Nordic Council of Ministers

International sustainability criteria for plastic products in a global agreement on plastic pollution

Contents

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List of abbreviations

APR	Association of Plastic Recyclers
BAT	Best Available Technique
BC	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes
BEP	Best Environmental Practice
BPA	Bisphenol A
COP	Conference of the Parties
CSR	Corporate Social Responsibility
EC	European Commission
EDC	Endocrine Disrupting Chemicals
EPS	Expanded Polystyrene
ESM	Environmentally Sound Management
EU	European Union
FSC	Forest Stewardship Council
HSE	Health, Safety and Environment
ILO	International Labor Organization
ILUC	Indirect Land-use Change
MEA	Multilateral Environmental Agreement
MR-MK	Nordic Council of Ministers for the Environment and Climate
MSC	Marine Stewardship Council
MSME	Micro-, Small- and Medium Enterprises
NDC	Nationally Determined Contributions
NPAP	National Plastic Action Plan
NSS	National Sustainability Standard
ODCs	Ozone-Depleting Chemicals
OECD	Organization for Economic Co-operation and Development
PACE	Partnership for Action on Computing Equipment
PCR	Post-Consumer Resin
POPs	Persistent Organic Pollutants

RECPnet	Global Network for Resource Efficient and Cleaner Production
RED	Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources
SC	Stockholm Convention on Persistent Organic Pollutants
SDGs	Sustainable Development Goals
SIN	Substitute It Now
SUPP	Single-Use Plastic Products
UN	United Nations
UNEA	United Nations Environmental Assembly
UNFCCC	United Nations Framework Convention on Climate Change

Executive summary

Currently, with more than one hundred and fifty countries expressing support for starting negotiations on a global agreement on plastic pollution following the next meeting of the United Nations Environmental Assembly (UNEA 5.2) in 2022, focus has shifted towards the consideration of what such an agreement may entail. This report follows a series of publications by the Nordic Council of Ministers on a potential global agreement on plastic pollution and will elaborate on and assess a proposed mechanism: international sustainability criteria for the life cycle of plastic products.

Sustainability criteria in a nutshell

International sustainability criteria may act as the nervous system of a global agreement: establishing what sustainability entails for plastic products during their life cycle; and directing and activating preventive and mitigating measures if plastic products fail to meet the criteria. The fulfilment of the sustainability criteria may be achieved by domestic implementation of international commitments through national policy instruments and control measures. The development of national plastic action plans and technical international and national sustainability standards may serve as tools to this end. Commonly agreed international measures and standards will contribute to harmonize action on the global level to meet the criteria.

Considering the complexity of plastic products, with different polymer types, additives, modes of production, functions, uses and management practices, the report argues that it is not possible to define one single overarching criterion for their sustainability. Instead, a set of sustainability criteria may collectively contribute towards the improved sustainability of plastic products.

Achieving a safe and sustainable plastics economy requires a systemic shift towards sustainable consumption and production and a circular economy, where virgin plastic consumption is reduced, and plastic products are safely reused for as long as possible, reducing the need for virgin materials and eliminating leakages and pollution throughout the plastic product lifecycle.

While this report and the proposed sustainability criteria address plastic products, including but not limited to plastic packaging, the criteria consider all stages of the plastics value chain, from resource extraction to primary pellet production, product design and manufacture, consumption, waste management and treatment at the end-of-life. This life cycle approach is necessary to ensure measures to limit plastic pollution do not cause negative trade-offs and problem-shifting along the value chain.

Determining relevant sustainability criteria

The report examines how sustainability criteria and similar concepts are applied in various frameworks, ranging from eco-labelling schemes to industry guidelines and international legal instruments. Sustainability criteria and criteria more generally have previously been used interchangeably with other similar terms such as requirements, guidelines, goals, standards, principles and so on.

In this report, international sustainability criteria for plastic products are understood as requirements to the sustainable content, design, manufacturing, consumption, collection and treatment at the end of life, to facilitate the reusability, repairability and recyclability of all plastic products and minimizing their environmental impacts and risks to human health throughout their lifecycle.

Figure 1. Analytical framework for locating international sustainability criteria in a global agreement on plastic pollution.

Concept and framework

To identify and assess relevant criteria, an analytical framework for the conceptualization and identification of international sustainability criteria and their role in a global agreement has been developed. Situated between the overarching elements of an agreement - the objective, goals, and principles - and the more concrete operational provisions (Figure 1), the criteria are intended to guide the design of the legally binding agreement, as well as its measures and provisions. Through national implementation of the agreement provisions, governments will formulate policies and measures to prevent and remediate plastic pollution, referring to the internationally agreed sustainability criteria.

Within this framework, the report argues that international sustainability criteria could be a core component of a global agreement alongside relevant provisions addressing financing, capacity development, monitoring and more.

The criteria proposed in this report are not intended to be exhaustive or final but illustrate what international sustainability criteria look like and which aspects they intend to address. The analytical framework emphasizes that sustainability criteria are formulated in response to the objective and goals of a global agreement, drawing on five principles of safe circularity[1]:

- **Safety**: Use of hazardous substances is minimized; intentional releases and addition of microplastics in products is eliminated, unintentional releases minimized; and safety considerations and precautions taken in circulation, reuse, repair and refill of plastic products.
- **Minimization**: Production and use of plastic products minimizes the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the product life cycle.
- **Durability and reusability**: Product design accommodates and encourages safe reusability, repairability, and refillability of plastic products, while single-use plastic products for which safe and environmentally sound alternatives exist are eliminated.
- **Recyclability**[2]: Recycling enables cost-effective material recovery minimizing energy loss and maximizing the number of recycling rounds.
- **Transparency**: Relevant information on chemical composition and hazard of plastic products is available along the value chain for manufacturers, governments, users, consumers and recyclers; relevant information on product composition, feedstock and end-of-life management is available to consumers and users; and commonly used definitions are agreed.

The principles of safe circularity are not to be confused with the more customary use of guiding principles in international environmental law, such as the polluter-pays principle, the no-harm principle and precautionary principle. Such principles are commonly embedded in the preamble of international treaties, but may also be reflected in the sustainability criteria, the provisions of the agreement and in national implementation of such.

In addition, prioritizing general tenets of the waste hierarchy such as reduce and reuse, that is, upstream measures, over downstream remediation efforts would be beneficial in the effective implementation of international sustainability criteria.

International sustainability criteria

Based on a review of literature and assessment of existing frameworks and mechanisms, a set of sustainability criteria is proposed (Box 1). The criteria are designed to guide considerations once plastics have been chosen as a material in product design and production, and do not address consideration with regards to substitution with other non-plastic materials. The criteria are to some extent overlapping, for instance with regards to safety and limiting the use of chemicals of concern, which may also have positive benefits for the recyclability of plastic products. Furthermore, the intricacy of regulating plastic products may require additional definitions and clarifications of key terms and concepts in provisions, control mechanisms, standards and guidance documents developed by dedicated expert groups under the agreement; including concepts such as recyclability and compostability, essential and non-essential uses of products, and bio-based plastics.

1. The principles are of equal importance, and not listed according to significance.
2. A product is recyclable if its successful post-consumer collection, sorting, and recycling is proven to work in practice and at scale (EMF, 2020a).

Box 1. Potential key sustainability criteria for plastic products

Proposed key sustainability criteria for safety:

- Hazardous chemicals[3] are handled safely and minimized in production processes and in plastic products.
- Reintroduction of chemically contaminated materials in recycling and reuse processes is avoided, until future technological advances can ensure safe extraction and appropriate destruction of hazardous chemicals[4].
- The production, collection and treatment of plastic products is in accordance with national and international legislation on human and workers' rights, including safe working conditions.
- Primary and secondary microplastic releases are minimized at every stage of the plastic life cycle.
- Plastic waste is traded in a manner which facilitates safe treatment at the highest level of the waste hierarchy.

Proposed key sustainability criteria for minimization:

- The feedstock for plastics is responsibly sourced[5], avoiding undesirable indirect land-use change and generating the least emissions.
- Plastic products are designed, manufactured, and managed so that:
  - Resource use is minimized;
  - The use of virgin plastic is significantly reduced;
  - Plastic products are manufactured with an ambitious and progressively increasing percentage by weight with materials from sustainably sourced renewable or recycled origin.

Proposed key sustainability criteria for durability and reusability**:**

- The design, manufacture, handling and management of plastic products throughout their lifecycle is done in a manner that:
  - maximizes the functional and safe use, repair and reuse.
  - maximizes durability and minimizes releases of secondary microplastics during the intended use and reuse of the product.

Proposed key sustainability criteria for recyclability:

- Products are designed for enhanced recyclability, considering and adapted to collection systems and technical infrastructure in markets that the products are entering, maximizing the production of high-quality recycled materials at the

3. The definition of what is considered chemicals of concern and hazardous chemicals will likely need to be considered and defined through expert groups, and aligned with legislation such as the Stockholm convention etc.
4. See for instance Leslie *et al.* (2016) and Das *et al.* (2021).
5. The definition of responsibly/sustainably sourced content will have to be further defined for different feedstock categories (recycled, biobased, virgin) as appropriate.

end of life.
- Pathways exist for the effective collection, sorting and recycling or composting of plastic products at the end of usable life in the markets they are intended for.

Proposed key sustainability criteria for transparency

- Relevant information on chemical composition, feedstock and hazard of plastic products is available along the value chain for manufacturers, governments, users, consumers and recyclers, facilitating substitution, optimal recycling, reuse and repair.
- Consumers have relevant and sufficient information to understand how to reuse, return or discard plastic products at the end of use.
- The fate of internationally traded plastic waste is recorded and traceable.

Measures and standards to fulfill the sustainability criteria

It was outside the scope of this report to provide a comprehensive overview of the operational provisions of a future agreement on plastic pollution. However, the report discusses a selection of relevant measures and tools that may be applied to meet the criteria, including national plastic action plans (NPAPs) and sustainability standards.

There are strong arguments for developing a coherent international framework, where measures, the requirements of NPAPs, and commonly accepted standards, are defined and agreed at the international level. Such harmonization would enhance the prospects of a level playing field internationally, increase predictability for industry, facilitate trade and reporting, and make global action more efficient.

The internationally agreed control provisions set up to meet the sustainability criteria may be implemented on the national level through establishing NPAPs and corresponding sustainability standards. The content, function and reporting of NPAPs can be outlined in provisions or annexes to the agreement, with specific requirements to prioritize action in line with the waste hierarchy in the development of national control measures. International technical standards could be integral in meeting the obligations of international sustainability criteria – setting the minimum requirements for products in the markets regulated by the agreement. The standards would delineate what this means in practice for the different product groups and material types, and in different contexts. This could for instance entail international standards for design for recyclability, drawing on existing developed standards, as well as standards or minimum requirements as to the actual rates of recycling or reuse of products.

The development of best available technique (BAT) and best environmental practice (BEP) is an example of measures and guidance that may be set up to meet the set sustainability criteria, while also ensuring a coherent practice among members to the agreement. BAT/BEP is widely used in other multilateral frameworks and is an efficient tool to outline acceptable best practices, design guidelines, minimum standards for plastic production and management and other components driving concerted action.

The concept of essential/non-essential use is another example of a modality that may be utilized both to eliminate the production of problematic and avoidable plastic products and to limit hazardous chemicals in plastic products and production processes. In this instance, problematic and avoidable plastic products refer to products which have a high risk of leakage, cannot be recycled and for which appropriate substitutes are available and accessible.

The agreement may set different requirements for the different categories of plastic products. The essential use concept is particularly relevant to address the criteria under the circularity principles of minimization, durability and reusability, and recyclability – tackling all three concerns to reduce the inflow of unnecessary plastic products. A challenge with this approach may be the geographical variation in use under different socio-economic settings, and different views in defining what is essential and not.

Addressing problem-shifting

The world faces multiple parallel environmental crises and recognizing the interrelationships between these is vital to prevent the emergence of new problems when addressing plastic pollution. The report addresses three dimensions of problem-shifting related to plastic pollution: between environmental stressors, along the plastic lifecycle and socioeconomically, and delineates how these dimensions may be addressed.

The proposed criteria have been formulated to account for concerns around problem-shifting. That would in many cases imply that several or all the identified criteria are applied and responded to collectively, rather than individually, thus reducing the risk of problem shifting, though possibly also contributing to blurring the optimal action hierarchy, targeting most cost-effective measures first.

The practical implementation of criteria may further entail utilizing lifecycle assessments, standards, certifications and other evaluations to consider how substitution and alternative materials may influence trade-offs. Similarly, problem-shifting may occur between stages of the plastic lifecycle, wherein changes to design may influence the likelihood of littering or recycling downstream in the lifecycle. Such concerns may be addressed through design guidelines and standards for product design to ensure that design and material choices have the intended impact.

Industry inclusion

Environmental challenges, such as plastic pollution, are frequently driven by different industrial and private sector activities throughout the value chain. The important role of industry and the private sector has been emphasized at several UNEA meetings that have addressed plastic pollution. This makes it essential to engage the private sector to ensure implementation, drive innovation and encourage investment in sustainable solutions, business models and technologies.

In the development of this report, views and perspectives on the design of a global agreement on plastic in general, and specifically on sustainability criteria, were collected from industry stakeholders. The discussions highlighted some of the challenges faced by the industry when addressing sustainability issues throughout the life cycle of plastic products. The importance of a transparent, safe and reliable supply chain of recycled material was stressed as pivotal for expanding the use of post-consumer resin. In particular, the relationship between the price of virgin plastics and recycled plastics was emphasized.

The environmental impacts of other non-plastic materials and the importance of lifecycle assessments also of substitutes was reiterated by several industry representatives. Several supported the idea of international standards, coherence and harmonization to improve market functioning and ensure a level playing field. As demonstrated in this report, these are all aspects that could be addressed by applying a combination of sustainability criteria, steering the control measures to that end. However, further work on each of the five principles of circularity elaborated in this report is needed in technical expert groups connected to the negotiation process.

The participation and proactiveness of most industry stakeholders showcase their interest in contributing to the development of a global agreement, including the design and development of effective sustainability criteria, while simultaneously stressing the shared responsibility of consumers, private and public sector. Related to this, the role of the informal sector was raised by several participants as crucial in the development of a global agreement and any sustainability criteria embedded in it.

1. Introduction

The versatility, affordability, durability and low weight of plastics have made plastic products ubiquitous in modern society (Barnes, 2019; Simon, 2019; Barrowclough and Birkbeck, 2020; Nielsen *et al.*, 2020; Tenhunen and Pöhler, 2020). Plastics are vital to addressing many of society's challenges, particularly in medical treatment and technology, preservation of foods, in hygiene and sanitation, modern communication, transportation systems and infrastructure. However, with accelerating production, consumption and leakages at the end-of-life[6] around the globe, plastic products contribute towards an unsustainable strain on the environment, biodiversity and human health – with plastics accumulating in oceans, rivers and soils at an unprecedented rate (Borrelle *et al.*, 2017, 2020; Rochman and Hoellein, 2020; Okoffo *et al.*, 2021). Current measures have proven insufficient, as plastics production is expected to increase considerably in a business-as-usual scenario (Lebreton and Andrady, 2019; Borrelle *et al.*, 2020; UNEP, 2021b). Less than ten percent of all plastic waste generated between 1950 and 2017 is estimated to have been recycled, and current recycling rates are completely insufficient to reduce the threats posed by plastic pollution to our environment, economies and society (UNEP, 2021b).

Plastics leak into the environment at every stage of the lifecycle: from production of primary plastic pellets[7]; consumption; and during collection, recycling and disposal of plastic wastes (UNEP, 2021b) and can cause harm in three main ways: through physical, chemical, and biological effects (FAO, 2021). In addition to the harm caused by the physical presence of plastics in nature, it is further exacerbated by the release of toxic chemicals during production and use of plastic products, and during recycling, incineration, disposal or degradation in the environment (Hahladakis *et al.*, 2018).

As most plastics and their chemical additives are made of fossil fuels[8], plastics also contribute to increasing greenhouse gas emissions from the use of fossil feedstocks in primary plastic production, product manufacturing and transport, energy use during recycling and material recovery, and from the breakdown of plastics in the environment (Royer *et al.*, 2018; CIEL, 2019; Ford *et al.*, 2022). In addition, escalating climate change may contribute to increasing plastic consumption, e.g. through plastic adaptation strategies (FAO, 2021; Ford *et al.*, 2022). Another concern is the significant air pollution arising during incineration and open burning of plastics (Gunthe *et al.*, 2021). Recent research further highlights the potential negative climate impacts of plastics linked to the reduction of primary productivity and carbon sequestration by mangroves and sea grasses impacted by both micro- and macro-plastic pollution (Martin, Almahasheer and Duarte, 2019; Harris *et al.*, 2021). Plastic pollution is thus deeply intertwined with the concurrent environmental crises of climate change, chemical pollution and biodiversity loss (BRS and MC, 2021).

6. While there is no clear-cut definition of end-of-life, we here use the term to describe the stage of the product lifecycle when it is discarded or recycled at the end of intended use. We distinguish between end-of-life and end-of-use, with end-of-use referring to the stage when the product is re-entered into reuse systems.
7. Plastic pellets are an intermediary form as plastics, used as raw materials in the production of plastic products.
8. Global industry figures indicate that bio-based plastic production currently accounts for 1 percent of total plastic production, with the remaining 99 percent originating from fossil resources (European Bioplastics, 2020; UNEP, 2021b)

Micro- and macro-plastic pollution also has significant societal and economic implications, directly impacting 12 of the UN Sustainable Development Goals (SDGs) (Walker, 2021, p. 4). Perspectives on interlinkages and relationships between plastic pollution, management, and each SDG are put forward also by Kumar *et al.* (2021). Tremendous consumption growth and high rates of leakages threaten the ability of the global community to sustainably manage plastic production, use and disposal (Walker, 2021, p.1). Plastic pollution has attracted increased societal attention, resulting in the adoption of an array of national and international policies meant to cope with it (Xanthos and Walker, 2017; Dauvergne, 2018). Whereas early plastic pollution regulation focused mainly on banning specific plastic products, more recent focus has been devoted to managing the full plastic value chain (Syberg *et al.*, 2021, p. 1).

The rapid increases in plastic pollution, and projected growth in plastic production, calls for systemic measures to tackle unsustainable production, reduce consumption of plastic products and mitigate leakage to environment (Borrelle *et al.*, 2020; Lau *et al.*, 2020). A global agreement on plastic pollution is increasingly recognized as an appropriate tool to stem the tide of plastic pollution, filling the gaps in global regulation and governance of plastic products and their wastes (UNEP, 2017; WWF, EMF and BCG, 2020; Sun *et al.*, 2021).

Following a united call by the Nordic Council of Ministers for the Environment and Climate (MR-MK) for the development of a new global agreement on plastic pollution in 2019 (MR-MK, 2019), the Nordic Council of Ministers published the first Nordic Report on possible elements of a global agreement on plastic pollution the subsequent year (Raubenheimer and Urho, 2020a). The report proposed three potential objectives for a global agreement: the reduction of marine plastic litter; sustainable waste management; and sustainable consumption and production across the life cycle of plastic products. However, from the discussions at the last three United Nations Environmental Assembly (UNEA) meetings and in other international forums, it is evident that different stakeholders and countries emphasize different parts of the plastic life cycle and fate (Sun et al., 2021), as further elaborated in section 1.1.

The report further introduced three operational mechanisms of such a global agreement:

1. International sustainability criteria for plastic products;
2. National plastic action plans (NPAPs) and
3. National sustainability standards (NSS).

The line of reasoning is that the international sustainability criteria may set the direction of the NPAPs and NSS – guiding action and ensuring harmonization and a level playing field globally. The NPAPs and NSS are among the tools national governments can utilize to meet the ambitions of a global agreement. While NPAPs will lay out the regulatory, fiscal, and legal approach to achieving the ambitions of the agreement, the NSS will guide industry to ensure harmonized action through technical standards to reduce plastic pollution. Notably, this list does not specify measures on the international level, however, the importance of commonly agreed international targets and measures are emphasized elsewhere in the report.

