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Circular economy measures to keep plastics and their value in the economy, avoid waste and reduce marine litter

Patrick ten Brink, Jean-Pierre Schweitzer, Emma Watkins, Charlotte Janssens, Michiel De Smet, Heather Leslie, and François Galgani

Abstract

We live in the plastic age (the “plasticene”), producing over 300 million tonnes (mt) of plastic every year globally, 5–15 mt of which flow into already polluted oceans. Plastic remains a key material in the global economy, but low rates of collection, reuse and recycling, emissions of microplastic from product wear and tear, and often insufficient disposal measures are leading to far-reaching environmental, health, social and economic impacts. The costs of inaction are unacceptably high. Globally there is a growing recognition of the need to address marine litter and rethink our approach to plastics and plastic packaging within the economy. Measures that enable a transition to a circular economy can avoid waste and reduce marine litter, and contribute to keeping plastics and their value in the economy.

(Submitted as [Global Solutions Paper](#))

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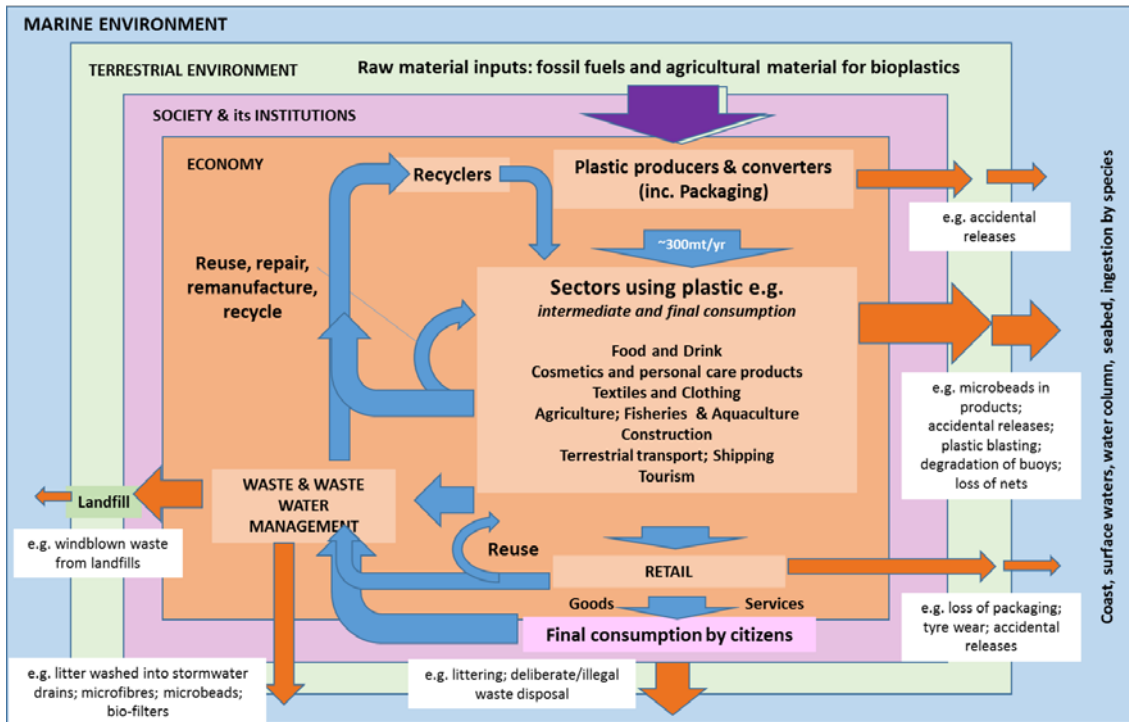
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Challenge

Seven of the G20 countries were amongst the top twenty contributors to marine litter ranked by mismanaged plastic waste in 2010 (Jambeck et al., 2015). The G20 Presidency of Germany should provide global leadership in addressing the failures of the plastics economy. National and international commitments, cooperation and implementation, through practical measures integrating circular economy principles, should be used to address the challenges of halting marine litter. This will provide solutions which benefit the environment, society and the economy.



