijor also passed a provincial ordinance to regulate the use of plastic bags for secondary packaging and prohibits the free distribution of plastic bags as primary packaging. The ordinance has been amended to require customers to bring their own bags when shopping, prohibits the sale of new plastic bags on Sundays, and prohibits the use of cellophane with cooked food. A nationwide ban on the use of single-use plastic in government offices was announced in February 2020. The Single-Use Plastic Products Regulation Act is the biggest threat to the supply of conventional packaging. Manufacturers would have to prove that their packaging products can be used multiple times. Otherwise, manufacturers will be forced to switch to producing alternative packaging products to comply with regulatory requirements.

3.3 Supply Analysis of Biodegradable Plastic Packaging

3.3.1 Level of Availability

There is no information on the level of availability for biodegradable plastic packaging as the available data does not differentiate biodegradable from non-biodegradable plastic. With different cities and municipalities regulating single-use plastic, most plastic manufacturers shifted their production with the market trend. The market has become inundated with a supply of self-labeled biodegradable plastic; some are marked as biodegradable, and others are labelled oxo-biodegradable. Most retailers and suppliers do not offer descriptions and verification regarding the product to verify whether the plastic is indeed biodegradable or simply oxo-degradable through additives. Majority of customers, especially MSMEs, do not require material testing data. Only large corporations, such as fast-moving consumer goods companies, supermarkets, and malls that order packaging in massive quantities, source out suppliers that can prove biodegradability of the packaging.

3.3.2 Market Players

ISO 14021 states that biodegradable materials should be able to degrade in a natural environment There are a few industry players that produce oxo-biodegradable plastic packaging using environmental technology verified (ETV) by the DOST-ITDI. ETV-013 has been issued for the additive BioMate, which has been verified as making plastics both photo and biodegradable. BioMate is also certified biodegradable by SP Technical Research Institute of Sweden and meets American standards for plastics biodegradability. BioMate causes the plastic to degrade via a two-step process: first, the plastic fragments due to oxidation and second, it biodegrades after attaining a molecular weight suited for consumption by microorganisms. The process of degradation continues in the presence of oxygen until the material is converted to biological materials without leaving fragments of petrochemicals. D&L Industries, Licton and Donewell are some of the companies that use BioMate in plastic packaging products. D&L Industries' Biorez product line is recognized by European standards for biodegradable plastics and received certification from Berlin-based organization Din Certco. Happy Green Packaging, a division of Robin Co, Ltd., offers a biodegradable product line that also uses additives.

3.3.3 Advantages and Disadvantages from Life Cycle Perspective

Intertek conducted an LCA of the types of packaging. Overall, conventional, and oxo-biodegradable packaging were found to have the lowest impact in nine out of eleven categories. The bio-based packaging was only superior in terms of litter effects. However, it is acknowledged that LCA remain disputed and may not cover the entire cradle-to-the grave life cycle. Globally, the infrastructure needed to process biodegradable plastics from collection through to high-temperature composting is still limited at industrial scale.

Table 3.2 Life cycle analysis of three different types of packaging

Impact Category	Unit	Conventional HDPE bread bag	Oxo-biodegradable HDPE bread bag	Bio-based bread bag
Global warming potential	g CO_2 eq	21.2901	21.3137	30.9120
Litter effects	M2.a	0.001	0.000	0.0003
Abiotic depletion	g Sb eq	0.240	0.241	0.2793
Acidification	g SO_2 eq	0.121	0.121	0.2421
Eutrophication	g PO_4 eq	0.007	0.007	0.0408
Ozone layer depletion	mg CFC-11	0.000	0.000	0.0022
Human toxicity	g 1,4-DB eq	1.712	1.712	6.2196
Fresh water aquatic ecotoxicity	g 1,4-DB eq	0.125	0.125	0.7564
Marine aquatic ecotoxicity	kg 1,4-DB eq	0.326	0.326	1.3444
Terrestrial ecotoxicity	g 1,4-DB eq	0.017	0.017	0.1246
Photochemical oxidation	g C_2H_4	0.006	0.006	0.0106

Source: Intertek[82]

While biodegradable plastics can theoretically shorten the life cycle of plastics and reduce environmental stress require exact conditions to biodegrade, which may not be encountered in a real environment[83]. It also would not biodegrade when landfilled. Without enough oxygen to break them down, they can still last for years and release methane, which is more harmful than carbon dioxide as GHG[84].

For large-volume plastic packaging without significant impurities, mechanical recycling has a smaller carbon footprint than chemical recycling. However, incineration to generate energy or exporting waste when incineration is not allowed (e.g., Philippines) is the likely end-of-life path for mixed or contaminated plastic.

In another study, three commercially available biodegradable plastic films are assessed for thermal response. The mechanism of degradation of the specimens is consistent with oxo-biodegradables in soil media. The results also show potential for treating reclaimed plastic products with an optimized energy framework that can provide high energy input at start-up operations whilst recovering valuable chemicals and products towards the end of the stream[85].

3.3.4 Opportunities, Obstacles and Threats Affecting Supply

With a 300 to 400 percent price premium, biodegradable resin is a more expensive alternative to conventional resins. Only top companies and brands are willing to spend more for it because their margins can absorb the added cost. Local availability, small minimum order quantities and price remain to be the primary considerations for SMEs. However, by leading the way, bigger clients can help packaging manufacturers commit to sustainability and stabilize the supply chain for biodegradable packaging, which can benefit SMEs later.

The labelling of biodegradable plastic packaging remains to be unregulated in the market. Suppliers indiscriminately label plastic products as biodegradable without providing verification and only few manufacturers provide DOST ETV information. Buyers who are mainly unaware of technical specifications would just use price and availability as the primary criteria for supplier selection. This devalues verified biodegradable plastic packaging products and demotivates manufacturers and sellers from supplying these. Close government monitoring is necessary to ensure that the products are marketed based on fact.

3.4 Supply Analysis of Bio-based Plastic (Bioplastic) Packaging

3.4.1 Level of Availability

Globally, bio-based plastics represent about 1% percent of the about 320 million metric tons of plastic produced annually[86]. The global bioplastics market is valued at USD 21 billion in 2017, and is projected to reach USD 68 billion by 2024, experiencing a 19% compounded annual growth rate during that period[87]. The rigid packaging segment makes up one third of the bioplastics produced in the global market. The Asia-Pacific market for bioplastics is projected to reach a total market size of USD 6.4 billion by 2023, increasing from USD 2 billion in 2017[88]. There is no available country-level data for the Philippines given the nascency of this product subgroup.

3.4.2 Market Players

Packaging based on renewables rather than fossil fuel-based feedstocks is still a niche market in the Philippines and a lack of support, local standards, and infrastructure hinders its mainstreaming. Suppliers of bio-based plastic packaging such as EcoNest, The Good Trade, and Ecolutions mainly import from other countries, primarily China. Most local manufacturers are small-scale MSMEs. It is difficult for local suppliers to manufacture on a large scale because they recently transitioned from research and development to commercialization. Moreover, given the wide array of biological material that can be used to produce packaging, the industry is fragmented and there is currently no association to serve as the voice for bioplastics in the country.

Most of the information about suppliers of bio-based plastic in the Philippines can only be found in news articles when these companies launch a new product. Such is the case in 2018, when DOST-ITDI developed a biodegradable polymer made from starch. However, it was not ready for commercialization because researchers still had to assess its marketability. At the time, there were no producers of biodegradable thermoplastic polymer in the country and there was only one local distributor of polylactic acid, a synthetic biodegradable polymer[89]. Recently, Denxybel Montinola, a Filipino scientist, developed a bioplastic made from algae and mango waste that dissolves in water. However, the research and development is still ongoing[90].

Philippine Bioresins Corporation is probably the most advanced bio-based plastic packaging company in the country as it has already been doing development and testing for at least five to six years. In 2019, Philippine Bioresins was recently given an ETV certificate by DOST-ITDI. The certificate confirms that the biodegradable PP produced by the company would be 64.6% degraded in 24 months compared to 4.5% in the same period for conventional plastic packaging[91]. The company is currently supplying San Miguel Corporation, the country's largest conglomerate, with bio-based packaging for cement and other non-food products.

Some Philippine manufacturers produce for the export market since the demand is higher in other countries. For instance, D&L Industries launched Bionolle Starcla, an environmentally friendly bag made from 100% plant-based materials. The starch-based biopolymer that can be used as garbage and shopping bags that fully decomposes in three months. The product is being shipped to Japan to be used in agriculture but is also in discussions with companies in Italy where there is large demand for these kinds of packaging materials[92].

3.4.3 Advantages & Disadvantages from a Life Cycle Perspective

LCA studies show smaller impacts for bioplastic packaging compared to conventional options when it comes to GHG emissions and fossil resource consumption but do not typically achieve overall superiority over plastic. Some polymers are heavier in weight and may even show a lower environmental performance. Not all bioplastics are biodegradable or compostable[93]. Environmental optimization of bioplastic is found in crop or feedstock selection, improvement of farming operations to lower agricultural emissions, as well as in biomass conversion[94].

Land use is a critical aspect of bioplastic life cycles. Biological feedstock can compete with agriculture placing pressure on food security. Biomaterials can also be found in agricultural wastes such as bagasse from sugarcane and pineapple fiber, but these also compete with biofuels. Significant direct and indirect land use change impacts should be accounted for. The selection of biobased material is also critical to the carbon footprint and eventual biodegradability of the packaging because not all are biodegradable. For instance, after one year in a marine environment at 30 degrees

Celsius, polylactic acid by about 8% whereas biopolymer PHBV biodegrades by about 80%[95]. The amount of carbon dioxide emission of bio-polymer PHB was the smallest among the bioplastics studied. The specific energy consumption of starch/polycaprolactone was the smallest among the samples[96].

While bioplastics can reduce GHG during the manufacturing phase, composting or burning waste bioplastics can put those emissions back into the air. Recycling bioplastics would reduce emissions but not in a significant way compared to conventional ones[97]. Bioplastic formulas affect the recyclability of the packaging. There are effects associated with the biogenic nature of the material when this undergoes recycling and substitutes conventional materials[98].

Switching to bio-based polymers is not the complete solution; it must be combined with other interventions in a multi-layered approach that reduce resource use. Biopolymer production costs need to be reduced, chemical recycling infrastructure needs to be developed and better plastic waste collection schemes to be put into place[99]. Researchers determined that the most drastic reduction resulted from using sugarcane (bagasse) as feedstock in greenhouse, manufacturing using 100% renewable energy, recycling all plastic waste, and reducing consumption of plastic packaging[100].

3.4.4 Opportunities, Obstacles and Threats Affecting Supply

An average of 200 kilo tons of true biodegradable plastic is produced globally each year, representing 0.3% of total plastics produced[101]. The small size of industry players producing biodegradable polymers signals an opportunity for those who want to venture into the manufacturing of plastics made of a biodegradable polymer. According to DOST-ITDI, plastic manufacturers can easily shift to this type of technology because there is no required investment for pre-processing equipment and skilled workers. They can still use their existing equipment to process thermoplastic starch pellets into polymer products.

Some manufacturer's view bioplastic packaging as marketable for non-food packaging because it has a shorter shelf-life compared to conventional packaging. Typically, bioplastic packaging has a shelf life of one to three years under specific environmental conditions, which may not be enough to protect food items. Bioplastic packaging also needs to be stored under certain conditions to ensure quality and performance, which may be inconvenient and proper storage could potentially be an additional expense.

Packaging using biological feedstock competes with the raw material requirements of other industries. For instance, the sugarcane industry in Negros produces bagasse as a waste material. However, there is also a high demand for bagasse, rice hulls and other agricultural wastes from the biofuels sector. Cassava and potato starch are also being used as livestock feeds. Competing for feedstock might result in price increases for chicken, endangering food security. New infrastructure or farms can be developed to supply biological feedstock, but care must be taken that it does not pressure land use or compete for resources with farms that supply food. The absence of a local manufacturing facility capable of processing bioplastic hinders local supply. Manufacturing bioplastic packaging is also more expensive compared to conventional plastics. According to manufacturers, there currently is not enough demand for businesses to invest in the required technology and infrastructure.

3.5 Supply Analysis of Pulp and Paper Packaging from Sustainable Forests

3.5.1 Level of Availability

An estimated 1.15 billion hectares of commercial forest are designated primarily for production, equivalent to roughly 30% of global forest area. This 2020 estimate reflects a slight decrease of about 50 million hectares since 2015. Although most production forests are natural forests, planted forests and tree plantations increased in area by 75% between 1990 and 2020 and are expected to play a growing role in meeting rising global demand for pulp and paper products. As of 2020, planted forests and tree plantations account for 7% of global forest area[102].

Paper is the most common substitute to plastics used for packaging. Paper packaging is a versatile and cost-efficient method to protect, preserve, and transport a wide range of products. The paper industry is estimated to be worth between USD 300 to 350 billion in the global value chain. In 2021, the global paper packaging market was valued at USD

64.4 billion and is expected to reach a value of USD 82.4 billion by registering a compounded annual growth rate of about 4.19%[103]. Figure 3.2 illustrates the steady global growth of paper and cardboard production from 2008 to 2018. China is the world's largest paper producer with a production volume of 110 million metric tons in 2018. The United States is second, producing 72 million metric tons in the same year. Japan distantly takes the third place. China's paper production far outweighs all other paper producers, and as a whole, Asia dominates regional global paper production, with a 47 percent share.

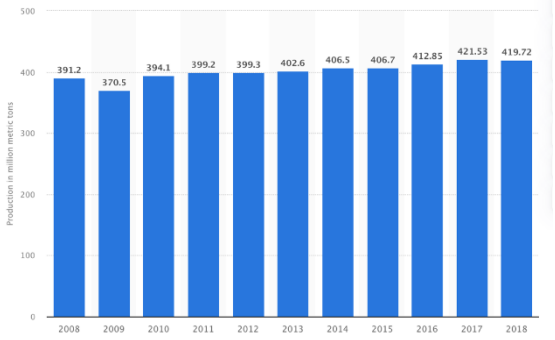


Figure 3.2 Production volume of paper and cardboard worldwide from 2008 to 2018 (in million metric tons)
Source: Statista[104]

Asia is one of the growth drivers especially on the increasing demand for packaging and shipping. According to the DTI, although the Philippines has limited contribution to the value chain, the pulp and paper industry in the country contributes about PHP 30 billion per year in domestic sales value to the economy. Consumption of paper and paperboard is at 19 kilograms per capita with total annual growth of 2.5% per year. There is projected demand for paper and board worth two million tons within five years, or at 400 thousand tons per year based on current consumption levels. Corrugated fiberboards and carton boards are some of the paper packaging materials with growing demand as it is used in packaging for exporting electronics, fresh fruits, garments, handicrafts, and furniture.

The 2017 Philippines Statistics Authority's Annual Survey of Philippine Business and Industry identifies 347 registered establishments involved in the manufacture of paper and paper products employing 22,000 people. There are also 93 establishments involved in the sawmilling and planing of wood and 386 establishments that manufacture wood, cork, straw, and plaiting materials.

Figure 3.3 illustrates the paper and paper products manufacturing value-added in the Philippines from 2009 to 2018. In 2018, the value added by the paper manufacturing industry in the Philippines amounted to around PHP 19.32 billion. The production capacity of the Philippines for wrapping packaging paper and board reached 1,049 metric tons (air dry) in 2019. However, the pulp and paper industry posted a double-digit decline (-17.3%) in terms of value of production index in 2020. It was also badly affected by COVID-19, with paper mills at 55% capacity utilization rate as of January 2021.

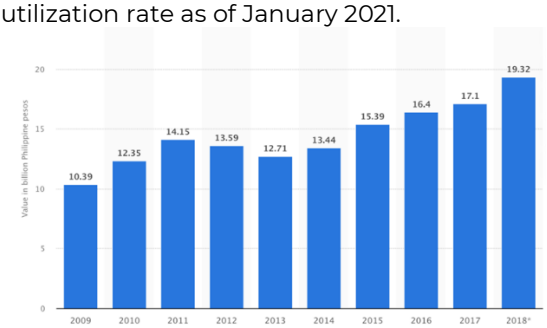


Figure 3.3 Paper and paper products manufacturing value added in the Philippines 2009-2018 (PHP billion)
Source: Statista

The Food and Agriculture Organization (FAO) of the UN[105] produces an annual yearbook on the production and consumption of forest products. 80% of pulp and paper production go into making corrugated boards and packaging. The Philippines is a net importer of paper products with import volumes more than thirty times that of export volumes. The country's pre-COVID strong economic performance has pushed a steady rise in supply requirements for corrugating container boards and carton boards as packaging materials for export products. Strong growth is also seen in the domestic market, particularly on packaging for processed foods, appliances, and other consumer goods.

3.5.2 Market Players

The Philippines currently has 24 non-integrated paper mills[1] with a total production capacity of 1.3 million tons of paper and paperboard per year, as well as four abaca pulp mills exporting 25,000 tons of specialty non-wood pulp per year. Almost all grades produced in the Philippines have a recycled fiber content of 95-100%, compared to the minimum recycled content of 25-35% implemented in developed countries. These are mostly derived from recycled paper,

[1] A paper manufacturer is a company that is in the business of producing paper. A paper mill refers to the actual factory or production facility for manufacturing paper from fibers.

mainly in the form of newsprint, printing and writing paper, tissue, container board, and other packaging paper and boards. In 2018, the Philippines recovered 0.855 million metric tons of recycled paper and imported another 0.209 million metric tons of recycled paper for paper production. The paper industry provides indirect jobs in the SWM sector. Furthermore, other fibers from agricultural waste (such as rice straw, banana, and sugarcane bagasse), as well as plants like kenaf and bamboo, can be supplemental sources of pulp in the industry. However, this can compete with the bioplastics and biofuels sectors.

Some packaging companies such as Robin Co., Ltd., specifically source pulp and paper from certified sustainably managed forests (e.g., Forest Stewardship Council certification) abroad rather than use local supply because local paper manufacturers often use recovered paper in making their products. Multinational consumer goods companies have strict packaging standards and require suppliers to show provenance or certification that the paper comes from sustainably managed forests. Packaging companies that supply large-scale orders are willing to do this since they experience economies of scale and can pass the cost premium to the client.

Forest certification provides assurance that the wood in a product comes from a well-managed forest, with an audited chain of custody running from the forest floor to the customer. Globally, 432 million hectares (about 11% of all forest area) is certified as well managed, much of this in North America and Europe. Europe has more than 70% of its forest area certified as being well-managed. About a quarter of chain of custody certificates in Europe are estimated to relate to paper and printed materials, demonstrating that the sector is a major supporter of forest certification[106]. While the Philippines has some commercial forests such as in Butuan, there are no any certified forests in the country. Most deforestation happens in the tropical countries such as the Philippines, with agriculture being the primary cause[107].

3.5.3 Advantages & Disadvantages from a Life Cycle Perspective

Paper manufacturers in the Philippines need to import recycled paper to supplement local collection, and for economic purposes (lower cost). While there have been calls to impose a ban on imported wastes including paper since these may carry hazardous wastes, this has not yet been implemented. DENR only regulates importation of waste material and there are guidelines to ensure no toxic substances are included. Companies that need virgin material or sustainable forest management-certified pulp or paper will also need to import, adding to the carbon footprint. Manufacturing paper can be resource intensive because it needs chemicals, water, and energy. Using renewable energy can lower GHG emissions but most paper mills in the Philippines are old and might not be compatible with renewable energy sources. It would also be costly to upgrade equipment to run on renewables. Paper packaging is also heavier and bulkier compared to plastics, requiring more space and more care in transportation, shipping, and warehousing. While paper is biodegradable, compostable, or recyclable, it is more difficult to dispose of it in a sustainable manner when the paper is laminated with another material such as wax, plastic film, or other polymers. Paper pouches, for example, have a plastic window to make the contents visible. In the absence of oxygen, it biodegrades anaerobically. Moreover, food packaging in contact with oil or grease cannot be recycled either. This and other residual wastes can be disposed of through incineration, which can convert the waste into energy or fuel. Republic Act 9003 only prohibits incineration of material that releases toxins. While it excludes incineration in waste management policies, it also does not really prohibit this.

An LCA of three types of grocery bags used the Boustead Model to calculate the life cycle of each grocery bag, producing results on energy use, raw material use, water use, air emissions, water effluents, and solid wastes. The results show that paper can be resource intensive in parts of its life cycle.

	Impact Summary of Various Bag Types (Carrying Capacity Equivalent to 1000 Paper Bags)		
	Paper (30% Recycled Fiber)	Compostable Plastic	Polyethylene
Total Enegy Usage (MJ)	2622	2070	763
Fossil Fuel Use (kg)	23.2	41.5	14.9
Municipal Solid Waste (kg)	33.9	19.2	7.0
Greenhouse Gas Emissions (CO2 Equiv. Tons)	0.08	0.18	0.04
Fresh Water Usage (Gal)	1004	1017	58

Figure 3.4 Life cycle assessment for grocery bags
Source: American Chemistry Council[108]

3.5.4 Opportunities and Threats

The paper packaging industry is critical to the export sector since high-quality and sophisticated packaging is a requirement for success in the global market. In the production of corrugated boxes, paper sacks, paper bags and carton boxes, the packaging sector uses liner-board and fluting medium, multiply paperboard, and kraft paper as

component materials. Improving the paper industry as a source of packaging inputs for exporters translates to better competitiveness of Philippine exports.

However, the Philippine Paper Manufacturers Association has identified several problems plaguing the industry. Due to regulations on logging, including log-ban policies, the local paper value chain is constrained by the availability of raw materials and there is no local source of virgin pulp. The industry presently operates without the presence of a local pulp mill, which is necessary to produce specialty and high-value paper products. Virgin materials are sourced from Sweden, Finland, Chile, United States and New Zealand. Local recycled paper quality is low due to poor yield or inefficient operation; its supply is also inadequate, resulting in a high acquisition price. Moreover, the demand for imported recycled paper has increased globally putting pressure on the supply chain. Many papermills in the country are old and small, and the frequent break down of equipment makes them costlier to operate compared to bigger mills. Some mills are not originally constructed to run on 100% recycled paper. Paper mills are also energy intensive and the high costs of electricity in the country affects the viability of the industry. Switching to more fuel-efficient technology or renewable sources of energy requires significant investment. Finally, the domestic market is being inundated with imported paper, which are cheaper from minimal duties or tariffs.

There are suitable areas in Mindanao for sustainably managed commercial forests using privately-owned tree farms, industrial tree plantations, and community-based forestry. Most sustainably managed forests are in temperate zones, using three species that thrive in cooler climates. Research and development can assess the suitability of local tree species as a source of quality pulp.

The demand for paper is steadily rising and pulp requirements are enough to establish a bigger pulp mill using the latest technology that would make production more efficient and less resource intensive. Domestic and foreign investments on a new mill will make the paper and pulp supply chain more productive and cost competitive.

3.6 Supply Analysis of Compostable Packaging

3.6.1 Level of Availability and Market Players

Compostable packaging is an even smaller niche compared to bio-based plastic packaging since not all bioplastics are fully biodegradable. Biodegradable packaging can degrade in any natural environment while compostable packaging may require certain conditions before it degrades. Compostable packaging is a subgroup of bioplastics, which requires it to be biologically decomposed under composting conditions and within the relatively short period of a composting cycle. Very few biodegradable packaging suppliers have declared their products as compostable.

Orera Technology is a sustainable manufacturer and distributor of packaging made exclusively from organically sourced Areca palm leaves and bagasse sugarcane. Other players such as EcoNest Philippines, Ecolutions, and the Good Trade are few players for compostable products however their products are sourced from abroad. These retailers offer bioplastic products that are also compostable such as cassava bags, sugar cane containers, and honeycomb wraps. EcoNest also provides end-of-life solutions for the packaging by selling home composting kits as well.

3.6.2 Advantages & Disadvantages from a Life Cycle Perspective

Not all materials are created equal. Some compostable packaging requires specialized industrial composting sites, or they are mixed with other non-compostable materials. While compostable material strengthens industrial composting as a waste management option it only works if there is a network of facilities. It is possible to turn compostable packaging into bioenergy**.** Composting packaging with other organic material is an option but requires conditions which allow safe compost to be produced[109]. From a value-added standpoint, composting can be insignificant because some biopolymers do not contain plant nutrients and, therefore, their degradation does not lead to the formation of valuable manure[110].

3.6.3 Opportunities, Obstacles and Threats that Affects Supply

An adequate supply of compostable packaging only makes sense if it is really composted at the end of the packaging's life. There is no industrial composting facility in the Philippines, which hinders mass composting. The bioreactors of DOST, which can reach 50 to 60 degrees Celsius, is the closest infrastructure resembling a composting facility, but it is mainly used for research and development, not continuously handling waste. Some compostable materials require higher temperatures, which renders the bioreactor as ineffective. While PLA only requires a minimum temperature of 39 degrees Celsius, it is difficult to attain that using home composting. Furthermore, there is no official verification that assesses packaging compostability in home conditions. Composting in the Philippines is more popular for fresh organic materials such as agricultural waste and food waste. For instance, a JICA-funded organic composting facility produces 10 tons of compost each week. Introducing packaging material which might not turn into compost due to inadequate environmental conditions could contaminate the entire batch of compost.

3.7 Recycling in the Philippines

The next two product categories, packaging from recycled content and recyclable packaging are dependent on the recycling stream in the Philippines. According to a 2020 study of the World Wide Fund for Nature (WWF) Philippines, at the national level, only 40% of packaging waste in the Philippines is collected, and only 9% of the plastic waste is recycled[111]. A Philippine Senate report in 2017 claims that the country's waste generation continues to rise with the increase in population, improvement of living standards, rapid economic growth, and industrialization especially in the urban areas. Calculations put daily waste generation at forty thousand tons in 2016, showing a steady increase from thirty-seven thousand tons in 2012[112]. The National Solid Waste Management Commission's (NSWMC) data analysis shows that over a five-year period, the Philippines is projected to generate 135.02 million metric tons of solid waste each year. Bacolod City is projected to generate almost a million metric tons of waste per year, with Iloilo City producing slightly less.

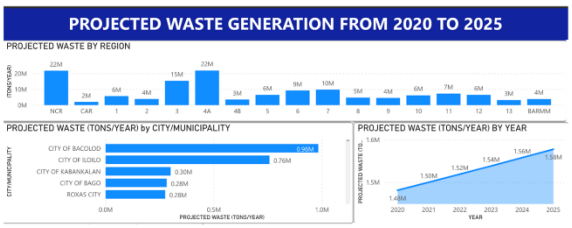


Figure 3.5 Projected waste generation per region 2020-2025
Source: National Solid Waste Management Commission

3.7.1 Local Government Waste Management

Republic Act 9003 mandates LGUs to be responsible for SWM in their respective cities and municipalities. As of 2015, solid waste diversion rate in Metro Manila is 48% while outside Metro Manila the rate is 46%. More specific data on the Philippines recycling rates for municipal waste, paper and plastics are not available. The recycling rates for packaging waste and paper have constantly increased in the Philippines over the last decade. For plastic packaging, the average recycling rate in the Philippines is significantly lower than for paper[113].