1.1 Scope of report

This report is situated in a policy environment in which there is growing momentum towards a global agreement on plastic pollution. Peru and Rwanda have put forward a draft resolution (Annex 1) for the next UNEA meeting (UNEA 5.2). The Peru-Rwanda draft resolution proposes to start negotiating a legally binding global agreement on plastic pollution with the objective to **prevent and reduce plastic pollution in the environment by covering all stages of the plastic life cycle and by adopting a circular economy approach to plastics**[9]**.**

The Nordic Council of Ministers for the Environment and Climate supports this draft resolution (MR-MK, 2021) and has actively worked for a global agreement. Following the call for a new global agreement to reduce the environmental impact of plastic pollution in 2019 (MR-MK, 2019), the Nordic Council has released three reports on plastic pollution: *Potential elements in a New Global Agreement*, *Strengthening the Global Science and Knowledge Base to Reduce Marine Plastic Pollution* and *The Role of Regional Instruments in Strengthening Global Governance of Marine Plastic Pollution*[10]. These publications have laid the foundation for this 4th report.

This report was commissioned to explore how international sustainability criteria can be formulated in a new global agreement on plastic pollution, and what potential measures to fulfil these criteria could be included in a new agreement. It builds on the previous Nordic Reports to further delineate and define international sustainability criteria: their scope, formulation and potential integration into a global agreement on plastic pollution.

While the objective and design of a potential agreement is not yet set, this assessment was carried out on the assumption that a global agreement will address the entire life cycle of plastic products, as was reiterated in the recent draft resolution. The full life cycle of plastic products is here understood to include resource extraction, primary plastic production, design, product manufacturing, consumption and waste prevention, management and recycling.

Acknowledging the systemic nature of plastic pollution, and the current trajectory of increases in plastic production and consumption, a binding global agreement aimed at tackling plastic pollution from a life cycle perspective[11] would need to address every stage of the plastic value chain (Wagner, 2022). Limiting the scope to address only the downstream symptoms of plastic pollution, such as marine litter, will significantly limit the impact and reach of a potential agreement and further risk triggering trade-offs with other environmental and societal concerns (Sun *et al.*, 2021). Plastic products contribute to significant environmental and health issues beyond the marine environment and an estimated 80 percent of marine plastics are generated on land, warranting upstream measures both to limit plastic leakages and reduce the amount of plastics going to landfills (Jambeck *et al.*, 2015).

Similarly, a global agreement focusing exclusively on waste management faces related issues as it risks neglecting the importance of prevention, sustainable design, the significance of volume and future growth scenarios, as well as interrelated

9. https://conferencemarinelitterplasticpollution.org/documents/
10. All three reports can be accessed at www.nordicreport2020.com
11. According to UNEP (2021a), a life cycle approach to plastic pollution ensures the identification of key hotspots in the production and consumption system by considering all potential impacts (on climate, ecosystems, toxicity, jobs, economy, etc.) caused by [plastic] products (and their alternatives), in each stage of their life cycle and can orient the selection of the best solutions for the environment and with best socio-economic implications.

concerns throughout the value chain with regards to chemical pollution, use of non-renewable resources and climate change.

Hence, in line with the mandate of this assignment and the draft resolution promoted by Peru and Rwanda, this report focuses on the entire life cycle of plastic products. **The analysis is intended to inform the UNEA discussions and potential negotiations around a global legally binding agreement and propose a mechanism for harmonizing and enhancing concerted global action to reduce plastic pollution.**

1.2 Key assumptions

As indicated in section 1.1, some key assumptions, scoping decisions and a project mandate have steered the report, and warrant further elaboration:

- The analysis and the report have been framed by a set of guiding questions developed by the Norwegian Ministry of Climate and Environment, in collaboration with the Nordic Steering Committee and the Project Advisory Committee. The complete list of guiding questions is provided in Annex 2. The authors were further encouraged to consider potential future needs and scenarios, although leaning on knowledge about existing frameworks and experiences.
- In line with previous knowledge products from the Nordic Council of Ministers and the recent draft resolution for UNEA 5.2, this report reflects the assumption of a hybrid structure of a global legally binding agreement, with binding targets and measures at the international level, and certain national flexibility to determine implementation of measures to achieve the objective of the agreement.

1.3 Approach

A global, legally binding agreement on plastic pollution must reflect global circumstances, concerns and realities. Management, regulations and standards vary widely between countries and stages of socio-economic development, including in terms of pollution impact, regulatory pressures, financial and resource constraints and access to technology.

To capture the diversity of perspectives, we have consulted industry, non-governmental and inter-governmental organizations, academia and civil society actors through dedicated expert workshops representing all continents, different stages of economic development, and segments of the plastic life cycle. Representatives from both formal and informal waste management systems have been included, of which some were consulted one-on-one. Acknowledging the risk of problem-shifting along the plastic value chain, the report takes a systems approach including key variables such as circularity, material efficiency, resource conservation and more.

The structuring and integration of criteria in an international legally binding agreement, and accompanying measures and modalities, are informed by a review of the use of criteria in existing regional and global environmental agreements, as well as consultations with policy experts. Combined with a literature review of the use of sustainability criteria in product design, labelling schemes and industry standards, the report proposes relevant sustainability criteria. While the reviews are backward-looking, aiming to inform future action by examining past experiences, the proposed criteria in this report and their structure aim to be forward-looking, considering future projections and potential regulatory developments, and aligning with a global ambition to eliminate plastic pollution. The report aims to identify international sustainability criteria which balance the specificity required to spur global action and harmonize approaches to tackle plastic pollution, while ensuring enough flexibility to allow for effective and appropriate implementation at the national level.

The report identifies potential key international sustainability criteria and proposes a framework for their elaboration. Chapter 2 establishes an analytical framework for the assessment of sustainability criteria for plastic products. **Chapter 3** reviews the use of criteria in existing international agreements and law, before drawing on the framework laid out in chapter 2 to identify key global criteria. In **chapter 4** potential modalities and measures to meet the criteria are identified throughout the different stages of the plastic life cycle, while **chapter 5** discusses how trade-offs between differing priorities may be anticipated and avoided. Finally, **chapter 6** looks into how industry can be involved in the identification, development and implementation of criteria.

1.4 Glossary of terms

The following explanation of terms used in this report is provided for the purposes of interpretation of discussions presented in the report. Where appropriate, commonly used definitions have been derived from the literature.

Avoidable or unnecessary plastic products:
Plastic products that are not essential for health and safety, or for the functioning of society.

Bio-based plastics:
A type of plastic derived from biomass such as organic waste material or crops grown specifically for the purpose, which may or may not be biodegradable.

Biodegradable plastics:
Bio-based or oil-based plastic is considered biodegradable when it breaks down to basic components (water, biomass and gas) with the aid of microorganisms, and meets the standards for biodegradability – providing information about the timeframe for biodegradation, the level of biodegradation, and the required surrounding conditions in order to make claims measurable and comparable.

Compostable plastics:
Plastic that has proven its compostability according to international standards and can be treated in industrial composting plants.

Downcycling:
To recycle (something) in such a way that the resulting product is of lower value than the original item: to create an object of lesser value from (a discarded object of higher value).

Essential use:
Uses considered essential because they are necessary for health or safety or other highly important purposes and for which alternatives are not yet established.

Hazardous chemicals:
Hazardous chemicals are substances with hazardous properties, that may cause significant adverse impacts on human health and the environment; such as, but not limited to, carcinogens, mutagens and chemicals hazardous to reproduction, persistent bio-accumulative and toxic substances, endocrine-disrupting chemicals, and chemicals with neurodevelopmental effects.

Plastic life cycle: Plastic life cycle is here defined as all life stages of plastic production, use and disposal; from raw materials and their processing, production of consumer products, transport at all stages, sales activities, usage, to reuse, recycling, disposal and recovery.

Plastic product:
Products made wholly or partly from plastic polymers.

Post-consumer resin:
Post-consumer resin is commonly used to describe polymers derived from recycled plastic products.

Recyclability:
A product is recyclable if its successful post-consumer collection, sorting, and recycling is proven to work in practice and at scale maximizing the number of recycling rounds without downcycling.

(material) Recycling:
Reprocessing, by means of a manufacturing process, of a used plastic material into a product, a component incorporated into a product, or a secondary (recycled) raw material; excluding energy recovery and the use of the product as a fuel.

Reuse:
Operation by which packaging is refilled or used for the same purpose for which it was conceived, with or without the support of auxiliary products present on the market, enabling the packaging to be refilled.

Single-use plastic products:
Single-use plastic products are items intended to be used only once before they are disposed or recycled.

2. The fundamentals of sustainability criteria

'Sustainability criteria' as a concept has not yet been widely applied in international multilateral agreements and may be unfamiliar to many. This chapter elaborates on how the term has been used to date and assesses how sustainability criteria can be related to the life cycle of plastic products. The development of sustainability criteria for plastic products rests on some key assumptions with regards to the objective, goals and principles of a future agreement on plastic pollution. Hence, this chapter explores and identifies a set of potential objectives, goals and principles which together constitute the analytical foundation for the assessment of sustainability criteria. Lastly, a critique of the application of a sustainability concept for plastic is raised and discussed, before highlighting the cross-cutting issues addressed in the report.

2.1. Product sustainability criteria

'Sustainability' is a widely used term in the international discourse, generally considered to address three interlinked pillars – the social, environmental and economic dimensions – as most commonly conceptualized in the Sustainable Development Goals. Meanwhile, the term 'criteria' refers to "a standard on which a judgement or decision may be based"[12] and is another well-established concept within international relations. Yet, the compound term 'sustainability criteria' is less well developed and requires some further deliberation on its application.

The notion of sustainability criteria has been explored from various scientific perspectives, and although there is not yet a widely accepted definition at the international level, it has been suggested that sustainability criteria (Pavlovskaia, 2014):

i. can be of a qualitative or quantitative nature,
ii. are not static and often require continuous assessment and modification over time,
iii. are usually developed to serve certain purposes, and
iv. different groups of actors at different levels can be responsible for setting and supporting the implementation of sustainability criteria.

On the international, regulatory level there are limited experiences with the application of sustainability criteria[13], and few – if any – examples exist of international sustainability criteria for plastic products specifically. Hence, a clear and coherent definition of international sustainability criteria for plastic products and how such criteria may be defined and used in practice is currently lacking and warrants examination.

12. According to the Merriam-Webster Dictionary.
13. One example is sustainability criteria for biofuels in the EU Renewable Energy Directive discussed in greater detail in chapter 3.

Differentiating categories of criteria

a. *International Sustainability Criteria*

The first Nordic Report on elements of a global agreement on plastic pollution (Raubenheimer and Urho, 2020a) presented a rather expansive definition of the concept of sustainability criteria for plastic. The report defined **international sustainability criteria for plastic products** as "*a broad term for cascades of inter-related directives, guidelines, best practices, codes, standards, and procedures intended to enable environmentally sound management of plastics*" (Raubenheimer and Urho, 2020a, p. 72). Evidently, their definition of international sustainability criteria is not a single set of all-encompassing criteria for all plastic products, but rather a compilation of 'tools' ranging from directives to guidelines and more specific best practices and standards. The authors propose that such 'tools' may be used in the international agreement, and that they may set the direction of measures and actions by the signatories to meet the objective and goals of the agreement.

b. *Product Sustainability Criteria*

Using examples from the biofuel sector Pavlovskaia (2014) define **product sustainability criteria** as *"requirements to the sustainable quality of a product and its sustainable production, which have to be fulfilled in order to acquire a sustainability status or certification"* (Pavlovskaia, 2014, p. 12). Product sustainability criteria, their content, development and implementation are thus linked to the understanding of what sustainability entails, as well as to the multiple functions criteria can assume – e.g. they may set an upper limit to the use of natural resources and provide institutional guidance (Gleick, 1998); help in detecting unsustainable trends and effects, hence identifying unsustainable policy approaches, for instance, policies increasing resource use or societal disparities; assess opportunities and risks deriving from economic, environmental, and social sustainability dimensions (Zink, 2005; Graymore, Wallis and Richards, 2009); and promote and safeguard sustainable products and their production (Pavlovskaia, 2014), just to mention a few.

This conceptualization of product sustainability criteria is used in eco-labelling schemes, product life cycle assessment and eco-design approaches to minimize the negative environmental and social impacts of products (Hallstedt, 2017). Contrary to the international sustainability criteria, these criteria are typically set for single products, product categories, processes or companies, enabling greater specificity in their formulation in accordance with the context of the firm or sector (Pavlovskaia, 2013).

c. *Product Environmental Criteria*

With regards to labelling, the ISO definition (ISO 14024) of **product environmental criteria** is *"environmental requirements that the product shall meet in order to be awarded an environmental label"* which *"should be expressed in terms of impacts on the environment and natural resources, or whenever that is not practicable, environmental aspects, such as emissions to the environment"* (Spengler *et al.*, 2020). Key to this definition is the emphasis on criteria being expressed "in terms of impacts of the environment and natural resources". Such product environmental criteria are generally designed to limit *environmental* impacts and prevent trade-offs throughout the life cycle, though social concerns are to a greater extent acknowledged in more recent labelling efforts, for instance in the German *Blue Angel* scheme (Spengler *et al.*, 2020).

Furthermore, Spengler *et al.* (2020) found in their review of the Blue Angel ecolabel scheme that many criteria diverged from impact criteria (e.g. limiting CO^2 equivalent emissions, or product toxicity to aquatic organisms etc.). Instead, criteria are in some instances expressed as limits to inputs (e.g. energy use) or outputs (e.g. substance emissions) or as strategies to control the product value chain (such as repairability or durability), as strategies may have a range of impacts that can be difficult to quantify, even though they are recognized as reducing the environment impact of products[14]. Overall, they identified 11 main and 52 subcategories of ecolabel criteria along the value chain (Annex 4).

The analytical foundation for international sustainability criteria for plastic products

The broad approach to the concept of sustainability criteria provided in several of these accounts, and in particular the international sustainability criteria proposed in the first Nordic Report (Raubenheimer and Urho, 2020a), makes international sustainability criteria challenging to apply in practice as they blend different hierarchical elements of a multilateral agreement (Figure 2). We argue that such a wide definition is not optimal, neither for clarifying the concept of sustainability criteria; how it relates to the different elements of an international agreement; nor for assessing how sustainability criteria are best applied. However, it brings attention to the importance of considering the application of criteria at different levels of the agreement.

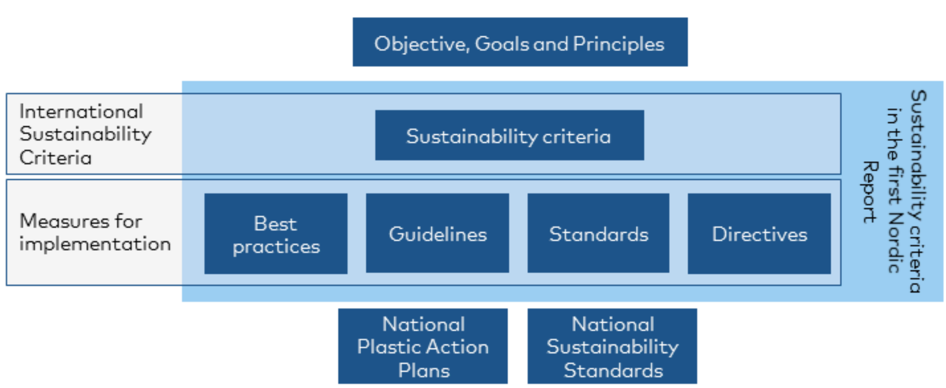

Figure 2. International criteria as applied in this report. Illustration of where this report conceptually places sustainability criteria in the organizational structure of a multilateral agreement, compared to first Nordic Report (Raubenheimer and Urho, 2020a). The listed measures are examples, and not a comprehensive account of potential measures that could contribute to fulfil the criteria.

14. For instance, the UNEP Life cycle Initiative found in their comprehensive review that reusable plastic products generally have a lower environmental impact that single-use products (UNEP, 2021a)

It has been argued that sustainability criteria may span across three tiers: strategic criteria, tactical criteria and absolute criteria (Hallstedt, 2017). These three tiers of criteria can be translated into layers of implementation tools in a global agreement, wherein:

- **Strategic sustainability criteria** describe overarching international criteria set out in a global agreement. These criteria are the guiding lights setting the direction of measures, national action plans and national sustainability standards to be developed in order to meet the objectives and goals of the agreement.
- **Tactical criteria** are used in the formulation of measures which require the development of guidelines, protocols and annexes. These criteria describe the tactical measures to achieve the long-term targets.
- **Absolute requirement criteria** are the specific requirements that must be met by parties to the agreement, or actors seeking to enter products into their markets. The short-term targets necessary to achieve the current time-bound aims, and which are likely to incrementally change to become more ambitious over time.

Hence, the use of criteria may include increasing levels of specificity from international sustainability criteria down to the absolute sustainability requirements or standards developed for set activities, sectors and products as is evident in Figure 2.

Figure 3. Illustration of sustainability criteria and their relationship with other components of a MEA, drawing on Pavlovskaia (2014), Hallstedt (2017), Raubenheimer and Urho (2020a) and Simon et al. (2021)

Drawing on these different perspectives, this report takes an alternate approach to sustainability criteria for plastic products by placing sustainability criteria higher up in the organizational hierarchy of multilateral instruments. For the purposes of this report, **international sustainability criteria for plastic products are understood as requirements to the sustainable content, design, manufacturing, consumption, collection and treatment at the end of life, to facilitate the reusability, repairability and recyclability of all plastic products and minimizing their environmental impacts and risks to human health throughout the plastic product lifecycle** (as illustrated in Figure 3).

2.2 Relating criteria to potential agreement goals and principles

As indicated in Figure 2, the design of sustainability criteria relates to the objective, goals and principles they are intended to support. Hence, some framing around the potential goals of an agreement is necessary in order to define the criteria. The final objective and goals of a global agreement on plastic pollution have evidently not yet been defined. However, in the draft resolution to commence negotiations at UNEA 5.2 in 2022, developed by Peru and Rwanda in collaboration with multiple other countries (Annex 1), the proposed objective states that the agreement shall "*prevent and reduce plastic pollution in the environment by promoting a circular economy and addressing the full life cycle of plastics*".

Goals of a potential agreement

Drawing on this *proposed* objective and for the purposes of this report, we see it necessary to elaborate on the *potential* goals of an international agreement and expand on some of the contemporary debates on the topic. In two seminal studies on a global agreement on plastic pollution, two different sets of goals have been proposed for a global agreement (Table 1). The goals promoted by Simon *et al.* (2021) maintain a slightly higher level of abstraction, aiming to limit the introduction of virgin materials to the value chain, and the loss of materials at the end of life, facilitated by the safe circularity of plastic products. The goals proposed by Raubenheimer and Urho (2020a), on the other hand, are issue-oriented, addressing four steps assumed to be central to eliminate plastic pollution.

Table 1. A selection of proposed goals for an international agreement on plastic pollution.

Simon et al. (2021)	Raubenheimer and Urho (2020a)
- Minimize virgin plastics production and consumption - Facilitate safe circularity of plastic products - Eliminate plastic pollution in the environment	- Elimination of problematic and avoidable plastic products. - Sustainable management of essential products. - Sustainable waste management. - Chemical hazard reduction.

It may be argued that Simon *et al.*'s goal to facilitate safe circularity of plastic products incorporates all four of the goals outlined by Raubenheimer and Urho. Safe circularity would necessitate elimination of problematic and avoidable products; the sustainable management of essential products; sustainable waste management; and reduction of hazardous chemicals. Additionally, Simon *et al.* propose goals for the minimization of virgin plastic production and consumption, as is required to decouple economic growth and exploitation of natural resources, as well as the elimination of plastic pollution already present in the environment, specifically. The two sets of goals may be further differentiated by how they relate to the different stages of the plastic product life cycle (Table 2).

Table 2. Comparison of the two potential sets of goals of an agreement on plastic pollution across the plastic product life cycle.