Source: adapted from ten Brink et al. (2016)

The leakage of all plastics into the environment, including the marine biosphere, must be prevented, and other negative externalities from the life cycle of plastic products must be reduced, as the issue is:

- Far-reaching - Plastics have a considerable footprint and impacts on: biodiversity (entanglement and ingestion by turtles, birds, fish and mammals), water and air quality (leaching of chemicals from plastics and release of plastic particles), human health (ingestion of plastic through seafood), society (degraded environments, costs of clean up and loss of wellbeing and livelihoods), economy (impacts on tourism, fishing and shipping, and loss of secondary materials), and public finance (municipal budgets for clean-up) (GESAMP, 2016).
- Growing - The quantity of plastic waste is rising on our land and in our rivers and seas. Given that most plastics do not truly degrade but rather gradually break

down into ever more numerous smaller particles, last year's plastics remain this year's problem and a problem for potentially hundreds of years into the future.

- Global - Plastics and plastics pollution do not respect borders. Plastic, plastic products, secondary raw material plastic and some waste are traded globally, and marine litter crosses continents in ocean currents, meaning the responsibility falls on all countries to act.

Plastic pollution can be prevented by applying the waste hierarchy to the plastic economy in order to drastically upscale the reduction, reuse and recycling of plastic waste. Plastic is a precious resource. When lost to the environment plastics degrade in quality, so many higher value opportunities for reuse and recycling are lost. Avoided waste also means avoided primary resource use. Many plastics are designed for single use without planning for the potential after-use pathways of reuse, recycling, or (industrial) composting. As such, they are incoherent with the circular economy and fail to account for their end-of-useful-life phase. Furthermore, many products contain toxic chemical additives or contain composite materials, rendering them difficult or impossible to recycle. Meanwhile, the costs of inaction are high (Watkins et al., 2017). The impact of plastic pollution on the oceans alone is at least US\$ 8 billion per year, based on natural capital costs (UNEP, 2014). The costs of action can be significant but have potential to create value, especially when considering upstream activities such as plastic packaging design that enables high quality recycling. Downstream ocean clean-up is a generally extremely costly, largely too late and only addresses part of the problem, because clean-up action comes only long after plastics have broken down into smaller fragments which become widely dispersed, causing pollution that damages ecosystems and health. Clean-up must therefore be a last choice intervention.

Plastic production must be decoupled from primary feedstocks, and over-packaging or unnecessary applications of plastics must be avoided where sustainable or less material-intensive alternatives exist (Schweitzer et al. 2018). Plastics are predominantly produced from fossil feedstocks, so wasting plastic drives emissions (greenhouse gases and pollution) and embedded energy losses. Alternative feedstocks exist for plastics, including those based on biomass. However these can have major sustainability impacts (on land and water use, biodiversity, indirect greenhouse gas emissions and creating competition with food production) and with current technologies cannot be scaled up to meet more than a fraction of potential demand (PBL, 2012). Recycling can supply secondary material, but there are often challenges to recycling (mechanical, material and chemical) depending on the type of plastics. To increase the uptake, quality and economics of recycling, concerted efforts are needed on upstream design and on downstream collection, sorting and reprocessing. This will also contribute to wider dematerialisation of economic growth. Markets continue to favour primary feedstocks over recyclates, and until the costs of negative externalities are internalised, unsustainable applications of plastics remain financially viable. This creates incentives for producers to use fossil feedstocks, in particular when oil prices are low.

The G20 should help catalyse the move to a circular economy for plastics, to keep this material and its value in the economy. In specific we put forward the following 4 policy recommendations for the G20:

1. Creating a global impetus for action on plastics and marine litter by encouraging implementation of existing commitments.
2. Encouraging a framework of circular economy measures to promote change across governance levels.
3. Developing and committing to a global roadmap for action on plastics and marine litter.
4. Ensuring collaboration and coherent approaches with other processes such as the Sustainable Development Goals (SDGs).

