



Diana Barrowclough and Carolyn Deere Birkbeck



Transforming the Global Plastics Economy: The Political Economy and Governance of Plastics Production and Pollution

Diana Barrowclough and Carolyn Deere Birkbeck*

Abstract

Despite growing alarm about plastic pollution, the production and use of plastics is forecast to continue to expand over coming decades. Efforts on the part of governments, civil society and business to reduce plastics pollution are encouraging signs of awareness and an appetite for engagement but are, nonetheless, failing to stem the tide of growing plastic production, use and waste.

To date, there has been remarkably little scholarly interest in the global plastics economy. Both the global political economy and root causes of the plastics crisis are vastly understudied. Most efforts towards change (whether voluntary or regulatory) have been focused on the 'end of life' of the plastics value chain, rather than its starting point. Attention to the upstream dimensions of the plastics economy – that is, to the production end of the plastics life cycle – is not yet central to international policy discussions nor are the international policy frameworks needed to address them.

This paper seeks to spur discussion on an integrated set of policies – and an enabling international framework – to support an effective transformation of the plastics economy, including a just and sustainable transition, away from excessive plastic production and unnecessary use. It brings together, for the first time in the literature, a first step toward an integrated analysis of what we call the missing 'political economy piece' of evolving global discussions of challenges and responses to plastic pollution. It highlights some critical policy steps that can be taken to help face these structural challenges and transform our economy away from the grip of plastics, along with a policy-oriented research agenda.

* Dr. Carolyn Deere Birkbeck is a Senior Research Associate at the Global Economic Governance Programme and a Senior Researcher at the Graduate Institute's Global Governance Centre. Dr. Diana Barrowclough is Senior Economist at the UN Conference on Trade and Sustainable Development.

This paper was supported by the Swiss Network of International Studies (SNIS) through its support for a project on Transforming the Global Plastics Economy, housed at the Global Governance Centre of the Graduate Institute in Geneva, Switzerland.

Table of Contents

Introduction	3
1. Evolving definitions of the ‘problem’ and solution	6
1.1. An overview of the reframing of the plastics crisis	6
1.2. Perspectives on sources of plastic pollution and root causes	9
1.3. Mapping today’s policy landscape – evolving responses and approaches by governments, industry and civil society	12
1.4. Missing development dimensions	21
2. Mapping the economic landscape for plastics production and waste – scale and economic drivers	23
2.1. Plastics and plastic products are many	23
2.2. The plastics life cycle: market structure, stakeholders and global supply chains	25
2.3. Explaining expanding production	32
3. The evolution of the international policy environment	35
Phase 1 – First awakenings to marine litter and emergent responses (1972–2012)	37
Phase 2 – Intensified and broadening focus on plastics pollution (2014–2017)	38
Phase 3 – Widening focus on plastic pollution, growing concerns about production and action on plastic waste trade (2017-present)	39
4. Strategic debates and new directions for global governance of plastics and plastic pollution	43
4.1. International environmental negotiations	43
4.2. Vital complementary approaches: international approaches to reducing plastics at source	44
5. Summary of key findings and research gaps	48
6. Policy-relevant research agenda	49
Annex 1 – Sample of corporate partnerships and social responsibility initiatives on plastics	52
Bibliography	58

Introduction

Despite growing alarm about plastic pollution, the production and use of plastics is forecast to continue to expand over coming decades. Efforts on the part of governments, civil society and business to reduce plastics pollution are encouraging signs of awareness and an appetite for engagement but are, nonetheless, failing to stem the tide of growing plastic production, use and waste. Even before the coronavirus crisis, it was evident that bolder steps were needed to help restore a better balance between humanity and the environment. This paper aims to highlight some critical policy steps that can be taken, sooner rather than later, to help face these structural challenges and transform our economy away from the grip of plastics.

Considerable efforts have been invested over the last few years in identifying and assessing sources and impacts of marine plastic pollution (Beaumont et al 2019; Boucher et al 2019). Consumer-led campaigns, business initiatives, and government-led policy efforts have all come into play at the national level. In terms of international cooperation, a wide range of intergovernmental processes and organisations are involved in some aspects of the plastic pollution challenge. At present, the most prominent inter-governmental processes, such as those associated with the UN Environment Assembly, focus on reducing plastic pollution in the world's oceans and marine environment, and on mobilising cooperation and resources 'downstream' to boost the quality and scale of waste management and recycling.