<table>
<tr><th>Stage of plastic life cycle</th><th colspan="2">Simon et al. (2021)</th><th colspan="3">Raubenheimer and Urho (2020a)</th></tr>
<tr><td>Resource extraction</td><td rowspan="5">Facilitate safe circularity of plastic products</td><td>Minimize virgin plastics production and consumption</td><td rowspan="4">Elimination of problematic and avoidable plastic products.</td><td rowspan="4">Sustainable management of essential products.</td><td rowspan="5">Chemical hazard reduction</td></tr>
<tr><td>Primary plastic production</td><td rowspan="4">Eliminate plastic pollution in the environment</td></tr>
<tr><td>Design and manufacture</td></tr>
<tr><td>Consumption and use</td></tr>
<tr><td>Waste management and treatment</td><td colspan="2">Sustainable waste management.</td></tr>
</table>

Whereas both of these approaches capture essential elements in how plastic pollution needs to be addressed in a life cycle perspective, the greater level of abstraction of the goals proposed by Simon *et al.* may provide the advantage that they simultaneously cover a broader range of issues, but also highlight the key aspects that the sustainability criteria should contribute to address throughout the value chain.

Principles informing international sustainability criteria

Adding a level of detail, Simon *et al.* (2021) propose a set of "Safe Circularity Principles for Plastic Products". The principles are intended to supplement the goals described above and further guide the development of criteria for sustainability in the plastic value chain. While Simon *et al.* (2021) propose four principles: durability, recyclability, safety and transparency, these created a disconnect between how the principles feeds into the goals of an agreement. For instance, their principles did not directly provide scope for criteria aiming to reduce the use of plastic materials in durable products and may thus neglect to address reduction and preventive measures.

The principles for safe circularity have therefore been altered and expanded for the purposes of this report to better capture and reflect all three goals proposed by the authors, resulting in the following set of principles:

- **Safety**: Use of hazardous substances is minimized; intentional releases and addition of microplastics in products is eliminated, unintentional releases minimized; and safety considerations and precautions taken in circulation, reuse, repair and refill of plastic products.
- **Minimization**: Production and use of plastic products minimizes the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the product life cycle.
- **Durability and reusability**: Product design accommodates and encourages safe reusability, repairability, and refillability of plastic products, while single-use plastic products for which safe and environmentally sound alternatives exist are eliminated.
- **Recyclability**[15]: Recycling enables cost-effective material recovery minimizing energy loss and maximizing the number of recycling rounds.
- **Transparency**: Relevant information on chemical composition and hazard of plastic products is available along the value chain for manufacturers, governments, users, consumers and recyclers; relevant information on product composition, feedstock and end-of-life management is available to consumers and users; and commonly used definitions are agreed.

The safe circularity principles are intended to specifically guide the development of international sustainability criteria, and should not be confused with the more customary use of principles in international environmental law such as the Stockholm Declaration (1972) and the Rio Declaration on Environment and Development (1992), which define and utilize guiding principles such as the no-harm principle, the precautionary principle and the polluter-pays principle in the development of measures and provisions of the legal texts (UNDESA, 2011; UN, n.d.). Such principles are commonly embedded in the preamble of international treaties, but may also be reflected in the sustainability criteria, the provisions of the agreement and in national implementation of such. Meanwhile the extended version of the safe circularity principles presented here is more specifically related to the international sustainability criteria for plastic products and their priorities.

Keeping in mind that the international sustainability criteria will operate in conjunction with other measures and provisions, including financing, monitoring, standards and action plans to meet these goals, they should be designed to answer to and contribute towards achieving the goals and the overall objective of the agreement. The revised principles highlight the importance of minimization and reuse in accordance with the waste hierarchy. In this context, minimization primarily refers to minimizing resource use, including reduction measures and ensuring that the tradeoffs between different feedstocks and materials are considered in order to minimize the total environmental impacts and emissions throughout the lifecycle.

15. A product is recyclable if its successful post-consumer collection, sorting, and recycling is proven to work in practice and at scale (EMF, 2020a).

The waste hierarchy[16] and the need for prioritization of control measures should also be reflected in the provisions of the agreement.

Thus, the complexity of plastic products and their use on a global level may require targeted principles to guide the development of international sustainability criteria, as compared to more closed systems such as organizations where broader principles are relevant to ensure that the organization minimizes its negative social and environmental impacts at every stage and for a broader range of environmental objectives (Broman and Robèrt, 2017).

Drawing on this discussion, this report will therefore elaborate on global sustainability criteria for plastic products leaning on the following *assumptive* objective, goals and principles:

Objective of agreement[17]

Prevent and reduce plastic pollution in the environment by promoting a circular economy and addressing the full life cycle of plastic products

Principles for safe circularity[19]

1. *Safety*
2. *Minimization*
3. *Durability and reusability*
4. *Recyclability*
5. *Transparency*

Goals of agreement[18]

- Minimize virgin plastic production and consumption
- Facilitate safe circularity of plastic products
- Eliminate plastic pollution in the environment

With the *analytical framework* in place, the next step is identifying what products and elements the criteria should cover and some of the debates around what sustainable plastic products entail.

16. Understood as waste prevention and re-use being the most preferred options, followed by recycling (including composting), then energy recovery, while waste disposal through landfills should be the very last resort (EC, no date).
17. As defined in the draft resolution by Peru and Rwanda (Annex 1). The objective may change during negotiations – in which case identified criteria may be altered accordingly.
18. Likewise, the goals identified are merely suggestions and may change if negotiations are started. This framework is designed to illustrate how criteria may be identified, and what they may be – and are subject to change when the objective, goal and principles are defined.
19. Modified from the principles proposed by Simon *et al.* (2021).

2.3. What do sustainable plastic products entail?

Predominantly derived from non-renewable resources, can plastic ever be deemed sustainable? The development of sustainability criteria for plastic products implicitly conveys the message that plastic products may be sustainable if certain criteria are met. However, the concept of sustainable plastic products is contested and necessitates further discussion.

A commonly repeated heuristic is the estimate that the design stage determines up to 80 percent of a product's environmental impact (European Commission, 2018). Decisions are made at the design stage which directly influence the end-of-life management of products (e.g. their level of recyclability, reusability and reparability) as well as the avoidance or restricted use of hazardous substance, and the use of secondary raw materials (European Commission, 2018). This requires a material ecosystem wherein the value of products, to the largest extent possible, is captured after use. Thus, criteria for sustainable plastic products require consideration of the entire plastic value chain, from resource extraction to primary plastic production, sustainable design and manufacturing, as well as use and management, treatment, re-entry to the value chain and disposal.

The OECD (2021, p. 11) define sustainable plastics as "plastics used in products that provide societal benefits while enhancing human and environmental health and safety across the entire product life cycle". Notably, this definition does not touch upon the fact that plastics are mostly derived from non-renewable resources, the predicted growth in production and consumption, the limitations to how many times plastic can be mechanically recycled, the current lack of feasibility in chemical recycling, the slow development of adequate management systems, and more. Rather, it is focused on the benefits offered by plastics. Hence, this definition implicitly suggests that plastics are sustainable if they are "better" than the alternative, and thus enhance human and environmental health and safety, and does not address many of the problematic sides of unsustainable plastic consumption with regards to over-consumption, unsustainable resource use and poor circularity of plastics.

With these constraints in mind, others argue that the concept of sustainable plastics relies on a pipe dream, as no ideal system for plastic management is currently operating either in developing or in developed countries and systemic changes are needed (PEW Charitable Trusts and SystemIQ, 2020). The latter is illustrated by the grand waste flows moving from developed to developing countries (Brooks, Wang and Jambeck, 2018). Furthermore, with current constraints to chemical recycling of plastic, limits exist to the number of cycles most plastic products can be mechanically recycled (Brouwer *et al.*, 2020; Schyns and Shaver, 2021). Hence, with the contemporary volumes of plastic production and the tremendous increase expected in coming years (Lebreton and Andrady, 2019), action to reduce consumption and production of plastic products is necessary. Furthermore, leakages throughout the plastic management system necessitate systemic changes towards a circular economy in its original definition as an economy which is "*restorative and regenerative by design and aims to keep products, components and materials at their highest utility and value at all times*" (EMF, 2015, p. 5) wherein *"one should rather focus on avoiding the recycling stage at all costs"* (WEF, 2019).

Most current plastic product sustainability initiatives are concerned with plastic packaging[20]. The plastic packaging sector is the single largest plastic product category, accounting for 36 percent of global production in 2017, and almost half of plastic waste generated (Geyer, Jambeck and Law, 2017). Packaging is also the most common category of marine litter (Morales-Caselles *et al.*, 2021). It is therefore natural that sustainability standards, requirements, guidelines and tools have prioritized this sector – and it may be anticipated that the packaging sector will receive considerable attention in the negotiations for a future agreement. Yet, international sustainability criteria may be designed to apply to all plastic product categories. Plastic products already face different standards and product requirements depending on their use[21]. Such nuances could be reflected in the lower criteria environment as illustrated in Figure 2 (measures, annexes, standards, guidelines, etc.).

Additionally, beyond the plastic value chain, criteria may address certain cross-cutting issues recognized as particularly important in reducing plastic pollution. Highlighting cross-cutting issues can also ensure that identified criteria and following measures do not contribute to problem-shifting; conversely, they create a common ground for discussions accounting for multiple dimensions, providing guidance on scope, methodology, targets, timelines. This report addresses four cross-cutting issues: management of single-use plastic products, microplastics, the informal sector and trade. These issues act as examples of concerns that sustainability criteria may address across the plastic value chain and are not intended to be exhaustive. Microplastics and single-use plastic products are two categories of particularly high concern due to their environmental impacts and the need for concerted action to tackle their releases (GESAMP, 2015). The informal sector on the other hand is given attention due to the integral role of this sector in the management of wastes in many countries (Gill, 2009; Nizzetto and Sinha, 2020), and the importance of the sector in providing livelihoods to millions of people (Velis, 2017; Gall *et al.*, 2020). Finally, trade is recognized as crucial to address the global flows of plastic products and wastes (UNCTAD, 2020). Further cross-cutting issues such as sea-based sources could also be addressed, as highlighted by Raubenheimer and Urho (2020a), but are not covered in this report. This report therefore considers how international sustainability criteria may address the entire plastic value chain, keeping in mind selected cross-cutting issues throughout.

In conclusion, this chapter has situated sustainability criteria organizationally in an environmental agreement. For analytical purposes, drawing on the scientific literature and other relevant experiences, we have extracted a set of a steering objective, goals, and principles to guide the further analysis of suitable sustainability criteria. Having presented some of the contestations of the concept of 'sustainable plastic products', we advance this assessment on the assumption that some practices of plastic production, use and management may be more sustainable than others. Furthermore, we expect that the listed cross-cutting issues will assist in shedding light on any flexibility challenges posed by an overarching set of international sustainability criteria.

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20. One of the most well-known examples include the Ellen MacArthur Foundation Global Commitment (EMF, 2020a).
21. Food-grade and medical plastics face more stringent quality and chemical safety standards than plastics intended for other sectors.

3. Key International Sustainability Criteria

Currently, no recognized international sustainability criteria are in place for the life cycle of plastic products[22]. This chapter reviews the use of criteria in current legal frameworks, before examining existing product criteria drawn from initiatives, guidelines, policies and standards. The review will inform the synthesis of potential international sustainability criteria for plastic products, drawing on the framework elaborated in chapter 2. Finally, key sustainability criteria are identified and discussed, and potential formulations of criteria are proposed.

3.1 Criteria in existing legal frameworks

The categorization of different types of sustainability criteria developed by Hallstedt (2015) and presented in Chapter 2, was originally developed for decision support in innovation, design and manufacturing. However, these categories may also have some relevance for the systematization of different criteria applied in other relevant environmental agreements and mechanisms as they provide an indication of the legislative level in which the criteria are situated.

The following section provides a brief description of how criteria are formulated and applied in a selection of multilateral environmental agreements (MEAs), regulations and mechanisms. The overview provides an indication of how criteria – and more specifically sustainability criteria - are used in various international legal frameworks. The list is not exhaustive and is based on input provided by different actors during stakeholder consultations.

A key message from this review is the variation in use of terms to describe criteria or similar concepts. Requirements, standards, conditions and components are all terms used for criteria or provisions with a function similar to criteria and are sometimes used interchangeably. More specifically, terms such as screening criteria and standard/requirement criteria are used to specify the type of criteria used.

The criteria reviewed serve two different core functions (Table 3):

- Classification/screening criteria: Criteria used to determine whether the item, product or substance is covered by the regulation or regulatory process, or not (e.g. Stockholm Convention, Montreal Protocol, EU Packaging Directive, Renewable Energy Directive).
- Standard/requirement criteria: Criteria used to determine whether authorities or businesses are meeting regulatory requirements, or fulfilling a certain standard, or what they must do (requirements) to fulfil such regulations or standards (e.g. Basel Convention, EU Packaging Directive).

22. Though the OECD (2021) have proposed sustainable *design* criteria for plastics.

In summary, the criteria used in existing agreements describe, frame and delimit what actions can be taken – and may define what are acceptable and not acceptable measures to take in order to achieve the objectives of an agreement or a regulation. These criteria do not act in a vacuum but are intended to be sufficiently fixed to guide action and implementation and give industry policy predictability and stability, yet with appropriate levels of flexibility to ensure adaptation to changing technologies, knowledge, capacity and best practices. In a review of sustainability criteria for biofuels it was distinguished between 'general sustainability criteria' and 'specific sustainability criteria', arguing that a set of complementary (not substitutable) criteria at different levels was required to ensure adequate efficiency (Allen *et al.*, 2016).

The criteria reviewed here were typically sector-specific, addressing issues such as greenhouse gas emissions, hazardous substances or biofuels (Table 3). Most of them are not particularly broad in scope and paid little attention to broader sustainability concerns or cross-cutting issues. The EU Packaging Directive (see Annex 3) is an exception in this regard. Even though the criteria in the Packaging Directive were labelled requirements, they provided a broad set of sustainability criteria that needed to be fulfilled in order to ensure sustainable management of packaging. Although the requirements were small in scope, covering one single, but important, segment of plastic products, these criteria went beyond technical requirements and addressed cross-cutting issues such as waste generation, workers' health and safety, and life cycle perspectives. Hence, the criteria used in the Packaging Directive are considered a highly relevant example for the development of sustainability criteria for the life cycle of plastic products and will be elaborated later in the chapter.

Next follows a short review of five international regulatory frameworks and their application of criteria or similar concepts:

Stockholm Convention on Persistent Organic Pollutants

The Stockholm Convention (SC) on Persistent Organic Pollutants[23] (POPs) is a multilateral environmental agreement that regulates hazardous chemicals. The convention has 185 parties and is a dynamic instrument, where new POPs may be listed at the request of member states. The convention currently regulates more than 30 substances.

The SC applies criteria to set the frame for the convention, i.e. to assess which chemicals should be considered for listing and regulation by the convention. The criteria are labelled "screening criteria", and provided that the proposed chemical fulfills the four screening criteria of persistence, bioaccumulation, potential for long-range environmental transport and adverse effects, it is put under further scrutiny and considered for listing. Hence, meeting the criteria and technically qualifying as a POP does not automatically imply listing under the convention, only that it will be included in the evaluation system: a process which also takes into consideration other variables such as socio-economic dimensions, exemptions, control measures, (chemical) alternatives, impacts on society, waste implications, access to information and public education, monitoring capacity, etc. (Steindal *et al.*, 2021).

How do the criteria relate to sustainability? As the criteria are process-oriented and do not determine whether control measures should be taken (they only relate to evaluation), they do not alone safeguard the sustainable control of these hazardous

23. http://chm.pops.int/

chemicals. The screening criteria resemble what Hallstedt (2015) has classified as strategic criteria, as they set the direction for the regulation (i.e. if screened chemicals meet these criteria, then they are eligible for further scrutiny). However, it could also be argued that they have some similarity with tactical criteria, since they help extract the chemicals eligible for further detailed assessment measures.

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal[24](BC) is a multilateral environmental agreement with the overarching objective to protect human health and the environment against the adverse effects of hazardous wastes. The convention is ratified by 189 Parties. The chief goals of the convention are to reduce the generation of hazardous waste, promote environmentally sound management (ESM) of such wastes, restrict transboundary movements of hazardous wastes (non-ESM) and facilitate a regulatory system for acceptable transboundary movements of such wastes[25].

The criteria for Environmentally Sound Management of hazardous waste under the Basel Convention may also have relevance for the development of sustainability criteria for plastic product (PACE, 2011). Despite the convention indicating a decision on ESM criteria at its first meeting, such a decision has never been made. Instead, further guidance on ESM criteria have been developed through "the series of general and technical guidelines adopted by COP"[25]. Although a broader set of criteria have been part of the discussion (Alter, 2000), two key sets of criteria can be elaborated; one set of criteria intended for the government level and another set of criteria more specifically for the industry facility level. The five criteria which have to be complied with at the **government level** to conform to ESM are:

1. Have a regulatory infrastructure and enforcement to ensure compliance with applicable regulations,
2. Authorization system of adequate technology and pollution control,
3. Set requirements for facility monitoring of waste management,
4. Take appropriate action when monitoring reveals non-compliance/emissions, and
5. Ensure adequate training and capacity among waste managers.

These criteria may be characterized as tactical criteria, i.e. criteria that are not formulated in the convention per se, but in supporting material and guidance adopted by the COP. These are steering criteria in the sense that they set a soft framework for what should be strived towards to conform to ESM. There is a certain level of flexibility for Parties in how they fulfil the set criteria.

24. http://basel.int/
25. Basel Convention definition of ESM: "Environmentally sound management of hazardous wastes or other wastes means taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes"

Similar criteria have been developed for the **business facility management level** by the Partnership for Action on Computing Equipment (PACE) – a multi-stakeholder partnership associated with the convention. These criteria define the required conditions and measures at the facility management level to be in conformity with ESM-requirements. The eight criteria are:

1. Management commitment to a systemic approach to achieve ESM in all aspects of facility operations,
2. Carry out risk assessments (public, worker health and safety),
3. Risk prevention and minimization (to public, worker health and safety and the environment),
4. Fulfil legal requirements,
5. Ensure awareness, competency and training,
6. Record-keeping and monitoring of ESM performance,
7. Corrective action to risks and deficiencies, and
8. Transparency and verification.

In supporting documents, and related to each of the specific criteria, a wide range of measures (and conformity checklists) have been proposed to ensure that the facility meets the criteria for ESM (PACE, 2011). The measures include activities, indicators, considerations, tools, procedures, etc. to meet the criteria and justify ESM of waste. Again, these criteria will indicate whether the facility conforms to ESM, although with certain flexibility in how it meets the eight criteria.

How do the criteria relate to sustainability? In this context criteria are defined as "characteristics, attributes or traits deemed important to achieve a desired principle, in this case ESM" (PACE, 2011, p. 9). Nonetheless, in various supporting and guidance documents, terms such as requirements, standards, conditions, components, characteristics, attributes and traits are occasionally used interchangeably with criteria. The criteria serve two purposes: they define what is expected and what are acceptable standards, and they direct further action, since both compliance and non-compliance trigger specific measures under the convention. As an example of soft law, with inherent flexibility in terms of implementation, the criteria leave no assurance of sustainable management of waste, although they do indeed set the condition for acceptable and non-acceptable measures.

Montreal Protocol on Substances that Deplete the Ozone Layer

The Montreal Protocol on Substances that Deplete the Ozone Layer[26] is a global agreement to protect the ozone layer applying a phase-out plan for ozone-depleting chemicals (ODCs). The agreement entered into force in 1989 and addresses both the production and consumption of ODCs.

The agreement has a set of criteria to define essential or non-essential use of certain substances (Decision IV/25). A substance is considered essential if it fulfils two criteria: it is necessary for health, safety or critical for society, and no technical or economically feasible alternative that is acceptable to health and environment exist. Furthermore, procedural criteria are set for the situation when the production and consumption of an essential substance should be permitted. The procedural criteria are that all possible economic steps must be taken to minimize use and

26. https://www.unep.org/ozonaction/

emissions, and secondly, that there must be a lack of sufficient quantity and quality from stocks or recycled substances. The substances deemed essential and thereby permitted are mostly exempted from the control provisions under Article 2 of the protocol.

How do the criteria relate to sustainability? Although the Montreal Protocol is an environmental agreement to protect the ozone layer, the essential use criteria under the agreement are not sustainability criteria per se. Instead, they are criteria used to define the scope of the protocol: what is covered and what is not. The separation of essential/non-essential is an agreement modality that provides the Parties with certain flexibility, depending on their capacity and national situation.