These recommendations are discussed in the following section.

Proposals

1. A global impetus for action on plastics and marine litter

The G20 should support the implementation of existing global commitments on marine litter.

Many governments, business leaders, scientists and citizens already recognise the scale of the problem of marine litter and failures in the plastics economy. Commitments have been made at a range of stakeholder levels which provide momentum for rethinking plastics.

- Target 14.1 of the 2030 Agenda for Sustainable Development seeks to prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris, by 2025.
- The United Nations Environment Assembly (UNEA-2) Resolution 2/11 Marine plastic litter and microplastics invites all states “in cooperation with industry and other stakeholders, at the national, sub regional and international levels, to organise and/or participate in annual campaigns for awareness-raising, prevention and environmentally sound clean-up of marine litter”.
- World leaders, at the Group of Seven (G7) meeting in Bonn in May 2015, committed to priority actions and solutions to combat marine litter (G7 Germany, 2015 and Japan, 2016). As stated by the World Economic Forum (WEF, 2016), the annual cost of marine litter is conservatively estimated at US\$ 40 billion. Tackling the challenge requires a systemic and collaborative approach, rethinking both packaging and plastics in general.

These commitments complement, build on and/or echo the calls for urgent political attention and practical action in a range of other global Conventions (e.g. the International Convention for the Prevention of Pollution from Ships), Commitments (e.g. the Honolulu Commitment for the prevention and management of marine debris), Declarations (e.g. the Manila Declaration on Furthering the Implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities), Partnerships (e.g. the Global Partnership on Marine Litter, GPML) and targets (e.g. within Aichi targets of the Convention on Biological Diversity).

Efforts to implement these commitments provide an important first step, but the commitments remain non-binding, are non-policy specific and do not yet encompass the whole range of actions needed to turn the tide on marine litter. Much of the practical action will take place at the local, regional and national levels, so G20 members' international commitments should also be reflected in initiatives at home.

2. Circular economy as a framework for change across governance levels

The G20 should promote the transition to a circular economy in order to create a plastics system that works in the long term, with enhanced system effectiveness, increased resource productivity and drastically reduced marine litter.

The drive for a transition to a circular economy in many countries has the potential to identify the policies and instruments necessary to attain global objectives on plastic waste. Previously, commitments to reduce levels of marine litter were not integrated with wider objectives on resource efficiency and terrestrial waste management. Public and private sector actions that support the transition to a circular economy provide a framework to simultaneously enhance the effectiveness of the plastics system through better design, increase its resource productivity and reduce negative externalities from plastics, including marine litter and its impacts.

Many countries have developed resource efficiency and circular economy strategies which integrate objectives to transform the plastics sector and simultaneously reduce marine litter. The Dutch strategy "A Circular Economy in the Netherlands by 2050" highlights marine litter as a global issue (Dutch Government, 2016). Furthermore, 12 countries have recently joined the *International coalition to reduce plastic bags pollution* to promote the elimination of single use plastic bags. The European Union Action Plan for the Circular Economy (European Commission, 2015) commits the European Commission to help reduce the impacts of marine litter, while increasing the value of materials in the EU economy. A forthcoming Strategy on "Plastics in the Circular Economy" is expected to become one of the main vehicles for addressing marine litter in the EU (ten Brink et al., 2016), with the reduction of leakage of plastics as one of its three core objectives. Innovative industry and private sector actors have likewise made commitments to improve the design of their products and packaging, particularly plastics, recognising the dividends which exist in reducing plastic waste and its negative externalities. One of the top five global consumer goods companies has committed to ensuring that by 2025, it is technically possible for 100% of its plastic packaging to be reused or recycled and there are established examples that it is commercially viable for plastics re-processors to recycle the material.