The result of Bacolod City's waste analysis and characterization survey shows that waste generation of Bacolod City is composed of 66.49% biodegradable waste; 3.93% recyclables; 27.45% residuals; 0.15% of e-waste and 0.21% special waste. Over half of commercial waste could potentially be recycled, compared to household waste, which is mostly biodegradable. There is great potential to recover useful materials from the waste by segregating recyclable and biodegradable materials. This would significantly reduce the volume of waste going to the final disposal facility. According to Bacolod City's ecological SWM plan, which covers the ten-year period from 2014-2024, the city's recycling programs as well as the private sector initiatives increased the quantity of municipal solid waste recycled into new products to an estimated 30-40 tons a day, equivalent to approximately 11% of the waste stream. While there are a few individuals involved in recovering waste materials for reuse or recycling, these activities are mostly informal in nature with very limited involvement of the government or Barangay. This is compounded by non-functional materials recovery facilities and the lack of low-cost recovery for recyclable materials, derailing targets for recovery rates. Bacolod also does not have a local recycling plant, which means that transport of waste to recycling facilities adds to its carbon footprint.

The ten-year SWM plan for Iloilo City traces recycling flow for the city. Two thirds of the collection come from the materials recovery facilities of the barangays. On the other hand, collection from the central business district is by door-to-door because of insufficient space. Most waste consolidators do not specify recycling involvement when registering for business permits, making it difficult to estimate the volume of wastes recovered and recycled. Based on the flow chart, wastes are transported to other cities for recycling.

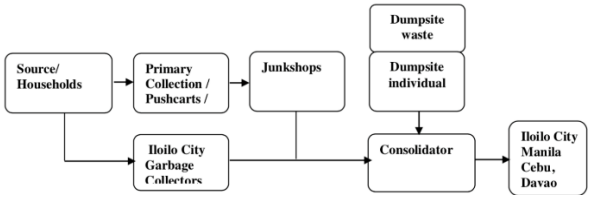


Figure 3.6 Recycling flow for Iloilo City
Source: Iloilo City ten-year solid waste management plan

Despite being passed twenty years ago, the Republic Act 9003 has still not been fully implemented. Most of the interviewees expressed disappointment in how their cities have handled waste management. In 2018, administrative cases against 108 local chief executives were filed for failing to prepare and submit their ten-year SWM plans. Respondents from Bacolod cited San Carlos City, Negros Occidental as good model for waste management. San Carlos City generates 19 tons of collected garbage daily, but only 35% of residual wastes go to the landfill because the city practices waste segregation. The city inked agreements with neighboring towns to utilize the excess capacity of the landfill. The municipalities pay a fee of PHP 1,000 per ton of residual waste. Its holistic approach in addressing its SWM issues led to San Carlos being named as a model city under the Association of Southeast Asian Nations (ASEAN) Environmentally Sustainable Cities Model Cities Program in 2015.

3.7.2 Extended Producer Responsibility

The OECD defines EPR as a policy approach where manufacturers are accountable for the treatment or disposal of post-consumer products. EPR is seen as a mechanism to prevent wastes at the source, promote product design for the environment and support the achievement of public recycling and materials management goals[114]. Greenpeace conducted a brand audit of plastic trash as part of its Break Free from Plastic program and three brands – Coca-Cola, Perfetti van Melle, and Mondelēz International, accounted for a third of the trash collected in Asia for the audit[115]. Coca-Cola and Mondelez responded by highlighting their different initiatives including reducing packaging waste in their value chains and investments in recycling programs.

EPR is centered on the principles that manufacturers should compensate actors who are doing the end-of-life management of their waste, packaging in this case. Most often it is the cities and municipalities that bear the cost of SWM and local governments are typically constrained by budgets. Residents also pay intangibly as poor waste management lowers quality of life.

In its report on EPR scheme assessment for plastic packaging waste, WWF recommends implementing a mandatory EPR scheme for consumer packaging materials and non-packaging plastic products to avoid substitutions in packaging design. The success of the EPR scheme depends on several factors. The foundation for effective SWM should already be in place with built-in flexibility to accommodate changes required by the EPR. Stakeholders should have adequate capacity to establish an EPR frame for their organizations. Strict monitoring systems are necessary to ensure accountability and compliance from the different stakeholders. The large volume of packaging used by the fast-moving consumer goods sector requires a recycling system with enough capacity to overcome current recycling bottle-necks and make a significant headway towards reducing waste that end up as marine debris[116].

EPR needs to be fair and equitable for it to work in the Philippines. Deposit schemes and nationwide EPR programs will affect the junk shop system. Mechanisms should be implemented at the local level, for instance, mandating a recovery system for the locality to include local stakeholders in the model. EPR should also be implemented in phases to factor in business recovery from the pandemic, with large corporations taking the lead, followed by medium companies, and finally to micro and small enterprises. Exploring EPR for large corporations from a tax recovery standpoint can be a good start.

3.8 Supply Analysis of Recyclable Packaging

3.8.1 Level of Availability and Market Players

Glass, paper, metal, and some types of plastic packaging are highly recyclable. Rigid plastics, in particular, have high recovery rates. Leading global brands and retailers such as Coca-Cola have made voluntary commitments to make their plastic packaging 100% recyclable over the next few years. It is not a question of market availability because packaging companies are able to respond to the market shift by also developing packaging solutions. The companies can create recyclable packaging should the client require it. Recyclability depends on the selection of materials and packaging design. For instance, the plastic bottles for Sprite in the Philippines used to be green but was recently changed to clear so that it can be recycled with other plastic bottles without leaching of colors. It is also contingent on the recycling system of the Philippines, which is weak.

3.8.2 Advantages & Disadvantages from a Life Cycle Perspective

Simply designed packaging using mono-material is best for recycling. However, the limitless variety of materials makes packaging complex and difficult to recycle. For instance, a cardboard food box or paper bag is often laminated or lined with plastic to make it more durable, but it prevents recycling. Some packaging manufacturers now offer products lined with bioplastic such as PLA, but its lower melting point can create issues for recycling plants.

Just because packaging is recyclable does not mean it gets recycled. Consumers can only be expected to do so much in terms of separation at source, which must be collected separately to prevent cross contamination. Several studies conducted by the World Bank identified several ASEAN countries, including the Philippines, where more than 75% of the material value of recyclable plastic is lost. With only 18 to 28% of recyclable plastic recovered and recycled in these countries, most plastic packaging waste is not only left to pollute the environment and its value to these economies is also lost[117].

Higher residual value plastics are more likely to be collected from disposal sites and then resold. PET bottles are one of the most valuable forms of plastic in the Philippines and the most retrieved due to its high residual value – or its predicted value after consumption. The Philippines has one of the highest PET bottle recovery rates at 90%. However, PET bottles only make up a fraction of total plastic waste in the Philippines. Eighty percent of total post-consumption plastic waste produced in Philippines are low residual value plastics composed of sachets and single-use plastic bags with almost zero collection rate[118].

Recycling capability also depends on the location, the market and the system being developed to achieve economies of scale. The Philippines has limited recycling facilities outside the most highly urbanized cities, which often means collecting waste packaging in cities and municipalities and then transporting these to a recycling facility in a different city or region. This complex recycling stream can be expensive, putting its viability into question. Most of the waste will collectively end up in the landfill when the recycling flow becomes too difficult for local governments to manage. Moreover, informal recyclers such as junk shops earn a living from retrieving the lost value of recyclable material. Building new recycling facilities endangers their livelihood[119].

Recycling emits GHG as well. Processing these waste materials into new useful products requires resources such as energy, water, or chemicals which can add on to the carbon footprint. Compared to virgin materials, recycling on average has lower energy requirements, producing fewer emissions. However, this is highly dependent on the type of material being recycled. There are also limits to the recyclability of a material because degradation is inevitable. There will come a time that the material could no longer be recycled and would have to be disposed of.

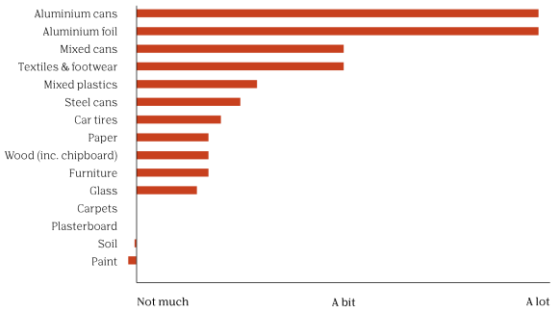


Figure 3.7 Net carbon emission savings of recycling vs producing virgin products
Source: Inka[120]

3.8.3 Opportunities, Obstacles and Threats Affecting Supply

The recycling industry must be ready to take up recyclable packaging once the shift occurs. The Philippines is a net exporter of plastic waste to countries that have demand for high quality plastic waste scrap due to the lack of domestic capacity for recycling and exporting provides more economic value. Localizing recycling through infrastructure investments is perhaps one of the biggest opportunities for the waste sector. This requires taking stock of the different recyclable materials for each location and matching it to the needs of local industries. For instance, Boracay does not recycle amber glass bottles despite the high volume of wine being consumed in the island because there is no local industry that requires recycled emerald glass bottles.

Several organizations are attempting to bridge this by improving collection and recycling in the Philippines and these can be replicated to scale in other parts of the country. The Philippine Alliance for Recycling and Materials Sustainability (PARMS) is a civil society organization that brings together stakeholders in the recycling value chain, including manufacturers, industry groups, retail groups, waste consolidators and haulers, recyclers, and non-government and government entities. PARMS together with the city government of Paranaque and several fast-moving consumer goods manufacturers – Mondelez Philippines, Nestle Philippines, Unilever Philippines, Proctor and Gamble Philippines and several others - are piloting a plastic waste recycling plant to increase resource recovery and reduce landfill dependence. It can be a private-public-civil society partnership model that can be replicated by cities nationwide[121].[122]

The Plastic Flamingo serves an example of how waste can be turned into a business opportunity. The startup is a social company that has developed an effective plastic waste collection system and through its recycling methods, transforms plastic into sustainable eco-lumbers that can be utilized in making furniture and emergency shelters. Individuals can drop off their wastes in 120 designated partner collection points across Metro Manila or subscribe to a monthly collection scheme for a fee. The wastes are segregated upon reaching the warehouse in Muntinlupa. Unsuitable materials are sent to other organizations who can process these. The Plastic Flamingo also works with large corporations since they generate large volumes of waste. Mondelez Philippines, one of the biggest processed food manufacturers in the country, partnered with The Plastic Flamingo to recycle 40 metric tons of post-consumer plastic packaging. FedEx was also recently announced as a partner and the company will collect PP waste for recycling.

3.9 Supply Analysis of Packaging from Recycled Content

3.9.1 Level of Availability and Market Players

Packaging with recycled content is mainly used for non-food packaging since virgin material is ideally used for food packaging to prevent contamination and toxicity. As explained in Section 3.5 the recovery rate for recycled paper is high since most paper produced in the Philippines are made from non-virgin materials. Glass bottles can also be melted and recycled to produce new glass products. However, most of the packaging recycling that occurs makes non-packaging products from packaging material. There is very limited information on the supply of packaging that has recycled content. Interviewees consider this packaging option to be the most unrealistic alternative since the country needs to first improve the recycling system before even considering manufacturing packaging out of recycled content.

3.9.2 Opportunities, Obstacles and Threats Affecting Supply

Most of the efforts are directed towards recycling plastic packaging material into different products such as eco-bricks and plastic chairs rather than back to packaging. There is limited information on market players involved in creating packaging from recycled content. Recycled plastic resins are not readily available in the Philippines. Packaging manufacturers will need to import from other countries, which increases the carbon footprint and increases the cost of production.

Packaging manufacturers, recycling companies and consumer good companies need to work together to ensure a steady supply of recycled material as inputs. In the Philippines, Coca-Cola Beverages Philippines has partnered with Indorama Ventures to build PETValue, the country's biggest bottle-to-bottle recycling facility in Cavite. This

initiative is part of the company's World Without Waste program which is to collect and recycle the equivalent of every beverage bottle and beverage can sold Coca-Cola by 2030. PETValue will be able to recycle 2 billion pieces of plastic bottles using green manufacturing technology. This requires Coca-Cola to activate its nationwide network of distributors and retailers as collection points.

Only the biggest corporations have the resources to initiate these kinds of programs. Manufacturing packaging from recycled content is challenged by the country's lack of waste infrastructure. This necessitates the government to put up necessary waste and recycling infrastructure to complete the packaging changes implemented by manufacturers.

3.10 Supply Analysis of Reusable and Long-Lasting Packaging

3.10.1 Level of Availability and Market Players

Reusable packaging will even have a greater impact when combined with a refilling program, which is an alternative to buy in sachets. Refilling allows consumers to only buy what their budgets allow without producing packaging waste each time. Small neighborhood stores initially used this model, but this has caught the attention of the corporate sector. Nutri-Asia piloted two Bring Your Own Bote zero waste stores in Metro Manila where consumers can refill cooking products such as vinegar, condiments, and cooking oil. The stores are constructed from eco-bricks that use plastic discards as a component. The stores also serve as drop-off points for plastic materials for repurposing. Other brands that have refilling stations include Messy Bessy and Human Nature. In 2019, Unilever launched All Things Hair Refillery, a mall-based refilling station where people can reuse empty shampoo and conditioner bottles. Consumers pay for products by the gram. To protect the brand, Unilever only allows refill bottles that match the variants available at the store. Alternatively, consumers can bring any bottle and exchange for a new reusable bottle or purchase one for PHP 10. Customers can also drop off extra plastic waste at no charge. Unilever Food Solutions is also exploring different refilling models such as refill at home, refill on the go, return from home, return on the go, and business-to-business refills and returns for large business orders.

3.10.2 Advantages & Disadvantages from a Life Cycle Perspective

The environmental impacts of packaging depend on its characteristics and can be offset by a minimum number of reuses. Numerous life cycle studies have shown that reusable PET bottles have the lower environmental impact compared to glass due to the high temperature required to produce glass[123]. Glass is heavier resulting in a higher carbon footprint during the transport phase[124]. According to a study published in the International Journal of Life Cycle Assessment, glass beverage bottles cause the most environmental damage, including global warming across its life cycle. Reusing a glass bottle three times lowers its carbon footprint roughly to that of a single-use plastic beverage bottle. If the plastic bottle gets recycled, however, then the glass bottle must be reused twenty times to make their carbon footprint comparable. Glass bottles are also preferred if there is a return or deposit system in place.

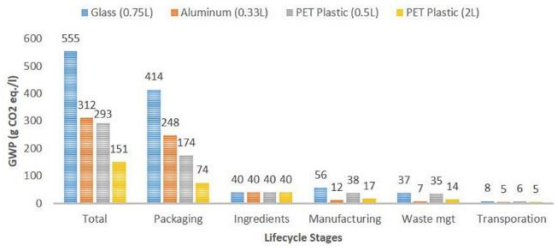


Figure 3.8 Global warming potential of beverage bottles
Source: International Journal of Life Cycle Assessment (January 2013)[125]

3.10.3 Opportunities, Obstacles and Threats Affecting Supply

Depending on the material, packaging can be reused a limited number of times before it loses integrity, making it unsafe. Consumer education is necessary to ensure that packaging is only used the recommended number of times before proper disposal. The information can be communicated through instructions and labels.

The reuse and refill model is still at the infancy stage in the Philippines with consumer companies still at the pilot and learning phase. This model is not scalable enough as of the moment to solve the waste issue in the country. Nascency also means that

corresponding regulatory guidelines are not in place at the moment. Consumer safety should be paramount since refilling has some inherent risks such as contamination, dilution or even tampering.

Several consumer goods companies around the world have piloted refilling stations but responses have been mixed. Refilling is generally less expensive, but the model comes at the cost of convenience. Many consumers are unwilling to change their ways because it is inconvenient to clean, and refill bottles every time[126]. Consumers must be encouraged to repeat the reuse and refill behavior until it becomes rote. Limited offerings in refilling stations means that consumers will need to visit several stores to complete their shopping. Refilling can also be complicated for some products such as cosmetics which rely on packaging as a marketing tool. This shows that there is no one-size-fits-all solution for refilling. The success of the refilling model depends on tailoring solutions to the needs of the target markets and keeping refilling systems simple and convenient for consumers.

The biggest opportunity for reusable packaging is at the business-to-business level. Transport packaging provides potential for innovation since a high volume of goods are transported all over the world each day. Reusable plastic pallets meet a wide number of storage and transportation needs, and they are available in rackable, stackable, and nestable options. Compared to cardboard boxes that can be used once or twice, reusable plastic boxes can be used hundreds of times before being recycled and reconstructed into another reusable plastic container.

Furthermore, unlike biological materials such as wood or cardboard, plastic boxes can be cleaned easily and would not rot, splinter, or absorb odors or moisture, a critical feature when freight takes several weeks or months. Plastic is also safer for transporting food due to its nonporous nature, preventing bacteria from spoiling fresh food. While the initial cost of purchase may be higher than cardboard boxes or wooden crates, the investment pays for itself after a minimum number of reuses. Lowering the cost of logistics results in better financial performance for manufacturers.

3.11 Enablers and Barriers

Based on the discussions in the preceding sections, a summary of the enablers and barriers per packaging type is presented in Table 3.3.

Table 3.3. Summary of enablers and barriers per packaging type

Type of Packaging	Enablers	Barriers
Biodegradable Plastic Packaging	• Intertek Europe LCA shows oxo-biodegradable packaging to have the lowest impact across several criteria • A few local manufacturers already produce certified products for international markets and can supply locally if there is demand	• While some manufacturers show a DOST ETV mark in their products, there are still a number of sellers that self-declare without verifiable proof. • Can last in landfills and release methane
Bio-based (Bioplastic) Packaging	• Market showing good growth potential • Development of new types of feedstocks • Smaller impact in terms of GHG emission and fossil resource consumption • Can be combined with renewable energy use and SWM • strategies for a multi-layered approach	• Price premium for the resin • Suppliers mainly import from China • Local developments are still in the R&D stage • Competition on agriculture and biofuels, pressure on land use • Not all are biodegradable • Type of biological feedstock and number of layers or materials may affect recyclability
Pulp and Paper Packaging from Sustainably Managed Forests	• Most common substitute for plastic – strong growth in PH market • Using renewable energy can lower resource use but many facilities in PH are old and would need upgrading • Improving paper packaging for exporters enables	• Need to import recycled paper to meet demand • Local recycled paper quality is low • Limited times of recycling for fibers • Importing of virgin material increases carbon footprint due to transportation • Resource intensive – water, energy, chemicals

Type of Packaging	Enablers	Barriers
	competitiveness of Philippine exports.	• Lamination, waxing, and contact with oily food prevents recycling
Compostable Packaging	• Some bioplastics are compostable	• Most compostable packaging requires industrial conditions • Lack of industrial composting facilities
Packaging with Recycled Content Recyclable Packaging	• Some materials highly recyclable • High PET bottles have high recovery rates • Private sector and non-government organization (NGO) mobilization key to improving recycling • Development of fair, inclusive and equitable EPR programs • Recycled content can be used for non-food packaging • Recycled content can be used for food packaging when proof of safety can be provided and demonstrated • Recycling lowers carbon footprint	• Inadequacy of waste facilities due to constraints in funding and manpower • Poorly implementation of Republic Act 9003 • Lack of local recycling facilities in the provinces in Visayas and Mindanao due to inadequate demand • Inter-island transport of wastes for recycling adds to the carbon footprint • Packaging made of multiple materials can be difficult or impossible to recycle • Majority of material value of recyclable plastic packaging is lost
Reusable and Long-Lasting Packaging	• Reusable PET bottles have a lower footprint compared to glass • Potential in B2B solutions – transport packaging	• Packaging is not infinitely reusable • Reuse and refill still in pilot stage in PH • Limited regulatory guidelines

CHAPTER 4
ANALYSIS OF DEMAND

4.1 Evolution of Demand

The analysis of demand looks at the commercial and retail sector and its customers as the primary source of demand for packaging products. As an intermediary in the value chain for consumer goods, commercial establishments such as malls and the retail stores within malls provide opportunities and threats to switch to more sustainable packaging options. The insights for this section are obtained from FGD with the different departments of SM Supermalls in Iloilo and Bacolod, FGDs with the two malls' food and non-food tenants, interviews with other associations of local producers of consumer goods, chambers of commerce organizations, other consumer advocacy groups an online survey with consumers who have shopped in either SM City Iloilo or SM City Bacolod.

Each company interviewed has different packaging requirements, making it difficult to aggregate demand for each of the packaging product groups in focus. Many consumer products are manufactured in neighboring Southeast Asian countries and these products are already shipped with packaging and would be logged based on the type of goods. Export and import data are also not as detailed; packaging materials are counted together with other products made from the same material (e.g., paper products), making it difficult to isolate the numbers. Furthermore, the Philippine Statistics Authority does not collect specific data related to the different products. While the Philippine Standard Industrial Classification identifies packaging activities with a code (82920), it is nested under business support activities and there are no further subgroups under it. Even the different industry associations are unable to provide data because there is a dearth in quantitative data for packaging products. Thus, the insights on demand are mainly anecdotal in nature, taken from the different interviews and FGDs.

4.1.1 Perspectives of SM Supermalls and SM Anchor Stores

The different departments of SM Supermalls in Bacolod and Iloilo manage the day-to-day operations of the malls including its two anchor stores – the supermarket and the department store – which are the main users of SM-labelled packaging. Packaging decisions are centralized for the entire SM network of stores. The head office in Manila makes all the decisions, sources out suppliers and purchases in bulk. These are then sent to each of the stores nationwide based on the submitted forecast demand. Both the supermarket and department store order every month and keep a two-month supply in its inventory. SM Affiliate Stores such as Surplus, Watson, and Ace Hard-ware have their own respective centralized purchasing unit which determines the standards for packaging to be rolled out throughout the different branches.

Products to be displayed and sold in the department store and supermarket already come in their packaging – the mall does not repack it anymore. Plastic bags are the main carrier bags for shoppers because they are durable and protect the goods, especially from the rain. All the plastic bags are biodegradable, although the respondents cannot fully describe the testing and verification process since it was done by the head office. They just know what the head office communicates to the stores.

SM City Iloilo Supermarket has also implemented the My Own Bag (MOB) program every Wednesday for the last four years, wherein the supermarket does not use plastic bags for that day. The program is not implemented in SM City Bacolod since the LGU approved the use of biodegradable plastic bags (SM sent a sample of the bags to the LGU). During MOB days, customers are encouraged to bring their own reusable shopping bags, pack groceries in the cartons provided by the supermarket (typically transport cartons from the goods on display) or purchase an SM-branded reusable non-woven PP eco bag for PHP 40. This bag has an estimated two-year lifespan. Cashiers are trained to sell the eco-bags, with the spiels

provided by the head office. The proceeds of the eco-bag sales fund SM environmental projects, such as helping farmers, tree planting through the SM Foundation. The head office does the research on sustainability projects. Marketing collateral on sustainability initiatives and on educating consumers are created at the head office and rolled out to the different stores. To encourage consumer participation during the first four years, the supermarket credited two SM Advantage Card points to the shopper's account every time he/she brings a reusable bag during MOB Day. This incentive is no longer in place since the MOB program is considered to be mainstreamed already. In the event the LGU imposes a total ban on all types of plastic bags, the supermarket can readily implement MOB every day.

SM City Iloilo Supermarket observed a 20% decline in plastic bag usage from 2017 until before the pandemic. This is attributed to the MOB program. In the past, the supermarket would utilize 200 packs (1,000 pieces / pack) of grocery bags each month but that was reduced to 180 packs each month with the MOB program. However, management noticed that the sales are lower every Wednesday compared to the pre-MOB Wednesdays, indicating that there are consumers that avoid Wednesday for grocery shopping. SM has two suppliers for eco-bags, which are also sourced by the head office in Manila. The supermarket in Iloilo typically sells 200 eco-bags each day, but the number has increased to 300 eco-bags per day during the pandemic. However, the experience is different in SM City Bacolod, which claims that the sale of eco-bags lags behind other branches because their consumers continue to prefer plastic bags.

Unlike the supermarket, the department store does not have an MOB Day and uses plastic bags every day. The demand for packaging is dependent on customer traffic and demand for the products being sold in the stores. While groceries are considered basic needs even and the supermarket continues to do brisk business at the height of the pandemic, the same cannot be said for the department store. Pre-pandemic, SM City Iloilo Department Store typically goes through 10 packs (also 1,000 pieces/pack) of biodegradable plastic bags each month. That number has dwindled to half mainly because of the reduced number of shoppers during the pandemic and not because customers have significantly altered their behavior regarding packaging. Employees who wish to purchase from the store are required to bring their own eco-bags and not use the plastic bags intended for customers.

According to the leasing department, there are no clauses in tenant contracts that specify the use of packaging. However, mall management monitors the tenants in partnership with the LGU to check if they are compliant to any local ordinances covering packaging and plastic use. In Iloilo, there is a five-year moratorium on the use of single-use plastic, which is formalized through a local ordinance, and will end by 2022.

SM also has a Trash to Cash program for the mall and the tenants and this is rolled out across all the SM malls nationwide. Every Friday and Saturday, accredited haulers buy cartons and other recyclable materials from tenants. There is a 90% participant rate in the program because some tenants have their own waste disposal and recycling methods. This program is positively received by tenants since it is convenient for them, and they are incentivized by the additional income. The haulers segregate the waste as they purchase it from the tenants and they are also responsible for the end of life of the waste. The head office approves the rates of the haulers and closely monitors that the haulers comply with DENR's environmental compliance. Mall management has noticed that the volume of waste hauled by the Trash to Cash program decreased due to an equivalent decrease in customer traffic. Hauling of waste is less frequent now compared to pre-pandemic times.

4.1.2 Perspectives of SM Tenants

Most of SM's tenants are chain retail stores; the tenants' headquarters are based in Metro Manila and these companies operate branches in different malls across the Philippines. Given that context, all procurement is centralized in nature. Packaging choices and the selection of suppliers are done by the purchasing department at the head offices. For international chains such as Dairy Queen, packaging should conform to the standards set out by the parent company abroad. Stores receive the products already in their display packaging and receive a supply of carrier bags to be kept as part of the inventory. Due to this scenario, most SM tenants are not familiar with different types of alternative packaging options since it is their head offices that do the research.

Packaging is considered to be part of branding material and its use is strictly monitored by the head offices. Some

companies assign a material code number to their packaging so it can be monitored by their inventory management software. Stores order packaging based on the monthly sales projections and are required to maintain at least one to two months of buffer stock in their inventory to prevent stockout scenarios. Chain stores are not allowed to purchase plain or nonbranded packaging from local suppliers in the event the store runs out of packaging. Emergency stocks are retrieved from the nearest branch, which is easy if there are multiple stores in one city. The interviewed stores shared anecdotes of emergency packaging stocks being sent via ferry to and from Iloilo or Bacolod or even air freighted from Cebu. Companies are willing to spend to ensure that stores only use official packaging, thereby, maintain the integrity of the customer experience. SM tenants do stress that these situations are rare and mainly occur due to the transport restrictions of the COVID-19 pandemic.

SM currently does not require its tenants to follow packaging guidelines as part of its leasing contract, but tenants are mandated to follow LGU ordinances which might affect packaging choices. Store packaging can vary from store to store due to local ordinances regarding plastic use. Stores located in these cities email a copy of the ordinance to the head office and the purchasing department will send packaging that conforms to the local regulations. Many stores are using biodegradable or semi-biodegradable plastic packaging, though this is mostly self-declared. Some stores are slowly shifting to the use of paper packaging, with some using brown paper bags. However, most of the paper packaging used for food are laminated or lined with another material to make it more durable. In most cases, presenting the packaging to the LGU is not required to obtain a local business permit although it has been noted that the LGU in Iloilo City sometimes visit stores to check that their packaging conforms to the local ordinance.