On the scholarly front, there has been growing interest in how international environmental policy and law could be strengthened to tackle marine plastic pollution, including its land-based sources (Haward 2018; Simon 2017; Raubenheimer & McIlgorm 2018; Tiller and Nyman 2018; Vince and Hardesty 2017, 2018). Several studies make the case for a new international treaty to address marine plastic pollution. At the same time, the global attention to marine plastic pollution is also spurring calls for widening the frame to recognise and tackle challenges of plastic pollution across the life cycle of plastics – from extraction through manufacturing to consumption and disposal – as well as the wider social, health and development challenges. In particular, amidst efforts to reduce carbon emissions and stem climate change, the carbon-intensity of the plastics, over 98% of which are based on virgin fossil-fuel derived feedstocks, adds a compelling new reason to rethink plastic production and use (Azoulay et al 2019).

To date, most efforts towards change (whether voluntary or regulatory) have been focused on the 'end of life' of the plastics value chain, rather than its starting point. Meanwhile, attention to the upstream dimensions of the plastics economy – that is, to the production end of the plastics life cycle – is not yet central to international policy discussions nor are the international policy frameworks needed to address them (Nielsen et al 2020). At the international level, action 'upstream' currently relies primarily on voluntary business efforts and corporate commitments, pressure from citizens and NGOs, hope that new technologies will fix key challenges, and a disparate set of uncoordinated national policies.

A broader perspective, which is the starting point for this research, builds on and goes beyond the focus on marine litter and pollution, to explore the role of the upstream challenges related to plastic production, and most importantly the production of excessive, unnecessary and problematic plastics.

To date, there has been remarkably little scholarly interest in the global plastics economy. Both the global political economy and root causes of the plastics crisis are vastly understudied. Beyond the chemistry literature on plastics, most scholarly attention has focused on understanding marine plastic pollution and on options for boosting international environmental law and cooperation on marine plastic pollution. Beyond a handful of histories of the chemical and plastics industry (Aftalion 2001; Fenichell 1996) and studies of the cultural anthropology of plastics consumption and pollution (Frankel 2011; Gabrys et al 2017; Hawkins, 2018; Hawkins et al 2015; Liboiron 2016), wider interdisciplinary attention has been limited (Vince and Stoett 2018). Although economics and politics of regulating chemicals has attracted scholarly attention for several decades (see, for instance, Hough 1998 and 2008; Swanson 1995, 1998), only a handful of studies address the challenges of global chemical governance, and these offer limited specific attention to plastics (Khan and Honkonen 2017; Escobar-Pemberthy et al 2018; Selin 2010; Tuncak & Ditz 2013). Although the political economy of plastic waste and waste trade is attracting growing attention from the media, think tanks and some scholars (Grosz 2011, GRID-Arendal 2019, Brook et al 2018; O'Neill 2018), it has not been a central theme in recent scholarly literature on the global governance of global waste and toxic waste trade (Grosz 2011; Khan 2016; Minter 2015; Pellow 2017). While interest of political scientists to the politics of plastics regulation and the framing of the plastics problem is growing, to date, there has been little systematic political or economic assessment of the range of global policy, regulatory and governance options for better responding to the 'upstream' causes of expanding plastic production and pollution.

Moving beyond voluntary business initiatives and appeals to consumer power and societal good will, this paper seeks to spur discussion on an integrated set of policies – and an enabling international framework – to support an effective transformation of the plastics economy, including a just and sustainable transition, away from excessive plastic production and unnecessary use.

The underlying thesis of this paper (and the wider project of which it is a part) is that moving beyond our excessive reliance on plastics requires greater scholarly and policy attention to the global political economy of the plastics economy – and specifically to the strong economic and commercial forces that propel expansion of the global plastic economy. Plastics is a big business, developed over several decades that employs millions of people around the world and is driven by a myriad of underlying socio-economic, institutional and political factors. The fossil fuel and petrochemical industries that underpin growth of the plastics sector – are among the world's most powerful in terms of economic might and political influence – have strong interests in "business as usual", or at least for as long as it can last, even whilst some important players in the industry have embraced the need to experiment with new, more sustainable alternatives. Further, the use of plastics has become so integral to many aspects of industrialization, development and trade – whether as manufactured products (ranging from television sets, the car and toy industries and synthetic clothes, or as packaging (including food products shipped to world supermarkets).