While some circular practices are long-established, the majority of these initiatives are still in their infancy, and plastic re-use and recycling rates remain low in all countries, especially in the case of lower value products. Whilst some countries are clear leaders in the development of advanced waste management infrastructure, plastic packaging is one of the major culprits of waste, inefficiency and litter creation within the global economy.

3. Developing and committing to a global roadmap for action on plastics and marine litter

The G20 should advocate for a global roadmap for action to address the life cycle of plastics and effectively valorise plastics in the economy whilst mitigating their environmental impacts.

In the context of the challenges outlined above and existing global commitments to simultaneously enhance the plastics economy, increase resource efficiency and reduce marine litter, a global roadmap is needed that includes a mixture of legal, voluntary, market based and informational measures across stakeholders to promote the transition to a circular and marine litter free economy. No environmental problem of this size has ever been effectively addressed without a solid legal framework, so the current heavy reliance on soft measures such as voluntary agreements needs to be augmented with formal policy measures and regulation.

3.1 Upstream measures: The G20 should support innovation, providing investment for the implementation of upstream solutions

Upstream and design led approaches to reducing plastic waste and pollution are cost-effective ways to implement the waste hierarchy. Without redesign many plastic products cannot be reused or recycled - currently as much as 30% of packaging products are destined for landfill or incineration (EMF, 2017).

Product- and eco-design: To facilitate the reuse of plastics in the economy all products should be designed with an after-use pathway in mind, and without planned obsolescence. Innovative solutions should address those products which have functional added value in the economy but cannot currently be recycled. This includes exploring alternative materials or products where they exist, for example using natural alternatives to plastic microbeads in personal care products or for ship-blasting. Designers and producers should avoid creating products that are inherently single use or inevitably destined for landfill. Extended producer responsibility (EPR) schemes (see below) can play a role in encouraging improved design. In addition, voluntary industry commitments can provide leadership for sector wide action. One of the big five global personal care product manufacturers pledged in 2017 to switch from plastic to paper based cotton bud sticks, recognising that their product contributed to plastic marine litter (Cotton bud Project, 2016).

Material selection: Special attention needs to be given to designing plastics without toxic chemical additives, as this undermines their potential for secondary uses as well as creating health and ecological risks. Chemicals regulations need implementation and reform to phase out toxic chemicals through substitution and circular economy solutions. For some applications, non-plastic materials may provide innovative, cost-effective and competitive alternatives with beneficial outcomes. Such substitutions and alternatives should be explored, researched and developed, alongside the re-design of old-generation plastic products to improve their reparability and recyclability.

Reducing microplastics from product wear and tear: Significant plastic leakages are caused by the normal use of certain products (e.g. tyres, clothing, fishing nets, buoys, artificial turf and paint). Together these represent diffuse but significant emissions of plastics that are impossible to collect or recycle. For such applications, alternatives should be sought further upstream, in the design phase.

Funding and investment to boost eco-design: Funding programmes, leveraging both public and private sector investment, should be established to support innovators and designers who target inefficiencies in the plastics sector and find upstream solutions to reduce plastic waste.

Sustainable sourcing: The cycling of materials should be the focus of innovation, but further research is needed to understand the potential role of alternative feedstocks, for example bio-based plastics and their potential for CO₂ capture and other impacts both positive and negative. A report by UNEP (2015) presents some of the limitations of biodegradable plastics with respect to marine litter.

Legislation and the rule of law: Governments and legislators should develop standards and definitions to provide clarity to producers, linking the design of products and packaging to the collection, sorting and recycling of these items. Confusing definitions of what is a waste and what is a resource can inhibit the reuse of otherwise valuable materials. Products with notable externalities should be regulated and where appropriate banned. The United States has legislated for a nationwide ban on the manufacture of rinse-off microbeads from 2017 (Congress, 2015).