For stores that have shifted to paper-based packaging, managers initially noticed that many customers demanded plastic packaging at the beginning because they were used to plastics. They handled it by explaining that the store could only provide paper packaging. Customers got used to it until it has become the norm. Some stores also have non-woven eco-bags as an option, but often as an additional charge or free for large purchases. In the case of Miniso, a household and consumer goods store, cashiers are trained to ask whether the customer requires a paper bag. Stickers can be used to mark a purchased product should the customer opt out from a carrier bag. H&M, a clothing store, does not provide paper bags and charge customers a fee should they want one.

Most of the stores participate in the SM's Trash for Cash program, which is convenient for them since the outsourced waste haulers are the ones picking up the waste materials from the mall. Non-food tenants tend to have less daily waste compared to the food tenants since they mainly dispose of transport packaging.

4.1.3 Perspectives of Other Local Business Owners

The demand for packaging is directly related to the actual demand for the product being sold. There is less packaging being required for manufacturing right now simply because there is a significant decrease in production due to the pandemic. Local business owners have more flexibility in choosing the type of packaging that they use since they do not have to conform to the standards set out by a national or international head offices. Packaging selection is primarily based on purpose. For instance, McNester, maker of mango and calamansi products, requires bottles that are resistant to heat so they use thicker PET bottles or glass bottles. Some of the respondents consider the use of paper and biodegradable packaging as shifting to a more sustainable option.

Industry associations encourage its members to try out different types of sustainable packaging, but the final choice is still with the entrepreneur. Members of the Negros Food Producers Association and the Negros Producers Association are also able to tap Central Philippine University (CPU) for packaging design and receive assistance for graphic design from the Department of Science and Technology.

4.1.4 Perspectives of Consumer Groups

A focus group was conducted with the officers of the Nationwide Association of Consumers, Inc. (NACI), the only consumer organization of national stature that has been accredited, so far, by the DTI. The organization's main advocacy is on consumer welfare and the economic empowerment of consumers. NACI operates through its regional and provincial chapters nationwide, and also through its affiliated organizations, in the provinces and represents its members in public hearings and conferences on matters that affect consumer

welfare. As part of its environmental advocacy, NACI represents the consumers as a member of the technical group in Philippine Congress on the issue of regulating plastic use and voted yes on the banning of single-use plastics. NACI also helps in the development of the corporate responsibility standards of the DTI and has helped in drafting the Competition Law.

NACI considers plastic as a major source of pollution and harmful to the environment, hence the vote for single-use plastics. The national board first met with the different chapters and members to get their agreement before they could put forth a vote. NACI acknowledges that the campaign against plastic pollution is difficult because the choice of packaging is often dependent on convenience and plastic packaging is the most convenient for most consumers. Furthermore, sachets are used by many consumers because of the affordability it brings, especially to low-income consumers. Despite advocating for no single-use plastics, NACI is unable to identify specific alternative materials that can replicate convenience and affordability. The use of banana leaves has been mentioned but has limited application.

4.1.5 Perspectives of Consumers

An online survey with 236 general consumers was conducted to document consumer shopping behavior in malls and assess their perception regarding the switch to more sustainable packaging options. The full results of the survey are available in Annex G. The respondents are mainly from Iloilo (73%) and Bacolod (16%) since these two cities will be the location for the pilot program, with the remainder from different provinces in Panay and Negros Islands. In terms of demographic profile, the majority are female (65%), single (76%), belong to Gen Z (44%) or millennial (47%) generations, are college graduates (73%) and earn less than PHP 20,000 a month (63%). More than a third of the respondents do not go to the mall while the pandemic is still ongoing while the rest mainly visit the mall once a month or every couple of months, a detail also verified by the interviews with SM mall management and tenants, who observed 50% less customer visits. The top three most frequently visited store categories are supermarket (82%), dining (68%), and shopping (64%), which indicate that these three categories use the most packaging in terms of quantity. Fast food establishments (79%) are the most frequently visited dining establishment type, while mobile phone stores (70%) top the electronics category, cinemas (61%), when things were normal, topped the entertainment category. Bills payment (51%) and banking services (45%) are the services most frequently availed of by the mallgoers. The department store (83%) mostly takes care of the mall goers' shopping needs, with clothing (67%) and footwear (58%) stores also in the mix in terms of foot traffic. This behavioral pattern indicates that customers focused on physiological needs such as basic necessities, food and clothing over other categories in which packaging in focus for this project may come from these top store categories.

In terms of knowledge, more respondents assess themselves as knowledgeable on sustainability compared to circular economy. The majority of respondents assess themselves as having sufficient knowledge (46%) or having some knowledge (30%) on sustainability, while only 2% have never heard the term at all. In contrast, a third of respondents have not heard about circular economy, and another third indicate very limited knowledge about the topic. Consumers tend to focus on simpler terms rather than more technical ones when describing sustainable packaging: reusable (89%), environment friendly (86%) and recyclable (78%) are the words most associated with sustainable packaging. These insights need to be considered when designing information and education materials. It should be noted that the majority of the respondents have the highest educational attainment and are millennials, which generally concludes that the respondents are aware of alternative packaging options and issues on marine litter. In a way, this is not conclusive since the survey did not gain the perspective of the lower income sector given that this is an online survey due to the COVID-19 pandemic. It is one of the limitations of the study.

Instead of broad concepts, more respondents had full knowledge (24%) or sufficient knowledge (42%) of local legislation regarding single-use plastic since it affects their day-to-day lives, and the majority (94%) support regulating single-use plastics. This has been brought about by widespread awareness (97%) on the contribution of packaging to river and marine litter. Thus, the majority (98%) express consciousness in terms of the role of the consumer in environmental protection and consider the environmental impact of packaging (90%) when choosing to buy a product.

Most shoppers (50%) go to the mall based on their schedule but there is a growing number of consumers (24%) who deliberately go on

the day when the malls do not use plastic bags. However, there is still a minute number of respondents (1%) who avoid the malls on a day where plastic bags are not made available to the consumers. Only 28% of the respondents bring their own shopping bags to the malls, but a significant number (61%) are considering doing it, which presents opportunities for the malls and the stores to convert these shoppers into actually changing their behavior.

Close to half of the respondents currently prefer to purchase consumer goods in small to medium bottles, with the remainder almost evenly split between purchasing the largest container (28%) and using various kinds of sachets (27%). Perhaps this behavior is also partially controlled by budgeting expenses, since two-thirds of the respondents earn PHP 20,000 or less each month. However, it can be noted that the remaining one third that earn more than PHP 20,000 can be possible premium payers or are those who are willing to pay extra charges for plastic packaging.

Majority (77%) are willing to choose products with environment friendly packaging if it is available in the stores. However, this is hindered by the actual availability of such packaging options, the top answer (67%) among the challenges consumers face as they switch to more sustainable options. Price (64%) is another limitation for sustainable packaging. The majority (66%) of respondents are not willing to pay an extra charge for plastic packaging but most are willing to bring their own shopping bags (98%) if there are discounts or rebates or bring their own containers (97%) if the stores offered refills. These may look good on paper, but stores have to make the process easy for consumers since convenience (47%) is one of the factors that prevent consumers from switching to more sustainable packaging. The quality and durability of more sustainable options are also challenges as many consumers view plastic packaging as more durable compared to other types of packaging.

In terms of post-purchase behavior, 92% claimed that they reuse packaging and containers as many times as possible before disposing of them, which is also a point made in the interviews. Grocery bags are reused by Filipino households as garbage bags, glass bottles are reused for preparing condiments (e.g., sinamak), and microwavable plastic takeout containers and plastic ice cream containers are reused as stackable containers for leftovers in the refrigerator or even serving dishes. The containers are disposed of once they crack or break. Two thirds of respondents segregate packaging and other waste materials when disposal while 91% practice some form of recycling or repurposing of packaging materials, and 44% have a home compost. However, only 60% claimed that waste packaging and containers are picked up or dropped for materials recovery or recycling, underscoring the gaps in the recycling stream.

4.2 Obstacles and Opportunities for Consumer Purchase of More Sustainable Alternative Packaging

4.2.1 Perspectives of SM Supermalls

SM Supermalls see sustainability as equivalent to cost effectiveness. Environmental initiatives such as using less packaging through MOB day, recycling water for toilets, selling recyclable packaging and containers to haulers means using less resources which results in savings or added income for the company. For instance, MOB saved SM City Iloilo the equivalent cost of 20,000 plastic bags each month and the growth in eco-bag sales allowed them to fund more sustainability projects. This is a good approach when dealing with the private sector since businesses look at sustainability programs from a balance sheet perspective. Investing in sustainability should show positive results in the cash flow, otherwise it will only be considered as cost or expenses.

One of the challenges in working with a conglomerate is that all aspects of the businesses tend to be centralized. While it ensures systematic management of mall operations, mall managers' hands are also tied when it comes to decision-making. Partnering with SM City Iloilo and SM City Bacolod on sustainable packaging programs would require approval from the head office in Manila, which can take time.

Respondents from SM noticed that age is a factor that affects behavior change in consumers. Older customers tend to insist on plastic packaging and have been harder to convince to participate in the MOB program while younger consumers are more conscious of their environmental footprint. Consumer education is part of SM Cares, the corporate social responsibility (CSR) arm of SM Supermalls. It was launched in 2004 to organize sustainability and community support efforts, into a comprehensive program

that tackles a wide range of initiatives. SM Cares has three flagship programs: Trash to Cash, Green Film Festival which shows environmental documentaries at SM Cinemas to high school students for free and participation in Manila Bay and International Coastal Cleanups. Partnering with SM Cares on an information and education campaign on sustainable packaging provides a good opportunity to scale the campaign since it will be rolled out across all the different SM Supermalls.

Providing refilling stations at the supermarket can be a good idea but will be dependent on the ability of the product manufacturer to offer refills. It also depends on being allowed by LGUs. However, there is concern that the convenience factor of just buying a new bottle outweighs the environmental benefit of refilling. The respondents shared an anecdote that they once offered a water refilling station at the mall, but it was later discontinued due to low sales. Mallgoers considered bringing large water containers inside the mall to be a big hassle.

4.2.2 Perspectives of SM Tenants

There are opportunities for the retail and commercial sector to be more responsible with packaging choices. Since packaging choices of chain stores are made at the corporate level, dialogues on alternative packaging should be opened with the head offices. This can take considerable time since large corporations need to consider numerous factors from pricing, availability, logistics, and alignment to corporate branding and values. International brands will also need to seek approval from the parent company. However, when these companies do shift to more sustainable packaging options, it will be on a much larger scale compared to a local small business.

Many mallgoers are highly aware of the use of paper as alternative packaging but are not familiar with the other options. According to SM tenants, there is a segment of consumers that are attracted to choosing sustainable brands and these can be highlighted in store marketing campaigns. Social media has been identified as the main communication channel for consumer education since the stores already maintain accounts across multiple platforms. One store suggested that perhaps it would be better if the store did not give customers options with regards to packaging; after initial protests, customers will eventually get used to store policy on packaging. These establishments bank on the loyalty of the customers to keep on patronizing their businesses despite shifts in the type of packaging being used.

For the food tenants of the mall, choosing alternative packaging is difficult because these have to be food-grade as well. The premium price as well as limited availability of food-grade alternatives is a deterrent for food businesses. There are also criticisms that alternative packaging such as paper boxes are less durable than conventional packaging, especially when dealing with liquids or hot food. Research and development need to be improved in order for alternative packaging to perform at par with plastic options.

4.2.3 Perspectives of Local Producers

For most of the local producers, sustainable packaging means that there is an adequate supply of packaging to meet their needs and keep enough products on the shelves. The quality of the packaging is also very important as it should extend the shelf life of a [food] product. Some food businesses find it difficult to use the more sustainable options because of the limitations of the material itself. For instance, one beverage producer remarked that bioplastic packaging is not as durable as plastic bottles, which can affect the integrity of the product. Furthermore, while some are using paper packaging, they opt for the ones with the inner plastic layer since it is more durable. This defeats the purpose of choosing paper packaging since it is more difficult to dispose of and recycle.

Price is another factor that hinders the adoption of more sustainable packaging options. Plastic packaging is cheap and given that many small business owners are struggling with only 40-50% production, the manufacturers cannot absorb the cost of the more sustainable option. The cost cannot be passed on to the consumer as well because the market cannot absorb it. There is a niche market of younger people that is willing to pay for alternative packaging, but it has to be visually pleasing as well so it can be posted on social media. This presents an opportunity for DOST, educational institutions, and other innovators to increase research and development on sustainable packaging in order to bring down the price. Business owners are willing to shift if the price is at par with the current packaging being used.

The local availability of packaging options in Iloilo and Bacolod is another challenge for small business owners. This refers to the limited array of packaging in general and not

just the more sustainable options. There are a number of companies that source their packaging needs from Cebu or Metro Manila. One respondent mentioned she regularly attends trade fairs in Manila to source out raw materials for production while another business owner is fortunate to attend packaging trade fairs in the United States. However, most SMEs make do with what is available from local suppliers.

Local producers and small business owners view EPR as the domain of large-scale manufactures of consumer products. EPR should begin with sachet products since that is a major source of pollution. It is also difficult to keep track of the waste packaging once the product is already in the hands of the consumer. One respondent does not find EPR to be effective since recovery is only a fraction of the total volume of goods sold. Rather than selling sachets and recovering them, manufacturers can place refilling stations in sari-sari stores since a large proportion of sachet users buy from sari-sari stores. Consumers can still buy "*tingi-tingi*" or piecemeal but use refillable containers to do so. Companies can give rebates in the beginning to spur people to bring their own container. Bacolod respondents cite the "*Wala Usik*" sari-sari store as an example.

Perhaps one of the biggest opportunities to shift to more sustainable packaging options rests in producers who export their products to international markets. Consumers from developed countries are more conscious of their environmental impact and are willing to pay more for a sustainable product. These countries are also stricter in their environmental laws and Filipino exporters need to follow country guidelines before they are allowed to ship their product. For instance, one respondent mentioned that she had to shift to kraft paper for her export product because plastic wrap is not allowed. Unfortunately, that is not the case in the local market. For those selling online, Shopee and Lazada require the use of EPS foam and bubble wrap, which adds to the amount of packaging. The shift to e-commerce during the pandemic has increased the amount of packaging waste.

Consumer education is important when advocating the use of more sustainable packaging options or no packaging at all. The basic education curriculum needs to be revamped to include environmental values and practices and inculcate more eco-friendly behavior in children. It is more difficult to change the behavior of adults, especially once they have experienced the convenience of using sachets or plastic packaging. The President of Metro Bacolod Chamber of Commerce cites Japan as an example, where the first three years of education focuses on behavior and values rather than academic knowledge.

While local ordinances are a good start, many respondents feel that the actual implementation and enforcement of the ordinances regarding single-use plastic and waste management are lacking. People will cooperate if they can see that the government is strictly implementing the ordinance and the penalties and fines that accompany it. For instance, residents of Bacolod are disheartened when they segregate waste, but the dump truck just collects everything without segregation and disposes it all in the same landfill.

4.2.4 Perspectives of Consumer Groups

NACI identifies price as the biggest obstacle to switching to more sustainable packaging options. The availability of alternative packaging is also a challenge in the provinces. While there is a movement of going back to bottles and other refillable types of containers, the actual execution can be difficult and it is more inconvenient for consumers, which can be considered a penalty in the eyes of consumers.

Changing the behavior of Filipino consumers often requires an incentive. NACI believes a system that has monetary incentives will make it attractive for consumers to switch to alternative packaging options. For instance, the discounts for bringing your own container should be big enough to offset the inconvenience of doing so.

The LGU has a big role to play because aside from monetary incentives, people change their behavior if it is required by law. For NACI, the main source of the problem is the disposal of plastic packaging. LGUs should comply with SWM legislation and properly implement programs at the local level. There should also be incentives for recycling, coupled with a more efficient system of recycling that makes it easier for households to participate. Improper waste disposal should have stiff penalties.

4.2.5 Perspectives of Consumers

The respondents in general show a positive attitude towards sustainability in their own means such that aside from there is already an ongoing practice, an overwhelming majority are willing to switch, get involved or participate in the alternative packaging options. Even if majority (66%) are sensitive to the price (packaging), there is still a niche for the remaining (34%) towards shift on sustainable packaging because availability of eco-friendly options (67%) is the top reason for switching to an eco-friendlier packaging while the challenges on durability (53%), convenience (47%) and quality (44%) and others may be a process to work on or may be considered.

While the survey respondents consider all stakeholders (80%) to be responsible for using or adopting sustainable packaging, more respondents identified consumers (71%) as the keystone for sustainable strategies, compared to manufacturers (61%), stores and malls (59%), government regulators (59%), or packaging suppliers (58%). This emphasizes that the market responds to the behavior and demands of the end-consumer.

Consumers consider optimizing the segregation and recycling stream (81%) as the best option for reducing packaging waste that end up in landfills, rivers, and ocean. Making alternative packaging more widely available (73%) will address the concerns that there are limited options for sustainable packaging in Iloilo and Bacolod and that can also be spurred by the government banning single-use plastics at all times (71%). Rather than penalizing customers by asking them to pay a premium for plastic packaging, consumers want the price of alternative packaging brought down (67%) so they will be at par or close to the price of conventional packaging. This can happen if more sustainable packaging options are manufactured at scale locally.

In terms of manufacturer response to lessening the plastic waste in the Philippines, consumers prefer that companies look for environment-friendly alternatives to plastic packaging (84%), use packaging that can be reused or repurposed (81%), or reduce the use of plastic in their products (77%). At the same time, companies should also be responsible in giving end-of-life instructions by educating their consumers on proper segregation and waste disposal (79%). Stopping the production and use of plastic packaging and manufacture take-back programs seems to be the least popular solution for consumers.

4.3 Summary of Enablers and Barriers

Based on the discussions in the preceding sections, a summary of the enablers and barriers to switching to more sustainable packaging options is presented in Table 4.1. These are general considerations because many consumers do not have comprehensive knowledge on the different alternative options and are unable to discuss for each packaging type.

Table 4.1 Summary of enablers and barriers to switching to alternative packaging options

Enablers	Barriers
• Dialogues have to be at the national level with head offices (both for retailers and manufacturers) - scale • Balance sheet perspective. Sustainable can be cost-effective for businesses • Consumer education programs can fill in knowledge gaps – starting at the basic education of children • Do not give options – banks on consumer loyalty • Increased R&D to bringdown price • Refilling stations in sari-sari stores vs sachet recovery program • Exporting to international markets requires rethinking packaging • Improved implementation of local ordinances • Monetary incentives to offset “inconvenience”	• Slower decision-making process due to centralized purchasing • Age and income as primary factors in behavior change • Refilling station depends on the ability of manufacturer to provide refills • Convenience factor of a new bottle might outweigh benefits of refilling • Limitation on durability, price and local availability • EPR considered to be for multinational enterprises only

CHAPTER 5
VERIFICATION OF SUSTAINABILITY REQUIREMENTS

Based on the information collected and presented in the previous chapters, this chapter develops a set of environmental, social, and economic requirements for sustainable packaging. The preliminary compendium of sustainability requirements outlined in Chapter 2 has been evaluated and trimmed down to be more relevant to the Philippine scenario based on the analysis of supply and demand of the products in focus. These were then presented to stakeholders for verification. Results of this verification are presented in this chapter.

5.1 Proposed General Sustainability Requirements

While sustainability requirements may differ for each packaging type due to differences in material, product process and value chains, this report posits that there are general environmental, economic, and social requirements that can be universally adopted by all types of packaging. These requirements generally refer to how more sustainable packaging alternatives shape opportunities, affect participation, and influence the overall welfare of the population. It can be argued that all packaging categories in this market readiness study could be evaluated under the same general requirements.

Table 5.1 Proposed general environmental requirements for packaging manufacturers

Component	Requirements
Material Composition	Resin is identified and stated
	No toxic substances
	No carcinogenic substances
	No BPA in petroleum-based plastics
	No PVC or chlorinated plastics
	No substances that can cause mutations or disrupt endocrine functions
	Heavy metal concentration should not exceed known standards
	Follows FDA, Hazard Analysis Critical Control Point (HACCP), and/or Halal Act standards if used for primary food packaging
	Follows PNS guidelines for inks, dyes, pigments, and other colorants used for packaging design and printing
	Packaging must not be manufactured in a manner which would prevent recycling
Cleaner and More Responsible Production	Manufacturer minimizes energy use
	Manufacturer minimizes water use
	Manufacturer practices pollution control and should comply with DENR standards for emissions and effluents
	Manufacturer tracks and reduces carbon emissions
	Manufacturer has a SWM plan
	Manufacturer has an environmental management system
	Manufacturer is certified ISO 14001 for environmental management systems
Transport	Follows environmental laws during transportation
Disposal	Packaging contains end-of-life instructions to guide consumers on proper disposal

Table 5.2 Proposed general socio-economic requirements for packaging manufacturers or suppliers

Component	Requirements
Sourcing	Paying fair price for input / raw materials (no undercutting of prices)
Local Production	Manufactured in the Philippines
	Company is majority-owned by a Filipino
	Input materials are also sourced locally
Taxes	Pays the right taxes and other tariffs
Employment	Generates local employment
	Follows labor regulations
	Pays fair salaries and provides benefits to employees
	No forced or child labor

Component	Requirements
	Maintains a healthy and safe workplace
	Gender-responsive, diverse, and inclusive workplace
Community Engagement	Improves quality of life of local communities
	Initiates CSR programs
	Provides consumer education programs on responsible consumption and disposal of packaging
Accountability	Reports on key environmental, social, and governance performance indicators

5.2 Proposed Sustainability Requirements Based on the Material Composition

Packaging must satisfy certain essential requirements relating to its size, design, and manufacture. Material composition is a significant component of packaging. The choice of material/s can be a crucial factor in learning how to package things better, which not only has a corresponding economic impact on the goods and the company but also has social and environmental implications. Based on the analysis from the previous chapters, there are packaging categories based on material composition: (1) Bio-based packaging; (2) Petroleum-based packaging; and (3) pulp and paper packaging. Each type has its own respective environmental and socio-economic requirements.

Table 5.3 Proposed sustainability requirements for bio-based packaging

Component	Requirements
Environmental requirements	Made from 100% renewable biological (bio-based) polymers
	Does not use genetically modified raw material
	Made from a single type of bio-based polymer
	Made from 100% biodegradable material and recoverable through composting and biodegradation (see 5.3.1)
	Sourced from sustainable land use farms
	Sourced from farms that use good agricultural practices (GAP) and good handling practices (GHP)
	Has a chain of custody for the origin of the biological materials
	Sourced mainly from agricultural wastes or by-products of food production
Socio-Economic requirements	Transparent and fair-trading practices with farmers and suppliers of biological feedstock
	Does not compete with food production

Table 5.4 Proposed sustainability requirements for petroleum-based packaging

Component	Requirements
Existing NELP-GCP Certification	NELP-GCP-2003004 for polyethylene & polypropylene packaging materials
Environmental requirements	Identification of the type of petroleum-based resin used to create the packaging
	Uses a single type of petroleum-based polymer
	Hold DOST-ITDI ETV 013 Certification if biodegradable additive is used
	Follow PNS 2097:2014 for plastic shopping bags
	Follow PNS 2104:2014 for plastics that degrade in the environment by a combination of oxidation and biodegradation
	Follow PNS 2102:2013 for compostable plastic
	Pass ASTM Tests for aerobic biodegradation or compostability
	Disintegrates after 12 weeks for compostability and completely biodegrades after six months based on EN 13432 or Percentage biodegradation of the product material should be greater than 60% in 24 months based on HKGLS
	100% recyclable if not biodegradable or compostable
	Percentage of recycled petroleum plastic content if the packaging is not food-grade
Socio-Economic requirements	Manufacturer has materials recovery facility / program
	Manufacturer has a buy-back program
	Manufacturer engages the formal and informal SWM sector for recovery

Table 5.5 Proposed sustainability requirements for pulp and paper packaging

Component	Requirements
Existing NELP-GCP Certification	NELP-GCP - 2008017 for paper envelope NELP-GCP - 2004006 for printing and writing paper NELP-GCP - 2008018 for paperboard
	Follow PNS guidelines depending on the type of pulp and paper product:

Environmental requirements	PNS 124:1988 for heavy-duty kraft paper PNS 123:2000 for extensible sack paper PNS 126:2003 for newsprint PNS ASTM D 6253:2010 for treatment and marking of wood packaging materials PNS 2096:2015 for paper bag PNS 2052:2019 for handmade paper packaging PNS 166:2019 for corrugating medium
	Certification if virgin pulp is sourced from sustainably managed forests abroad
	Traceability of origin / chain of custody if virgin pulp sourced locally
	Ratio of recycled fiber to virgin pulp
	Recycled paper must be sourced locally
	No chlorine or halogenated bleaching agents used
	Minimal use of fresh water with majority of the water reused or recycled throughout the production process
	100% recyclable via the waste paper recycling cycle
Socio-Economic requirements	Sourced from forests that practices agroforestry to provide economic benefits to local communities
	Sourced from forests that engages upland indigenous communities in sustainable forest management

5.3 Proposed Sustainability Requirements Based on End-of-Life Stage

Most stakeholders, from suppliers, regulatory agencies, and to consumers, recognize that packaging produces waste and requires additional end-of-life options other than dumping on a landfill. This can be an inefficient use of resources since the recovery, reuse, and recycling of materials are forever lost when disposal is through a landfill. Moreover, there are other environmental, health, and social consequences that result from poor management of solid waste in landfills. This assumes that packaging waste makes its way into landfills in the first place; in many cases improper disposal leads to clogged creeks and rivers. Recovery options for packaging can follow circularity principles and close the loop from cradle-to-the grave. Four packaging categories are identified based on end-of-life-options: (1) biodegradable and compostable packaging; (2) packaging made from recycled content; which goes together with (3) recyclable packaging with EPR; and (4) reusable packaging and long-lasting alternatives. The succeeding tables detail the specific environmental and socio-economic requirements for each packaging category.