EU Packaging and Packaging Waste Directive (1994)

The EU has developed rules on packaging and packaging waste, including design and waste management, which entered into force in 1994[27]. The regulation is set up to deal with the increasing quantities of packaging waste, which cause environmental problems, and to harmonize regulations in the internal market.

The Directive applies criteria to aid the definition of the term "packaging". Beside a specific definition of packaging, additional criteria are set up to aid users to determine what is considered packaging and not. The three criteria under article 3 of the Directive provide a clarification of its scope and potential misunderstandings, functionality considerations related to the definition, and related technicalities that may confuse the user. Beyond these criteria, the Directive also sets 'requirements' to the composition, use and nature of packaging (Article 9, Annex II). These requirements may also be understood as criteria, framing the demands put on member states that place packaging on the market (Article 9). If the packaging is not designed, produced or commercialized according to these essential requirements (criteria), then it shall not be placed on the market.

How do the criteria relate to sustainability? The first set of criteria which aid the definition has little relevance to sustainability. However, the second set of criteria discussed above (the requirements of Annex II) may very well fall within the category of sustainability criteria. Although they only cover one category of products (packaging) these criteria are relatively extensive, and they also include other materials besides plastics. They encompass minimization of material use, optimization of reuse, recovery and recycling, minimizing the footprint of waste material, reduced content of hazardous chemicals and preventing leakages to the environment, safeguarding the health and safety of the workforce, optimizing properties for effective incineration, and minimizing inadequate decomposition processes. Together, these criteria cover a large part of the sustainability aspects of packaging, including some cross-cutting issues such as workforce health and safety, as well as hazardous chemicals. They do not, however, encompass areas such as raw material extraction, safeguarding the informal sector, or restrict predicted consumption increases.

27. Directive 94/62/EC

Renewable Energy Directive 2018/2001/EU

The Renewable Energy Directive (RED) is a regulation to promote the use of renewable energy in the EU[28]. The updated directive from 2018 reinforced the sustainability criteria of bioenergy through different provisions. Biofuels have been hailed as an important supplement of fuel to reduce greenhouse gas emissions, however, their production has typically taken place on cropland used for growing food or feed for livestock (Valin *et al.*, 2015). This has pushed agriculture into new pristine areas with high carbon stock, such as peatlands, wetlands and forests (i.e. indirect land use change – ILUC). ILUC may trigger an increase, rather than the intended decrease, in greenhouse gas emissions.

The RED is one of few frameworks that applies the term 'sustainability criteria'. The comprehensive set of criteria is in brief designed to determine what is sustainable biofuel, bioliquid and biomass fuel, and what is not (including production). If the fuel meets the set requirements of Article 29, paragraphs 2–7 and 10, they count towards EU renewable energy targets and are eligible for financial support. The criteria encompass various issues, including the monitoring and management requirements of operators and national authorities, reporting, and limitations on raw material extraction from specific sources.

How do the criteria relate to sustainability? The sustainability criteria under RED are extensive but narrow in scope. Their main purpose is to distinguish between the sustainable production of biofuel, bioliquid and biomass fuel, and those practices that are not. Biofuels which do not meet the criteria are not eligible for financial support and cannot be accounted for when determining compliance with renewable energy targets in the EU. The criteria are extensive in the sense that they describe a wide range of unsustainable production of such fuels, and they are narrow in the sense that they do not address cross-cutting issues such as overconsumption, safeguarding local livelihoods, and temporal aspects and changes related to land-use, to name some examples. This also narrows the sustainability aspect associated with RED.

28. Directive 2018/2001/EU

Table 3. Overview of criteria, criteria category and their use in selected MEAs and mechanisms.

Name	Concept	Criteria*
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes	Criteria for government management systems and for business facilities to conform to environmentally sound management.	- Specific management and legal system - Risk assessment, prevention, minimization
Stockholm Convention on Persistent Organic Pollutants	Screening criteria for (potential) persistent organic pollutants. The criteria are used to determine which chemicals should be subject to further regulatory assessment and whether further process should be taken.	- Persistence; - Bioaccumulation; - Potential for long-range environmental transport; - Adverse effects
EU Renewable Energy Directive 2018/2001/EU	Sustainability and greenhouse gas emissions saving criteria for biofuels, bioliquids and biomass fuels. The criteria in the EU Renewable Energy Directive identify which biofuels count towards the renewable energy shares of the members states and compliance with renewable energy targets as well as eligibility for financial support.	Operators or national authorities have monitoring or management plans in place in order to address the impacts on soil quality and soil carbon. Biofuels, bioliquids and biomass fuels from agricultural biomass shall not be made from raw material obtained from land with a high biodiversity value, high-carbon stock, or that was peatland in January 2008. Biofuels, bioliquids and biomass fuels from forest biomass shall meet set criteria to minimize the risk of using biomass from unsustainable production, as well as land-use, land-use change and forestry criteria.
Montreal Protocol on Substances that Deplete the Ozone Layer	Essential use decision criteria. A controlled substance qualifies as essential only if it meets set criteria. Substances which do not meet the criteria are subject to normal control measures under the Protocol.	It is necessary for the health and safety—or is critical for the functioning— of society (encompassing cultural and intellectual aspects). There are no available technically and economically feasible alternatives or substitutes that are acceptable from the standpoint of environment and health. Production and consumption, if any, of a controlled substance for essential uses is permitted only if: All economically feasible steps have been taken to minimize the essential use and any associated emission of the controlled substance. The controlled substance is not available in sufficient quantity and quality from the existing stocks of banked or recycled controlled substances.
EU Packaging Directive	The Directive follows the waste hierarchy advocating for 1) reduction in packaging waste, 2) reuse, recycling and other forms of recovering packaging waste and 3) as a last resort final disposal. Article 9, paragraph 1 requires all packaging put on the market to meet the requirements defined in Annex II within three years of the directive entered into force.	Requirements for manufacturing and composition including packaging volume and weight, design for reuse and recovery, and chemical safety throughout value chain. Requirements for the reusable nature of packaging: Physical properties and characteristics shall enable several trips or rotations. Packaging should be possible to be processed after use in order line with health and safety requirements of the workforce. And packaging must meet the requirements for recoverable packaging when it is no longer in use. Requirements for the recoverable nature of packaging with set requirements for material recycling, energy recovery, composting, and biodegradable packaging.

* The criteria have been simplified for the sake of space, full criteria are found in the source texts.

3.2 Review of existing product sustainability criteria

Product sustainability criteria are used in various voluntary ecolabel schemes or assessments which consider environmental impacts of products through their life cycle (Nordic Swan Ecolabel, Life cycle Assessments). However, most of these labels apply single-issue claims, i.e., labor rights (Fair Trade), sustainable forestry (FSC Labelling), sustainable fisheries (MSC Labelling), which may contribute to problem-shifting due to the lack of a systemic and comprehensive approach taking into account the social, economic and environmental impacts of products (UNEP and ITC, 2017).

Such criteria have also been used by the industry to set voluntary standards and commitments – either for individual companies or through industry organizations. With regards to plastic products, there are numerous schemes: individual company commitments; national or regional Plastic Pacts[29]; and industry-specific guidelines and best practices (APR Design Guidelines; Plastics Europe 2030 Voluntary Commitment).

The Association of Plastic Recyclers (APR) has created an extensive *Design Guide for Plastics Recyclability* (APR, 2018, 2021) to guide product designers towards more recyclable packaging. The design guide differentiates between different polymer types, providing guidance on which material and design choices are "preferred" and which are "non-recyclable" or "unknown". The design guide is created with North American infrastructure in mind – and illustrates the complexities of technical guidance on recyclability which require considerations of dimensions, colors, additives, barrier layers and more. As these considerations depend on the available infrastructure and waste collection and sorting system, it is apparent that the international sustainability criteria must maintain a higher level of abstraction.

An overview of common criteria used in existing guidelines, frameworks and commitments is provided in Annex 5. Table 4 provides examples of some selected criteria, measures and indicators separated by each stage of the plastic life cycle. Many of these are designed for a specific industry or national context, giving them a greater level of specificity and preventing a direct transposition to the global context. Instead, this report draws on existing criteria and standards to identify the overarching strategic criteria that may be applied globally to guide national action.

29. Plastic pacts are a network of voluntary initiatives to limit plastic pollution by moving towards circularity of plastics. The initiatives are led by local organizations, bringing together business, governments and civil society.

Table 4. Examples of existing or previously proposed criteria or requirements to plastic products and processes.

Life cycle stage	Criteria	Source
Extraction	The production and use of plastics is fully decoupled from the consumption of finite resources	[1]
	Use less plastic in the first place, and switch to recycled content;	[3]
	Reduce virgin plastic packaging by 50% by 2025, with one third (more than 100,000 metric tons) coming from an absolute plastic reduction.	[3]
	Plastic products are sourced, manufactured, transported, and recycled using renewable energy	[4]
Primary plastic production	Choose materials that are recycled and that can be further recycled or choose rapidly renewable biobased plastic products that can be used to generate compost	[7]
	Should be manufactured to the extent possible using non-toxic, recycled material	[6]
	Compare materials based on the extent of recycling options available over the geographic regions where the product will be sold.	[7]
	Is manufactured using clean production technologies and best practices	[4]
Design and manufacture	Produce and manufacture plastic products in a way that maximizes resource efficiency and eliminates toxic chemicals and pollution in order to protect workers, the community around the production or manufacturing facility, and the environment.	[7]
	Compare materials based on whether they contain hazardous chemical constituents or constituents that interfere with recycling. Avoid additives that degrade the quality of recycled plastic.	[7]
	Prefer plastics that meet performance requirements with no, or few, additives.	[7]
	Reduce unnecessary material use	[2]
Consumption	Reuse models are applied where relevant, reducing the need for single-use packaging	[1]
	Eliminate hazardous chemicals used in plastic products, and pollution and waste associated with product use.	[7]
	Provide information on multiple non-waste paths, and least harmful waste paths appropriate for the area in which the product is sold.	[7]
Collection and treatment	Is effectively recovered and utilized in biological and/or industrial closed loop cycles	[4]
Cross-cutting issues		
Informal sector and labor rights	It is essential to respect the health, safety, and rights of all people involved in all parts of the plastics system, and particularly to improve worker conditions in informal (waste picker) sectors.	[1]
Microplastics	Ban on the manufacturing, import, and placing on the market of any toiletries (including natural health product and non-prescription drug) for cleansing or hygiene that contain microbeads	[8]
Single-use plastic products	Elimination of problematic or unnecessary plastic packaging through redesign, innovation, and new delivery models is a priority	[1]
Trade	Trade of plastic waste is in accordance with the provisions of the Basel Convention.	BC

References:
[1] EMF (2020a) Global Commitment,
[2] Norwegian Green Dot Design for Circularity (Grønt Punkt, 2021),
[3] Unilever (no date) Plastic Targets.
[4] Sustainable Packaging Coalition (2011)
[6] APR (2021) Design Guidelines
[7] OECD (2019a) sustainability criteria for plastics from a chemicals perspective.
[8] Canada Microbeads in Toiletries Regulation (Canada, 2017).

The criteria listed in Table 4 illustrate some of the issues for identifying criteria. Criteria targeting a certain sector, such as packaging criteria, can have a higher level of specificity than criteria for all plastic products. For instance, the criterion in Table 4 requiring that one "choose materials that are recycled and that can be further recycled or choose rapidly renewable biobased plastics that can be used to generate compost" [7], may not be appropriate for most thermoset plastics which are unrecyclable with current state-of-the-art technologies (Zhang *et al.*, 2021). Meanwhile, the criterion that products are "manufactured to the extent possible using non-toxic, recycled material" has a broader range of applicability as it is less prescriptive. It is therefore apparent that the formulation of criteria requires close scrutiny to prevent unforeseen consequences and trade-offs, and to ensure that the formulation of criteria contribute towards the stated objectives of a potential agreement.

The EU Packaging Directive can provide relevant examples of how criteria (in the directive referred to as requirements) can be formulated to provide sufficient rigor and flexibility. For instance, under Requirement 3(a) "Packaging recoverable in the form of material recycling", the directive demands that "*Packaging must be manufactured in such a way as to enable the recycling of a certain percentage by weight of the materials used [...]. The establishment of this percentage may vary, depending on the type of material of which the packaging is composed.*" (Directive 94/62/EC Annex II). The criterion is both specific in stating that packaging must adhere to certain standards yet allowing the actual percentage to be determined in accordance with existing technologies and the type of material.

3.3. Sustainability criteria across the product life cycle

Prior to discussing potential criteria in detail, the function of criteria should be reiterated. The discussed international sustainability criteria are not necessarily requirements products must meet to be put on markets, but long-term strategic criteria guiding the development of measures, including standards and national action plans. When criteria are not met, this could activate measures to remediate the situation – similar to how hazardous wastes require prior informed consent from the receiving country when the wastes do not meet certain criteria. The criteria discussed here are primarily intended for plastic products but may also be relevant for other non-plastic products and substitutes. Presently, few plastic products would likely meet a potential set of international sustainability criteria due to the chemical and plastic pollution associated with current production and consumption practices, as described in the introductory chapter. The criteria are intended to ensure a global vision for sustainable production and consumption of plastic products, and the prevention of plastic pollution.

The following section discusses potential criteria which could be related to each of the five principles, elaborating on what they may entail, key considerations and current debates. Due to the interrelated nature of the five principles, the corresponding criteria may to some extent overlap. The criteria are designed with an understanding that the waste hierarchy will be an integral concept in determining the appropriate line of action and prioritizing along the 5 R's (refuse, reduce, reuse, repurpose, recycle).

3.3.1. Safety

The sustainability criteria on safety relate both to reducing the environmental harm of plastic products, as well as the harm to humans and livelihoods from plastic pollution throughout every stage of the plastic value chain. The circularity principle of safety as proposed by Simon *et al.* (2021) is here expanded to also include issues such as worker health and safety, protection of livelihoods of waste workers in the informal sector, and trade. In other words, the criteria responding to the safety principles applies a wider concept of safety including a broad range of implications for humans, environment, and society in general.

Throughout the life cycle of plastic products both humans and the environment are exposed to plastic particles (nano and micro) and chemicals that may have deleterious impacts (Gallo *et al.*, 2018; Conti *et al.*, 2021).

Workers are exposed to chemicals and microplastics in the production of plastic products or in manufacturing of plastic products. However, informal workers operating with crude mechanical recycling methods and without any protection probably face the highest risk of health impact. Such occupational exposure to heated plastics, plastic dust and fine particles, chemical pollution in air, water, dust and food, and biological and chemical hazards associated with biomedical waste are posing a major threat to worker health (Gallo *et al.*, 2018; Prata, 2018; Cook and Halden, 2020; Wang *et al.*, 2020). Improving the health and safety legislation, processing techniques, stimulating the use of protective gear, providing the workers with health protection insurance, and implementing health, safety and environment (HSE) procedures are some examples of how these worker health and safety issues may be addressed. These perspectives could be incorporated as a specific element directly in a global agreement, or alternatively, explicitly cross-linked to labor rights regulations under the International Labor Organization (ILO) or similar.

Consumers are exposed to nano- and microplastics through diet and inhalation of particles in air, dust and products (Catarino *et al.*, 2018, 2021; Prata, 2018). While the health impacts of such ingestion are uncertain, the precautionary principle indicates the need to address the risks associated with chemical additives that may leak from the product during use and storage, thereby exposing consumers through similar routes.

The environmental hazard and impact of plastics, both macro- and microplastics, along with any associated plastic-associated chemicals is another issue of concern. Plastics waste released to the environment can cause entanglement of biota (e.g. ghost fishing), smothering of benthic habitats and ingestion which can lead to malnutrition, starvation, and ultimately death of impacted individuals (Kühn, Bravo Rebolledo and van Franeker, 2015; UNEP, 2021b). Littering, fly-tipping, crude and inadequate management systems and more contribute to releases to land and aquatic systems, and emissions to air. One of the most profound sources of environmental chemical pollution is the open and often illegal burning of residual and household waste, which when burned at sub-optimal temperatures releases toxic dioxins and furans, substances regulated under the Stockholm Convention on POPs (UNEP, 2019a).

In order to embed hazardous chemicals in the life cycle of plastic products, a global agreement on plastic pollution should harmonize with existing MEAs, including the Stockholm Convention on POPs and the Basel Convention on hazardous waste. However, these instruments only cover a fragment of all hazardous chemicals identified in plastic products and processes. An illustrative example is the group of endocrine disrupting chemicals (EDCs), of which many are used as additives in plastic products (e.g. phthalates, BPA, etc.), counting more than 800 compounds that are known or suspected to be EDCs (UNEP/WHO, 2012). Furthermore, a recent study found more than 1500 chemicals of concern in plastic products (Aurisano *et al.*, 2021). Most of these compounds are not regulated under current international regimes. Hence, in order to achieve a coherent system of standards, guidelines and measures steered by the safety criteria, an internationally accepted system or list could be applied to identify unwanted chemicals in plastic products (e.g. the EDC list developed by WHO/UNEP (2012), the SIN List developed by ChemSec[30], or an aggregated version of national inventories/registries of hazardous chemicals etc.).

Trade is an issue that does not necessarily relate to safety. Legal trade of plastic material and waste that is not regulated under the Basel Convention, or where a prior informed consent procedure applies, is not necessarily a safety issue if handled in an environmentally sustainable manner in the recipient country. On the contrary, illegal trade may certainly be a safety issue as it is occurring in the shadow economy, mostly under the radar of national authorities, thus not adhering to local regulation and avoiding monitoring and enforcement (Interpol, 2020). Trade may also be addressed by the criteria on recyclability and transparency.

How may sustainability criteria be designed to incorporate such broader safety aspects? A comprehensive study titled "A Chemicals Perspective on Designing with Sustainable Plastics" argues that any criteria incorporating hazardous chemicals may be developed on the basis of three sustainable design principles: holistic design and life cycle thinking, maximization of resource efficiency, and elimination and minimization of hazards and pollution (OECD, 2019a, 2021). Departing from product design and by evaluating each life cycle stage of plastic production in accordance with these three principles, the report elucidated specific sustainable design criteria targeting chemical consumption and pollution.

Drawing on the above discussion, five key potential sustainability criteria are proposed for plastic product to address the principle of safety.

Proposed key sustainability criteria for safety:

- Hazardous chemicals[31] are handled safely and minimized in production processes and in plastic products.
- Reintroduction of chemically contaminated materials in recycling and reuse processes is avoided, until future technological advances can ensure safe extraction and appropriate destruction of hazardous chemicals.
- The production, collection and treatment of plastic products is in accordance with national and international legislation on human and worker rights, including safe working conditions.
- Primary and secondary microplastic releases are minimized at every stage of

30. https://sinlist.chemsec.org/
31. The definition of what is considered chemicals of concern and hazardous chemicals will likely need to be considered and defined through expert groups, and aligned with legislation such as the Stockholm convention etc.

the plastic life cycle.
- Plastic waste is traded in a manner which facilitates safe treatment at the highest level of the waste hierarchy.

3.3.2. Minimization

Minimizing resource use is crucial throughout the value chain to increasingly decouple plastic product production and consumption from resource depletion, increasing greenhouse gas emissions and environmental degradation. While criteria on durability and reusability may address reducing the need for new products by prolonging product lifetime, criteria on minimization here address whether the product with all its components is necessary in the first place. Simplifying plastic products may have benefits not only for easing recycling processes downstream, for instance by choosing mono-layered packaging designs rather than multi-layered packaging (Löw *et al.*, 2021). Reducing the amounts of additives, limiting the range of polymers used and simplifying manufacturing processes to produce the final product may also reduce environmental impacts of the plastic product across the value chain – however, such measures require consideration of life cycle impacts to determine the impacts of various trade-offs. In other words, plastic products should be produced in a manner which balances minimizing resource use while maintaining the utility of the final product.