New business models: Structural waste should be avoided in all economic sectors. Producers should consider shifting from selling goods to providing services or access to (rather than ownership of) goods where this can increase product durability and reduce material demand and waste from the manufacturing stage through to product end of life. Business models based on reusable packaging exist in the context of B2B (e.g. Svenska Retursystem, operating a pool of reusable packaging for the whole retail sector) and B2C (e.g. Splosh and Replenish, shipping active cleaning ingredients to be used in refillable bottles; and Repack, developing reusable transport packaging for e-commerce). Other innovative delivery models such as The Disappearing Package avoid packaging altogether, rethinking the entire packaging concept.

3.2 Consumption based measures: The G20 should create the right incentives for producers and citizens to dematerialise the plastics economy and decouple it from negative externalities

Information and economic signals should favour the most sustainable and resource efficient solutions. Market based instruments in particular can help to dematerialise the plastics sector.

Reduction and behavioural change: Citizens have the power to create a signalling effect by reducing their consumption of unnecessary and wasteful products. They would benefit from understanding the implications of the products they purchase and the waste they produce and the existence of (or potential for) substitutes.

Political action: Citizens are ready to accept policies and products that are designed to prevent plastic pollution. They are signing petitions (e.g. in favour of higher recycling targets and plastic bag bans), supporting anti-litter civil society initiatives (e.g. against plastic ingredients in personal care products), and crowdfunding highly publicised inventions that offer quick technical solutions (e.g. ocean clean-up apparatus and synthetic microfibre catchers). Policy makers can utilise this constructive civil society engagement to enhance their political leadership and mandate to facilitate policy change.

Product labelling and transparency: Regulated labelling should be used to identify sustainable products. Giving consumers access to the right choices should be a key objective of policy makers. This also applies to businesses: producers typically lack access to sufficient chemical information on the materials they procure to manufacture products such as clothing, water bottles and home furnishings. Transparency on the chemical and material composition of products should be used to facilitate reuse and recycling. The implications of product additives such as flame retardants, plasticisers, pigments, fillers and stabilisers must be better understood by policy-makers, business and citizens, and where possible they should be avoided if they inhibit re-use.

Taxes and charges: Even small charges can have a strong signalling effect on consumers, creating incentives to switch away from polluting plastic products (Newman et al., 2015). The Irish plastic bag levy introduced in 2002 effectively reduced per capita consumption of single use plastics bags from 328 to 21 bags per year (Department of Housing, 2014).

Public procurement: Public budgets represent significant investment pools which can create economies of scale for the development of sustainable products and services. Public authorities should implement in-house procurement guidelines that reduce plastic waste and marine litter. The City of Hamburg introduced green public procurement rules banning municipal use of a range of plastic based single use products, including coffee capsules, bottles and utensils (Stadt Hamburg, 2016).

Removing environmentally harmful subsidies (EHS): Public investments should be proofed against negative impacts on resource efficiency and environmental degradation. Efforts should be made to reform EHS that drive waste and pollution (Oosterhuis and ten Brink (eds.), 2014).

3.3 Waste management: The G20 should support the development of effective waste management infrastructure to implement the waste hierarchy, upscale the cycling of plastics in the economy, and prevent leakage into the environment and organisms, including humans

The collection and sustainable management of waste are key to reducing the leakage of plastics into the environment. Major leakages of plastic waste into the oceans are attributable to poor waste management infrastructure in countries across the globe (GESAMP, 2016). In the context of the circular economy, waste management should cover municipal waste as well as industrial waste from a range of sectors. Cascading uses of plastic resources and industrial symbioses can maintain plastics' value within the economy.

Separate waste collection: Emphasis should be placed on moving away from landfill and energy recovery towards re-use and recycling. Separate municipal waste collection is a key element within this infrastructure, to make recycling a convenient option for citizens to deal with their waste plastics. Re-use opportunities in the plastic packaging sector, ranging from reusable B2B crates to refillable bottles for beverages and cleaning products, exceed US\$ 9 billion (EMF, 2017).