Table 5.6 Proposed sustainability requirements for biodegradable and compostable packaging

Component	Requirements
Environmental requirements	Packaging should be tested for biodegradability under real conditions
	If made from plastic, packaging should follow: PNS 2104:2011 - Standard specification for plastics that degrade in the environment by a combination of oxidation and biodegradation PNS 2102:2013 - Specifications for compostable plastic
	Packaging should be compostable under home composting conditions and achieve 90% degradation in 12 months at ambient temperature based on TUV Austria Belgium and French NF T 51-800 standards
	Hold DOST-ITDI ETV 013 Certification if biodegradable additive is used to make oxo-biodegradable plastic packaging
Socio-Economic requirements	Appropriately labelled for segregation and collection at source in the event packaging is not biodegraded or composted at home

Table 5.7 Proposed sustainability requirements for packaging made with recycled content

Component	Requirements
Environmental requirements	Follows PNS ISO 18604:2016 on material recycling for packaging and distribution of goods
	Follows PNS ISO 18605:2016 on energy recovery for packaging and distribution of goods
	Percentage of recycled material content
	Traceability of origin for the recycled content
	Absence of any contaminants from the use of recycled content
	Can only be used for non-food packaging
	100% recyclable
	Inclusion of both formal and informal waste management sector in the recycling plan

Component	Requirements
Socio-Economic requirements	Packaging manufacturer works with LGUs and local recyclers as part of the EPR program

Table 5.8 Proposed sustainability requirements for recyclable packaging with EPR

Component	Requirements
Environmental requirements	Packaging states type/s of materials used
	Made from a single material (monomaterial)
	Materials can be separated without the use of special tools if packaging uses multiple material types
	Does not use incompatible materials that are known to impede separation or reprocessing or to reduce the quality of recyclate.
	100% recyclable
	Follows the appropriate PNS guidelines: PNS ISO 18606:2016, which specifies procedures and requirements for packaging that are suitable for organic recycling PNS ISO 18604:2016 on material recycling for packaging and distribution of goods PNS ISO 18605:2016 on energy recovery for packaging and distribution of goods
	Manufacturer has an EPR scheme including return and take-back programs
	Manufacturer has a collection and recycling plan
Socio-Economic requirements	Inclusion of both formal and informal waste management sector in the recycling plan
	Packaging manufacturer works with LGUs and local recyclers as part of the EPR program

Table 5.9 Proposed sustainability requirements for reusable packaging and long-lasting alternatives

Component	Requirements
Environmental requirements	Follows the sustainability requirements for packaging depending on material composition (see 5.2)
	Follows PNS ISO 18603:2016 Packaging and the environment – Reuse for packaging to be classified as reusable
	Follows PNS ASTM D 6198:2009 - standard guide for transport packaging design if the packaging is intended for this purpose
	Follows PNS 1030-1:1988 for reusable glassware and ceramic ware in contact with food
	Reusable packaging must be 100% recyclable after number of time for reuse has been maximized
	Provide guidelines on the minimum number of times packaging should be reused to have a lower environmental impact over a competing alternative
Socio-Economic requirements	Provides guidelines on the maximum number of times packaging can be safely be reused
	Provides guidelines on the care, cleaning, disinfection, and safe storage of packaging
	Consumer goods producer has a refilling model to complement the reusable packaging
	Consumer good producer provides a returnable packaging scheme (e.g., deposits)

5.4 Validation of Sustainability Requirements and Possible Means of Verification

Due to the COVID-19 pandemic, the non-exhaustive list of sustainability requirements was presented to packaging industry stakeholders – government agencies, packaging manufacturers and retailers, business groups, representatives from the retail and commercial sector, consumer groups, other civil society organizations, and other programme partners – through an online document. The document aims to validate the sustainability requirements and means of verification for the different types of sustainable packaging. Participants were free to include additional sustainability requirements that were not on the initial list but were deemed as a significant criterion. Eleven emailed responses were received: five from different DTI offices, two from packaging companies, one social enterprise, and the remainder from the Climate Change Commission (CCC), IVL Swedish Environmental Research Institute, and one from GIZ. The frequency counts of votes as well as reasons for inclusion or exclusion of sustainability requirements, and the possible means of verification are detailed in the succeeding tables.

Table 5.10 Validation of general environmental requirements for packaging manufacturers

Requirements	Y	Reason	N	Reason	Verification
No toxic substances	9	Health hazard as toxic substances have long-term effects on health			All ingredients must be specified and listed Compliance to Current Good Manufacturing Practices Documentation including Material Safety Data Sheet (MSDS) Certificate of Analysis
No carcinogenic substances	9	Carcinogenic substances shall be avoided to minimize the risks to health such as development of cancer			Disclosure of all substances present in packaging materials Compliance to Current Good Manufacturing Practices Documentation including MSDS Certificate of Analysis
Follows PNS guidelines for inks, dyes, pigments, and other colorants used for packaging design and printing	9	To determine that the manufacturer is compliant to standards in manufacturing packaging and printing Should also allow for equivalents based on country of origin			Tested by PAB accredited laboratories for chemical testing Supplier certifications Compliance to Current Good Manufacturing Practices Documentation including MSDS Certificate of Analysis
Manufacturer has a SWM plan	9	To ensure that all solid wastes are not being thrown to bodies of water and are properly disposed *Most companies have this in place*			Waste management plan manual Submission of hygiene and sanitation report Periodical report on the implementation of SWM plan Define stages (for example, start with zero waste to landfill) and gradually move into more holistic aspects of SWM
Manufacturer has an environmental management system	9	To ensure that the manufacturer has a plan towards environmental management Many companies have this in place Should also allow for equivalents based on country of origin			Environmental management plan with monitoring and audits to ensure that it is followed
Manufacturer practices pollution control and should comply with DENR standards for emissions and effluents	8	Manufacturing should be environment friendly to lessen pollution Standard requirements were already set by DENR for pollution control			Verified by DENR Standards checklist
No BPA in petroleum-based plastics	8	Health hazard			All ingredients must be specified and listed Compliance to Current Good Manufacturing Practices Documentation including MSDS Certificate of Analysis
No PVC or chlorinated plastics	8	Health hazard			All ingredients must be specified and listed Compliance to Current Good Manufacturing Practices Documentation including MSDS Certificate of Analysis
Heavy metal concentration should not	8	Health hazard. Excess may cause harm and can contaminate food products			All ingredients must be specified and listed

Requirements	Y	Reason	N	Reason	Verification
exceed known standards					Tested by PAB accredited laboratories for chemical testing Compliance to Current Good Manufacturing Practices Documentation including MSDS Certificate of Analysis
Follows FDA, HACCP, and/or Halal Act standards if used for primary food packaging	8	Health implications standards are necessary for market expansion and exports Should also allow for equivalents based on country of origin			Refer to FDA CGMP Manual, HACCP manual / documents. Partner with FDA, DOST, and other agencies for certification
Follows environmental laws during transportation	8	Transports should be made with the most efficient transport methods to minimize carbon monoxide emissions during transportation and/or maximize the benefit of economies of scale			Monitor if the manufacturer implements pooling of resources, scheduling in acquiring raw materials and in transporting of packaging materials
Packaging contains end-of-life instructions to guide consumers on proper disposal	7	For consumers' safety	1	This is based on personal preference of the brand owner and not on the packaging manufacturer.	Must be visible in packaging sample Allow for compliance by making information available off-label to cater to small size packaging
Resin is identified and stated	7	Can have possible affect health and safety of consumers	1	There are so many types and grades of resins and different combinations are needed to achieve desired packaging properties.	All ingredients must be specified and listed Certification issued by corresponding government agencies such as FDA or DOST International certification since the majority of resin manufacturers are global companies who follow global standards
No substances that can cause mutations or disrupt endocrine functions	6	Health hazard	1	Substances must be specified.	All ingredients must be specified and listed
Manufacturer tracks and reduces carbon emissions	6	Lower carbon emissions will benefit the environment	2	Will just add to cost Manufacturers are all trying to save energy consumption and carbon emissions already even without a law	
Manufacturer is certified ISO 140001 for environmental management systems	6	To ensure that the manufacturer follows an environmental management system Should also allow for equivalents based on country of origin	2	Are these requirements for certain sizes of operations? Too expensive and difficult for medium enterprises.	ISO 14001 Certification
Packaging must not be manufactured in a manner which would prevent recycling	5	Should be biodegradable It is better if it is recyclable to lessen the wastes that are difficult to decompose Recycling or	3	This assumes recycling is the only end of life option but other models are possible: repair, modularity, biodegrading, etc. This can be used as an excuse to stick to	Must provide sample Plan for possible recycling treatment of packaging materials being manufactured

Requirements	Y	Reason	N	Reason	Verification
		repurposing should be allowed. We are trying to save on materials. The definition will need to take into account recycling perspective readiness of local collection and recycling with readiness of infrastructure, or this must be defined from a local infrastructure technical recycling perspective.		plastic materials. "Recyclability" is dependent on local availability of recyclers or aggregators. For example, what is technically highly recyclable like PET is not being collected in Mindanao because it does not make economic sense to aggregate there and send to the recyclers in Luzon. This requirement would just lead to confusion and could be an excuse for minimal compliance.	
Manufacturer minimizes energy use	5	Less energy consumption means lower carbon footprint	3	No significant impact on product or end user. Energy use is subjective. Few factories actually minimize energy use – but rather try to use energy effectively. Rather than being particular about minimization of energy or water in particular, would prefer a perspective that looks at overall resource usage. Choices have to be made at every point of their product or production design, we cannot dictate those choices. Making these requirements might prevent other, more net-positive choices that improve overall resource use, that we could not even imagine at this point.	Monitor the electric consumption and/or green initiatives such as installation of LED lights Normally the criteria will be something like an energy audit made and action plan implemented or something Start as a best practice motivator to support industry development and gradually move into the requirement stage
Manufacturer minimizes water use	4	To be efficient in water usage To start as a best practice motivator to support industry development to gradually move into requirement the stage	3	No significant impact on product or end user. Water use is subjective. Even without a law, manufacturers are all trying to minimize already. Factories focus on effective use of water. Also, if water is reused, how is that handled? Prefer a perspective that looks at overall resource usage	Water use audit Implementation of a water action plan Start as a best practice motivator to support industry development and gradually move into the requirement stage

Table 5.11 Validation of general socio-economic requirements for packaging manufacturers or suppliers

Requirements	Y	Reason	N	Reason	Verification
Pays the right taxes and other tariffs.	9	Current law and companies need to follow local rules on taxation. Source of income of the government To ensure that manufacturers do their responsibilities to the government			Submission of copy of ITR, BIR or LGU tax certificates
Generates local employment	9	Source of income and benefits for the local community. To check if the manufacturer contributes to achievement of SDGs in the Philippines, particularly in employment generation and poverty reduction. Current law already, but a mix of local and foreign should be allowed			Personnel records List of employees and from what province in the Philippines
Maintains a healthy and safe workplace	9	Current law already To protect the employees, especially if there are harmful chemicals involved during the production.			Building safety compliance Manual for health and safety protocols
Follows labor regulations	8	Current law already To ensure fair treatment of employees based on the Labor Code			Occupational health and safety monitoring and audit Company policies and manual
Pays fair salaries and provides benefits to employees	8	Current law already To provide decent income and to ensure promotion of decent work			Monitoring on compliance to labor laws
No forced or child labor	8	Current law already To protect children's rights			No child labor policy DSWD certification
Gender-responsive, diverse, and inclusive workplace	8	Current law already To ensure equal rights and non-discrimination to employees who are members of LGBTQ+			Gender inclusion policy
Consumer education programs on responsible consumption and disposal of packaging	7	Benefit for the consumers and environment To ensure that advocacies on sustainable consumerism are being implemented	1	This is up to the brand owner, not the packaging manufacturer.	Can start by defining this as a motivator factor (i.e., giving recognition for companies who are applying this) rather than requirement factor and allow for wider scope of engagement and type of engagement and meeting of requirements at different levels of engagement
Paying fair price for input / raw materials (no undercutting of prices)	6	Fair trade Ideal but it would depend on how this is done. This is a complicated criterion			Demonstration through any recognized local or international certification system

Requirements	Y	Reason	N	Reason	Verification
Reports on key environmental, social, and governance performance indicators	6	To be able to track outputs and outcomes Transparency to their customers and public is a key item in any ecolabel	1	Hard and costly to monitor. No unnecessary expenses.	DENR ECC Reports Transparent reporting of ESG performance on the web page could be a requirement Can start by defining this as a motivator factor (i.e., giving recognition for companies who are applying this) rather than requirement factor and allow for wider scope of engagement and type of engagement and meeting of requirements at different levels of engagement
Improves quality of life of local communities	5	Additional benefits for the locals	1	Their first community are their employees.	Can start by defining this as a motivator factor (i.e., giving recognition for companies who are applying this) rather than requirement factor and allow for wider scope of engagement and type of engagement and meeting of requirements at different levels of engagement
Manufactured in the Philippines	5	Protect local manufacturing Only apply to products that the Philippines has shown competitiveness and supply capability	3	Not necessary. Might choke innovation. This is not necessarily a factor affecting sustainability.	Reference to list of manufacturers in the Philippines Company declaration
Company is majority-owned by a Filipino	5	Current law to benefit Filipino business sector There are corporations owned by mixed nationals but we can choose companies with Filipino as major owners/stockholders	4	Not necessary. Why limit ownership? Foreign input is needed to improve. This is not a factor affecting sustainability.	Thru legal documents Reference to list of companies that are majority-owned by Filipinos DTI or SEC Certificate
Initiates CSR programs	3	Additional benefits for the locals	2	Not all companies can afford this.	Implementation of CSR programs that are linked to sustainability programs of collection and recycling
Input materials are also sourced locally	3	To maximize the utilization of local inputs/input materials	5	Not necessarily a factor of sustainability. Might choke innovation. The Philippines does not manufacture the majority of the raw materials.	Reference to list of input materials and its sources production centers

Other possible sustainability requirements:

- Have a Sustainability Office or Officer in the management or executive team. Define the scope of work of the sustainability officer in their corporate by-laws, which includes oversight over all areas of operation. Define sustainability key performance indicators and monitoring systems for tracking by management team, include in annual reports.
- Sustainability assessment on all products and local operations to create a baseline.

Table 5.12 Validation of sustainability requirements for bio-based packaging

Requirements	Y	Reason	N	Reason	Verification
Made from 100% biodegradable material and recoverable through composting and biodegradation (see 5.3.1)	6	For environmental protection and conservation If it is possible, restrict to only biodegradable ones	2	No supply, too expensive, cannot meet the properties required for packaging. Cannot be mixed with recyclables. Should be carefully considered the viability as biodegradability may not necessarily solve waste management/ litter issues and a premature deployment of such requirements may have a counter effect on overall carbon footprint of the packaging life cycle.	List of sources and type of materials used
Transparent and fair-trading practices with farmers and suppliers of biological feedstock	5	To ensure that the farmers (not the middle-men) are the ones who benefit from fair-trading	1		Compliance to fair trade Fair trade certification
Does not use genetically modified raw material	5	May be harmful Genetically modified raw materials may have long-term effects to health	2	Not be aware of the total impact of GMOs on sustainability, do not see how the root material's being genetically modified would impact the packaging material's viability. Also, genetic modification may be a way to get to better packaging material. It would depend on the context that the material will be used.	List of raw materials used
Sourced from sustainable land use farms	5	Can start by defining this as a motivator factor and gradually mandate this in line with UN SDGs, and when sourcing biobased polymers, it should not create another problem	2	Will affect cost and will choke product development and scaling	Third party certification (ex. Bonsucro)
Sourced from farms that use GAP and GHP	5	Quality sources To start as a motivator	2	Will affect cost and will choke product development and scaling	Third party certification (ex. Bonsucro)
Does not compete with food production	4		2		
Has a chain of custody for the origin of the biological materials	4	Proper tracking of materials To start as a motivator	2	Will affect cost and will choke product development and scaling.	Chain of custody documents Third party certification
100% made from renewable biological (bio-based) polymers	3	Would prefer to say 100% biodegradable materials (which may not be polymers)	3	Might choke material combinations that would mainstream use and not affect the total biodegradability of the product.	If it is not possible to have 100% renewable material, we can have a range of labels based on percentage of bio-based content

Requirements	Y	Reason	N	Reason	Verification
				No supply, too expensive, cannot meet the properties required for packaging. Need to consider the total life cycle and also in terms of food safety, economy of scale etc. Increased use of renewables can be encouraged with setting of realistic requirements on scope, level (%) and timeline.	
Sourced mainly from agricultural wastes or by-products of food production	3		3	Chokes possibilities and material innovations. Commercial availability might not be viable. Need to check for implementation feasibility	
Made from a single type of bio-based polymer	2		4	Chokes possibilities and material innovations Technological advancement may allow production from more than one type of bio-based polymer The world and especially the Philippines is not yet ready. A single type of polymer cannot meet the properties required currently. Let us wait for film manufacturers to develop newer packaging materials before we push for this. It would depend on the purpose of the items. Some materials have layers which perform distinct functions to fulfill particular objectives.	

Does it make sense for the packaging made from 100% renewable materials?

- 100% biodegradable with grades on how much of it comes from bio-based polymers. But secondary, as long as the whole packaging is biodegradable.
- This cannot be done. There are no available materials that will provide the proper properties of packaging materials yet. The world is trying to develop it, once it is commercially available, that is the time Philippine laws can be made. Right now, it is too early. There is nothing we can use.
- More practical and realistic to just require the use of a range of labels based on bio-based content.
- It would not make sense to make packaging 100% renewable because of other factors that should be accounted for: (1) Supply and demand impact to renewable base material vis-à-vis other renewable materials; (2) Biodiversity and communities should not be affected; (3) Material validation where it should fulfill intended functionality that contributes to the overall end product (product composition, food safety, shelf life); (4) Assurance that the

carbon footprint generated for this shift should be better, as a drastic implementation may lead to adverse results instead of intended ones.

Do we include all types of biopolymers or restrict to just the biodegradable ones?

- Biodegradable only, what is the point of going bio-based if not biodegradable? (3 comments)
- Recycling and repurposing of plastic waste is the correct direction.
- Bio-based polymers should not be restricted to only biodegradable as recycling is another viable solution for its end of life. Biodegradable materials need particular conditions to fulfill the entire process, which may need additional infrastructure, as opposed to bio-based being integrated in existing recycling facilities in the country.

Table 5.13 Validation of sustainability requirements for petroleum-based packaging

Requirements	Y	Reason	N	Reason	Verification
Manufacturer has materials recovery facility / program	6	For easy materials recovery To ensure residual value of the manufactured packaging materials			
Manufacturer engages the formal and informal SWM sector for recovery	6	To engage all available stakeholders for SWM			List of formal and informal partners for SWM
Identification of the type of petroleum-based resin used to create the packaging	5				
100% recyclable if not biodegradable or compostable	5				
Uses a single type of petroleum-based polymer	5		1	Multiple polymers are okay as long as they are easily separated.	
NELP-GCP-2003004 for polyethylene & polypropylene packaging materials	4				
Hold DOST-ITDI ETV 013 Certification if biodegradable additive is used	4	Compliance to existing standards	1	Would rather have no biodegradable additive used at all. If petroleum-based packaging is even still being allowed, it should then be 100% viable for recycling.	
Follow PNS 2097:2014 for plastic shopping bags	4	Compliance to existing standards			Certification that it follows standards
Follow PNS 2104:2014 for plastics that degrade in the environment by a combination of oxidation and biodegradation	4	Compliance to existing standards	1		Certification that it follows standards
Follow PNS 2102:2013 for compostable plastic	4	Compliance to existing standards		Petroleum-based cannot be compostable or biodegrade so there would still be microplastic pollutants	Certification that it follows standards
Pass ASTM Tests for aerobic biodegradation or compostability	4		1	Petroleum-based cannot be compostable or biodegrade so there would still be microplastic pollutants	Certification that it follows standards

Requirements	Y	Reason	N	Reason	Verification
Disintegrates after 12 weeks for compostability and completely biodegrades after six months based on EN 13432 or Percentage biodegradation of the product material should be greater than 60% in 24 months based on HKGLS	4		1		
Percentage of recycled petroleum plastic content if the packaging is not food-grade	4		1	Seems unnecessary, but the companies should want to do it to show they are trying to be more sustainable.	
Manufacturer has a buy-back program	4		1	Could choke other schemes	

Are ASTM tests for aerobic biodegradation and/or compostability available here in the Philippines?

- Yes, SGS Philippines and DTI-BPS have adopted and approved as PNS the standards of the ASTM International on test methods for plastic film which will serve as reference test methods for evaluating the performance of plastic bags for disposing of biohazardous medical waste.

Is it practical for a packaging to be made up of a single type of petroleum-based polymers or would multiple polymers be okay if they are easily separated?

- No such thing as "easily separated". Any additional required step to make a material viable input for recycling would still add cost, and would deter its use in recycling.
- Okay if they are identifiable and can be separated.

Table 5.14 Validation of sustainability requirements for pulp and paper packaging

Requirements	Y	Reason	N	Reason	Verification
Follow PNS guidelines depending on the type of pulp and paper product	5	Should follow existing standards To ensure that standard type of pulp and paper product is used			Check the materials used
Certification if virgin pulp is sourced from sustainably managed forests abroad	5	For quality Assurance that using the material is consistent in fulfilling other UN SDGs			Certificate (e.g., FSC)
Traceability of origin / chain of custody if virgin pulp sourced locally	5	Traceability is important			
Sourced from forests that practices agroforestry to provide economic benefits to local communities	5	Benefits for the locals			
Sourced from forests that engages upland indigenous communities in sustainable forest management	5	Benefits for the locals			
Minimal use of fresh water with majority of the water reused or recycled throughout the production process	4	Efficient use of water Conservation of freshwater	1	This can be promoted as a best practice, but should not necessarily be a requirement.	
100% recyclable via the waste paper recycling cycle	4	Simple recycling method	1	Materials should not be necessarily limited to	

Requirements	Y	Reason	N	Reason	Verification
				particular streams, as long as the materials get recycled. It would be acceptable should the material flow into another stream due to better value creation.	
Recycled paper must be sourced locally	4	To encourage more recycling businesses in the Philippines and contribute to reusing/recycling paper wastes	2	Not necessary. International certification bodies such as FSC are able to provide a robust validation system that assures us that the forest products are managed responsibly.	List of sources of recycled paper
Ratio of recycled fiber to virgin pulp	3		1	Recycled fiber and virgin pulp have different characteristics, and these would be important depending on the materials used. For particular functionalities such as an importance of rigidity, there would be instances where using recycled pulp would entail more resources used vs virgin because of the difference of their structure.	
No chlorine or halogenated bleaching agents used	3	Water security	1	This may not be necessarily a factor for sustainability.	

Other possible sustainability requirements:

- There must be a recognition of other multi-layer paper-based packaging, their recyclability, and the existing recycling solutions already available in the country and considering the total life cycle impact (or LCA), paper-based packaging often out-performs other non-renewable or fossil-based packaging.

Table 5.15 Validation of sustainability requirements for biodegradable and compostable packaging

Requirements	Y	Reason	N	Reason	Verification
Packaging should be tested for biodegradability under real conditions	5	Actual test shall be done to ensure biodegradability			Testing results Indicate period of actual biodegradability
If made from plastic, packaging should follow: PNS 2104:2011 - Standard specification for plastics that degrade in the environment by a combination of oxidation and biodegradation PNS 2102:2013 -Specifications for compostable plastic	5	Should follow existing standards To follow standards specified for plastics			Compliance with standards
Appropriately labelled for segregation and collection at source in the event	5	Waste segregation for easy identification			Indicated on the label/ markings of label

packaging is not biodegraded or composted at home					
Packaging should be compostable under home composting conditions and achieve 90% degradation in 12 months at ambient temperature based on TUV Austria Belgium and French NF T 51-800 standards	4	Should be compostable			
Hold DOST-ITDI ETV 013 Certification if biodegradable additive is used to make oxo-biodegradable plastic packaging	4	For quality and safety			

Other possible sustainability requirements:

- Existing biodegradable or compostable packaging must ensure protection of existing biodiversity and communities, while having a validation system in place to ensure responsibility. Implementation feasibility and economies of scale, where supply is able to meet demand at the right price for market accessibility.
- Biodegradability should not be a requirement for all packaging as it is not a catch all solution for waste management and resource management. There needs to be existing infrastructure and waste streams to support this. Furthermore, there needs to be awareness among the different stakeholders to ensure that these are recovered successfully. Otherwise, this may set a false notion among the general public that as long as it is biodegradable, it can be thrown anywhere since it will go away on its own, and therefore exacerbate the littering problem. Recyclability must also be another option for waste management.

Table 5.16 Validation of sustainability requirements for packaging made with recycled content

Requirements	Y	Reason	N	Reason	Verification
Absence of any contaminants from the use of recycled content	5	There should be no contaminants			
100% recyclable	4	Should be recyclable			
Follows PNS ISO 18604:2016 on material recycling for packaging and distribution of goods	4	Compliance to existing standards	1	Subject to the time when such option is validated, commercial feasibility of supply chain	
Follows PNS ISO 18605:2016 on energy recovery for packaging and distribution of goods	4	Compliance to existing standards	1	Subject to the time when such option is validated, commercial feasibility of supply chain	
Percentage recycled material	4		1	Subject to the time when such option is validated, commercial feasibility of supply chain	
Traceability of origin for the recycled content	4	Traceability is important	1	This would not be a clear factor to drive sustainability and may be challenging to prove the origins of all recyclable content	
Can only be used for non-food packaging	4	For safety purposes and to avoid contaminants on processed food	1		Manufacturer declaration
Inclusion of both formal and informal waste management sector in the recycling plan	3		1	Not requirement but best practice	
Packaging manufacturer works with LGUs and local recyclers as part of the EPR program	3	To ensure compliance of the EPR program	1	Not requirement but best practice	

Do we set a minimum for recycled content percentage or do we accept the manufacturer's declaration of percentage of recycled content?

- Set acceptable minimum standards for recycled content percentage.
- There should be acceptance of the manufacturer's declaration of recycled percentage as long as this is validated by third party organizations. Minimum recycled content should not be enforced before full validation and feasibility is done, so as to avoid creating new challenges in the source of this shift. Example would be food packaging – enforcing recycled content prior certainty of its feasibility may result in food safety issues.

Table 5.17 Validation of sustainability requirements for recyclable packaging with EPR

Requirements	Y	Reason	N	Reason	Verification
Manufacturer has a collection and recycling plan	5	For easy collection and recycling			
Packaging states type/s of materials used	4	To know what type was used	1	Unsure how the label will be presented on packaging. Currently, there are existing packaging specifications in a document that is available to [company's] partners. Brand owners are to be transparent on this.	Identification of the materials used
Does not use incompatible materials that are known to impede separation or reprocessing or to reduce the quality of recyclate	4	For easy recycling	1	Unsure on the parameters as it is hard to quantify this as it is. Also, unsure of the specific standards to enforce this.	
Follows the appropriate PNS guidelines	4	Follows standards To ensure compliance with standards of recycling	1	Should also be accepting of the equivalent / comparable European standards available.	Check implementation of PNS ISO
Manufacturer has an EPR scheme including return and take-back programs	4	To ensure proper waste management/	1	Should not be a requirement because heavily dependent on the readiness of the recycling infrastructure in the country Immediate implementation may be potentially onerous to the consumers, especially those affecting essential goods which is a complex system to administer Can be encouraged as a best practice and to start on voluntary basis	
Inclusion of both formal and informal waste management sector in the recycling plan	4	For proper waste disposal	1	Focus should be overall recycling and not necessarily a particular sector	
Packaging manufacturer works with LGUs and local recyclers as part of the EPR program	4		1	EPR system should be multi material involving all stakeholders to ensure level playing field and eliminate free-riders Brand owners should be the main stakeholder – drive to EPR because they make the decision of packaging choice	

Requirements	Y	Reason	N	Reason	Verification
				and full visibility of what goes into the market Packaging manufacturers are one step behind the value chain	
100% recyclable	4	To minimize waste. Should be recyclable. On the basis of technical recyclability, there is known technology to properly recycle this into another product that is useful	1	Up to 90%	Refer to material composition of recycled packaging
Materials can be separated without the use of special tools if packaging uses multiple material types	3			Unsure how "special tools" are defined. If there are solutions in the market for separation as a step prior to recycling and if it can be separated as part of the recycling process, then it should be acceptable	
Made from a single material (monomaterial)			3	Dependent on the objective of the packaging and product. There are some packaging that has multiple material serving a particular purpose for the objective of food safety	

Other possible sustainability requirements:

- The labels in the packaging must be easily identifiable. The packaging must be designed in a way that it cannot be improperly disposed of easily. For example, a snap-on closure or connect the cap technology that attaches the cap to the bottle. In this way, companies can easily collect the cap and individuals cannot just mindlessly dispose of the cap.