Criteria could also address minimization by targeting the use of virgin materials. Extraction of the raw materials and production of virgin plastics has significant environmental impacts (CIEL, 2019; Zheng and Suh, 2019), and to meet global ambitions to achieve net zero greenhouse gas emissions and the 1.5-degree target, it is necessary to reduce the total inflow of virgin plastics. Such criteria may guide measures to reduce consumption of unnecessary products which increase the demand for plastic raw materials; trigger product design which minimizes plastic content; drive demand for alternative feedstocks; and guide investment to innovative technologies for recycling. One example from the EU packaging directive is the limit to the packaging volume and weight to the "minimum adequate amount to maintain the necessary level of safety, hygiene and acceptance for the packed product".

Increasing the uptake of PCR can contribute to improving recycling rates as the market value of recyclable plastic is expected to increase with growing demand. Requirements to the amount of PCR content are increasingly acknowledged as an appropriate measure to increase market demand for PCR and drive the establishment of PCR supply chains. However, the current lack of harmonized standards and poor guidelines and quality assurance of PCR materials may hinder the uptake of PCR materials, and the risk of reintroduction of legacy chemicals in recycled content poses a health risk (Wagner and Schlummer, 2020). A criterion on PCR in plastic products could contribute to drive the harmonization of PCR standards, incentivize development of new technologies and business models for provision of PCR – including the informal sector as well as providing stability to the recycling sector which is currently vulnerable due to price instability of virgin plastics compared to the relatively inflexible cost of recycling (Gall *et al.*, 2020; Simon *et al.*, 2021).

Minimization in this context further entails weighing different concerns and ensuring that criteria intended to reduce environmental impacts from plastic pollution, for instance through substitution or by improving recyclability or durability, do not come at the cost of increasing energy use, hazardous chemicals or indirect land-use change[32] from production of bio-based plastics. Similarly, criteria may address the use of plastic products in waste-to-energy applications, which in some instances may be more environmentally favorable as they prevent leakages of plastic products into the environment, yet these should not be seen as a long-term solution resulting in infrastructural lock-ins (Sharma *et al.*, 2021). Drawing on the criteria/ requirements of the EU Packaging Directive that set requirements to optimize management of packaging waste and clean incineration processes (Annex 3), criteria on efficiency may also steer the fate of the plastic when recycled and during incineration.

Proposed key sustainability criteria for minimization:

- The feedstock for plastics is responsibly sourced[33], avoiding undesirable indirect land-use change and generating the least emissions.
- Plastic products are designed, manufactured, and managed so that:
    - Resource use is minimized;
    - The use of virgin plastic is significantly reduced;
    - Plastic products are manufactured with an ambitious and progressively increasing percentage by weight with materials from sustainably sourced renewable or recycled origin.

3.3.3. Durability and reusability

The principle of durability and recyclability is intended to guide measures to decouple economic growth and resource use (Simon *et al.*, 2021). Criteria related to durability and reusability will contribute to plastic products lasting longer and enduring several cycles of reuse, keeping plastic products in the economy longer before eventual recycling. A durable plastic product cannot exist disengaged from its system of use, and therefore requires criteria across the value chain to ensure products are durable in effect, and not just in design. However, durability is not necessarily a virtue in and of itself, as some products which are intended for single use out of necessity[34] (see Chapter 4 for further elaboration of essential and non-essential plastic products) should not be designed for several cycles of reuse (OECD, 2019a).

Durability and reusability criteria could also contribute towards the shift away from single-use plastic products (SUPP). SUPPs are by definition[35] used for short durations and criteria addressing durability may therefore go beyond mandating

32. Indirect land use change refers to the risks of environments with high carbon stocks (such as peatlands, forests and wetlands) being converted to agricultural lands because of the displacement of agricultural land for growing feedstock for biofuels and bio-based plastics. For example, increased demand for corn for bioplastics could trigger expansion of production in order to maintain supply.
33. The definition of responsibly/sustainably sourced content will likely have to be further defined for different feedstock (recycled, biobased, virgin) and product (medical, food-packaging, industrial etc.) categories as appropriate.
34. For instance, medical supplies or other plastics which would contaminate the recycling chain or constitute a risk during reuse or recycling.
35. Products made wholly or partly from plastic and that are not conceived, designed or placed on the market to accomplish, within their lifespan, multiple trips or rotations by being returned to a producer for refill or reused for the same purpose for which they were conceived (EU, 2019).

greater durability and drive the shift away from single-use models altogether – excepting single-use products that are unavoidable and necessary out of health and safety concerns and for which no alternatives exist. Shifting to reuse models requires changing every stage of the plastic value chain, from designing products for safe reuse, developing business models which incorporate scope for refurbishment, repair and refilling, changing consumer attitudes and behaviors, and providing infrastructure for effective collection and reuse of products (ECOS, 2021a). In other words, problematic and unnecessary products are designed out of the market.

The idea of problematic and unnecessary products was initially utilized to address plastic packaging, defined as packaging that is not effectively circular[36] ; contains hazardous chemicals; can be avoided or replaced by a reuse model; hinders recyclability or compostability of other products; and has a high likelihood of being littered or ending up in the environment (EMF, 2020a). A similar criterion may be applied to other categories of plastic products to identify products of particular concern and priority.

The trade-offs between durability, chemical use and potential for recycling at the end of life is another concern which could be addressed by sustainability criteria. Additives such as plasticizers, stabilizers and colorants often prolong the durability and change the physio-chemical properties of plastic products and can introduce unintended side-effect by reducing the quality of recyclates from the product, as well as introducing health risks. The health risks can be introduced either from exposure to hazardous chemicals during use, from the incineration, pyrolysis, open burning or other processes at the end of life (Zweifel and Amos, 2001; Verma *et al.*, 2016). The importance of such risks is closely related to the quality and functioning of the waste management system. Trade-offs between durability and recyclability must be balanced to ensure minimal environmental impacts of the products throughout the life cycle.

It is an ongoing debate whether plastics designed to break down in nature, such as biodegradable bio-based plastics and plant-based materials, also have severe side-effects (Singh, Samuel and Hurley, 2021). Such materials can increase formation of microplastics (Zimmermann *et al.*, 2020) as less durable plastic materials, e.g. due to the material itself and/or additives, may still not fully break down into their basic building blocks under real environmental conditions. Reduced durability might therefore in worst case lead to an increased formation of microplastics and nano-plastics.

Microplastics originating from larger plastic materials, termed secondary microplastics, are considered as possibly the largest proportion of microplastic released into the environment, but with large spatial variation (Andrady, 2017). Secondary microplastics are those generated through the wear and tear of in-use large plastic items, as well as the breakdown products of plastic items, such as fibers generated during use of fishing gear or shedding from clothes, or the degradation products of lost fishing gear (Cole *et al.*, 2011). Designing products to become more durable and less likely to break down into microplastics could therefore be explored as an avenue to reduced plastic emission and subsequently the generation of microplastics (European TRWP Platform, 2019).

36. Reusable, recyclable or compostable.

Proposed key sustainability criteria for durability:

- The design, manufacture, handling and management of plastic products throughout their lifecycle is done in a manner that:
    - maximizes the functional and safe use, repair and reuse.
    - maximizes durability and minimizes releases of secondary microplastics during the intended use and reuse of the product.

3.3.4. Recyclability

In simple terms, recyclability refers to the potential for plastic products to be recycled at the end of life. It is increasingly recognized that a product which is recyclable may not be recycled in practice. Recycling can be too technically demanding, expensive or resource intensive for recycled resin to be competitive compared to virgin materials both with regards to economic costs and environmental impacts. This is compounded by the lack of effective systems for collection and sorting of wastes, high rates of contamination and consumer confusion as to whether a product is recyclable (Maris *et al.*, 2014). Criteria on recyclability should therefore tackle recyclability throughout the value chain, including designing for functional recyclability, ensuring collection and segregation systems are in place, that recycling infrastructure exists, and that consumers and producers are incentivized to recycle plastic products at the end of use.

Design for recyclability is a concept derived from eco-design which entails various strategies to improve the likelihood of products being recycled (Maris *et al.*, 2014). Commonly communicated as guidelines, as seen in section 3.2, such strategies include preferring mono-materials over multi-layer materials, preferring designs which are easy to clean and disassemble, avoiding hazardous chemicals and additives which hamper recycling, as well as specific technical guidelines on color, size, ease of identifying the materials and more (APR, 2021; BPF, 2022). Such technical specifications may vary depending on the national context, and a potential criterion on design for recyclability could require products to be designed for recycling in the markets they enter, as well as the elimination of plastic products which could contaminate waste streams.

Design for recyclability is not sufficient to ensure products are recycled, as is evident in the relatively low recycling rates for most packaging in Europe despite legislation on packaging (Tabrizi, 2021). Exceptions exist, for instance the relatively high rates of recycling of PET bottles in some countries[37]. These high recycling rates are driven by effective recycling infrastructure, standardized bottle formats, use of financial incentives and ease of identifying which products are included in the system. Knowing that it is possible to achieve high recycling rates in practice when systems are well designed, further criteria could require that products entered into a market are recycled in practice. For instance, as in the EU Packaging Directive, by mandating a minimum requirement of recycling for different product categories.

Criteria on recyclability could also guide recycling towards closed-loop systems and maintaining materials at the highest possible quality. Closed-loop recycling refers to

37. An estimated 90 percent of PET bottles included in the Norwegian deposit-return system is returned (Infinitum, 2021)

recycling processes wherein plastic products are recycled to feed back into producing the same or similar product (Ellen MacArthur Foundation, 2016), reducing the need for virgin feedstock. An added benefit of closed-loop systems is the assurance that the resulting resin meets eventual requirements to the chemical content. However, current mechanical recycling technologies still have limitations due to degradation of PCR, typically necessitating input of virgin materials to meet quality requirements (Schyns and Shaver, 2021). While technological advances such as chemical recycling may contribute to improve these numbers, present estimates suggest only one percent of plastic materials are recycled more than once, though materials such as PET has the potential for several cycles of recycling under the appropriate conditions (La Mantia and Vinci, 1994; Geyer, Jambeck and Law, 2017). Therefore, recyclability criteria must be seen in relation to durability requirements, as product reuse should be maximized before eventual recycling at the end of usable life.

Recycled plastic products should further be treated at the highest possible level, avoiding downcycling, landfilling, incineration and waste-to-energy solutions which contribute to linear consumption patterns (Ellen MacArthur Foundation, 2016). Criteria could prioritize recycling at the highest possible quality, while still considering the resource demands of recycling. For instance, plastic food containers made of polystyrene present challenging recovery dynamics, making recycling – although technically possible – often financially non-viable. Because of the porosity of foamed plastic products, cleaning such products, which are often contaminated with food or drinks, is difficult and energy-intensive, further increasing the economic and environmental costs of recycling (UNEP, 2018, p. 15). Such products, which prove difficult to recycle would not meet criteria for design for recyclability and could be phased out. A criterion on recyclability could also be formulated to contribute towards cost-effectiveness and minimization of resource use, acknowledging that PCR is not always preferable if it has a greater environmental footprint than virgin materials.

Proposed key sustainability criteria for recyclability:

- Products are designed for enhanced recyclability, considering and adapted to collection systems and technical infrastructure in markets that the products are entering, maximizing the production of high-quality recycled materials at the end of life.
- Pathways exist for the effective collection, sorting and recycling or composting of plastic products at the end of usable life in the markets they are intended for.

3.3.5. Transparency

Criteria on transparency may relate to traceability of the chemical composition of products, their input materials (including the proportion of recycled materials), information and monitoring of trade flows of plastic products and plastic wastes, the potential hazards of products and how they may be reused, recycled or discarded at the end of life, as well as agreed upon and clear definitions of labelling claims such as recyclability, biodegradability and compostability (UNEP and CI, 2020).

The content of plastic products is subject to various claims with regards to the use of recycled feedstock and bio-based plastics. Product claims on the 'green' properties of plastic products must be qualified and motivated by their functional properties and justified through certifications or standards (Pellis *et al.*, 2021). Criteria on content should address the transparent disclosure of the origin of feedstock, whether it is sustainably sourced biomass[38] or recycled plastics[39] by harmonizing definitions and preventing negative trade-offs from unsustainable approaches.

Transparency on the chemical composition of plastic products can be challenging as formulations may be proprietary and current standards for reporting chemical content are lacking, preventing full disclosure throughout the value chain (OECD, 2019a). Criteria on transparency of chemical content may drive the development of guidelines and standards for thresholds for disclosure and use of identifiers and safety data sheets[40] throughout the value chain. Alternatively, this may also be addressed by national reporting regimes and registries that are confidential to the general public, however accessible for government and agencies and for research purposes, e.g. the chemical registration systems under ECHA, the Nordic Product Registries, China New Chemical Substance Notification (Steindal and Grung, 2021). Relevant information on the chemical composition of products should be available to all actors throughout the lifecycle, including manufacturers, governments, users, consumers and recyclers, in order to enable safe substitution, recycling and reuse.

Additionally, uneven definitions of labelling claims such as recyclability, biodegradability and compostability create downstream issues as they prevent effective sorting of plastic wastes and contribute to contamination of waste streams (UNEP and CI, 2020). Labelling is intended to both guide consumer choice and nudge consumers to reduce the environmental impacts of products during and after use (Bratt *et al.*, 2011; UNEP and CI, 2020). However, lack of harmonized standards for product claims may result in varying definitions lacking consensus on what claims of compostability or biodegradability entail (OECD, 2019b). Most plastic products labelled as biodegradable or compostable require special conditions for biodegradability (Greenpeace, 2020). The artificial conditions under which products are tested are not transferable to actual conditions, and in situ tests have shown poor performance in many environments (Balestri *et al.*, 2019; Haider *et al.*, 2019). Biodegradable products may therefore not fully degrade in the natural environment, particularly in colder climates and conditions such as in the deep seas (UNEP, 2021b). A criterion could therefore target labelling regimes to ensure that biodegradable and compostable products are only labelled as such if functioning infrastructure exists for their collection and treatment or they are home compostable. If such products should be allowed to trade it is important to develop an international coherent standard, that takes into account local differences and capacities. Alternatively, to set overarching targets that are implemented using national action plans.

Similar issues exist with regards to claims of recyclability. While all plastic products

38. Preventing unintended land-use change or use of food-grade materials in the production of bio-based plastics.
39. Downcycled or repurposed plastic, such as use of pet bottles in the production of recycled polyester, could be disincentivized by not allowing labelling as "recycled" for instance.
40. As chemicals can have multiple names, conventions are in place for their identification, such as Chemical Abstract Services numbers (CASRN), International Union of Pure and Applied Chemistry numbers (IUPAC) and others (EINECs, INCI) (OECD, 2019a).

are technically recyclable, many products may not actually be recyclable in the markets they enter, or the recycling capacity is too low to recycle all recyclable products. In the United States, the state of California has imposed new legislation banning the use of the chasing arrow symbol on non-recyclable products and packaging (*Senate Bill 343*, 2021), with a set of criteria for identifying recyclable and non-recyclable products. Key in the Californian legislation are requirements to the proportion of the population that have access to recycling infrastructure for the given product, as well as the extent to which the product is indeed collected for recycling. Criteria on recyclability could similarly contribute to setting clear direction as to what products can be understood as recyclable in each market.

Currently, there is no harmonized definition of recyclability which accounts for real-life conditions such as the availability of recycling infrastructure and costs of recycling, nor universally enforced standards on communicating recyclability (ECOS, 2021b). Industry associations such as the APR and Plastics Recyclers Europe also recognize the need for a global, harmonized definition of recyclability of plastic products and packaging, and stipulate four conditions for the definition of recyclability[41]:

1. The product must be made with plastic that is collected for recycling, has market value and/or is supported by a legislatively mandated program.
2. The product must be sorted and aggregated into defined streams for recycling processes.
3. The product can be processed and reclaimed/recycled with commercial recycling processes.
4. The recycled plastic becomes a raw material that is used in the production of new products.

Green claims on reusability, refillability, recyclability, compostability, biodegradability, recycled- and bio-based content of plastic products should therefore be checked against a robust set of specific criteria, to ensure transparency and trustworthiness, and empower consumers with information which can truly inspire conscious choices (ECOS, 2021b).

Finally, transparency and traceability of trade flows of plastic wastes and their fate should be encouraged to ensure accountability in global trade of wastes. Poor transparency results in limited accountability to exporters of wastes, in particular with regards to transmissions of plastic wastes (Interpol, 2020). Requirements to traceability of waste flows and the rates of recycling of traded wastes can contribute to hold governments accountable for the impacts of plastic wastes leaving national systems.

Proposed key sustainability criteria for transparency

- Relevant information on chemical composition, feedstock and hazard of plastic products is available along the value chain for manufacturers, governments, users, consumers and recyclers, facilitating substitution, optimal recycling, reuse and repair.

41. https://recyclass.eu/recyclability/definition/#

- Consumers have relevant and sufficient information to understand how to reuse, return or discard plastic products at the end of use.
- The fate of internationally traded plastic waste is recorded and traceable.

4. Approaches to fulfil sustainability criteria

The design of a global agreement on plastic pollution would depend on the degree of stringency and regulatory commitments. A legally binding agreement may be a highly regulatory top-down approach, or a bottom-up mechanism that allows the Parties to set their own targets and self-determine control measures. For this discussion on sustainability criteria the analysis is built on the assumption that both types may be relevant, as well as any gradient between the two.

The type of agreement may also steer the different modalities and the corresponding control measures embedded in the treaty. The provisions may range from highly prescriptive and binding, to soft and discretionary. They may entail commitments to ban or phase out certain products or processes, and softer measures such as encouragements, phase-down measures or guidance. Drawing on existing agreements and treaties, some approaches have relevance also for the management of plastics products and plastic pollution. Two already suggested modalities include the formulation of national action plans and sustainability standards (Raubenheimer and Urho, 2020a). National action plans are suggested as a modality with significant freedom in how a Party decides to implement the agreement, some also allow the Parties freedom to decide its targets. However, to enhance international coherence and harmonization, control mechanisms, targets and the content of such action plans may be agreed at the international level. Similarly, with standards, a set of overarching international (sustainability / technical) standards may be determined to ensure coherence and cooperation on equal terms, whereas national standards may be more specific and adapted to local circumstances. These elements will be further elaborated in this chapter. The following discussion is not intended to be exhaustive but presents some potential modalities and measures in an agreement, and how they may be designed to respond to the suggested sustainability criteria.

4.1 Integrating sustainability criteria with operational implementation mechanisms

4.1.1. National action plans

National actions plans are used as an instrument in several MEAs, even though the terminology may differ between the different regimes. Nationally determined contributions (NDCs) under the United Nations Framework Convention on Climate Change (UNFCCC) as elaborated in the Paris Agreement (Box 2) outline the progressive measures taken by the states to mitigate climate change and could be described as the plan of action for meeting the obligations of the agreement. Meanwhile, under the Minamata Convention on Mercury, countries are encouraged to create a 'national plan' for controlling mercury emissions (Article 8.3) and releases (Article 9.4), as well as a 'national action plan' on artisanal and small-scale gold mining to phase down certain practices, formalize the sector and safeguard human health (Article 7, annex C). Furthermore, parties are required to develop an implementation plan for their actions to meet the obligations under the convention (Article 20).

Box 2. Paris Agreement Article 4

2. Each Party shall prepare, communicate and maintain successive nationally determined contributions that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions.

3. Each Party's successive nationally determined contribution will represent a progression beyond the Party's then current nationally determined contribution and reflect its highest possible ambition, reflecting its common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.

NPAPs could likely be an important tool for parties to ensure compliance with the international sustainability criteria and corresponding operational measures. An agreement may require parties to develop NPAPs utilizing regulatory, fiscal, information, voluntary and management measures to meet the criteria at the national level. Such plans may either be intended to cover all the obligations of a potential agreement (as in the Paris Agreement) or could target certain sectors (as in the Minamata Convention).

Indeed, NPAPs are acknowledged as a "vehicle for progress across nations and regions by empowering countries to set targets and develop and implement national policies, tailored to meet specific national needs and circumstances and addressing the life cycle of plastics" (Grid-Arendal, 2020, p. 1) and there is increasing support for their inclusion as a core component of the new global agreement to tackle plastic pollution[42].