Waste management infrastructure and services: Direct investment in waste infrastructure is needed in all countries to increase the rate of recovery and reduce the leakage of plastics. Although landfilling should be the least-preferred option, investment in sanitary landfills is still desirable in countries where informal and unprotected landfills are a major source of plastic pollution. It has been estimated that between 4.8 to 12.7 million tonnes of marine litter enters the seas from land-based and coastal sources around the globe each year (Jambeck et al., 2015).

Export of plastic waste: In general, plastic waste should not be exported for disposal or treatment in locations with significantly lower treatment standards than the country of origin. Countries which export waste for recycling should have responsibility to assess and take into account the impacts of that trade. An estimated 15 million tonnes of plastic is traded per year as waste destined for recycling (Velis, 2014).

Water treatment and waste water: Surface runoff, rivers and sewage waters are key pathways for marine litter, transferring significant volumes of material from land to sea. Measures to improve the quality of freshwater treatment and management, including stormwater, can help reduce transboundary flows of both larger plastic items and microparticles.

Infrastructure for maritime and fisheries marine litter: Whilst terrestrial sources are the most important, an estimated 0.5 to 5.9 million tonnes of plastics enters the oceans from sea-based sources every year (Ocean Conservancy, 2012). Appropriate waste infrastructure at ports can reduce this flow of waste. In 2012, the Korean Ministry of Ocean and Fisheries provided financial support to local governments to install Styrofoam compactors, and to fishermen to replace old buoys with high-density, less easily degraded buoys (Arcadis, 2014).

Deposit refunds and extended producer responsibility (EPR): Producers should be made responsible for their products after the point of sale. Deposit refund and EPR instruments, which support the uptake, quality and economics of recycling, thus reducing marine littering, should be implemented, with due consideration for pricing to cover the costs of the schemes and offer incentives to support circular economy actions, e.g. by using fee modulation for plastics (see Watkins et al. 2017). EPR schemes also encourage producers to design their products to be suitable for take-back and recycling. In Germany, the Verpackungsverordnung established EPR on packaging, prioritising refillable bottles and introducing a one way deposit for PET bottles (EUR 0.25); 98.5% of refillable bottles are returned (Zero Waste Europe, 2010).

Clean-up and collection: Given the size of the oceans and the scale of the marine litter problem, clean-up activities are costly, largely ineffective and create an unhelpful illusion that upstream measures are not necessary. This is the case for macroplastic (i.e. visible to the eye) and

microplastic pollution, both of which are pervasive in our oceans. The transfer of marine litter and microplastics to the ocean floor means that surface water clean-up activities do not target the bulk of the litter and are not a cost-effective solution. Whilst upstream measures should be preferred, clean-up may be a suitable last resort for addressing marine litter in limited zones such as urban areas, tourist beaches and ports where the litter causes severe social and economic damage.

3.4 Worldwide engagement in awareness of impacts and the need for social change: The G20 should act to increase both political and public awareness of the impacts of plastic pollution in the environment and on organisms, including humans, and the opportunities which exist in recovering the value of plastic as a resource through circular economy tools.

The availability of data on the scale of the marine litter issue and of structural waste in the plastics sector has played a major role in driving the global agenda. Nevertheless knowledge gaps exist, particularly on impacts and costs, and the awareness of consumers remains low and needs additional support. Likewise, cases of best practice that illustrate the socio-economic and environmental benefits of action are increasingly showing that preventative measures are preferable to clean-up. Systematic investment in the research and evaluation of policy experiments is needed in order to identify and communicate good practice cases to catalyse action.

Knowledge gaps must be addressed to improve our understanding of the drivers, impacts and mitigation of plastic waste production and marine litter. The public sector should continue to support expert groups to drive dedicated research into marine litter, the plastics economy and plastic materials governance. Civil society-driven beach clean-ups remain the major contributor to data on the presence of marine litter on coastlines around the globe. The NGO Ocean Conservancy maintains one of the largest open-access databases of beach clean data, including the collection of over 12,000 tonnes of litter (Ocean Conservancy, 2017).