Is it practical to require 100% recyclable or do we accept a declaration of the percentage recyclable?

- Accept a declaration of the percentage recyclable that qualified as acceptable based on available standards.
- No, it is not practical to require 100% today until a time that all factors are proven ready and feasible to meet the demands of the industry while ensuring food safety and protection to take into account the interest of the consumers.

Table 5.18 Proposed sustainability requirements for reusable packaging and long-lasting alternatives

Requirements	Y	Reason	N	Reason	Verification
Follows the Sustainability Requirements for packaging depending on material composition (see 5.2)	6	Should follow existing standards for material composition of packaging			Check implementation of specific policy/criteria
Provide guidelines on the minimum number of times packaging should be reused to have a lower environmental impact over a competing alternative	6	To minimize health hazards To clearly define the maximum number of times of reusing the packaging			Indicated in the packaging material
Provides guidelines on the maximum number of times packaging can be safely be reused	6	To minimize health hazards For the consumers To ensure safety and sanitation			Indicated in the packaging material Check existing guidelines and implementation of care, cleaning, disinfection, and

Requirements	Y	Reason	N	Reason	Verification
					safe storage of packaging
Follows PNS ISO 18603:2016 Packaging and the environment – Reuse for packaging to be classified as reusable	5	Should follow existing standards			
Follows PNS ASTM D 6198:2009 - standard guide for transport packaging design if the packaging is intended for this purpose	4	Should follow existing standards			
Follows PNS 1030-1:1988 for reusable glassware and ceramic ware in contact with food	4	Should follow existing standards			
Reusable packaging must be 100% recyclable after number of times for reuse has been maximized	4	Environmentally friendly			
Consumer good producer provides a returnable packaging scheme (e.g., deposits)	4	For the consumers To foster cooperation and rewards system for consumers and manufacturer			
Provides guidelines on the care, cleaning, disinfection, and safe storage of packaging	3	For the consumers			
Consumer goods producer has a refilling model to complement the reusable packaging	3	For the consumers			

Other possible sustainability requirements:

- Not having a net benefit for recycling value chain and net carbon benefit based LCAs. Without a robust system and infrastructure to fully support, reusable/refillable packaging may not generate net benefit in the total life cycle carbon footprint perspective.

Table 5.19 Top three packaging categories that would be the best options for initial ecolabelling

No.	First Choice	Second Choice	Third Choice	Reason for Selection
1	Bio-based packaging	Biodegradable and compostable packaging	Reusable packaging and long-lasting alternatives	To minimize waste and pollution in the environment
2	Bio-based packaging	Biodegradable and compostable packaging	Packaging made with recycled content	Feasible, doable, and more budget friendly for the manufacturer
3	Bio-based packaging	Pulp and paper packaging	Packaging made with recycled content	
4	Bio-based packaging	Biodegradable and compostable packaging	Reusable packaging and long-lasting alternatives	Excellent way for a company to reduce its carbon footprint, reduce the trash that ends up in landfills and the world's oceans, and reduce cost in processing
5	Bio-based packaging	Biodegradable and compostable packaging	Reusable packaging and long-lasting alternatives	Bio-based plastics can help reduce reliance on fossil fuels, support sustainability in the industry and allow manufacturers to diversify feedstocks. Compostable and biodegradable plastics are both materials that can break down over time in a specific environment so they would reduce the "accumulation" of plastic waste. Sustainable packaging communicates that the brand is acting responsibly and environmentally-friendly. And this kind of packaging builds customer trust. So much plastic is being thrown away every day that reusable alternatives are needed to be considered.

No.	First Choice	Second Choice	Third Choice	Reason for Selection
				Moreover, not only governments and companies but also individuals are thinking of ways to reduce the need for single-use plastics. It might encourage the consumers more if categories are easily identifiable in the packaging.
6	Pulp and paper packaging	Renewable (bio based) OR recyclable content in packaging	Carbon reduction/ carbon neutral packaging	LCA as this gives us a complete understanding on the factors that drive sustainable packaging. Carbon footprint is the most critical component in defining sustainability. The factors must be in line with yielding a lower carbon footprint. For recyclable content, better make sure that the benefits are there as premature requirements for this may lead to adverse/ larger impact.

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

6.1 Final list of sustainability requirements for each sub-category of packaging product in focus, and possible means of verification to be retained based on the opportunity and feasibility

In lieu of the workshop, a questionnaire was sent out to the different stakeholders of the market readiness study to validate the sustainability requirements and means of verification for the different types of sustainable packaging. This final list of sustainability requirements is based on the tally of responses received from these stakeholders, as detailed in Chapter 5.4. The selected requirements are those that majority of the respondents find acceptable and have few to no objections. Sustainability requirements that have more votes for exclusion have been eliminated from the final list. The different means of verification are classified to be short-term (implementable in less than a year), medium-term (implementable within 2-3 years) or long-term (implementable within 4-5 years). These inputs were presented to the Technical Committee for Sustainable Packaging on 13 October 2021 for final verification.

Table 6.1 Final list of general environmental requirements for packaging

REQUIREMENT	RANK	MEANS OF VERIFICATION		
Environmental		**Short-Term**	**Medium-Term**	**Long-Term**
No toxic substances	1	All ingredients must be specified and listed	Compliance to Current Good Manufacturing Practices	Documentation including MSDS Certificate of Analysis
No carcinogenic substances	1	Disclosure of all substances present in packaging materials	Compliance to Current Good Manufacturing Practices	Documentation including MSDS Certificate of Analysis
Follows PNS guidelines for inks, dyes, pigments, and other colorants used for packaging design and printing	1	Supplier self-declared certification	Compliance to Current Good Manufacturing Practices. Tested by PAB accredited laboratories for chemical testing	Documentation including MSDS Certificate of Analysis
Manufacturer has a SWM plan	1	Submission of hygiene and sanitation report	Waste management plan manual. Periodical report on the implementation of SWM plan	
Manufacturer has an environmental management system	1		Environmental management plan with monitoring and audits to ensure that it is followed	
Manufacturer practices pollution control and should comply with DENR standards for emissions and effluents	2	Verified by DENR Standards checklist		
No BPA in petroleum-based plastics	2	All ingredients must be specified and listed	Compliance to Current Good Manufacturing Practices	Documentation including MSDS Certificate of Analysis
No PVC or chlorinated plastics	2	All ingredients must be specified and listed	Compliance to Current Good Manufacturing Practices	Documentation including MSDS Certificate of Analysis
Heavy metal concentration should not exceed known standards	2	All ingredients must be specified and listed	Compliance to Current Good Manufacturing Practices. Tested by PAB accredited laboratories for chemical testing	Documentation including MSDS Certificate of Analysis
Follows FDA, HACCP, and/or Halal Act standards if used for primary food packaging	2	Refer to FDA CGMP Manual, HACCP manual / documents	Partner with FDA, DOST, and other agencies for certification	

REQUIREMENT	RANK	MEANS OF VERIFICATION		
Follows environmental laws during transportation	2	Monitor if the manufacturer implements pooling of resources, scheduling in acquiring raw materials and in transporting of packaging materials		
Packaging contains end-of-life instructions to guide consumers on proper disposal	3	Must be visible in the packaging sample	Allow for compliance by making information available off-label to cater to small size packaging	
Resin is identified and stated.	3	All ingredients must be specified and listed	Certification issued by corresponding government agencies such as DFA or DOST	International certification since the majority of resin manufacturers are global companies who follow global standards
Measurement of energy and water use during the manufacturing process (added by the Technical Committee)	-	Reporting on the source of the resources (e.g., renewable)	Monitoring of energy and water use per production volume based on utilities bills	LCA with energy and water audits

Table 6.2 Final list of general socio-economic requirements for packaging

REQUIREMENT	RANK	MEANS OF VERIFICATION		
Socio-Economic		**Short-Term**	**Medium-Term**	**Long-Term**
Pays the right taxes and other tariffs	1	Submission of copy of ITR, BIR or LGU tax certificates		
Generates local employment	1	Personnel records List of employees and from what province in the Philippines		
Maintains a healthy and safe workplace	1	Building safety compliance	Manual for health and safety protocols	
Follows labor regulations	2	Company policies and manuals	Occupational health and safety monitoring and audit	
Pays fair salaries and provides benefits to employees	2	Monitoring on compliance to labor laws		
No forced or child labor	2	No child labor policy DSWD certification		
Gender-responsive, diverse, and inclusive workplace	2	Gender inclusion policy		
Consumer education programs on responsible consumption, proper usage, and disposal of packaging	3	Portfolio of programs		
Paying fair price for input / raw materials (no undercutting of prices)	4	Self-declaration	Demonstration through any recognized local certification system	Demonstration through an international certification
Reports on key environmental, social, and governance performance indicators	5	DENR ECC Reports	Transparent reporting of ESG performance on the web page and annual reports	

Table 6.3 Final list of sustainability requirements for bio-based packaging

REQUIREMENT	RANK	MEANS OF VERIFICATION		
		Short-Term	**Medium-Term**	**Long-Term**
Percentage of biodegradable material and recoverable through composting and biodegradation	1	Self-declaration of percentage List of sources and type of materials used	Range of labels based on bio-based content.	Certification that it is 100% biodegradable (transition from bio-based to biodegradable)

REQUIREMENT	RANK	MEANS OF VERIFICATION		
		Short-Term	Medium-Term	Long-Term
Transparent and fair-trading practices with farmers and suppliers of biological feedstock	2	Self-declaration of compliance to fair trade principles		Fair trade certification.
Does not use genetically modified raw material	3	List of raw materials used		
Sourced from sustainable land use farms	3			Third party certification (ex. Bonsucro)
Sourced from farms that use GAP and good handling practices GHP	3		Certification of GAP or Certificate of GHP	International third-party certification (ex. Bonsucro)
Does not compete with food production	4	Self-declaration from supplier of biological material		
Has a chain of custody for the origin of the biological materials	4		Chain of custody documents	Third party certification

Table 6.4 Final list of sustainability requirements for petroleum-based packaging

REQUIREMENT	RANK	MEANS OF VERIFICATION		
		Short-Term	Medium-Term	Long-Term
Manufacturer has materials recovery facility / program	1	Self-declaration	Inspection of facility	
Manufacturer engages the formal and informal SWM sector for recovery	1	List of formal and informal partners for SWM		
Identification of the type of petroleum-based resin used to create the packaging	2	Self-declaration	Documentation from suppliers of the resin	Documentation from laboratory testing
100% recyclable if not biodegradable or compostable	2	Self-declaration		Certification of relevant test results
Uses a single type of petroleum-based polymer	3	Self-declaration		Certification of relevant test results
NELP-GCP-2003004 for polyethylene & polypropylene packaging materials	4			Green Choice ecolabel
Follow PNS 2097:2014 for plastic shopping bags	4		Certification that it follows standards	
Follow PNS 2102:2013 for compostable plastic	4		Certification that it follows standards	
Hold DOST-ITDI ETV 013 Certification if biodegradable additive is used	5	Submission of certification from additive supplier		
Follow PNS 2104:2014 for plastics that degrade in the environment by a combination of oxidation and biodegradation	5		Certification that it follows standards	
Pass ASTM Tests for aerobic biodegradation or compostability	5		Submission of ASTM test results	
Disintegrates after 12 weeks for compostability and completely biodegrades after six months based on EN 13432 or Percentage biodegradation of the product material should be greater than 60% in 24 months based on HKGLS	5			Certification of relevant test results
Percentage of recycled petroleum plastic content if the packaging is not food-grade	5	Self-declaration	Range of labels based on recycled plastic content	Certification of percentage recycled plastic content
Manufacturer has a buy-back program	5	Announcement that company will implement a buy-back program	Documentation on the buy-back program	Audit of the buy-back program

Table 6.5 Final list of sustainability requirements for pulp and paper packaging

REQUIREMENT	RANK	MEANS OF VERIFICATION		
		Short-Term	Medium-Term	Long-Term
Follow PNS guidelines depending on the type of pulp and paper product.	1	Self-declaration		
Certification if virgin pulp is sourced from sustainably managed forests abroad	1		Certification of origin	
Traceability of origin / chain of custody if virgin pulp is sourced locally	1	Product description Disclosure by suppliers	Chain of custody documents Certification of GAP	
Sourced from forests that practices agroforestry to provide economic benefits to local communities.	1	Product description Disclosure by suppliers	Site visit Certification of GAP	
Sourced from forests that engages upland indigenous communities in sustainable forest management	1	Product description Disclosure by suppliers	Site visit Certification of GAP	
Minimal use of fresh water with majority of the water reused or recycled throughout the production process.	2		Transparent reporting of ESG performance on the web page and annual reports	LCA
100% recyclable via the waste paper recycling cycle	2	Self-declaration	Transparent reporting of ESG performance on the web page and annual reports	LCA
Recycled paper must be sourced locally	3	List of sources of recycled paper		
Ratio of recycled fiber to virgin pulp	4	Self-declaration	Range of labels based on recycled fiber content	Certification of percentage oof recycled fiber
No chlorine or halogenated bleaching agents used	4	All ingredients must be specified and listed	Compliance to Current Good Manufacturing Practices	Documentation including MSDS Certificate of Analysis

Table 6.6 Validation of sustainability requirements for biodegradable and compostable packaging

REQUIREMENT	RANK	MEANS OF VERIFICATION		
		Short-Term	Medium-Term	Long-Term
Packaging should be tested for biodegradability under real conditions	1	Self-declaration of biodegradability	Submission of ASTM test results of actual biodegradability	
If made from plastic, packaging should follow: PNS 2104:2011 - Standard specification for plastics that degrade in the environment by a combination of oxidation and biodegradation PNS 2102:2013 -Specifications for compostable plastic	1		Assessment of compliance with standards	
Appropriately labelled for segregation and collection at source in the event packaging is not biodegraded or composted at home	1	Indicated at the label		
Packaging should be compostable under home composting conditions and achieve 90% degradation in 12 months at ambient temperature based on TUV Austria Belgium and French NF T 51-800 standards	2		Submission of test results	
Hold DOST-ITDI ETV 013 Certification if biodegradable additive is used to make oxo-biodegradable plastic packaging	2	Submission of certification from additive supplier		

Since compostable packaging is a subset of biodegradable packaging there can be a section on general sustainability requirements that applies to both types of packaging. An additional section can describe the requirements that are only specific to compostable packaging. Furthermore, it is still unclear if ASTM tests are available in the Philippines. According to one of the respondents of the questionnaire, it is available, but this has been refuted by the Technical Committee. While local laboratories offer ASTM testing, samples are usually sent abroad, depending on the test method required. Laboratories in the Philippines are currently not ready to conduct some of these tests in-country.

Table 6.7 Final list of sustainability requirements for packaging made with recycled content

REQUIREMENT	RANK	MEANS OF VERIFICATION		
		Short-Term	Medium-Term	Long-Term
Absence of any contaminants from the use of recycled content	1	Self-declaration on product specification	Results of sample test	
100% recyclable	2	Self-declaration and printed on the packaging		LCA
Follows PNS ISO 18604:2016 on material recycling for packaging and distribution of goods	3	Product specification	Assessment of compliance with standards	
Follows PNS ISO 18605:2016 on energy recovery for packaging and distribution of goods	3	Product specification	Assessment of compliance with standards	
Percentage recycled material	3	Self-declaration of percentage	Range of labels based on recycled content	
Traceability of origin for the recycled content	3	List of sources and type of materials used		
Can only be used for non-food packaging	3	Indicated in product specification		
Inclusion of both formal and informal waste management sector in the recycling plan	4	List of formal and informal partners for SWM		
Packaging manufacturer works with LGUs and local recyclers as part of the EPR program	4	Announcement that company will implement an EPR program	Documentation on the EPR program	Audit of the EPR program

Table 6.8 Final list of sustainability requirements for recyclable packaging with EPR

REQUIREMENT	RANK	MEANS OF VERIFICATION		
		Short-Term	Medium-Term	Long-Term
Manufacturer has a collection and recycling plan	1	Submission of a collection and recycling plan	Annual monitoring reports	
Packaging states type/s of materials used	2	Identification of the materials used		
Does not use incompatible materials that are known to impede separation or reprocessing or to reduce the quality of recyclate.	2	Self-declaration on product specifications		
Follows the appropriate PNS guidelines	2	Check implementation of PNS ISO standards		
Manufacturer has an EPR scheme including return and take-back programs	2	Announcement that company will implement an EPR program	Documentation on the EPR program	Audit of the EPR program
Inclusion of both formal and informal waste management sector in the recycling plan	2	List of formal and informal partners for SWM		
Packaging manufacturer works with LGUs and local recyclers as part of the EPR program	2	Announcement that company will implement an EPR program	Documentation on the EPR program	Audit of the EPR program
100% recyclable	2	Declaration of material	Assessment from a recycling facility	

REQUIREMENT	RANK	MEANS OF VERIFICATION		
		Short-Term	Medium-Term	Long-Term
		composition of recycled packaging		
Materials can be separated without the use of special tools if packaging uses multiple material types	3	Self-declaration on product specifications		

Table 6.9 Final list of sustainability requirements for reusable packaging and long-lasting alternatives

REQUIREMENT	RANK	MEANS OF VERIFICATION		
		Short-Term	Medium-Term	Long-Term
Follows the Sustainability requirements for packaging depending on material composition	1	Check implementation of specific policy/criteria		
Provide guidelines on the minimum number of times packaging should be reused to have a lower environmental impact over a competing alternative	1	Indicated in the packaging material		
Provides guidelines on the maximum number of times packaging can be safely be reused including reheating instructions (as amended by the Technical Committee)	1	Indicated in the packaging material		
Follows PNS ISO 18603:2016 Packaging and the environment – Reuse for packaging to be classified as reusable	2		Assessment of compliance with standards	
Follows PNS ASTM D 6198:2009 - standard guide for transport packaging design if the packaging is intended for this purpose	3		Assessment of compliance with standards	Results of ASTM testing
Follows PNS 1030-1:1988 for reusable glassware and ceramic ware in contact with food	3		Assessment of compliance with standards	
Reusable packaging must be 100% recyclable after number of times for reuse has been maximized	3	Declaration of material composition	Assessment from a recycling facility	
Consumer good producer provides a returnable packaging scheme (e.g., deposits)	3	Announcement that company will implement a returnable packaging scheme	Documentation on the return scheme	Audit of the return scheme
Provides guidelines on the care, cleaning, disinfection, and safe storage of packaging	4	Indicated in the packaging user material		
Consumer goods producer has a refilling model to complement the reusable packaging	4	Announcement that company will implement a refilling model	Guidelines and documentation on the return scheme	Audit of the return scheme

According to the Technical Committee, DOST-ITDI is preparing for a study about safety on using reusable plastic packaging in 2022 as part of their R&D plans.

Table 6.10 ranks the different packaging categories in terms of best options for initial eco-labelling. Respondents were asked to identify their top three choices of packaging categories with the most potential for ecolabelling. Categories were given a score of 3 points for every inclusion as the first choice, 2 points for second choice and 1 point for the third choice. The points were tallied and presented in Table 6.10.

Table 6.10 Ranking of packaging as best options for initial ecolabelling

Rank	Category	Score
1	Bio-based packaging	17 points
2	Biodegradable and compostable packaging	8 points
3	Pulp and paper packaging	5 points
4	Packaging made with recycled content	4 points
5	Re-usable packaging and long-lasting alternatives	3 points

Bio-based packaging emerged as the top choice by a wide margin for initial ecolabelling with respondents believing that renewable resources lessen reliance on fossil fuels. Biodegradable and compostable packaging

ranked second as it is considered a good way to reduce trash that ends up in landfills. Pulp and paper packaging, ranked third, is the most commercially available, making it feasible and doable.

6.2 Recommendations for sustainable strategy and sustainable action plans of the local retail sector

In order to implement actions towards the sustainable strategy direction, it has to be holistic, collaborative, in high-spirit, persistent and with firm commitment towards the shift to sustainable or alternative packaging materials. There must be an organizational development plan. It is a plan that would highly consider an organization as an open system. In an open system, there is interdependence and exchange and if ever there are changes, there could be acceptance or resistance to change. Resistance to change is the greatest challenge for this project due to many factors raised in this study. Therefore, the plan must have clear, compelling, consistent, and specific objectives to maintain the ongoing sustainability programs while creating systematic step by step process in achieving target results involving stakeholders in smaller scale while carefully reaching impactful outcomes.

6.2.1 Policy Regulators and Implementors

National Government – The concern on marine litter is not only in the national setting but global. Therefore, while the government has several laws and regulations on the environmental protection and sustainability, it can continually make more laws or policies. Even with debatable issues on the use of SUP, or on packaging materials, the nature of how laws are made are almost always in holistic approach and for the greater good. In the case of sustainable packaging or alternative packaging, the public policy would strengthen and uphold the cause within the Philippines. In preparation for implementation, there should be a phase-by-phase approach or certain number of years allowance for the transition period. Therefore, certain minimum classifications of packaging materials should be set for inclusivity so as not to hurt all business sectors. Conventional and alternative packaging should coexist but to a certain degree based on regulations that will be set by the government which is another area for study.

Government Agencies – The respective and relevant government agencies must be in a collective effort in the enforcement of public policies. The role of government agencies being in the forefront is crucial. Transparency in the protocols, processes, procedures, and in the controlling functions is highly recommended. This is to maintain the integrity and the commitment to adherence to policies and goals. When the citizens acknowledge this practice, the shift to sustainable or alternative packaging and other pro-environmental directives may easily be facilitated.

Local Government Unit – Awards and recognition on a per regional, community like sitio, purok could be a very good practice in order to promote sustainable community building where there is cooperation and understanding of the direction for the developmental causes. The LGU should be consistent in their advocacies, that is to continue and help promote their projects like Wala Usik and no-plastic bag policies (Bacolod and Iloilo). Incentives, and awards, on a per community basis can uplift the spirit of being environmentally conscious citizens. The recognition that would be given in a collaborative approach may inspire or encourage neighboring communities to do the same. These positive practices can help carry out adopting alternative packaging materials.

6.2.2 NGOs and Other Organizations For-A-Cause

Organizations which are into advocacies like protecting marine life would serve as a controlling mechanism in the aspect of the impact of the shift to sustainable or alternative packaging materials. Their monitoring activities can be the gauge of collective performance which can be an indicator of national or local sustainable development goal achievement. NGOs will serve as the link between the government and the people. They can help involve the citizens to watch over their own communities. In their respective advocacies, the communities they penetrated will be enticed to work in smaller steps and eventually encourage them to help carry out environmental causes. Majority of the citizens of the country are at the poverty level, (also considering the culture and other factors) NGOs and Other organizations for a cause can serve as catalysts for change. Communities in the grassroots level may be

encouraged in a patiently and persistent manner in the course of upholding or exhibiting environmental practices even if it will take years of promoting the good causes. How will this connect with the shift to alternative packaging materials? The mere habits and practices that will be shown by people in the poverty level is an indicator of collective change. Slowly putting habits into practice and practice into habits will promote environmental attitude and behavior.

6.2.3 Local Retail Sector

Strategic and Holistic Business Role Model Feature with organizational support for other sectors to follow. One of the best implementing actions is through leadership. As a driver for change, being able to spearhead in the switch to alternative packaging can create impressions towards other sectors. It is like creating a model towards patronizing sustainable types of packaging. In the promotion aspect, start with awareness and knowledge sharing through digital platforms in a certain period of time. This would help educate consumers in terms of salient features and advantages. A showcase of how alternative packaging is processed emphasizing on the sustainable advantages to address issues on unclear messages about alternative packaging. In the physical stores, create an ambiance. Activities could be involving publication materials or taglines or slogan type of ads in the conspicuous places of the mall. They can allot a particular space within the mall to emphasize sustainability packaging programs through display of products and the sustainable type of packaging materials.

6.2.4 Local Retailer (SM City Bacolod and SM City Iloilo)

SM has already been practicing CSR which already includes pro-environmental activities (trash to cash, MOB etc.). While most of the decision making is centralized, the malls can continue to work on the opportunity of the ongoing practices. Based on the survey conducted, the majority of the respondents were from 18-14 years old (43.6%). Based on interviews, it has been found that young customers show a positive attitude to SM Cares program/ activities compared to older customers. Thus, the younger generation can be prospects for alternative packaging. Since SM Cares is already an existing program, some items might be considered to promote more or to help improve the program:

- Rewards Programs to incentivize consumers for behavior change
    - SM Advantage points for alternative packaging purchase and reuse (next shopping)
    - Referral reward scheme can be rewarded with points (SM Advantage) or through the use of mobile application
- Membership programs or Associations – the customer may feel sense of belongingness and recognition as part of the program
- Information Drive upon entrance or in conspicuous places about the shift to sustainable options and provide section or area for packaging options visibility and availability
- Digital marketing communications (for consumer education) and show or demonstrate the effects of the shift towards sustainable options
- SM personnel as promoters (internally will be rewarded by SM as employer)
- Use of Mobile apps in the SM Care program to facilitate points and rewards linking it to SMAC
- SM may also redefine or redesign the SM Care program or the SM Advantage points system to highlight sustainable packaging options.

These suggested activities may be implemented in certain phases or stages of the promotional activities.

6.2.5 SM Tenants

As the SM tenants belong to the SM Community, their compliance to the (SM) internal organization's regulations is already a significant step in moving forward towards sustainable practices. They are encouraged to support and align their organization's day-to-day operations to SM's goals. Their constant practices and involvement within the mall's premises and even if they are under the directives/control of their respective head or main offices is already an impactful approach to their own or respective customers.

6.2.6 Suppliers/Producers of Alternative Packaging

The results of this study show the challenges on the different aspects in the conduct of business from supply chain, importation of raw materials, costing, to premium prices and maintaining or increasing the market of their packaging products. It is advantageous for those businesses in the large scale for they have their consistent business buyers but for those in the smaller scale, staying and surviving in the business is a major concern. Linkages and partnership contracts with businesses in the large scale (also into

alternative packaging) may be helpful not just by staying in the business but a possible opportunity for improving own products (meeting business partner expectations) and customer reach. Integrated marketing communications through digital advertising directed to the target audience by affiliating with appropriate social media organizations (who are also into environmental causes) can help increase the market or promote their products.