NPAPs can play a significant role in tackling plastic pollution by planning and setting a concrete set of actions, targets and timelines (see Box 5 in Annex 6 for examples) to:

1. setting out measures for the phase out and regulation of categories of plastic products through legal, regulatory, fiscal and voluntary instruments;
2. create and enable consistency in design, use and disposal of plastics products through standards and incentives;
3. improve data inventories on plastic waste streams (plastics data collection) by facilitating a better coordination among various actors along the value chains;

42. See for instance the explicit reference to the need for "strong" NPAPs by U.S. Secretary of State Anthony Blinken in November 2021 (Blinken, 2021)

4. enable public-private partnerships to fast-track the phase-out of particularly problematic plastic materials;
5. carry out plastic products recycling effectively by enabling the adoption of affordable technologies for plastic waste recycling, developing and/or improving standards on this matter;
6. make all actors aware of the need to understand their legal responsibility of engaging in plastic waste management;
7. promote and support the innovation and enhance the effective partnerships, and thus, reducing risks related to public health, ecosystems, scarcity of materials, as well as fostering circular design of plastic products, the use of recycled plastics;
8. incentivize citizens, institutions, and other waste generators to do their best in aligning their thinking and actions with the waste hierarchy principles – i.e. prevention, waste reduction at source, reuse, responsible segregation of plastic waste and disposal;
9. promote community education programs to help citizens make more informed purchasing decisions, etc.

Several countries and regions have already developed NPAPs targeting different time horizons, including short (2024), medium (2030) and long term (2042) goals, actions and measures aligned with the waste hierarchy[43] and in some cases also aligned with the SDGs, and many more countries have initiated the process of developing such action plans.

A review of some existing NPAPs (Annex 6) emphasized the importance of principles and sustainability criteria in creating a common ground for discussions, between a wide and heterogenous group of stakeholders, on key aspects that need to be considered when making the shift to a sustainable and circular plastics economy, developing regional plastics strategies, or monitoring and evaluation frameworks to keep track of and evaluate progress in making this shift.

Furthermore, principles and sustainability criteria will provide guidance on the various areas (e.g. materials and substances/additives, scales, sources, pathways and sinks, measures) that can be considered in defining the scope; as well as on methodology, targets and timeframes, enabling NPAPs to:

1. function as 'living documents' that reflects the highest possible ambition and progression over time,
2. display minimum common elements that avoid incomplete or incomparable information between regions,
3. engage relevant sectors in a participatory approach to prepare, implement and review the NPAP,
4. introduce measures that ensure sustainable management of plastic products across the life cycle,
5. develop a cross-sectoral coordination mechanism to implement the plan.

In practical terms, the global agreement can set requirements for the format, content and reporting of implementation progress of the NPAPs in the agreement text, with guidelines for the content of NPAPs provided in an annex to the

43. Prevent, reduce, reuse, recycle, disposal.

agreement[44]. The guidelines for NPAPs may also further delineate the relationship between sustainability criteria and the content of the NPAPs, and include provisions for equity and inclusion of the informal sector if deemed relevant, as well as other HSE concerns throughout the plastic products value chain[45].

4.1.2. International and national sustainability standards

International design standards for sustainability (sustainability standards) have been proposed as a core component of a global agreement (Raubenheimer and Urho, 2020b). Such technical standards could be integral in meeting the obligations of international sustainability criteria – setting the minimum requirements for products in the markets regulated by the agreement. While a hybrid agreement may largely determine *what* the global society aims to achieve, the *how* may to some degree be left to the nation states to determine. In this context, *international* sustainability standards can ensure a level playing field by setting minimum requirements for products, guided by the sustainability criteria.

The standards are further intended to motivate for compliance with the agreement, by activating further measures for products which do not meet the standards (see section 4.2). Whereas criteria could require for products to be safe, use minimal resource, durable and reusable, recyclable and transparently produced and consumed, the standards would delineate what this means in practice for the different product groups and material types, and in different contexts. This could for instance entail international standards for design for recyclability, drawing on existing developed standards (see section 3.2), as well as standards or minimum requirements as to the actual rates of recycling or reuse of products.

Such standards may be binding or voluntary and may be provided in the guidance documents under the agreement. International standards face the challenge of avoiding "lofty pronouncements" with low impacts, while also ensuring the standards are not too closed and lacking sensitivity to local conditions (Christensen, Morsing and Thyssen, 2017). Stakeholder inclusion is therefore key to ensure that any agreed standards are formulated so as to be globally relevant, while maintaining the sufficient rigor to drive action towards standardizing plastic products, their design, production and management at the end of life.

The international standards may be further transposed into national sustainability standards, which are more sensitive to local conditions and designed to ensure that any products entering a market meet the sustainability criteria in practice. Such national standards may pertain to recyclability – for instance, while bio-based plastics may be recyclable in some countries with infrastructure developed to process this waste stream, they may contribute to contaminate other waste streams if no such infrastructure exists. Whereas international standards are developed with the aim of supporting global commitments that are comparable, feasible and realistic on the global level, and to facilitate global trade, the national standards will be adapted to national circumstances when such are needed to ensure the most effective treatment.

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44. In the UNFCCC some requirements to NDC are set out in Article 4 of the agreement text, meanwhile the Minamata Convention provides guidelines in Annex C on action plans for artisanal and small-scale mining.
45. The Minamata Convention provides a good example of inclusion of the informal sector in provisions through Article 7 and Annex C on artisanal and small-scale gold mining.

4.2. International regulatory measures and obligations

Adding to NPAPs and international sustainability standards, the global agreement will contain various operational measures and provisions to reduce and eliminate plastic pollution. Such provisions will be set up to meet the objective, goals and principles of the agreement, and to fulfil the steering sustainability criteria. It is outside the scope of the present report to provide a complete overview of measures in a global agreement on plastic pollution. Hence, the following section will be limited to the review of some relevant modalities and measures that may be used to fulfil some of the sustainability criteria previously presented.

4.2.1 Best environmental practices and best available techniques

In multilateral environmental agreements the concept of Best Available Technique (BAT) and Best Environmental Practice (BEP) is commonly applied to determine acceptable technologies, practices and procedures of production and processing[46]. The agreement may contain obligations to implement BAT/BEP in certain types of production, or it may encourage such practice. The complete description and definition of what is considered BAT/BEP is often determined and developed by a dedicated (technical) expert group and thereafter adopted by the COP, commonly in the form of non-binding guidance documents[47].

The application of BAT/BEP may be relevant for several aspects of the plastic product life cycle. It may also respond to several of the criteria exemplified in Chapter 3. A relevant example is the BAT/BEP guidance developed under the Stockholm Convention on POPs for the recycling and disposal of waste containing polybrominated diphenyl ethers (PBDEs) (BAT/BEP Group of Experts, 2021). This group of chemicals is still commonly found in certain types of plastics, even though it is banned under the convention. The guidance is linked to the provisions of the convention and provides a comprehensive overview of BAT/BEP for reuse, recycling, separation and treatment technologies, management options, thermal recovery and treatment options, etc. Similarly, a capacity building project carried out in Indonesia set forth to develop BAT/BEP for the life cycle of plastic products, in particular the recycling and disposal practices, and to enhance local waste management to prevent PBDEs from being used or recycled into new products (UNEP, 2021c).

Hence, BAT/BEP is a type of measure with high potential to contribute to fulfil the criteria under circularity, resource minimization, safety and transparency. BAT/BEP may be designed so that it enhances the chance of a contaminant free and high-quality supply chain of recycled plastic material, responding to the call of industry stakeholders for improving the supply side of recycled plastic material (see more in Chapter 6). It may contribute to improving occupational health, by setting a

46. Under the Minamata Convention BAT is defined as «those techniques that are the most effective to prevent and reduce emissions and releases of mercury to air, water and land and the impact of such emissions and releases on the environment as a whole, taking into account economic and technical considerations for a given Party or a given facility within the territory of that Party». BEP is defined as: "the application of the most appropriate combination of environmental control measures and strategies".
47. While BAT/BEP is an approach that refer to treatment techniques, technologies and other means to control pollution, a standard sets a certain requirement, a minimum level of concrete control measures to be materialized.

standard for acceptable practices that enable a healthy production and working environment, and it may determine a certain level of transparency in how Parties implement their commitments applying BAT/BEP. Using the example of chemicals, the BAT/BEP (requirements or encouragements) could also be formulated to enable transparency in the supply chain, providing openness around inventories, production processes and potential contamination of the recycled material. Similarly, it may be used to set best practices for end-of-life management; for the minimization of microplastic releases; reducing losses of plastic pellets, etc. (OSPAR Commission, 2018; Raubenheimer and Urho, 2020a).

4.2.2. Trade and market restrictions

The implementation of sustainability criteria and the interlinked sustainability standards may be further supported by trade measures limiting trade of products which do not meet the agreed sustainability standards, a commonly applied modality in MEAs. Such measures may set specific requirements for import and export, and apply Prior Informed Consent (PIC) procedures, similar to those applied under the Basel, Minamata, Stockholm and the Rotterdam Conventions[48]. Under the Basel Convention, export of certain groups of hazardous wastes must meet criteria on environmentally sound management for the wastes. If the criteria are not met, PIC must be granted by the receiving state. Similar procedures could be implemented for the trade in plastic products, wherein products which do not meet international or national sustainability standards, must be granted PIC before entry into markets. Such PIC procedures may then require the recipient country to prove that the plastic product will be sustainably managed and treated at the end of useable life, for instance through extended producer responsibility (EPR) mechanisms (Raubenheimer and Urho, 2020b).

Historically, Parties that are not members of specific treaties will refrain from linking to those. However, compromises and solutions have been found to solve such issues in the past. The question in that case would be what gaps are present in the existing frameworks and what parts of international plastic trade (raw material, pellets, products and waste) will be necessary to curb or control, in order to reach the set targets of the potential agreement on plastic pollution.

The measures of the EU Packaging Directive may prove as a relevant example in this regard: Article 9 of the directive stipulates that member states shall comply with relevant harmonized international standards, transposed into national standards (Box 3.).

48. http://www.pic.int/

Box 3. EU Packaging Directive, Article 9

1. Member States shall ensure that three years from the date of the entry into force of this Directive, packaging may be placed on the market only if it complies with all essential requirements defined by this Directive including Annex II.

2. Member States shall, from the date set out in Article 22 (1), presume compliance with all essential requirements set out in this Directive including Annex II in the case of packaging which complies:

> **(a)** with the relevant harmonized standards, the reference numbers of which have been published in the *Official Journal of the European Communities*. Member States shall publish the reference numbers of national standards transposing these harmonized standards;
>
> **(b)** with the relevant national standards referred to in paragraph 3 in so far as, in the areas covered by such standards, no harmonized standards exist.

3. Member States shall communicate to the Commission the text of their national standards, as referred to in paragraph 2 (b), which they deem to comply with the requirements referred to in this Article. The Commission shall forward such texts forthwith to the other Member States.

Member States shall publish the references of these standards. The Commission shall ensure that they are published in the *Official Journal of the European Communities.*

4. Where a Member State or the Commission considers that the standards referred to in paragraph 2 do not entirely meet the essential requirements referred to in paragraph 1, the Commission or the Member State concerned shall bring the matter before the Committee set up by Directive 83/189/EEC giving the reasons therefor. This Committee shall deliver an opinion without delay.

4.2.3. Essential use

For certain categories of plastic products and chemicals, given the nature of their use (for example, plastic products used in medical applications) the concept of essential use may be relevant. Essential use allows the "temporary continuation of activity that is otherwise contrary to the obligations of a treaty" and act as an exemption under the agreement[49] (UNEP, 2010, p. 1). Previous experiences may be drawn from the Montreal Protocol which phased out the use of ozone-depleting substances (ODS) except for certain essential uses in Decision IV/25.

The identification of essential use under the Montreal Protocol (1987) relies on two criteria:

- it is necessary for health, safety or is critical for the functioning of society; and

49. A familiar concept is the use of positive list (all are allowed, except those listed) and the negative list (all are banned, except those considered essential).

- there are no available technically and economically feasible alternatives or substitutes that are acceptable from the standpoint of environment and health.

Typically, essential use exemptions are valid for a limited time period until alternatives are technically and economically viable. The essential use concept can thus accommodate the difficulty of some parties to an agreement to meet their obligations in the short term while retaining the overall rigor and ambition of an agreement (UNEP 2010). In such cases, funding for innovative research and development may be needed to identify chemical or engineering alternatives and to make them technically and economically feasible. These gaps will provide strong market incentives for the development of alternatives by industry (Cousins 2019). Other examples of international environmental agreements incorporating essential use and similar exemptions are the Stockholm Convention and the UNECE Convention on Long-Range Transboundary Air Pollution. The essential use concept has also been advocated for the regulation of PFAS (Blum *et al.*, 2015; Cousins *et al.*, 2019), and is increasingly considered in the context of general chemicals regulations as reflected in the EU Chemicals Strategy which commits to defining "criteria for essential uses of the most harmful chemicals" (Cousins *et al.*, 2019; EC, 2020; Garnett and Calster, 2021).

Expanding the essential use approach to plastic products may be relevant both for regulating the use of chemicals of concern in products, as well as for certain product categories such as single-use plastic products and plastic packaging (EMF, 2020a; Raubenheimer and Urho, 2020a).

Distinguishing between essential, non-essential and problematic plastic packaging allows for measures to be designed and implemented according to the category of use (EMF, 2020a). Screening criteria for essential packaging have been proposed as providing necessary protection, containment, convenience, communication and efficiency (EMF, 2021). Similarly, problematic, non-essential plastic packaging is identified using the following screening criteria (EMF 2020):

1. It is not reusable, recyclable or compostable[50].
2. It contains, or its manufacturing requires, hazardous chemicals that pose a significant risk to human health or the environment (applying the precautionary principle).
3. It can be avoided (or replaced by a reuse model) while maintaining utility.
4. It hinders or disrupts the recyclability or compostability of other items.
5. It has a high likelihood of being littered or ending up in the natural environment.

The proposed sustainability criteria targeting single-use plastic products and problematic plastic products could utilize similar screening criteria to identify product categories or groups for exclusion and inclusion in eventual lists in annexes to the agreement. These lists and screening criteria could be designed by technical working groups, involving relevant stakeholders. The expert group could identify which product categories are considered problematic and thus subject to measures to redesign or eliminate such products, except for products identified as 'essential' in accordance with the above criteria, while also taking into account geographical and

50. Extensive definitions and subsequent criteria are provided for each of these three terms in the Commitment Definitions and Key Terms (EMF, 2020a)

socioeconomic differences in capacity. Essential use thus allows for general restrictions, with set exemptions to prevent environmental or societal harm as a consequence of restrictions where alternatives not yet exist.

5. Addressing problem-shifting

A key concern for the development of international sustainability criteria is the potential for problem-shifting when implementing measures intended to reduce the negative environmental and social consequences associated with plastic pollution. This chapter highlights three key considerations with regards to problem-shifting: between environmental problems; along the value-chain; and across stages of development. As a common theme throughout the chapter are the issues associated with shifting from plastic materials in products to substitutes such as bio-based plastics, fabrics, wood-derived products or other materials. It is well established that plastics, particularly when comparing single-use products, in some instances perform better in lifecycle analyses (Spierling *et al.*, 2018; UNEP, 2021a), emphasizing that substitution is not always the solution and may indeed have worse environmental impacts, highlighting the importance of considering preventive and reuse measures. Referencing the waste hierarchy and in particular prioritization of elimination, circulation and substitution could also contribute to limit the risks for problem-shifting in the implementation of measures to limit plastic pollution (EMF, 2020b). The following sections will further discuss potential issues of problem-shifting and elaborate on potential pathways to tackle some of these potential adverse consequences in the implementation and design of criteria and subsequent provisions.

5.1. Problem-shifting between environmental crisis

The world faces not one, but three concurrent environmental crises of global scale: climate change, biodiversity loss and pollution (Anderson, 2020). In identifying criteria and measures, recognizing the interrelationships between these three crises is vital to prevent problem-shifting where measures to reduce one issue may have unforeseen consequences for another. The proposed criteria have been formulated with the aim of ensuring concerns around problem-shifting are considered, for instance with regards to the principles of resource efficiency and safety.

Any measures must consider the risks of contributing towards habitat loss, land use change and climate change to ensure proposed 'solutions' to plastic pollution do not cause further environmental problems in the long term[51]. As an example of how one such issue may be considered, the proposed criteria encompass caveats on sustainably sourced raw materials, which could include provisions to limit indirect land-use change from the production of feedstock from bio-based plastics. A recent EU Horizon 2020 project, STAR-ProBio[52], developed a set of criteria, qualitative and quantitative indicators, and related metrics, encompassing the three pillars of sustainability (social, economic and environmental) as well as cross-cutting aspects, such as circularity and indirect land-use change. Specifically, STAR-ProBio put

51. An example is the promotion of oxo-degradable plastics which were intended to degrade under sunlight, but instead had the unintended effect of contributing to increased microplastic pollution.
52. www.star-probio.eu

forward two tools for stakeholders in order to assess specific bio-based products sustainability: (1) a sustainability assessment tool (IAT, Integrated Assessment Tool) – as a tailored instrument for the assessment of specific bio-based products enabling also the comparison of the bio-based products against fossil-based products, and (2) a sustainability certification tool (SCT) – as an overarching umbrella, describing the methodological framework and underpinnings. These tools may provide a good starting point for further discussions on how potential environmental problem-shifting can best be addressed in the case of plastic products.

With regards to the climate impacts of measures to limit plastic pollution, note can be taken from the EU Taxonomy for Sustainable Finance Delegated act on climate[53] which outlines technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation. The criteria for plastic products in their primary form are presented in Box 4, and are utilized in conjunction with set criteria to do no significant harm to climate change adaptation, sustainable use and protection of water and marine resources, transition to a circular economy, pollution prevention and control and protection and restoration of biodiversity and ecosystems. It is further worth noting that the criterion on biomass refers to the sustainability criteria for biofuels under the EU RED discussed in Section 3.1.

Box 4. EU Taxonomy Technical screening criteria for plastics in their primary form and their substantial contribution to climate change mitigation[54] - Annex 1, section 3.17.

The activity complies with one of the following criteria:

a. the plastic in primary form is fully manufactured by mechanical recycling of plastic waste;
b. where mechanical recycling is not technically feasible or economically viable, the plastic in primary form is fully manufactured by chemical recycling of plastic waste and the life cycle GHG emissions of the manufactured plastic, excluding any calculated credits from the production of fuels, are lower than the life cycle GHG emissions of the equivalent plastic in primary form manufactured from fossil fuel feedstock. Life cycle GHG emissions are calculated using Recommendation 2013/179/EU or, alternatively, using ISO 14067:2018 or ISO 14064-1:2018. Quantified life cycle GHG emissions are verified by an independent third party.
c. derived wholly or partially from renewable feedstock and its life cycle GHG emissions are lower than the life cycle GHG emissions of the equivalent plastics in primary form manufactured from fossil fuel feedstock. Life cycle GHG emissions are calculated using Recommendation 2013/179/EU or, alternatively,

53. Document C(2021)2800
54. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI_COM:C(2021)2800

using ISO 14067:2018 or ISO 14064-1:2018. Quantified life cycle GHG emissions are verified by an independent third party.

Agricultural biomass used for the manufacture of plastics in its primary form complies with the criteria laid down in Article 29, paragraphs 2 to 5, of Directive (EU) 2018/2001. Forest biomass used for the manufacture of plastics in its primary form complies with the criteria laid down in Article 29, paragraphs 6 and 7, of that Directive.

Such guidelines for assessing the climate impacts of measures to shift from plastic feedstock to alternative materials could be incorporated under the sustainability criteria for minimization, and similar considerations could be expanded to other substitutions required under the criteria, ensuring that measures do not have unintended consequences.

5.2 Problem-shifting along the value chain

The complexity of environmental governance and risk for problem-shifting is evident along the plastic value chain. Meeting the sustainability criteria will require consideration of how measures may have impacts both upstream and downstream in the plastic life cycle. For instance, increased demand for recycled polyester in clothing has raised concerns that PET which could be recycled in closed-loop systems for beverage bottles are instead repurposed into plastic fibers (WRAP, 2020). Such repurposing constitutes a degradation of the material, as textiles rarely re-enter recycling loops, and at the end of life typically end up in landfills, incineration or are used for further repurposing as fill materials (US EPA, 2017). Thus, requirements to the recycled content of products should be "responsibly sourced", which could include requirements to avoid repurposing and degradation of PCR.