Data must be generated and used to inform citizens. Smartphone applications have facilitated local authorities and NGOs in collecting local data on marine litter (e.g. the EEA Marine Litter Watch app, Trashhunters app). Citizens and public procurement officers can also be empowered with better data on the products they buy (e.g. the Beat the Microbead app, the Good Scrub Guide), finding opportunities to reduce their contribution to marine litter. The United Nations Environment Programme massive open online course (MOOC) in 2015-2016 on marine litter provided free public access to the latest research. A 2nd edition of the MOOC in 2017 will continue this.¹

Examples of success must be shared to assess and demonstrate the benefits of action. Examples of activities where the benefits of action are greater than the costs of inaction can

¹ For more information on the MOOC, see <https://www.marinelittermooc.org/>

motivate future activities. Successful initiatives which deliver tangible reductions in the production of plastic waste and pollution provide useful examples to scale up and replicate in other locations.

4. Ensuring collaboration and coherent approaches with other processes such as SDGs

The G20 should make the case for action on plastics and marine litter by building on the links to SDGs and other ongoing processes and targets.

The SDGs provide a valuable framework for progress on marine litter and the circular economy. Efforts on these topics must therefore be made compatible with the key institutions, actors and processes engaged in the SDGs to ensure policy coherence and effectiveness of initiatives. Beyond the specific Target 14.1 on marine litter, there are potential synergies to be found across the 2030 agenda including: Goal 6 on clean water and sanitation, Goal 9 on industry, innovation and infrastructure, Goal 11 on sustainable cities and communities, Goal 12 on responsible consumption and production, and Goal 17 on partnerships to achieve the goals. This demonstrates that increasing the sustainability of plastics and plastic products, implementing circular economy tools in the plastics sector, and reducing the leakage of plastics to the environment could play a part in achieving several of the SDG targets.

Implementation Overview, Recent Progress & Next steps

Encouraged by the opportunities offered by circular economy measures to save resources, and concerned about the growing level of plastic in the oceans, the deterioration of water quality and impacts on biodiversity, health, society and the economy, we call on policy makers, business communities, civil society organisations, scientists and citizens to commit to concrete actions to catalyse a transition to a circular economy and address the marine litter problem. We invite them to submit an individual and joint vision for a circular economy response to marine litter, to help keep plastic and its value in the economy and out of the oceans, and hence realise ecological, social and economic benefits, while meeting our common commitment to SDG 14.1.

At the 2017 G20 summit in Germany, the G20 adopted two declarations -- the G20 Marine Litter Action Plan, and the G20 Resource Efficiency Dialogue. In the former, the G20 puts forward a 'G20 Operational Framework' which promotes several actions to reduce marine litter including sustainable waste management, waste water treatment, awareness raising and increased stakeholder engagement. The Marine Litter Action Plan also establishes a voluntary Global Network of the Committed (GNC) to share knowledge and experiences on the action plan. The G20 Resource Efficiency Dialogue will be set up to exchange opinions and experiences on policies and best practices that increase resource efficiency along the life-cycle of natural resources, products and infrastructure. The topic is clearly rising on the international agenda. At the Our Ocean conference in Malta in October 2017 many countries, organisations, NGO's and companies announced measures, actions and financial commitments to address marine pollution, for example through bans on plastic microbeads, waste management projects or

research.² The European Commission is expected to deliver a Plastics Strategy early 2018 that should include draft measures to address the leakage of plastics into the environment. Campaigners from #Rethinkplastic started a petition with currently over 665,000 signatures demanding the European Commission to commit to put an end to plastic pollution and establish an effective European plastic strategy (We Move Europe, 2017). At the G20 summit in Argentina in 2018, we expect progress on the issue of plastics and marine litter to be discussed under the task force on 2030 Agenda for Sustainable Development, taking into account the urgency of action, and the possibility of effective action as demonstrated by initiatives across a growing range of countries.

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² A full overview of the commitments can be found on https://ourocean2017.org/sites/default/files/ooc-2017-list-of-commitments_en.pdf [accessed 29/11/2017].

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