ANNEX A

LIST OF INTERVIEW PARTICIPANTS FROM GOVERNMENT REGULATORY AGENCIES

Board of Investments	
Mr. Rommell Madronio	Light Industry Division
Mr. Manuel Cruz	Chief Investment Specialist and Division Chief, Light Industry Division
Mel Pajarillo	Project Evaluations and Registration Division
Department of Environment and Natural Resources - EMB SWMD	
Ms. Juvy Serafin	Solid Waste Management Division
Ms. Bhona May Onate	Solid Waste Management Division
Ms. Derumol-Ofiaza Meyeth	Solid Waste Management Division
Ms. Majoe Cristobal	Solid Waste Management Division
Department of Environment and Natural Resources - EMB Region VI	
Ms. Josephine Gallo	Solid Waste Management Section
Ms. Era Maris Murillo	Environmental Information Unit
Department of Science and Technology - ITDI	
Engr. Rey Esguerra	Chief, Environmental and Biotechnology Division
Ms. Daisy Tanafranca	Chief, Packaging Technology Division
Department of Trade and Industry - Iloilo Province	
Ms. Mutya Eusores	OIC Division Chief, Industry Development Division
Mr. Kurt Tugaff	Consumer Protection Unit
Ms. Grace Benedicto	Consumer Protection Unit
Department of Trade and Industry - Negros Occidental	
Ms. Rachel Nufable	OIC Provincial Director, Negros Occidental
Mr. Engiemar Tupas	Senior Trade and Industry Development Specialist
Department of Trade and Industry - Regional Operations Group	
Mr. Jaworski Rifareal	Monitoring and Evaluation Division
Mr. Edwin Pasahol	Programme Development Head
Mr. Alfee Rey Galapon	Bureau of Small Medium Enterprises Division

ANNEX B

LIST OF INTERVIEW PARTICIPANTS FROM PACKAGING MANUFACTURERS AND SUPPLIERS

Packaging Suppliers	
Ms. Wendy Chua	Ecolutions PH
Ms. Nikki Sevilla	Econest
Mr. Prince Ang	Compostable Horizons Group
Mr. Robin Co	Happy Green Packaging
Mr. Robert Co	Happy Green Packaging
Mr. Pocholo Queing	Happy Green Packaging
Mr. Winston Co	Sigma Packaging

ANNEX C

LIST OF INTERVIEW PARTICIPANTS FROM LOCAL GOVERNMENT UNITS IN ILOILO CITY AND BACOLOD CITY

Local Government of Bacolod City	
Mr. Ramel Palalon	LGU Bacolod Department of Public Services of the Solid Waste Division
Ms. K'la Lopez	Representative, Office of Councillor Lopez
Mr. CL Lopez	City Councillor
Ms. Dianne Clama-an	Office of Councillor Lopez
Local Government of Iloilo City	
Mr. Ronald Cartagena	Executive Secretary for ENRO
Mr. Neil Ravena	Chief of Solid Waste Management and Sanitary Landfill

ANNEX D

LIST OF INTERVIEW PARTICIPANTS FROM SM SUPERMALLS

SM City Bacolod	
Ms. Julia Javellana	Assistant Mall Manager
Ms. May Castro	PR Manager
Mr. Van Sombito	Building Manager
Ms. Dominique Schulze	Leasing Manager
Ms. Ria (last name, unidentified)	Asst. Manager, SM Supermarket
Ms. Rose Mae Tacluyan	Fix Asset and Supply Manager
Mr. JM Palacios	SM Warehouse
SM City Bacolod Tenants	
Ms. Sheena Marie Cerbas	Mesa Filipino Moderne
SM City Iloilo	
Mr. Gilbert Domingo	Mall Manager
Mr. Darrel Defensor	Asst. Mall Manager
Mr. Jufel Sobusa	SM Supermarket
Mr. Troy Camarista	PR Manager
Mr. Andrew Alutaya	SM Department Store
Ms. Jonalyn Lim	Leasing Department
Mr. Nino Rey	Engineering Department
Ms. Racent Aducal Arcega	Marketing Department
Mr. Limuel Lajo	unidentified
Ms. Jonalyn Lim	unidentified
SM City Iloilo Tenants	
Mr. Gary Apachicha	Dairy Queen
Mr. Rey Taguman	Dunkin Donuts
Ms. Charrie Debuque	Store Manager, Surplus SM City Iloilo
Mr. Juan Paolo Perez	Store Manager, Mini Depato Corp (Miniso)
Ms. Reysyl Tababa	AM Mini Depato Corp

ANNEX E

LIST OF INTERVIEW PARTICIPANTS FROM BUSINESS GROUPS

Manufacturers	
Ms. Rebecca Tunongbanua	Manager, McNester Food PRoducts
Metro Bacolod Chamber of Commerce	
Mr. Frank Carbon	Chief Executive Officer
Mr. Willard Gallo	Board of Directors
Philippine Chamber of Commerce - Iloilo Chapter	
Ms. Luanne Lei Ramos	Board of Director
Ms. Ma. Rosalyn Mandero	Board of Director
Ms. Alma Tayo	Board of Director

ANNEX F

LIST OF INTERVIEW PARTICIPANTS FROM CIVIL SOCIETY ORGANIZATIONS

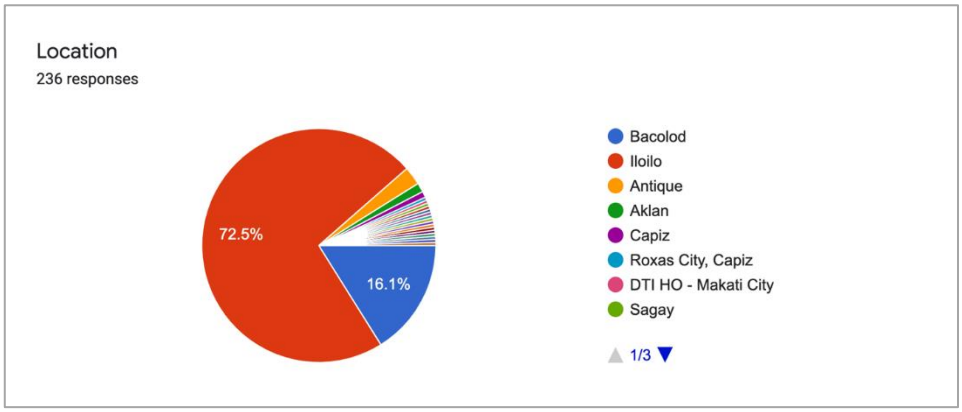
Central Philippine University	
Mr. Ron Adrian Dionaldo	Professor, Packaging Engineering Department
Nationwide Association of Consumers, Inc.	
Mr. Teddy Robillos	Member
Mr. Jose Pepito	Chairman
Ms. Hannah Sionny	Member
Association of Negros Producers	
Ms. Arlene Infante	President, Association of Negros Producers
Ms. Elsi Gonzaga	President, Association of Negros Food Producers
Philippine Plastics Industry Association, Inc.	
Mr. Danny Ngo	President
Plastic Flamingo	
Ms. Anne-Sophie van der Spek	Chief Product Officer
Marine Conservation Philippines	
Mr. Soren Knudsen	Program Manager

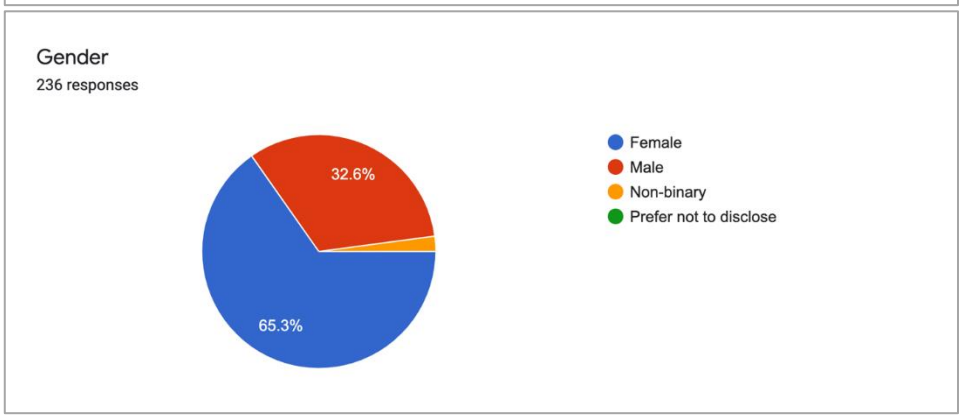
ANNEX G

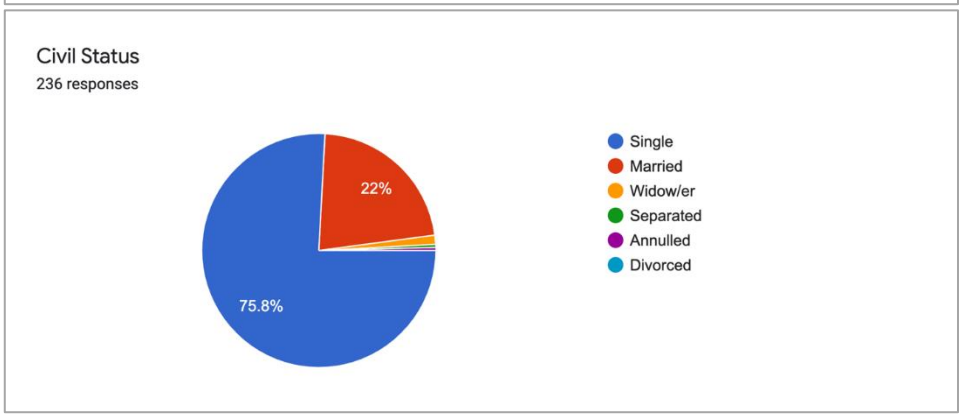
RESULTS OF THE CONSUMER SURVEY

n=236 RESPONSES

Part 1. Consumer Profile

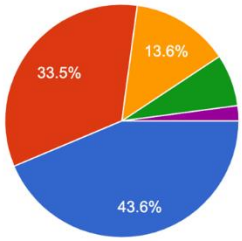






Age Range

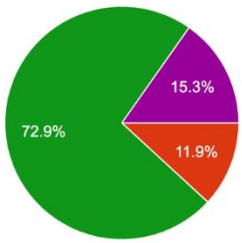
236 responses



- 18-24 years
- 25-34 years
- 35-44 years
- 45-54 years
- 55-64 years
- 65 years and above

Highest Educational Attainment

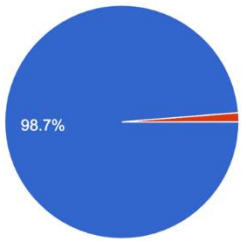
236 responses



- Elementary
- High School
- Vocational
- College
- Post-Graduate

Nationality

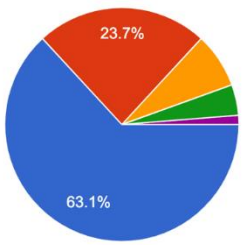
236 responses



- Filipino
- Non-Filipino

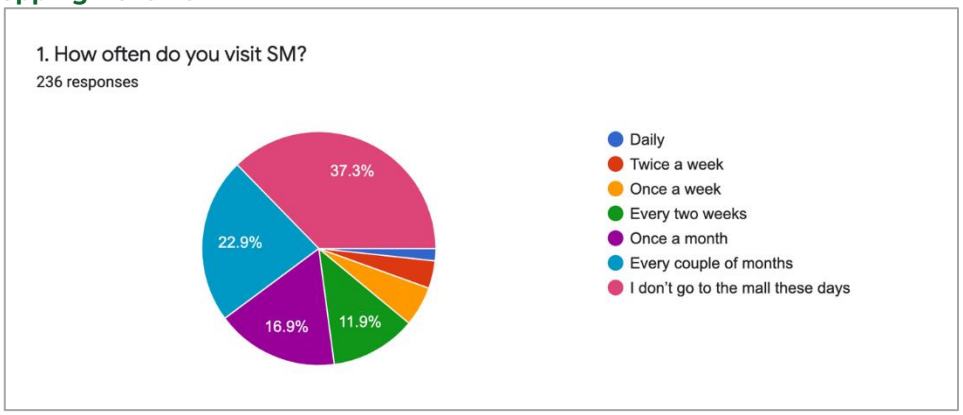
Gross Monthly Income

236 responses

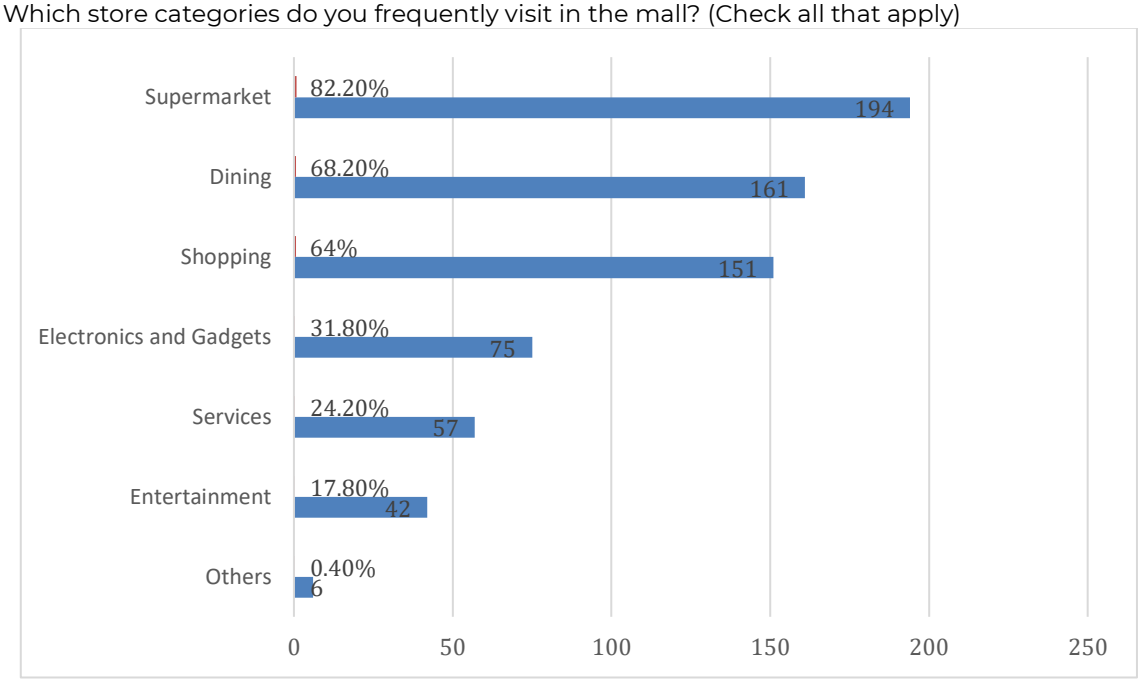


- Under 20,000 pesos
- 20,000-39,999 pesos
- 40,000-59,999 pesos
- 60,000-99,999 pesos
- 100,000-249,999 pesos
- 250,000 and over pesos

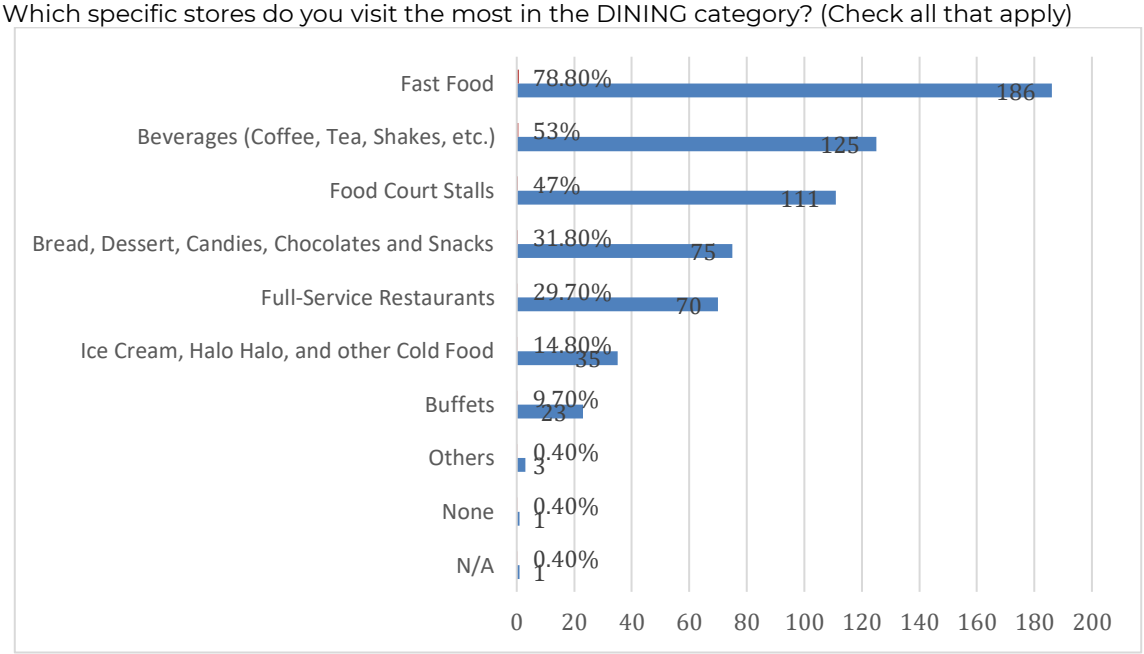
Part 2. Shopping Behavior



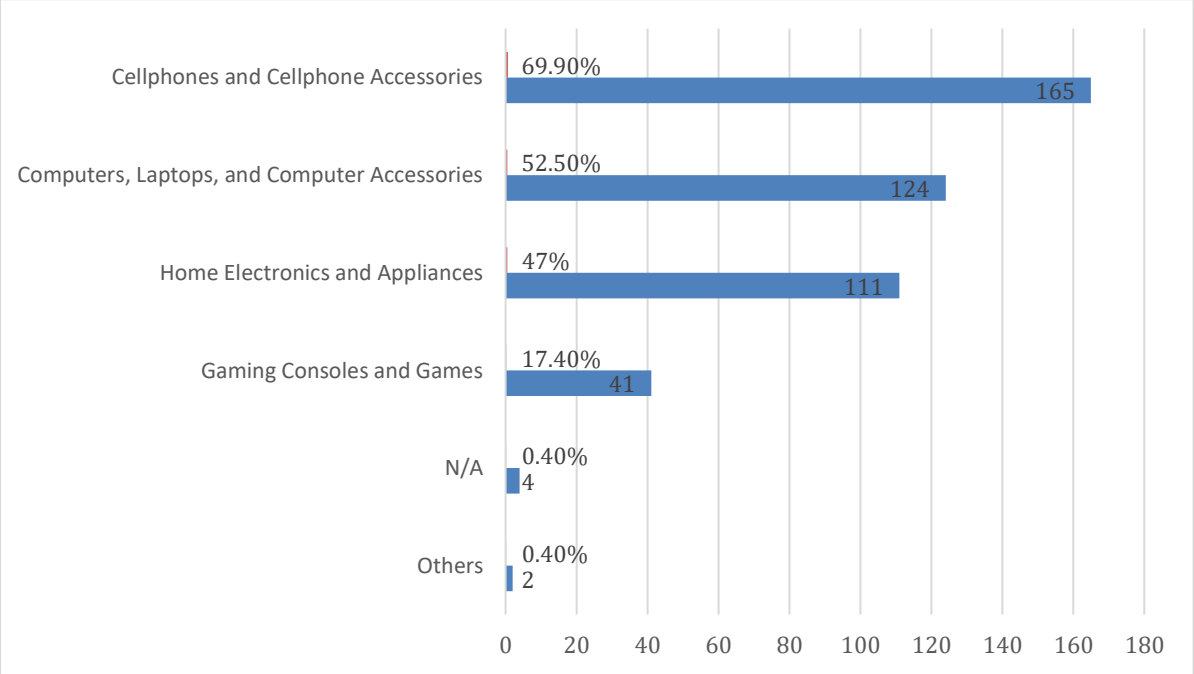
2. Which store categories do you frequently visit in the mall? (Check all that apply)



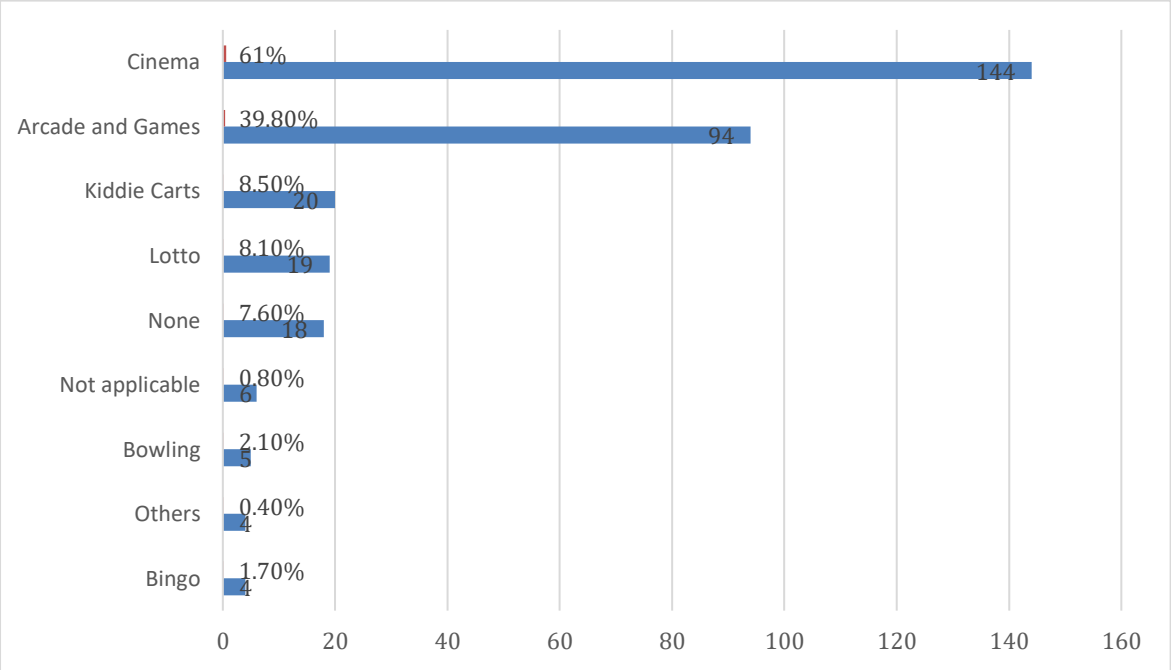
3. Which specific stores do you visit the most in the DINING category? (Check all that apply)



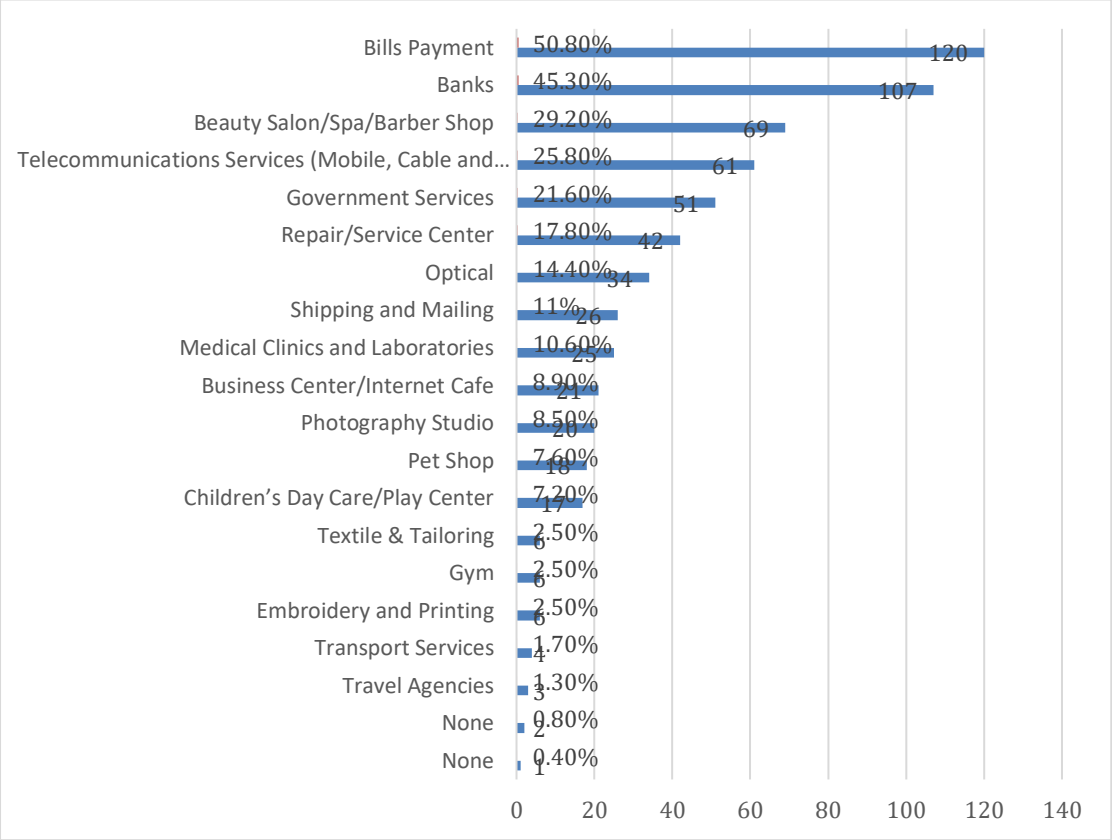
4. Which specific stores do you visit the most in the ELECTRONICS and GADGETS store category? (Check all that apply)



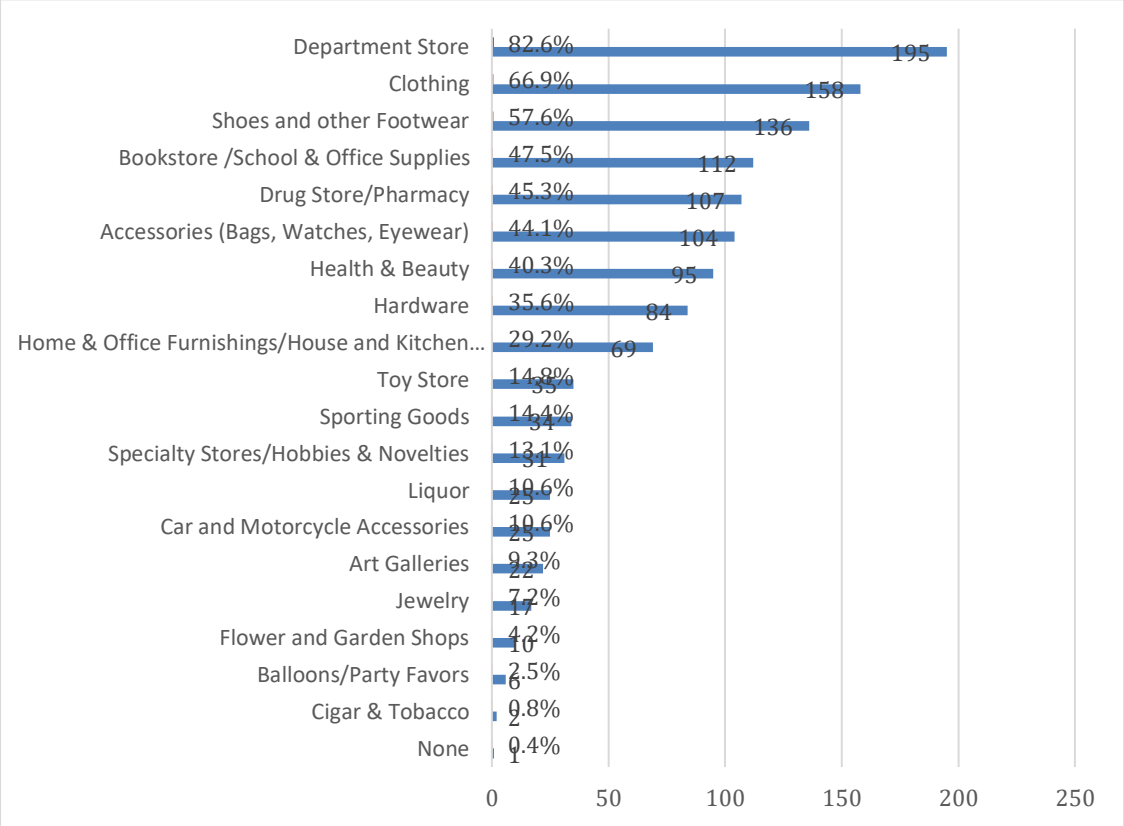
5. Which specific stores do you visit the most in the ENTERTAINMENT store category? (Check all that apply)



6. Which specific stores do you visit the most in the SERVICES store category? (Check all that apply).



7. Which specific stores do you visit the most in the SHOPPING store category? (Check all that apply)



Part 3. Consumer Perception on Sustainable Packaging

1. How knowledgeable are you on the concept of CIRCULAR ECONOMY?

236 responses

2. How knowledgeable are you on the concept of SUSTAINABILITY?

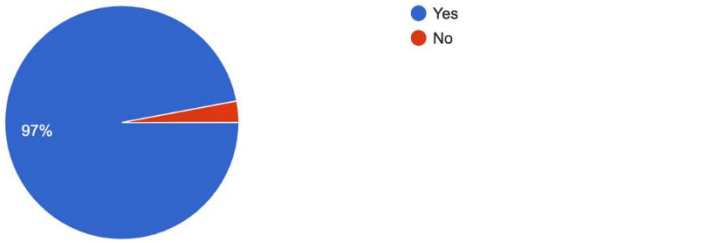
236 responses

3. How knowledgeable are you on the government regulation(s) on banning SINGLE-USE PLASTICS in your locality?

236 responses

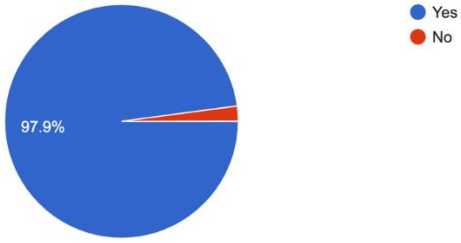
4. Are you aware that packaging contributes to garbage we see in rivers and oceans?