A further measure to prevent problem-shifting along the value chain is the utilization and identification of BAT/BEP for plastic products alongside standards and guidelines for industry. As highlighted by the UNEP Life Cycle Initiative[55] in their assessments of SUPP, while one can compare the relative environmental benefits of different material types with varying environmental impacts depending on the available infrastructure for collection and treatment, the best practice is switching to reuse models altogether. Identifying such best practices may contribute to prevent greenwashing and ineffective measures by guiding businesses towards better alternatives. Such assessments, which could be expanded to social life cycle assessments, could be run by a scientific body under the agreement, collating the evidence for best practices for various sectors and contexts.

Preventing problem-shifting along the value chain is also acknowledged in the sustainability criteria with regards to the risks of contamination of waste streams and prevention of effective recycling. Consequences from substitution with bio-

55. https://www.lifecycleinitiative.org/

based plastics is a particularly relevant consideration, as most bio-based plastic products may be biodegradable or recyclable, but often require separate waste streams. Introducing bio-based plastic products to markets without separate collection may cause more harm than good. The case of bio-based plastic products also illustrates problem-shifting associated with substituting conventional plastics with alternative materials without an analysis of the life cycle of the material: if raw materials are derived from first-generation crops (rather than by-products or organic waste) then such production may be associated with the same environmental problems that large-scale agriculture brings, with regards to the use of pesticides, herbicides, and the conversion of land used to grow food (Posen *et al.*, 2017; Spierling *et al.*, 2018).

5.3 Problem-shifting across stages of development: Social and economic impacts of (in)action

As discussed, problem-shifting is commonly encountered and of concern in environmental governance at the global level. When a cheap, versatile, easily accessible and widely used material such as plastic is under consideration, the chance of adverse social and economic impact from measures is obvious. Actions to mitigate environmental impacts often burden already marginalized communities disproportionately, creating additional social problems out of environmental ones (Jones 2018). Burden on low-income and marginalized communities, low-income countries and indigenous peoples can be mitigated by seeing the synergies between a potential agreement on plastic pollution and all the SDGs - in particular by including language on human rights, gender, indigenous people and local communities, as well as ensuring participation of affected stakeholders, including informal workers and better understanding of the consequences and implications of measures (Jones, 2018; Walker, 2021). Similarly, in some instances, the use of plastics will be closely aligned with economic and social dimensions of sustainability, such as increasing crop yields or affordability of certain products (e.g. transferring products into smaller units such as sachets, thereby leveraging market access for low-income consumers). In such cases a holistic approach would be required.

The criteria should therefore be formulated to ensure the safe and equitable production, consumption and treatment of plastic products throughout their life cycle. In the development of guidelines, standards and measures, consideration must also be given to the socioeconomic impacts of such measures. Plastic pollution already puts undue burdens on marginalized communities, whether they are the fence line communities around industrial plants, the populations of low-income countries impacted by the plastic waste trade, workers in the informal waste sector or the communities negatively affected by worsening livelihoods from the harm caused by plastic pollution to fisheries and tourism. The measures to mitigate the issue must therefore be designed to not worsen the situation.

An example of the importance of considering the problem-shifting of measures and policies is the Chinese import ban on wastes. The 2017 ban on imports of 24 categories of waste, including plastic waste, in China had significant consequences on global trade in plastic wastes (Brooks, Wang and Jambeck, 2018). The sudden policy shift resulted in large amounts of waste from Europe and North America being diverted to South-East Asian countries with poor infrastructure for environmentally sound management and recycling of such wastes (Wen *et al.*, 2021). The transmission of environmental problems from developing countries to developed countries is not new[56], and a new global agreement should contain provisions for preventing further spatial problem-shifting. While some advocate for the export of recyclables as a pathway towards development providing livelihoods to communities in the recipient countries, others argue for domestic treatment of domestic wastes as a pathway to ensure responsible management of wastes and integrating the negative externalities of plastic production and consumption (Wen *et al.*, 2021). However, for small island developing states, requirements to the domestic treatment of all wastes may be difficult due to limited space and capacity for setting up the necessary infrastructure and may require regional cooperation models for waste management (UNEP, 2019b). Potential criteria and measures targeting trade and the location of recycling activities must therefore take into account the potential trade-offs and spill-over effects such restrictions may have, whether it is by shifting material flows to countries with poorer regulations, or by limiting the capacity of member states to treat their wastes in an environmentally and financially sound manner.

56. Though there are critiques of this developed-developing dichotomy and its implicit power relations (see for instance Furniss (2015)), it is still a helpful framing to illuminate the predominant trends in environmental problem shifting as is evident in global waste flows.

6. Industry inclusion

Environmental challenges such as plastic pollution are frequently driven by different industrial activities throughout the value chain, which makes it essential to engage the private sector to 'reverse negative megatrends and enforce positive trends' (UNEP, 2019c, p. 5). While private sector and industry activities can drive environmental degradation, they can also help drive green growth as businesses and entrepreneurs provide the skills, investment and knowledge for innovation and change.

As described, the sustainability criteria will draw on the objective, goals and principles of a future agreement, providing scope and direction for further policy action. Developing, refining and fulfilling such sustainability criteria for the life cycle of plastic products will require inclusion and commitment from industry and the private sector throughout the plastic value chain, from raw material extraction, to design, manufacturing, vendors, waste collectors and managers, recyclers, collectors, entrepreneurs, technology developers and producers, and more.

The private sector is increasingly subject to national and international restrictions, regulations and expectations of change with regards to plastic pollution. The push for a new multilateral environmental agreement on the life cycle of plastic products would potentially have significant impacts on the organization and operation of the global plastic value chain, possibly shifting the power balance between various actors and creating new 'winners' and 'losers' in the supply chain. However, the private sector can provide crucial inputs in the early stages of framing an agreement. By developing new business models, strategies and methods to eliminate or reduce the use of plastic products and the adverse impacts of their use, the private sector will be at the forefront of implementing measures towards the goals of the agreement.

This chapter will provide some general experiences and examples of involving the industry in framing global agreements, present feedback and viewpoints from stakeholder consultations and some key considerations when it comes to business involvement in the specific development of a plastic pollution agreement.

6.1 Involvement of industry in development of multilateral environmental cooperation

Industry is widely acknowledged as an essential actor in international environmental cooperation. One initiative that illustrates industry commitment to address issues such as environment, human rights, labor rights and anti-corruption, is the voluntary and non-binding United Nations Global Compact. The initiative has more than 13,000 private sector participants worldwide, committed to fulfil and report on the ten principles under the pact. The three environmental principles of the UN Global Compact acknowledge that policies and operations of businesses can play a major role in reducing impacts on resource use and the environment:

- business should support a precautionary approach to environmental challenges;
- undertake initiatives to promote greater environmental responsibility; and,
- encourage the development and diffusion of environmentally friendly technologies.

Another example where industry provided instrumental support was the Montreal Protocol where the effective resolution of the transboundary issue of ozone-depleting chemicals has been ascribed to the convergence of political values, scientific knowledge, emergence of viable chemical alternatives and economic incentives: all of which were necessary to drive international change (Maxwell and Briscoe, 1997; Whitesides, 2020).

There are multiple ways in which industry historically has engaged in the establishment and operation of multilateral environmental agreements. Modes to engage the private sector and business interests can be modelled on those outlined in UNEP's Strategy for Private Sector Engagement which recognizes the strategic importance of engaging the private sector in "addressing environmental challenges through sustainable business practices" (UNEP, 2019c, p. 24).

Industrial activities and waste management are mostly regulated at a local or national level (Raubenheimer and Urho, 2020b). Thus, authorities commonly consult with national industry both when developing *national* regulations and policy, and when negotiating *international* regulations (e.g. Rosendal *et al.*, 2020). Industry views are commonly collected through public consultations in written form or consultation meetings (e.g. partnerships, networks, platforms, cross-sector roundtables etc.). Another common practice is for national authorities to collect input from national enterprises and submit these views or aggregated data to the secretariat, review committee, expert group or similar of the global agreement. Internationally, governments also bring key industry representatives to the negotiations to provide guidance and enhance the understanding economical and employment implications. In addition to this interaction between governments and domestic industry, multilateral agreements are themselves a mode for engagement. Powerful business actors and associations also engage directly at the negotiating meetings.

Other venues for interaction are also facilitated by the UN, other inter-governmental organizations, or multi-stakeholder partnerships such as the Life Cycle Initiative and the Global Network for Resource Efficient and Cleaner Production (RECPnet). Parallel and supportive arenas for interaction between public and private sector have been organized through setting up partnerships under the Basel Convention and the Minamata Convention. These are all examples of arenas that may serve as a basis for determining how a global agreement can be designed to systematically address the life cycle of plastic products in an integrated manner, with measures responding to the overarching objective, goals and principles of the convention, through steering sustainability criteria.

Throughout the last UNEA meetings, several statements have been made with regard to the role of industry. Resolution 4/6 (para 4) on marine plastic litter and microplastics encouraged close collaboration with the private sector in tackling plastic pollution with various actions. The same resolution encouraged UNEP to develop guidelines for use and production, standards and labels and to incentivize businesses and retailers to commit themselves to using sustainable practices and products, amongst others. Another resolution 3/7 (para 6) noted the important role of key sectors such as plastic product producers, retailers and the consumer goods industry, as well as importers, packaging firms and transport firms, to contribute to the reduction of marine litter, including microplastics, arising from their products and activities, as well as to provide information on the impacts arising from their products throughout their life cycle, and encourages innovative approaches such as the use of extended producer responsibility schemes, container deposit schemes and other initiatives.

6.2. Industry stances on a global framework and sustainability criteria

For this report, business representatives were gathered for stakeholder consultations, in groups or one-to-one, to identify how industry could engage in development and fulfilment of sustainability criteria. Although the consultations were run early in the process based on a preliminary framework for sustainability criteria, the stakeholders provided several relevant concerns and proposals for the design and role of such criteria. The industry representatives, representing all continents and most segments of the plastic and waste management industry (directly or indirectly through business associations), emphasized the following:

Key perspectives

The importance of improving recyclability through improving the quality and supply of recycled material was highlighted as one of the main challenges by the industry representatives. Many emphasized that they could not meet the demand for recycled material of adequate quality (physical properties and chemical content), thus having to use a larger share of virgin plastic than originally intended. In order to be reprocessed into certain desired applications, recycled plastics must have specific mechanical properties and processing characteristics (Demets *et al.*, 2021). The problem of sorting out biodegradable plastic products that contribute to contaminating waste streams was one of several problems related to contamination of the recycled material. Adding to this, several stressed the unpredictability of virgin plastics prices as a concern. The cost of production, and thus price, of virgin plastics are closely related to volatile oil prices. When oil prices are high, PCR is more competitive, but struggles to respond to falling demand when oil prices decrease, as the costs of producing PCR is typically more stable and linked to the human and logistical costs of collection and treatment. Related to this, some stakeholders noted the large difference between countries, especially between the nations with reliable waste management systems and those lacking proper waste management.

Several of the participants saw the need to emphasize the role of consumers and raising their awareness, and some added that industry merely supplies what consumers want. The importance of increasing awareness about waste segregation and recycling, but also democratizing waste management through decentralized systems, was raised during the discussions.

During consultations some actors raised the importance of linking the sustainability criteria to the functionality of products, arguing that this is also essential for its potential impact. If the plastic product is not operating as intended (e.g. protect food content or inhibit evaporation) it may trigger new problems. Other concerns raised were that the product focus could be too narrow, exemplified by the SUPP regulations introduced in many countries, where SUPP are regulated predominantly according to duration of use and risk of leakage, and not because they belong to a specific product category or their inherent qualities. Another line of reasoning was that plastics may sometimes be the better choice with regards to environmental impacts compared to alternative materials. Hence, it is critical that future management systems take into account life cycle assessments of the non-plastic alternatives. Representing different regions and local capacities, some argued that a global agreement must reflect the local context and thus policies should not be "copy-pasted" between countries.

Way forward under a global agreement

The various issues and concerns raised by the industry are highly relevant for the development of the global agreement in general, and for the sustainability criteria for plastic products in particular. In addition to pointing out the problems of current practices, stakeholders also suggested various solutions to how these challenges may be addressed.

The advantages of market- and science-based solutions that stimulate innovation, enabling markets to capture value from plastic waste and promoting a range of recycling and waste management solutions were highlighted by stakeholders, arguing that governments should promote such initiatives and developments. Several participants promoted a life cycle perspective where external costs (e.g. impact on environment) are integrated into the product price. Governments could incentivize the market by making virgin material more expensive than recycled material. Correspondingly, some argued strongly for international standards and quality requirements that could ensure a level playing field and predictability for businesses. The polluter pay principle was also promoted in this regard. Some stakeholders suggested that EPR and take-back schemes should prioritize products that are difficult to recycle, whereas others emphasized the importance of incentivizing new technology and warned against setting up a regulatory framework that could close the door to innovation. Concerning the latter, it was argued that products that are not recyclable today may be recyclable in the future.

Hence, temporal flexibility and stepwise implementation schemes were highlighted as key in a future agreement, considering different capacities among countries. Similar perspectives have been raised by Raubenheimer and Urho (2020b) who suggested a global EPR scheme, founded on the polluter pays principle, and applying global design standards that internalize the full cost of plastic production and consumption. Other perspectives highlighted by individuals were the use of responsible public procurement policies to incentivize market change; the benefit of the essential use concept, also considering feasibility and viability of alternatives for the poor; compliance with labor laws; and the importance of matching infrastructure and infrastructure development with EPR regulation.

6.3 Key considerations related to industry involvement in a new global agreement

The views and perspectives brought forward in discussions with the industry highlight the proactiveness of some actors in the sector in finding a way to deal with plastic pollution. Several representatives have already participated in initiatives to develop both industry and policy solutions and expressed interest in actively contributing to further development of a global agreement. Hence, the deliberations revealed a general support for a broad international approach encompassing all societal sectors, while simultaneously stressing the need for national and local adaptations taking into account the geographical differences in capacity. Effectively translating global measures into industry change at the national and local level is therefore key to the successful implementation of such agreements (Bodansky, Brunnée and Hey, 2008). This is particularly the case for plastic products, whose production, recycling and waste management are an important source of livelihoods in several countries. As discussed, measures under multilateral agreements could be associated with large economic and social impacts and trade-offs.

Concerning sustainability criteria, there was consensus that a global agreement should provide incentives for a transparent and standardized supply chain of recycled material, replacing virgin plastic. The criteria for recyclability and transparency would potentially contribute to steering the agreement in that direction. A criterion for recyclability could be supported by internationally accepted standards on plastic quality and chemical contamination, possibly categorizing different qualities and relating them to different types of use. To develop such standards, also referred to as global design standards, industry expertise would play a crucial role.

The role of the informal sector was raised by several participants as crucial in the development of a global agreement and any sustainability criteria embedded in it. A large share of businesses operating in or at the borderline of the informal sector are micro-, small- and medium sized enterprises (MSMEs). Informal sector actors and MSMEs are rarely part of the international deliberations on international policy. Most international initiatives and collaborations involve large multinational corporations, whereas research largely focuses on how large companies implement EPR schemes, sustainable business models or corporate social responsibility schemes (CSR) in response to government policies, environmental threats and public pressure. What is less well understood is how MSMEs respond to these same drivers, and what influences them to change practices.

In South- and South-East Asia in particular, MSMEs are vital in the economic ecosystem. While there is significant variability between countries, MSMEs are estimated to be responsible for 97 percent of the total number of enterprises and employ more than 60 percent of the workforce (ADB, 2020). These enterprises are important drivers of innovation and poverty alleviation, and due to their size, they can be more flexible and adaptive to changes in the regulative environment. Furthermore, the large number of MSMEs means that while their individual environmental footprints are small, the aggregated impact is considerable (OECD and ERIA, 2018). Hence, involving MSMEs and the informal sector in the development of a global agreement is essential to ensure a sustainable approach. However, as these actors are rarely involved in the international debate and have few arenas to promote their views and perspectives. In response, such arenas could be facilitated, and these views integrated to enhance the potential impact of an agreement. Such involvement will also ensure that sustainability criteria set the direction for both environmentally and socioeconomically sustainable management of plastic products through their life cycle.

7. Key messages and recommendations

- There is increasing momentum and support for negotiating a legally binding global agreement on plastic pollution.

- A global agreement on plastic pollution must acknowledge the systemic changes required along the plastic products' value chains to prevent adverse physical, chemical and biological impacts. Sustainability criteria can contribute to guide action in such a global agreement towards more sustainable production, consumption and management of plastic products throughout the value chain – as well as tackling cross-cutting issues such as trade, labor rights, and particularly problematic categories of plastic products and their chemical additives and contaminants.

- This report proposes an analytical framework for the identification of sustainability criteria, situating them in the organizational structure of a global agreement as the link between the global objectives and goals, and national and international implementation measures. Five principles for safe circularity are identified to guide the comprehensive development of sustainability criteria for plastic products: safety, minimization, durability and reusability, recyclability and transparency.

- The analysis shows that there is no one overarching criterion for sustainability which can encompass and guarantee sustainable plastic products. Rather, there is a variety of criteria within the five principles for circularity which collectively may contribute to the improved sustainability of plastic products throughout their lifecycle.

- The proposed criteria are designed to enable safe circularity of plastic products, limiting the input of virgin materials, minimizing hazardous chemicals, prolonging product durability and time in use, and enhancing reuse and recycling systems to feed back into production processes. Collectively, these criteria will steer the agreement in the direction of sustainable production and consumption. Furthermore, by limiting input materials, heeding the waste hierarchy and improving circularity, the risk of leakages is reduced, and linear use patterns are interrupted throughout the plastic product lifecycle.

- Multilateral environmental agreements must balance specificity and stringency, with participation and local capacity. Hence, the international criteria should provide sufficient specificity and stringency to effectively guide global action, while also including mechanisms that enable effective national implementation depending on local capacity. Different technological, financial and research support mechanisms should be applied to implementation capacity. Aligning with the waste hierarchy and prioritizing upstream preventative measures, criteria may be fulfilled through international measures and implemented through national plastic action plans, sustainability standards, and more.

- Implementation may be guided by a range of provisions addressing different aspects of the plastic lifecycle of which best practices identified through BAT/BEP, essential use concepts and trade measures are some suitable tools to address the sustainability criteria. Inspiration could be drawn from existing frameworks such as the Montreal Protocol, the Basel Convention and the Stockholm Convention. A framework involving national action plans and sustainability standards may contribute to ensuring transparency, coherence and local flexibility to comply with the measures.

- The effective and equitable implementation and fulfilment of the sustainability criteria requires recognition of the potential for problem-shifting and an adequate consideration of the potential trade-offs. The report highlights three key concerns with this regard: between environmental problems; along the value-chain; and across stages of development. Any measures to implement criteria should consider consequences and benefits to human health and to the environment, environmental justice, trade-offs and equity concerns including unintended consequences of shifting from plastics to non-plastic products and materials.

- The private sector and industry have the key to both the source and the solution to the plastic menace. Broad industry inclusion is thus important in formulating sustainability criteria and subsequent standards aligning with the polluter-pays principle, in the implementation of an agreement and to drive investment and innovation in new technologies and business models. Efforts to include industry should be designed to integrate the views and perspectives of both international conglomerates and MSMEs across all regions to prevent problem-shifting and enable equitable and sustainable development.

- This assessment has provided an overview of how sustainability criteria may be understood and applied in a global agreement on plastic pollution. Further research and assessment are needed to determine how such criteria can be further integrated with the operational elements and with a complete set of provisions in a future agreement.