236 responses



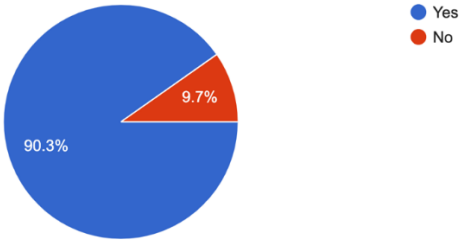
5. Are you conscious on your role as a consumer in protecting the environment?

236 responses



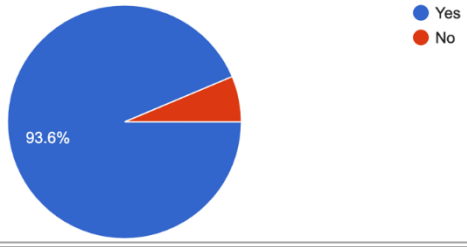
6. Do you consider the environmental impact of packaging when choosing whether to buy the product?

236 responses



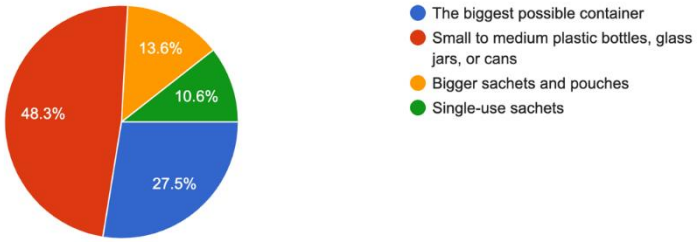
7. Do you support government regulation on banning single use plastics such as shopping bags?

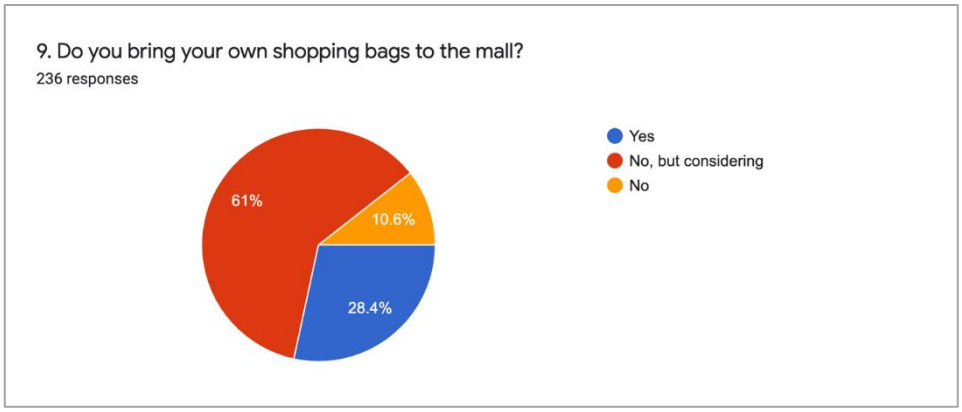
236 responses



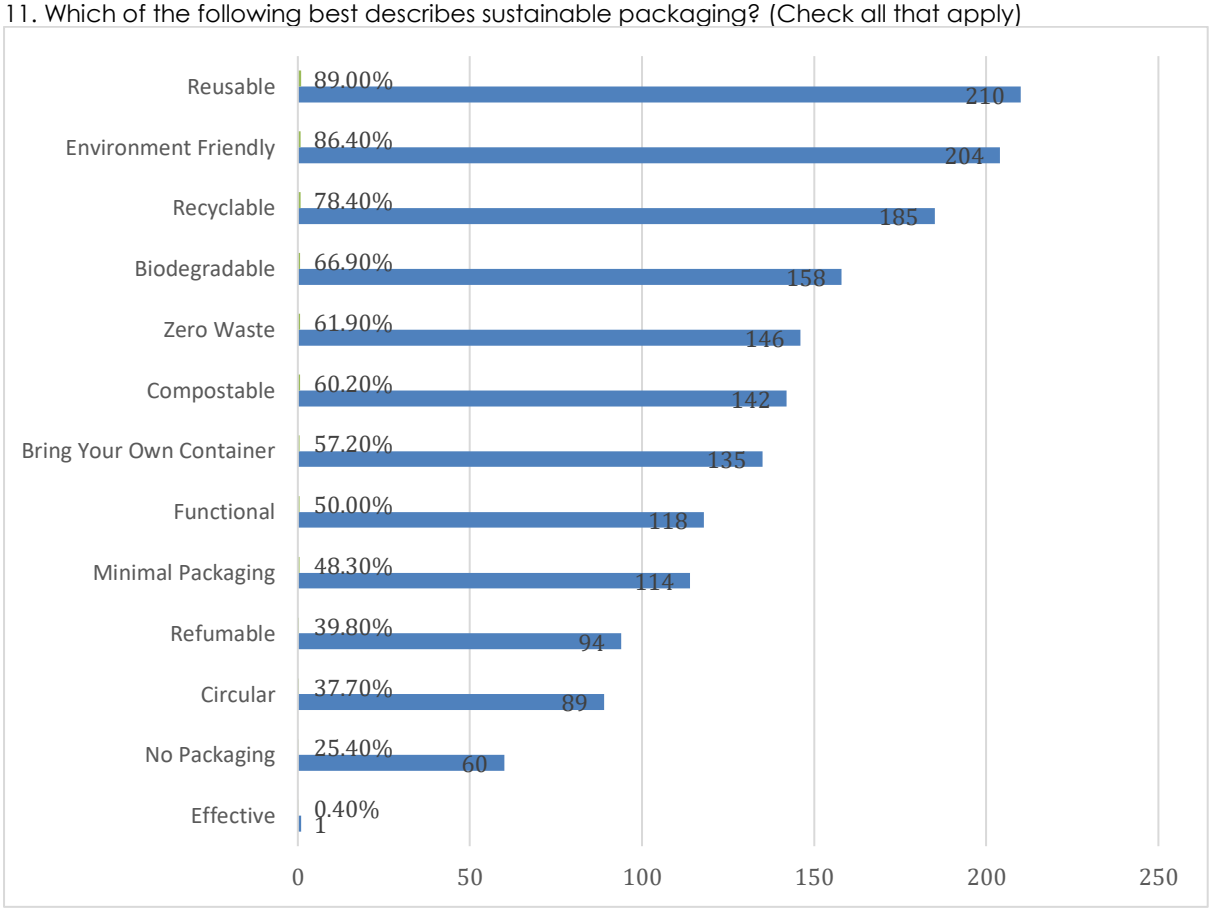
8. When buying products that come in different sizes, do you mostly buy:

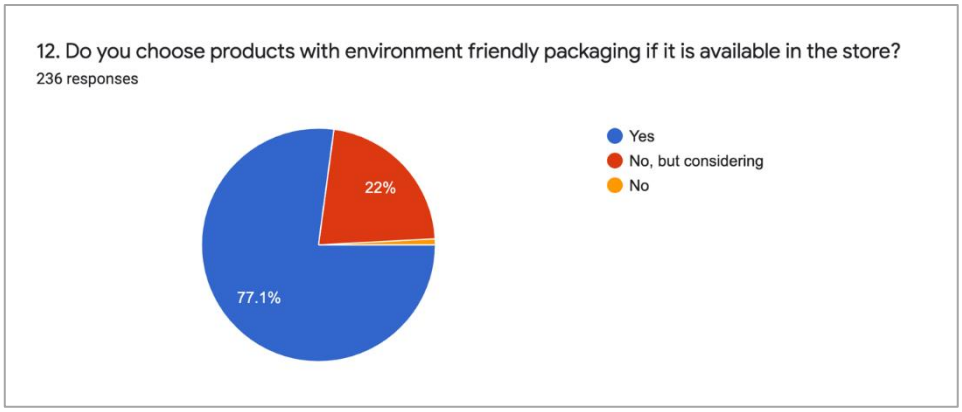
236 responses

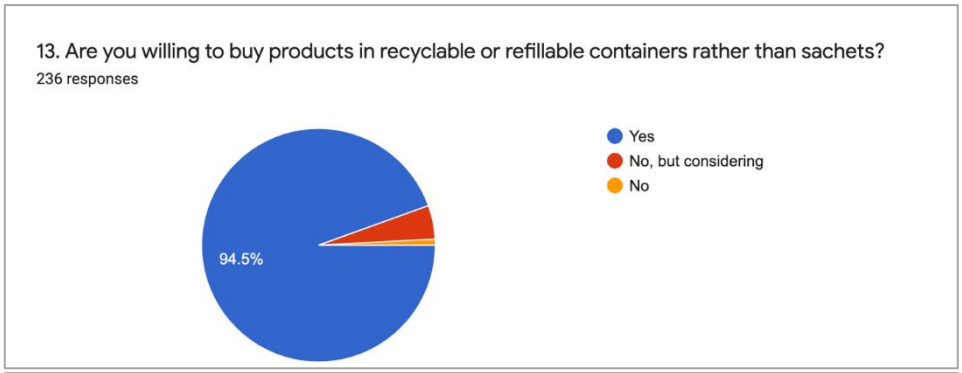


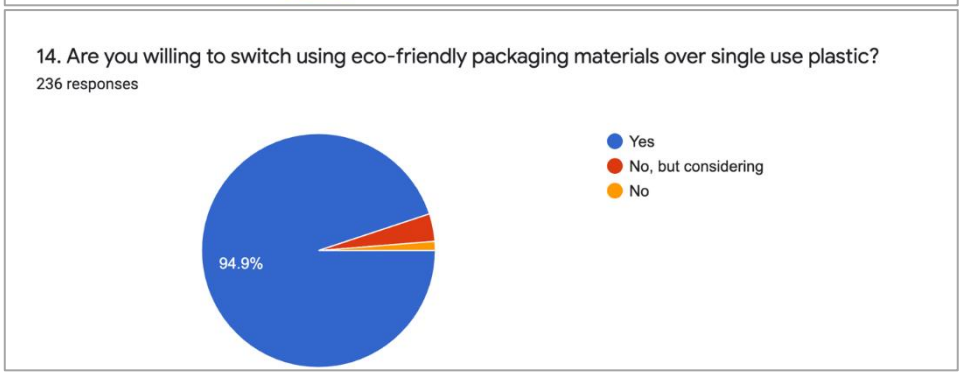


11. Which of the following best describes sustainable packaging? (Check all that apply)

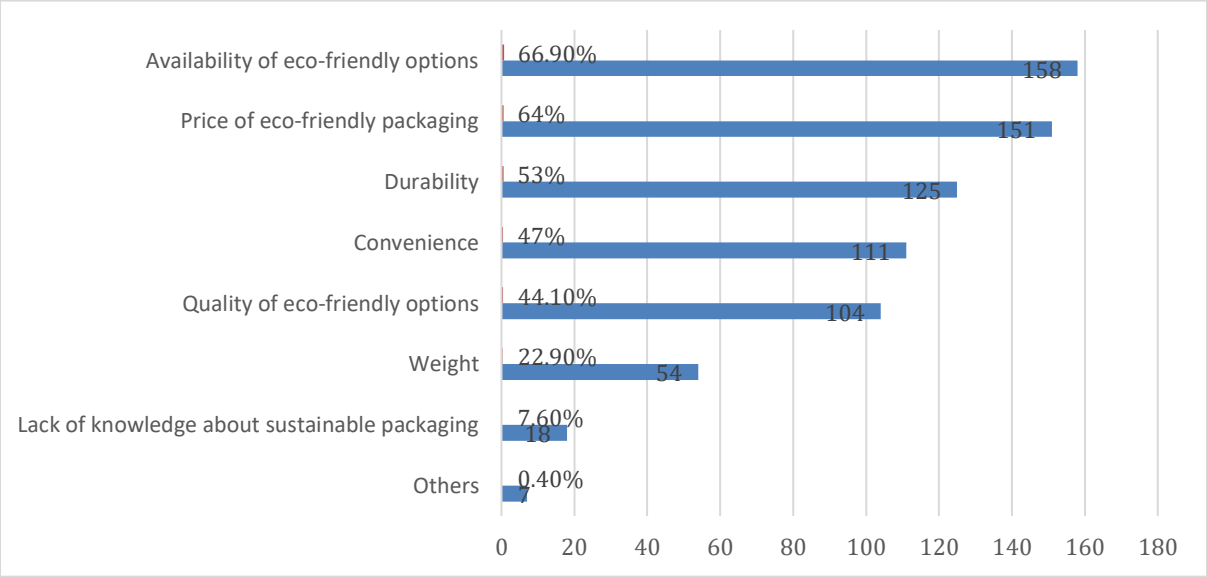


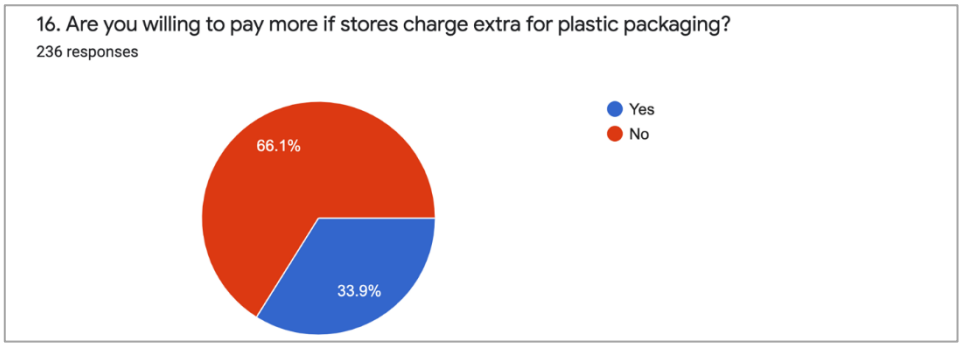


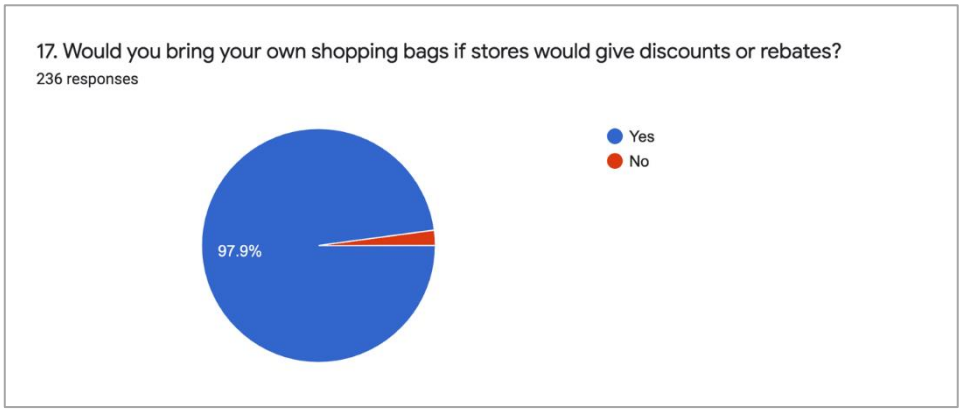


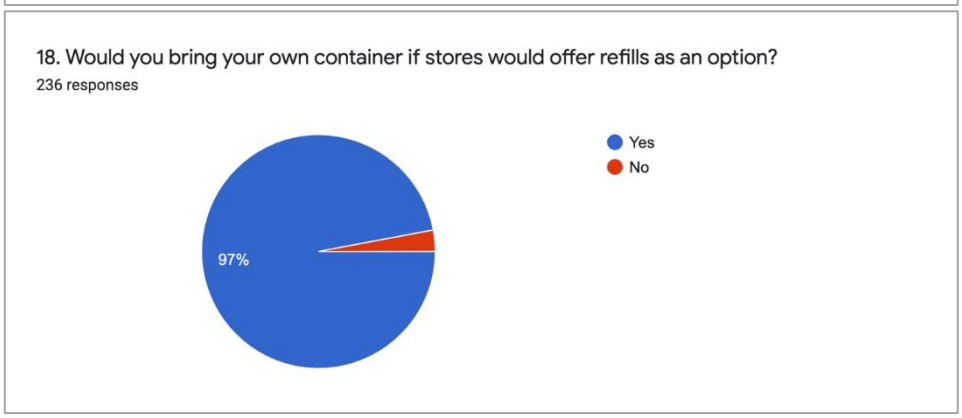


15. What would prevent you from switching to more eco-friendly packaging? (Check all that apply)

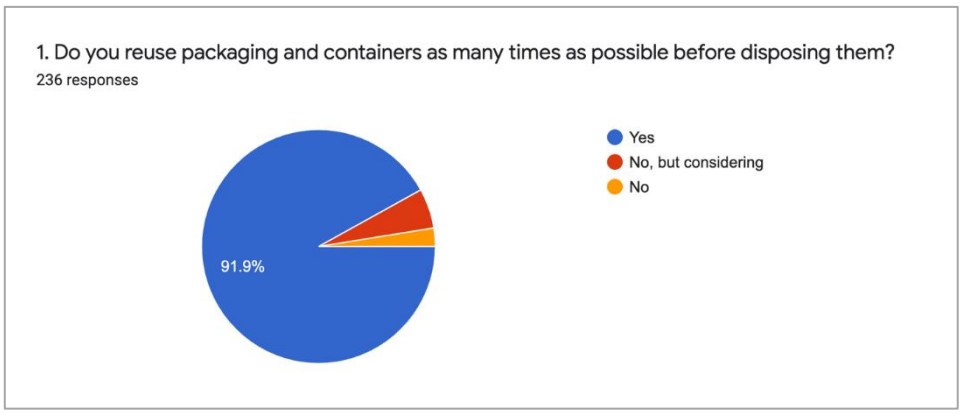






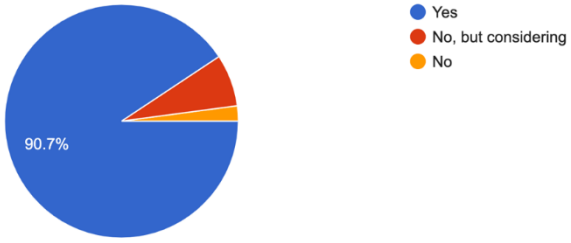


Part 4. Post-Purchase Behavior



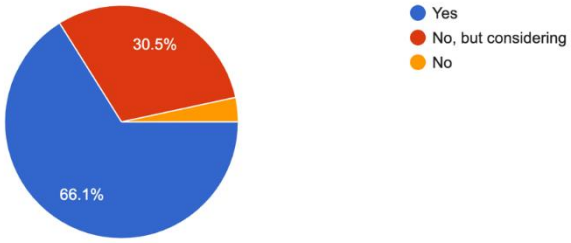
2. Do you recycle or repurpose the packaging materials you use?

236 responses



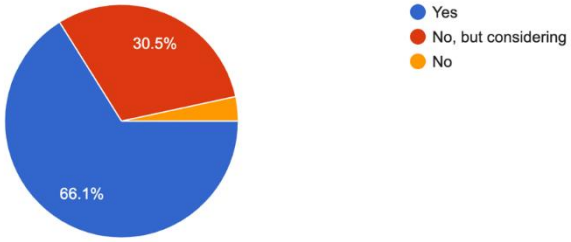
3. Do you segregate packaging and other waste materials when you dispose of them?

236 responses



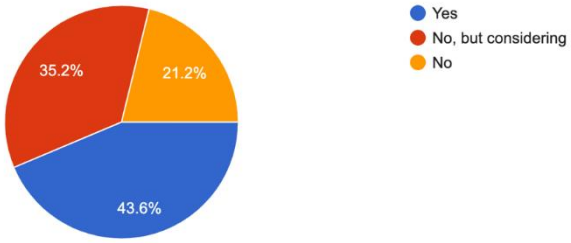
3. Do you segregate packaging and other waste materials when you dispose of them?

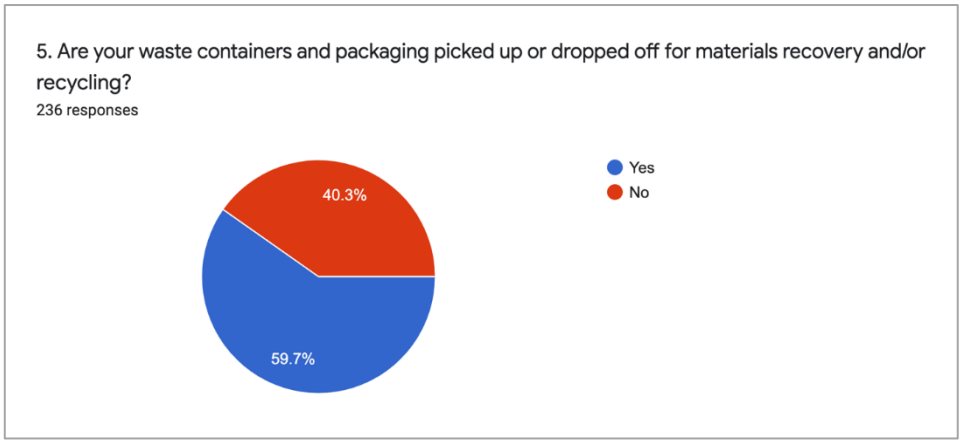
236 responses



4. Do you have a home compost?

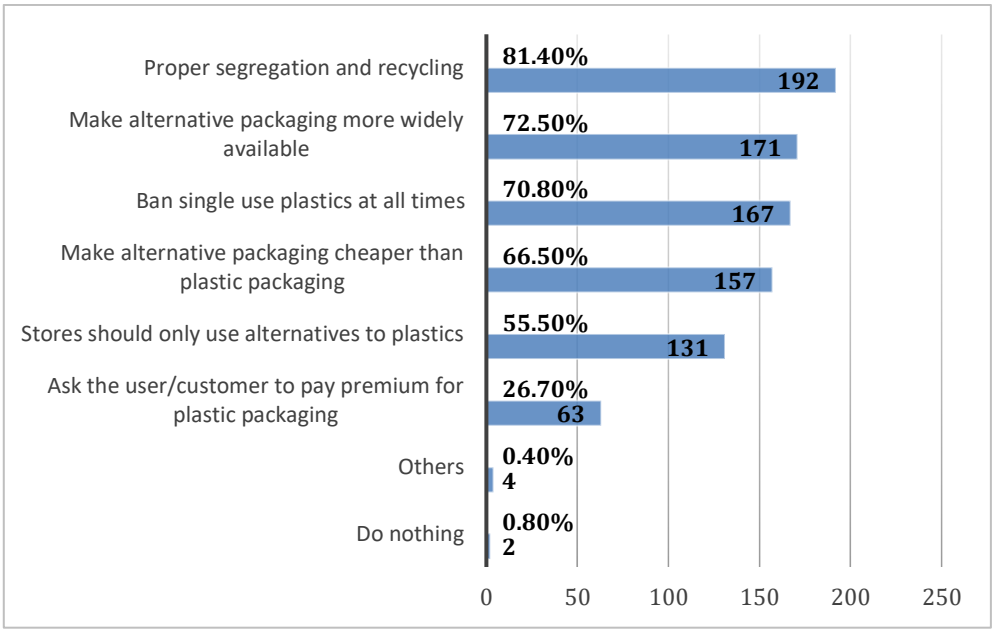
236 responses



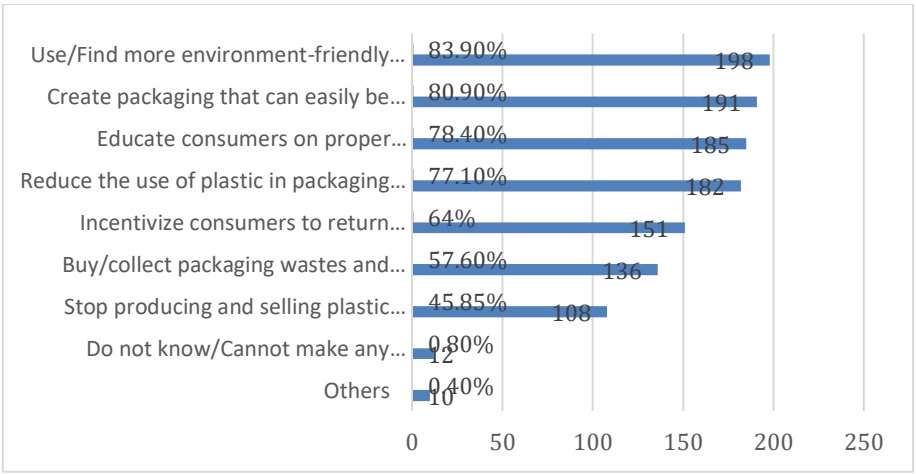


Part 5. Solutions

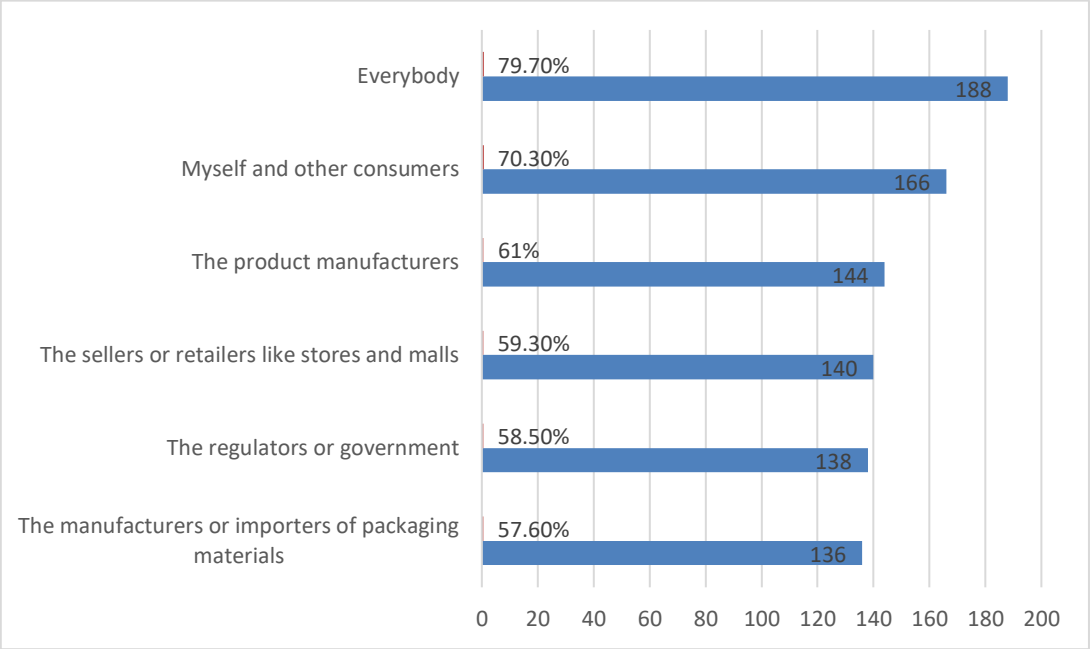
1. What is the best way to reduce packaging waste from entering landfills, rivers, and oceans? (Check all that apply)



2. What is your suggestion/opinion on how companies could help lessen plastic waste in the Philippines? (You may check more than one)



3. Who do you think is responsible in using or adopting sustainable packaging?



ANNEX H
REFERENCES

[1] The European Organization for Packaging and the Environment. (2021). About Packaging. Retrieved from https://www.europen-packaging.eu/about-packaging/

[2] Henkel AG & Co. (2021). Sustainable Packaging. Retrieved from https://www.henkel.com/sustainability/sustainable-packaging

[3] International Union of Food Science and Technology. (2018 November). Sustainable Packaging. Retrieved from http://www.iufost.org/sites/default/files/documents/sibs/Sustainable-Packaging_SIB.pdf

[4] Jimenez, C. (2018 April 12). Sustainable Packaging. Christian Brothers University, USA. Retrieved from http://packcon.org/index.php/en/articles/114-2018/216-sustainable-packaging

[5] PricewaterhouseCoopers LLP. (2010). Sustainable packaging: threat or opportunity?. Retrieved from https://www.pwc.com/gx/en/forest-paper-packaging/pdf/sustainable-packaging-threat-opportunity.pdf

[6] Sustainable Packaging Alliance. (2005). Defining sustainable packaging. Retrieved from http://www.sustainablepack.org/research/subpage_PageID_10_id_7.html

[7] GreenBlue. (2011). Definition of Sustainable Packaging Version 2.0 (Revised August 2011). Retrieved from https://sustainablepackaging.org/wp-content/uploads/2017/09/Definition-of-Sustainable-Packaging.pdf

[8] Guillard, V., Gaucel, S., Fornaciari, C., Angellier-Coussy, H., Buche, P. & Gontard, N. (2018 December 04). The Next Generation of Sustainable Food Packaging to Preserve Our Environment in a Circular Economy Context. *Front. Nutr.* 5:121. Retrieved from https://www.frontiersin.org/articles/10.3389/fnut.2018.00121/full

[9] Jimenez, C. (2018 April 12). Sustainable Packaging. Christian Brothers University, USA. Retrieved from http://packcon.org/index.php/en/articles/114-2018/216-sustainable-packaging

[10] Nguyen, A.T., Parker, L., Brennan, L. & Lockrey, S. (2020 April 10). A consumer definition of eco-friendly packaging. *Journal of Cleaner Production, 252*. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0959652619346621

[11] International Union for Conservation of Nature. (2021 November). Marine plastic pollution. Retrieved from https://www.iucn.org/resources/issues-briefs/marine-plastics#:~:text=At%20least%208%20million%20tons,causes%20severe%20injuries%20and%20deaths.

[12] Parker, L. (2020 September 8). Plastic food packaging now outpaces cigarette butts as most abundant beach trash. Retrieved from https://www.nationalgeographic.com/science/article/plastic-food-packaging-outpaces-cigarette-butts-most-abundant-beach-trash

[13] Boucher, J. and Friot D. (2017). Primary Microplastics in the Oceans: A Global Evaluation of Sources. Gland, Switzerland: IUCN. 43pp. Retrieved from https://portals.iucn.org/library/sites/library/files/documents/2017-002-En.pdf

[14] Readfearn, G. (2020 December 13). Deadliest plastics: bags and packaging biggest marine life killers, study finds. Retrieved from https://www.theguardian.com/environment/2020/dec/14/deadliest-plastics-bags-and-packaging-biggest-marine-life-killers-study-finds

[15] Ocean Conservancy. (2020). Together, we are Team Ocean: International Coastal Cleanup 2020 Report. Retrieved from https://oceanconservancy.org/wp-content/uploads/2020/10/FINAL_2020ICC_Report.pdf

[16] SEA Circular. (n.d.). Philippines. Retrieved from https://www.sea-circular.org/country/philippines/

[17] De Vera-Ruiz, E. (2020 July 15). Use of plastic sachets a concern for environmental groups. Retrieved from https://mb.com.ph/2020/07/15/use-of-plastic-sachets-a-concern-for-environmental-groups/

[18] Ranada, P. (2019 September 23). Sari-sari store conundrum: How can you help poor Filipinos reduce plastic waste?. Retrieved from https://www.rappler.com/moveph/sari-sari-store-conundrum-ways-help-filipinos-reduce-plastic-waste

[19] SEA Circular. (n.d.). Country Profile: The Philippines. Retrieved from https://www.sea-circular.org/wp-content/uploads/2020/04/SEA-circular-Country-Briefing_THE-PHILIPPINES.pdf

[20] Global Alliance for Incinerator Alternatives. (2019 June). Plastics Exposed: How Waste Assessments and Brand Audits are Helping Philippine Cities Fight Plastic Pollution, 2nd Edition. Quezon City, Philippines. Retrieved from https://www.no-burn.org/wp-content/uploads/Plastics-Exposed-2nd-Edition-Online-Version.pdf

[21] Center for Food Safety and Applied Nutrition, Office of Food Additive Safety. (2021 July). Guidance for Industry: Use of Recycled Plastics in Food Packaging (Chemistry Considerations). Retrieved from https://www.fda.gov/regulatory-information/search-fda-guidance-documents/guidance-industry-use-recycled-plastics-food-packaging-chemistry-considerations

[22] Food and Drug Administration. (2021). FAQs. Retrieved from https://www.fda.gov.ph/faqs/

[23] Food and Drug Administration. (n.d.). Implementation of Administrative Order No. 2019-0007, Overview: Guidelines for Manufacturers and Traders. Retrieved from https://www.fda.gov.ph/wp-content/uploads/2019/09/Guidelines-for-Manufacturers-and-Traders.pdf

[24] Zhongnan Jia, M. (2020). Biodegradable Plastics: Breaking Down the Facts. *Greenpeace East* Asia. Retrieved from https://www.greenpeace.org/static/planet4-eastasia-stateless/84075f56-biodegradable-plastics-report.pdf

[25] Plastics Europe. (2021). Plastics Europe: accelerating sustainable solutions valued by society. Retrieved from https://www.plasticseurope.org/en/about-plastics/what-are-plastics/large-family/biodegradable-plastics

[26] Haider,T.P., Völker, C., Kramm,J., Landfester, K. & Wurm, F.R. (2018 July 04). Plastics of the Future? The Impact of Biodegradable Polymers on the Environment and on Society. *Angewandte Chemie International Edition, 58*, 1. p. 50-62. Retrieved from https://onlinelibrary.wiley.com/doi/full/10.1002/anie.201805766

[27] Circular. (2021 April 12). UK Government may ban oxo-degradable plastics following consultation. Retrieved from https://www.circularonline.co.uk/news/uk-government-may-ban-oxo-degradable-plastics-following-consultation/

[28] UN Environment. (2018 June 05). The state of plastics: World Environment Day Outlook 2018. Retrieved from https://www.unep.org/resources/report/state-plastics-world-environment-day-outlook-2018

[29] British Plastics Federation. (2021). Biobased, biodegradable and oxo-degradable plastics. Retrieved from https://www.bpf.co.uk/press/biodegradable-and-oxo-biodegradable-plastics.aspx

[30] Australasian Bioplastics Association. (2019). FAQ. Retrieved from https://bioplastics.org.au/resources/faq/
[31] Augustin, J. (2020 March 25). Seaweed over plastic: Indonesia's race towards sustainable packaging. Retrieved from https://www.eco-business.com/news/seaweed-over-plastic-indonesias-race-towards-sustainable-packaging/
[32] European Brand & Packaging Design Association. (2021). The front-runner in edible packaging materials. Retrieved from https://www.epda-design.com/the-front-runner-in-edible-packaging-materials/
[33] British Plastics Federation. (2021). Biobased, biodegradable and oxo-degradable plastics. Retrieved from https://www.bpf.co.uk/press/biodegradable-and-oxo-biodegradable-plastics.aspx
[34] Oakes, K. (2019 November 5). Why biodegradables won't solve the plastic crisis. Retrieved from https://www.bbc.com/future/article/20191030-why-biodegradables-wont-solve-the-plastic-crisis
[35] Eventige Media Group. (2021). The Truth About Biodegradable Plastic Packaging. Retrieved from https://www.eventige.com/blog/biodegradable-plastic-packaging
[36] United Nations Economic Commission for Europe. (2021). Circularity. Retrieved from https://unece.org/forests/circularity
[37] EU Science Hub. (2018). How EU pulp and paper industry can reduce greenhouse gas emissions. Retrieved from https://ec.europa.eu/jrc/en/news/how-eu-pulp-and-paper-industry-can-reduce-greenhouse-gas-emissions
[38] Van Oel, P.R. and Hoekstra, A.Y. (2010). The green and blue water footprint of paper products: methodological considerations and quantification, Value of Water Research Report Series No. 46, UNESCO-IHE, Delft, the Netherlands. Retrieved from https://waterfootprint.org/media/downloads/Report46-WaterFootprintPaper_1.pdf
[39] Moreira, M.S. (2020 August 24). Is Paper A More Sustainable Flexible Packaging Material Than Plastic? Retrieved from https://www.forbes.com/sites/woodmackenzie/2020/08/24/is-paper-a-more-sustainable-flexible-packaging-material-than-plastic/?sh=7ab28c6b12d4
[40] American Recycling. (2011 May 20). Contamination in Paper Recycling. Retrieved from http://americanrecyclingca.com/2011/05/paper/contamination-in-paper-recycling/
[41] The Regents of the University of Michigan. (2021). Recycling Bin Contamination. Retrieved from http://sustainability.umich.edu/environ211/recycling-bin-contamination
[42] Dreizen, C. (2017 March 22). Where, how and why ocean plastic is being used as packaging feedstock. Retrieved from https://www.packagingdigest.com/sustainability/where-how-and-why-ocean-plastic-being-used-packaging-feedstock
[43] United States Environmental Protection Agency. (2020). Recycling Basics. Retrieved from https://www.epa.gov/recycle/recycling-basics
[44] GWP Group. (n.d.). Recyclable packaging. Retrieved from https://www.gwp.co.uk/advantages/recyclable-packaging/
[45] European Commission Eurostat. (2021). Recycling rate of packaging waste by type of packaging. Retrieved from https://ec.europa.eu/eurostat/web/products-datasets/-/cei_wm020
[46] Berg, P., Feber, D., Granskog, A., Nordigården, D. & Ponkshe, S. (2020 January 30). The drive toward sustainability in packaging—beyond the quick wins. Retrieved from https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/the-drive-toward-sustainability-in-packaging-beyond-the-quick-wins
[47] Cho, R. (2020 March 13). Recycling in the U.S. Is Broken. How Do We Fix It? Retrieved from https://news.climate.columbia.edu/2020/03/13/fix-recycling-america/
[48] Grosse, F. and Mainguy, G. (2010). Is recycling "part of the solution"? The role of recycling in an expanding society and a world of finite resources., *S.A.P.I.EN.S* [Online], 3.1 | 2010, Online since 10 February 2010, connection on 21 November 2021. Retrieved from https://journals.openedition.org/sapiens/906
[49] Parker, L. (2018 December 20). Here's how much plastic trash is littering the earth. Retrieved from https://www.nationalgeographic.com/science/article/plastic-produced-recycling-waste-ocean-trash-debris-environment
[50] Zero Waste Scotland. (2021). Recycling and the circular economy. Retrieved from https://www.zerowastescotland.org.uk/circular-economy/recycling
[51] Coelho, P.M., Corona, B., Klooster, R.T. and Worrell, E. (2020 May). Sustainability of reusable packaging–Current situation and trends. *Resources, Conservation & Recycling: X, 6.* Retrieved from https://www.sciencedirect.com/science/article/pii/S2590289X20300086
[52] Ellen MacArthur Foundation. (2019). Reuse: Rethinking packaging. Retrieved from https://www.ellenmacarthurfoundation.org/assets/downloads/Reuse.pdf
[53] Reusable Packaging Association. (2021). Cost Savings with Reusable Packaging. Retrieved from https://www.reusables.org/reusable-packaging/cost-savings/
[54] Packaging Europe. (2021 January 25). A deep dive into reusable packaging solutions. Retrieved from https://packagingeurope.com/a-deep-dive-into-reusable-packaging-solutions/
[55] The Regents of the University of Michigan. (2020 October 26). Mythbusting: 5 common misperceptions surrounding the environmental impacts of single-use plastics. Retrieved from https://news.umich.edu/mythbusting-5-common-misperceptions-surrounding-the-environmental-impacts-of-single-use-plastics/
[56] https://www.astm.org/
[57] https://bcorporation.net/certification
[58] https://bpiworld.org/Certification
[59] https://www.blauer-engel.de/en
[60] http://www.mepcec.com/renzheng/show-119.html
[61] https://cedar-grove.com/
[62] https://www.din.de/en
[63] https://www.environmentalchoice.org.nz/about-us/about-environmental-choice-new-zealand/
[64] https://ec.europa.eu/environment/ecolabel/
[65] https://www.european-bioplastics.org/
[66] https://www.cen.eu/work/products/ENs/Pages/default.aspx
[67] https://ic.fsc.org/
[68] https://geca.eco/
[69] https://greenliving.epa.gov.tw/newPublic/Eng/GreenMark/First
[70] http://www.jbpaweb.net/english/e-gp2.htm
[71] http://el.keiti.re.kr/enservice/enindex.do

[72] http://www.nordic-ecolabel.org/product-groups/
[73] https://www.pefc.org/
[74] https://www.rainforest-alliance.org/business/tag/2020-certification-program/
[75] https://www.sgls.sec.org.sg/index.php
[76] https://www.forests.org/
[77] http://www.tei.or.th/greenlabel/en/
[78] http://www.tuv-at.be/home/
[79] https://www.compostingcouncil.org/
[80] https://www.biopreferred.gov/BioPreferred/faces/catalog/Catalog.xhtml
[81] http://www.verus-co2.com/about.html
[82] Edwards, C. and Parker G. (2012 May). A Life Cycle Assessment of Oxo-biodegradable, Compostable and Conventional Bags. Retrieved from https://www.biodeg.org/wp-content/uploads/2020/09/intertek-final-report-15.5.121.pdf
[83] United Nations Environment Programme. (2015). Biodegradable Plastics and Marine Litter. Misconceptions, concerns and impacts on marine environments. United Nations Environment Programme (UNEP), Nairobi. Retrieved from https://wedocs.unep.org/bitstream/handle/20.500.11822/7468/-Biodegradable_Plastics_and_Marine_Litter_Misconceptions,_concerns_and_impacts_on_marine_environments-2015BiodegradablePlasticsAndMarineLitter.pdf.pdf
[84] Tan, J.H. (2021 May 31). INSIGHT: Bio-based and biodegradable plastics and their role in plastics circularity. Retrieved from https://www.icis.com/explore/resources/news/2021/05/31/10646523/insight-bio-based-and-biodegradable-plastics-and-their-role-in-plastics-circularity
[85] Al-Nasser, A.Y., Behbehani, M.H., Sultan, H.H., Karam, H.J., Al-Wadi, M.H., Al-Dhafeeri, A.T., Rasheed, Z. and Al-Foudaree, M. (2019). Thermal Response and Degressive Reaction Study of Oxo-Biodegradable Plastic Products Exposed to Various Degradation Media. *International Journal of Polymer Science, vol. 2019*, Article ID 9612813. Retrieved from https://www.hindawi.com/journals/ijps/2019/9612813/
[86] European Bioplastics. (2017 December). Report: European Bioplastics. Retrieved from https://docs.european-bioplastics.org/publications/market_data/2017/Report_Bioplastics_Market_Data_2017.pdf
[87] Barrett, A. (2019 August 8). Global Bioplastics Market To Grow by 20%. Retrieved from https://bioplasticsnews.com/2019/08/08/global-bioplastics-market-to-grow-by-20/
[88] Business Wire. (2018 June 28). Asia-Pacific Bioplastics Market Outlook to 2023 - Analysis by Type and End-use Industry. Retrieved from https://www.businesswire.com/news/home/20180628006385/en/Asia-Pacific-Bioplastics-Market-Outlook-to-2023---Analysis-by-Type-and-End-use-Industry---ResearchAndMarkets.com
[89] Department of Science and Technology. (2018 May 21). DOST-developed biodegradable substitute to synthetic plastics offers opportunity for plastic manufacturers. Retrieved from https://stii.dost.gov.ph/808-dost-developed-biodegradable-substitute-to-synthetic-plastics-offers-opportunity-for-plastic-manufacturers
[90] Living Circular. (2020 January 9). Mangos + algae = bioplastic. Retrieved from https://www.livingcircular.veolia.com/en/eco-citizen/mangos-algae-bioplastic
[91] Lucas, D.L. (2019 November 17). In major green thrust, SMC to shift to biodegradable plastic packaging. Retrieved from https://business.inquirer.net/283557/in-major-green-thrust-smc-to-shift-to-biodegradable-plastic-packaging#ixzz6yicdOaeg
[92] Sapp, M. (2019 March 21). Philippines plastic manufacture goes bio with starch-based biodegradable plastics. Retrieved from https://www.biofuelsdigest.com/bdigest/2019/03/21/philippines-plastic-manufacture-goes-bio-with-starch-based-biodegradable-plastics/
[93] Department of Ecology, State of Washington. (2014 August). Focus on “Biobased”, “Biodegradable”, & “Compostable” Plastics. Waste 2 Resources Program – August 2014. Publication Number 14-07-017. Retrieved from https://www.bpiworld.org/Resources/Documents/Washington%20State%20Biobased%20Fact%20Sheet%20Aug%2014.pdf
[94] Detzel, A., Kauertz, B. and Derreza-Greeven, C. (2012). Study of the Environmental Impacts of Packagings Made of Biodegradable Plastics. Retrieved from https://www.umweltbundesamt.de/sites/default/files/medien/461/publikationen/4446.pdf
[95] Lamberti, F.M., Román-Ramírez, L.A. & Wood, J. (2020). Recycling of Bioplastics: Routes and Benefits. *J Polym Environ, 28,* 2551–2571. Retrieved from https://link.springer.com/article/10.1007/s10924-020-01795-8
[96] Sakamoto, Y. (2012). Life cycle assessment of biodegradable plastics. *J. Shanghai Jiaotong Univ. (Sci.) 17,* 327–329. Retrieved from https://link.springer.com/article/10.1007/s12204-012-1279-8
[97] Patel, P. (2019 May 2). Four strategies to tackle the carbon footprint of plastic. Retrieved from https://www.anthropocenemagazine.org/2019/05/reducing-the-carbon-footprint-of-plastic-is-doable-but-not-easy/
[98] Tonini, D., Schrijvers, D., Nessi, S. et al. (2021). Carbon footprint of plastic from biomass and recycled feedstock: methodological insights. *Int J Life Cycle Assess 26,* 221–237. Retrieved from https://link.springer.com/article/10.1007/s11367-020-01853-2
[99] Lamberti, F.M., Román-Ramírez, L.A. & Wood, J. (2020). Recycling of Bioplastics: Routes and Benefits. *J Polym Environ, 28,* 2551–2571. Retrieved from https://link.springer.com/article/10.1007/s10924-020-01795-8
[100] Patel, P. (2019 May 2). Four strategies to tackle the carbon footprint of plastic. Retrieved from https://www.anthropocenemagazine.org/2019/05/reducing-the-carbon-footprint-of-plastic-is-doable-but-not-easy/
[101] Filiciotto, L. and Rothenberg, G. (2020). Biodegradable Plastics: Standards, Policies, and Impacts. *ChemSusChem, Volume 14*(1). p. 56-72. Retrieved from https://chemistry-europe.onlinelibrary.wiley.com/doi/10.1002/cssc.202002044
[102] World Resources Institute. (n.d.). Production Forests. Retrieved from https://research.wri.org/gfr/forest-designation-indicators/production-forests
[103] Market Watch. Global Paper Packaging Market Size 2021-2026 With Top Countries Data Industry Size, Share, Business Growth, Revenue, Trends, Market Demand Penetration and Forecast. Retrieved from https://www.marketwatch.com/press-release/global-paper-packaging-market-size-2021-with-top-countries-data-and-covid-19-analysis-industry-size-share-business-growth-revenue-trends-market-demand-penetration-and-forecast-2021-04-22
[104] Tiseo, I. (2021 October 19). Production of paper and cardboard worldwide 2008-2018. Retrieved from https://www.statista.com/statistics/270314/global-paper-and-cardboard-production/

[105] Food and Agriculture Organization of the United Nations. (2020). Forest Products. Retrieved from https://paperonweb.com/FAO2018.Paper.pdf

[106] Two Sides. (n.d.) Paper production and sustainable forests: The facts. Retrieved from https://www.twosides.info/documents/factsheets/2-Paper-Production-and-Sustainable-Forests.pdf
[107] The World Resources Institute and The World Business Council for Sustainable Development. (2016). Guide. Retrieved from https://sustainableforestproducts.org/Sustainable_Forest_Management
[108] American Chemistry Council. (n.d.). Plastics. Retrieved from https://plastics.americanchemistry.com/Life-Cycle-Assessment-for-Three-Types-of-Grocery-Bags.pdf
[109] Wojnowska-Baryła, I., Kulikowska, D. and Bernat, K. (2020). Effect of Bio-Based Products on Waste Management. *Sustainability 2020, 12(*5), 2088. Retrieved from https://www.mdpi.com/2071-1050/12/5/2088
[110] Pauer, E., Wohner, B., Heinrich, V. and Tacker, M. (2019). Assessing the Environmental Sustainability of Food Packaging: An Extended Life Cycle Assessment including Packaging-Related Food Losses and Waste and Circularity Assessment. *Sustainability 2019, 11*(925). Retrieved from https://www.mdpi.com/2071-1050/11/3/925/pdf
[111] Gozum, I. (2020 December 9). Communities bear the weight of the Philippines' plastic waste problem. Retrieved from https://www.rappler.com/environment/tackling-plastic-waste-from-communities
[112] Senate of the Philippines. (2017). Philippine Solid Wastes: At a glance – November 2017. Retrieved from http://legacy.senate.gov.ph/publications/SEPO/AAG_Philippine%20Solid%20Wastes_Nov2017.pdf
[113] Asian Development Bank. (2020 February). Circular Economy in the Philippines: An assessment of existing initiatives, policies and identification of potentials to support the Philippine Action Plan for Sustainable Consumption and Production (PAP4SCP). Retrieved from https://www.adb.org/sites/default/files/project-documents/50158/50158-001-tacr-en_0.pdf
[114] Organisation for Economic Co-operation and Development. (n.d.). Extended producer responsibility. Retrieved from https://www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm
[115] Neo, P. (2018 October 11). 'Top polluters in Asia': Coca-Cola, Mondelez respond to Greenpeace plastic waste audit findings. Retrieved from https://www.foodnavigator-asia.com/Article/2018/10/11/Top-polluters-in-Asia-Coca-Cola-Mondelez-respond-to-Greenpeace-plastic-waste-audit-findings
[116] WWF-Philippines. (2020 October). EPR Scheme Assessment for Plastic Packaging Waste in the Philippines. Retrieved from https://wwf.org.ph/wp-content/uploads/2020/12/WWF_REPORT_EPR_Philippines_2020.pdf
[117] Mora, A.G. and Kwakwa, V. (2021 March 29). Plastic waste is a growing menace, and a wasted opportunity. Retrieved from https://asia.nikkei.com/Opinion/Plastic-waste-is-a-growing-menace-and-a-wasted-opportunity
[118] Business Mirror. (2018 July 3). PET bottles have 90 percent retrieval rate in the Philippines. Retrieved from https://businessmirror.com.ph/2018/07/03/pet-bottles-have-90-percent-retrieval-rate-in-the-philippines/
[119] Plastic Bank. (2020). Philippines. Retrieved from https://plasticbank.com/philippines/
[120] Inka, LLC. (2020). Why Recycling Isn't the Answer Part 3: Carbon Footprint. Retrieved from https://www.inka.world/blogs/the-lunch-club/why-recycling-isnt-the-answer-part-3-carbon-footprint
[121] Nestle. (2018 June 15). PARMS turns over proposed design of recycling facility to Parañaque City. Retrieved from https://www.nestle.com.ph/media/news/parms-recycling-facility-design
[122] The Manila Times. (2021 April 1). Mondelez PH strengthens commitment towards Zero Waste to Nature. Retrieved from https://www.manilatimes.net/2021/04/01/public-square/mondelez-ph-strengthens-commitment-towards-zero-waste-to-nature/858181
[123] Gomes, T.S., Visconte, L.L.Y. & Pacheco, E.B.A.V. (2019). Life Cycle Assessment of Polyethylene Terephthalate Packaging: An Overview. *J Polym Environ 27,* 533–548. https://link.springer.com/article/10.1007/s10924-019-01375-5
[124] Stefanini, R., Borghesi, G., Ronzano, A. *et al.* (2020). Plastic or glass: a new environmental assessment with a marine litter indicator for the comparison of pasteurized milk bottles. *Int J Life Cycle Assess 26,* 767–784. Retrieved from https://link.springer.com/article/10.1007/s11367-020-01804-x
[125] Amienyo, D., Gujba, H., Stichnothe, H. and Azapagic, A. (2012). Life cycle environmental impacts of carbonated soft drinks. *The International Journal of Life Cycle Assessment 18*(1). Retrieved from https://www.researchgate.net/publication/257679872_Life_cycle_environmental_impacts_of_carbo nated_soft_drinks
[126] Cavale, S., Naidu, R. and Reuters. (2019 November 2). Procter & Gamble, rivals take refills into beauty aisle. Retrieved from https://news.abs-cbn.com/business/11/02/19/procter-gamble-rivals-take-refills-into-beauty-aisle

Philippine Center for Environmental Protection
and Sustainable Development , Inc.

4B Development Academy of the Philippines,
San Miguel Avenue, Ortigas Center, Pasig City
1600 Philippines
greenchoicephilippines@pcepsdi.org.ph
www.pcepsdi.org.ph

Learn more about the project:

Co-funded by the European Union

Implemented by