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Annex 1. Draft resolution by Peru and Rwanda

Draft resolution text

- **Proposing member States : PERU, RWANDA**
- **Co-sponsoring member States : COSTA RICA, ECUADOR, EUROPEAN UNION AND ITS MEMBER STATES, GUINEA, NORWAY, PHILIPPINES, SENEGAL, SWITZERLAND.**
- **Contact addresses: acuerdoglobal@minam.gob.pe, cariaso@rree.gob.pe, info@rema.gov.rw**

SUGGESTED ACTION BY THE UNITED NATIONS ENVIRONMENT ASSEMBLY ON AN INTERNATIONALLY LEGALLY BINDING INSTRUMENT ON PLASTIC POLLUTION

The United Nations Environment Assembly may wish to consider the adoption of the draft resolution on an internationally legally binding instrument on plastic pollution:

The United Nations Environment Assembly,

Notes with concern that the high and rapidly increasing levels of plastic pollution, including microplastics, represent a serious environmental problem at a global scale, negatively impacting all three dimensions of sustainable development,

Reaffirming United Nations General Assembly resolution 70/1 of 25 September 2015, by which the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development, and recalling Sustainable Development Goal 14 and its target 14.1, and all interrelated goals,

Recalling United Nations Environment Assembly resolutions 1/6, 2/11, 3/7, 4/6, 4/7 and 4/9, and reaffirms the importance of the long-term elimination of discharge of plastics, including microplastics, into marine, terrestrial and freshwater environments and of avoiding detriment from plastic pollution to ecosystems and the human activities dependent on them,

Recognizing the inherent transboundary nature of the issue of plastic pollution and the need to tackle it at its sources,

Underlining that a more circular economy, one of the current sustainable economic models, in which products and materials are designed so that they can be reused, remanufactured or recycled and therefore maintained in the economy for as long as possible along with the resources they are made of, and the generation of waste, especially hazardous waste, is avoided or minimised, and greenhouse gas emissions are

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prevented and reduced, can significantly contribute to sustainable consumption and production,

Notes with appreciation the significant body of work conducted by United Nations Environment Programme, scientific and legal advisory bodies, the Environment Management Group and other actors since the adoption of resolution 1/6 in 2014, and the intergovernmental work and the Chair summary of the Ad Hoc Open-Ended Expert Group on Marine Litter and Microplastics, which reflects all views expressed in its meetings, presents options and sets out, as a basis for actions, the elements and design of potential response options to address plastic pollution,

Welcomes efforts made by governments and international organizations to minimize the negative impact of plastic waste on the environment, in particular through national and regional action plans and other initiatives, such as G7 and G20 initiatives like the action plans of 2015 and 2017 addressing marine litter, Osaka Blue Ocean Vision, Ocean Plastics Charter, the ASEAN Framework of Action on Marine Debris and the Bangkok Declaration on Combating Marine Debris, APEC Roadmap on Marine Debris and to reduce plastic and microplastic pollution, recognizing that they are complementary to a coherent and coordinated global response,

Reaffirms the importance of close cooperation and coordination as well as synergy among international conventions and instruments to prevent plastic pollution and avoid its adverse effects on human health and wellbeing and the environment, including the International Convention for the Prevention of Pollution from Ships, Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Stockholm Convention on Persistent Organic Pollutants, Rotterdam Convention on the Prior Informed Consent Procedure for certain Hazardous Chemicals and Pesticides in International Trade, United Nations Convention on the Law of the Sea, London Convention and Protocol, Strategic Approach to International Chemicals Management, United Nations Framework Convention on Climate Change, Convention on Biological Diversity as well as among international organizations, regional instruments and programs, non-governmental organizations and the private sector,

Underlining that further international action is needed by developing an international legally binding instrument on plastic pollution, taking a comprehensive approach to prevent and reduce plastic pollution in the environment, including microplastics, by promoting a circular economy and addressing the full lifecycle of plastics,

Recognizes that member states provide, within their capabilities, resources in respect of those national activities that are intended to implement a new international legally binding instrument in accordance with their national policies, plans and programmes,

Acknowledges that some legal obligations arising out of a new international legally binding instrument will require financial and technical assistance and include technology transfer to developing countries and countries with economies in transition,

1. *Requests* the Executive Director to convene an intergovernmental negotiating committee under the auspices of the United Nations Environment Assembly with the mandate to prepare an international legally binding instrument to address plastic pollution, commencing its work in 2022 with the goal of completing by the sixth session of the Environment Assembly;

2. *Agrees* that the intergovernmental negotiating committee is to develop an international legally binding agreement based on a comprehensive approach to prevent and reduce plastic pollution in the environment, including microplastics, by promoting a circular economy and addressing the full lifecycle of plastics from production, consumption and design to waste prevention, management and treatment, including provisions:

(a) To specify the objectives of the instrument and establish as necessary targets, definitions, methodologies, formats, and obligations;

(b) To achieve sustainable production and consumption of plastics, including the uptake of secondary and alternative raw materials;

(c) To address product design and use, including compounds, additives and harmful substances as well as intentionally added microplastics;

(d) To promote national action plans to prevent, reduce and remediate plastic pollution, tailored to local and national circumstances and the characteristics of specific sectors, and to support regional and international cooperation and coordination;

(e) To increase knowledge through awareness-raising and information exchange on best practices to prevent plastic pollution and promote behavioral change;

(f) To monitor and report on national and international progress on implementation of the agreement;

(g) To provide scientific and socio-economic assessments and to monitor and report on plastic pollution in the environment;

(h) To cooperate and coordinate with relevant regional and international conventions, instruments and organizations;

(i) To specify financial and technical arrangements, as well as technology transfer assistance, to support implementation of the convention

(j) To address implementation and compliance issues;

(k) To promote research and development into innovative solutions;

3. *Also agrees* that the intergovernmental negotiating committee, in its deliberations on the instrument that it develops, should:

(a) consider the need for a financial mechanism to support the implementation of the priorities and objectives of the agreement, including the option of a dedicated multilateral fund;

(b) consider the need for a mechanism to provide scientific and socio-economic advice and guidance, including the option of a dedicated body;

(c) promote cooperation and coordination with relevant regional and international instruments and existing technical and scientific bodies to ensure synergies and avoid duplication;

(d) consider any other aspects that the intergovernmental negotiating committee may consider relevant;

4. *Recognizes* that the mandate of the intergovernmental negotiating committee may be supplemented by further decisions of the Environment Assembly;

5. *Decides* that participation in the intergovernmental negotiating committee should be open to all Member States of the United Nations and its specialized agencies, to regional economic integration organizations, as well as relevant stakeholders, consistent with applicable United Nations rules;

6. *Requests* the Executive Director, as a priority action, to provide the necessary support to the intergovernmental negotiating committee as well as to developing countries and countries with economies in transition to allow for effective participation in the work of the intergovernmental negotiating committee;

7. *Requests* the Executive Director to convene as soon as possible the first meeting of the intergovernmental negotiating committee, in particular to discuss the timetable and organization of its work;

8. *Urges* all relevant actors to continue and enhance national and regional actions to reduce plastic pollution during the preparation of the international legally binding instrument;

9. *Invites* governments and other stakeholders in a position to do so to provide extra budgetary resources to help to support the implementation of the present resolution;

10. *Requests* the Executive Director to facilitate the participation of and close cooperation and coordination with relevant regional and international instruments and initiatives and all relevant stakeholders in the context of the mandate of the intergovernmental negotiating committee.

Annex 2. Guiding questions

Guiding questions for the 4th Nordic Report on Sustainability Criteria for Plastic Products in a Global Agreement on Plastic Pollution.

1. What are possible key sustainability criteria for plastics in a global agreement to prevent plastic pollution looking at the entire life cycle of plastic products?
2. How can the criteria be formulated in the agreement text?
3. What are some possible modalities for parties to fulfil sustainability criteria in a global agreement?
4. How can commitments by parties to fulfil sustainability criteria be formulated?
5. What are good examples from existing mechanisms and agreements that could be used as inspiration?
6. How can single use plastic products be addressed?
7. How can business and industry engage and contribute to developing and fulfilling the sustainability criteria?
8. How could the link between sustainability criteria and the national level implementation or mechanisms to meet these criteria function in practical terms?

Annex 3. European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste

(Disclaimer – the directive on packaging and packaging waste is currently under review to assess the opportunity for improving design for reuse and promoting high quality recycling, as well as strengthening their enforcement (EC, 2021))

Annex II. ESSENTIAL REQUIREMENTS ON THE COMPOSITION AND THE REUSABLE AND RECOVERABLE, INCLUDING RECYCLABLE, NATURE OF PACKAGING

1. Requirements specific to the manufacturing and composition of packaging

- Packaging shall be so manufactured that the packaging volume and weight be limited to the minimum adequate amount to maintain the necessary level of safety, hygiene and acceptance for the packed product and for the consumer.
- Packaging shall be designed, produced and commercialized in such a way as to permit its reuse or recovery, including recycling, and to minimize its impact on the environment when packaging waste or residues from packaging waste management operations are disposed of.
- Packaging shall be so manufactured that the presence of noxious and other hazardous substances and materials as constituents of the packaging material or of any of the packaging components is minimized with regard to their presence in emissions, ash or leachate when packaging or residues from management operations or packaging waste are incinerated or landfilled.

2. Requirements specific to the reusable nature of packaging

The following requirements must be simultaneously satisfied:

- the physical properties and characteristics of the packaging shall enable a number of trips or rotations in normally predictable conditions of use,
- possibility of processing the used packaging in order to meet health and safety requirements for the workforce,
- fulfil the requirements specific to recoverable packaging when the packaging is no longer reused and thus becomes waste.

3. Requirements specific to the recoverable nature of packaging

(a) Packaging recoverable in the form of material recycling

Packaging must be manufactured in such a way as to enable the recycling of a certain percentage by weight of the materials used into the manufacture of marketable products, in compliance with current standards in the Community. The establishment of this percentage may vary, depending on the type of material of which the packaging is composed.

(b) Packaging recoverable in the form of energy recovery

Packaging waste processed for the purpose of energy recovery shall have a minimum inferior calorific value to allow optimization of energy recovery.

(c) Packaging recoverable in the form of composting

Packaging waste processed for the purpose of composting shall be of such a biodegradable nature that it should not hinder the separate collection and the composting process or activity into which it is introduced.

(d) Biodegradable packaging

Biodegradable packaging waste shall be of such a nature that it is capable of undergoing physical, chemical, thermal or biological decomposition such that most of the finished compost ultimately decomposes into carbon dioxide, biomass and water.

Annex 4. Categories of product sustainability criteria for ecolabels

Relevant life cycle phase	Main category of criteria	Subcategories
Raw material sourcing	Environmental criteria	- Environmentally sound (raw) material sourcing, minimum share of certified (raw) material - Minimum share of secondary material - Minimum share of (certified) biobased material - Exclusion of certain materials/Requirement to use a certain material - Use of secondary components
	Social criteria	- Labor standards - Requirements related to potential conflict raw materials
Production process	Environmental criteria	- Limiting the use of energy, water, and other resources - Exclusion of/requirements related to the use of certain hazardous processing aids - Limiting air emissions, emissions to water, and waste production - Exclusion of certain processes/other requirements related to certain processes - Environmental management systems - Exclusion of animal testing
	Social criteria	- Labor standards
Distribution	Distribution	- Information about emissions from transport or location of production site
Use	Energy and other resource use during use phase	- Maximum energy use/minimum efficiency - Limiting water use - Limiting the use of other consumables (e.g. paper)
	Hazardous substances in the product	- Generic exclusion/limit to hazardous substances in product - Exclusion/limit to substances in certain materials - Exclusion/limit to substances in certain components
	Emissions during use	- Limiting substance emissions - Limiting radiation emissions - Limiting noise emissions
	Longevity	- Direct requirements regarding life time/durability - Minimum guarantee period - Design for reparability - Minimum period for the availability of spare and wear parts - Access to and cost of spare parts, access to repair information (stakeholder groups) - Batteries (rechargeability, replaceability, capacity, life time) - Availability of interfaces (upgrading possibilities) - Availability of software updates - Availability of data erasure options - Availability of maintenance/repair service
Disposal	Disposal	- Design for recyclability (dismantling, choice of recycling-friendly materials, marking of materials) - Reusability of components - Availability of take-back service for product/components - Biodegradability
Across several phases/ unspecific	Packaging and documentation	- Material selection - Ratio of packaging weight to product utility (packaging efficiency) - Limiting hazardous substances in packaging - Permeability of packaging for air emissions - Recyclability and marking of materials - Availability of take-back system
	Information	- Information duties regarding environmental aspects covered by other criteria or as standalone requirement - Differentiated information towards end-users and professionals - Location of the information (product, packaging, documentation, internet) - Restriction of claims used in advertising
	Other issues	- Fitness for purpose/quality (non-environmental aspects such as comfort, ergonomics, performance) - Product/data security - Various services (e.g. offer of trainings) -Other criteria

(Spengler et al., 2020)

Annex 5. Examples of existing or proposed criteria for plastic products and processes

Table 5. Examples of existing or proposed sustainability criteria for plastic products and processes.

Life cycle stage	Criteria from existing standards, regulations and best practices	Source
Extraction	The use of plastics is fully decoupled from the consumption of finite resources	[1]
	Over time, remaining virgin inputs (if any) should switch to renewable feedstocks where proven to be environmentally beneficial and to come from responsibly managed sources.	[1]
	Use more renewable and recycled materials; Use less plastic in the first place, and switch to recycled content; Optimizes the Use of Renewable or Recycled Source Materials	[2] [3] [4]
	Is sourced, manufactured, transported, and recycled using renewable energy	[4]
Primary plastic production	Using recycled content is essential (where legally and technically possible) both to decouple from finite feedstocks and to stimulate demand for collection and recycling.	[1]
	Choose materials that are recycled and that can be further recycled or choose rapidly renewable biobased plastics that can be used to generate compost	[7]
	Should be manufactured to the extent possible using non-toxic, recycled material	[6]
	Compare materials based on the extent of recycling options available over the geographic regions where the product will be sold.	[7]
	Select plastics based on feedstocks that preserve natural capital (maximize resource efficiency) and provide performance and sustainability benefits.	[7]
	Over time, the production and recycling of plastics should be powered entirely by renewable energy.	[1]
	Select plastics that can have the best recycling profiles. For example, prefer plastics that can be recycled multiple times, plastics that can be recycled using technologies that have minimal impacts to recyclers, and plastics with multiple options for waste management pathways to allow for variability between regions with different waste management infrastructures and cultural norms.	[7]
	Is manufactured using clean production technologies and best practices	[4]
Design and manufacturing		
	All plastic packaging is 100 percent reusable, recyclable, or compostable	[1]
	Compare materials based on whether they contain hazardous chemical constituents or constituents that interfere with recycling. Avoid additives that degrade the quality of recycled plastic.	[7]
	All plastic packaging is free of hazardous chemicals, and the health, safety, and rights of all people involved are respected	[1]
	Prefer plastic materials made via chemical processes that minimize the use of and exposure to hazardous substances.	[7]
	Prefer plastics that meet performance requirements with no, or few, additives.	[7]
	Should be designed/manufactured with the goal to be recyclable to the maximum extent possible	[6]
	Reduce unnecessary material use / Should use minimum levels resource possible	[2] [6] [4]
	Compare products based on worst-case waste disposal and recycling scenarios.	[7]
	Compare products based on how well specific information can be communicated to consumers about what to do with the product after use.	[7]

	Packaging is designed for recyclability including:----------------Packaging is clearly labelled; Packaging is not made with multilayer and combined materials; Combined materials are easy to separate; Materials feel and look like what they are; Packaging informs and motivates to source separate; Product leftovers are easy to remove; Packaging is easy to compress.	[2]
	Produce and manufacture plastics products in a way that maximizes resource efficiency and eliminates toxic chemicals and pollution in order to protect workers, the community around the production or manufacturing facility, and the environment.	[7]
	Minimize empty space in packaging.	[2]
	Products maintain high residual value at the end of life	
Consumption	Reuse models are applied where relevant, reducing the need for single-use packaging	[1]
	Eliminate hazardous chemicals used in plastic products, and pollution and waste associated with product use.	[7]
	Should be reusable	[6]
	Provide information on multiple non-waste paths, and least harmful waste paths appropriate for the area in which the product is sold.	[7]
	Durable products have a minimum guarantee period	[5]
	All plastic packaging is reused, recycled, or composted in practice	[1]
	Availability of take-back service for product/components	[5]
	Using refill stations to cut out new plastic completely and switching to alternative materials such as paper, glass or aluminum.	[3]
Collection and treatment	No plastics should end up in the environment. Landfill, incineration, and waste-to-energy are not part of the circular economy target state.	[1]
	Help collect and process more plastic packaging than is sold	[3]
	Is effectively recovered and utilized in biological and/or industrial closed loop cycles	[4]
Cross-cutting issues		
Informal sector and labor rights	It is essential to respect the health, safety, and rights of all people involved in all parts of the plastics system, and particularly to improve worker conditions in informal (waste picker) sectors.	[1]
Microplastics	Ban on the manufacturing, import, and placing on the market of any toiletries (including natural health product and non-prescription drug) for cleansing or hygiene that contain microbeads	[8]
Single-use plastic products	Elimination of problematic or unnecessary plastic packaging through redesign, innovation, and new delivery models is a priority	[1]

References:
[1] EMF (2020a) Global Commitment,
[2] Norwegian Green Dot Design for Circularity (Grønt Punkt, 2021),
[3] Unilever (no date) Plastic Targets.
[4] Sustainable Packaging Coalition (2011)
[6] APR (2021) Design Guidelines
[7] OECD (2019a) sustainability criteria for plastics from a chemicals perspective.
[8] Canada Microbeads in Toiletries Regulation (Canada, 2017).

Annex 6. Example of actions and targets extracted from NPAPs

Box 5. Example of specific set of actions and targets excerpted from reviewed NPAPs

Phase out & Regulations

- Phase out non compostable plastic packaging products containing additive fragmentable technology that do not meet relevant compostable standards (AS4736-2006, AS5810-2010 and EN13432) by year …
    - § Phase out expanded polystyrene in loose fill and molded consumer packaging (by year …), and food and beverage containers (by year …)
- Phase out PVC packaging labels (by year …)
    - § Regulate unsorted mixed plastic waste exports and imports
- Regulate unprocessed single polymer or resin waste plastic exports

Create and enable consistency in design, use and disposal of plastics products

- § Co-design sector-specific best-practice guidance on plastic use to signal how to align to a future country plastics system, accounting for impacts of the Basel Convention amendments
- § Expand the waste levy to all landfill types and increase tonnage cost to discourage landfilling of recyclable waste plastic and the use of single-use plastic products
- § Implement an industry-informed fit-for-purpose container deposit scheme
- § Mandate product stewardship for priority products that contain plastics, including packaging, tires, agricultural plastics, e-waste
- § Develop and implement biodegradable and compostable plastic products standards
- § Facilitate access for organizations to life cycle assessment-based decision-support tools, supported by country-specific datasets

Improve plastics data collection/inventory

- Finance projects to audit and quantify knowledge data gaps for plastics, including use, collection, reuse, recycling, disposal and leakage in the country
- Mandate ongoing data collection at product level and establish an open data framework with a centralized database that includes measures for material type, weight, color, recycled content, contamination, reuse, industry, source and end market (local or overseas), location, and average product lifetime of all plastic used in the country
- Support standardization and national roll-out for citizen science litter monitoring projects
- Incentivize labelling of plastic type by manufacturers (resin ID code)

Mitigate environmental and health impacts of plastic products

- Develop and implement manufacturing and pre-production plastic pellet handling standards and regulations
- Identify knowledge gaps and develop research agenda related to hazards, impacts and remediation of plastic products, aligning to international conventions and pacts and connecting with international research efforts, with a particular focus on impacts on local communities, microplastics, environmental and food safety of recycled plastic and new materials, developing methods for monitoring nano-plastics and potential toxic effects of plastics
- Invest in systems to prevent macro and microplastics entering the environment

References - reviewed NPAPs:

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Ministry for the Environment (2021). National Plastics Action Plan for Aotearoa New Zealand. Wellington: Ministry for the Environment. Available at: https://environment.govt.nz/assets/publications/National-Plastics-Action-Plan.pdf

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Ministry of Environment (2021), National Action Plan on Plastic Waste Management 2021-2030 Sri Lanka. Available at: https://www.ccet.jp/sites/default/files/2021-08/srilanka_report_web_fin_pw.pdf

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