Amidst the COVID-19 pandemic, the struggle to ensure access to adequate personal protective equipment, much of which is plastic – from masks and gloves to bottled disinfectant – has underlined the practical benefits and applications of plastics but does not diminish the case for a more environmentally sustainable plastics economy. Rather, it underscores the need for recognising the many types of plastics with different purposes,

degrees of necessity, potential for reuse and recycling, environment and health impacts, and durability. A clear case remains for minimizing plastics production for unnecessary, excessive and wasteful end-uses; promoting less environmentally harmful alternatives and substitutes; and reducing production and use of virgin plastics in the plastics economy. Indeed, for many, the Covid-19 is a timely warning of another enduring crisis – the climate crisis – predicted to have even more far-reaching social, economic and environmental effects, and to which the plastics sector contributes greatly in terms of greenhouse gas emissions. On the positive side, as governments seek to spur economic recovery from the Covid-19 crisis, they have an opportunity to transform and re-start production processes in a more sustainable way and to reflect the newfound possibilities of consumers to change long-held habits and preferences. On the negative side, the plunge in oil and gas prices associated with Covid-19 is putting further downward pressure on the already low price of fossil fuel feedstocks that drive expanding virgin plastic production, which may put at risk sustainability efforts in the plastics sector (CIEL 2020; ICIS 2020). So long as virgin plastic is cheap, market incentives to recycle plastic, to reduce certain kinds of production and to invest in alternatives will be limited.

Transforming the plastics economy, as with wider low-carbon transformation, will demand attention to economic considerations such as the barriers to adaptation and how to address stranded assets, including those related to fossil fuels and petrochemical production, as well as a recognition that vested interests may not adapt quickly and will deploy political resources to defend the status quo (Ansari and Holz 2020). It will require attention to the links between the upstream and downstream phases of the plastics economy – as exemplified by circular economy approaches that aim to create synergies between recycling, more recycled content in plastics and the redesign of plastics to make them more easily recycled (EMF and WEF 2017; OECD 2019a). Further, in today's highly integrated global economy, where money and products flow easily across many borders, concerted international policy co-ordination and action will be essential to support national regulatory efforts to address plastic pollution - no single country can succeed alone.

In this context, this paper brings together, for the first time in the literature, a first step toward an integrated analysis of what we call the missing 'political economy piece' of evolving global discussions of challenges and responses to plastic pollution. It offers an introductory mapping of global production in plastics, the market structure of the plastics economy; the key stakeholders and commercial players in the global plastics economy – traders, investors and financial institutions – and their strategies; as well as the international finance, investment and trade flows that propel current trends. It also aims to improve understanding of the political economy of existing responses from the private sector, citizens and government as key designing appropriate legislative policies, rules and norms. In so doing, it identifies gaps in data and in the literature on the policy and regulatory responses necessary to transform the global plastics economy and reduce plastic pollution.

Looking ahead, this paper argues that a bold, integrated coordinated policy approach is needed, which reflects the complexity of the plastics sector and the multifaceted aspects of the plastics challenge. Critically, the success of efforts to sustainably transform the global plastics economy in order to reduce our excessive consumption of plastics and to find a new, less polluting and low-carbon path, will depend on providing support for various adaptation and transition phases, to get 'buy in' for the necessary leaps and to stay on track. There are two sides of the same coin that need to be addressed – namely promoting a *just*

transition as part of the process to secure a *sustainable transformation* away from conventional plastics toward a more sustainable future. Here, there is a parallel with wider calls for a Global Green New Deal for a carbon-neutral economy (UNCTAD 2017 and 2019), which represent a potentially significant nexus of economic and environmental sensibilities that also argue for a sustainable transformation of the economy and a just transition away from environmentally and socially degrading economic processes.

Outline of this paper

Part 1 of this paper reviews the evolving framing of the plastics crisis and views on appropriate responses, highlighting the wide range of initiatives on the part of government, business and civil society – from the voluntary to legally enforceable. Part 2 maps key trends in the political economy of plastic production, identifying key phases and stakeholders in the plastic value chain and key drivers of expanding production. Part 3 reviews the evolution of the international policy landscape over three phases. Drawing on this background, Part 4 identifies strategic debates on future directions for global governance of plastic pollution and plastics, arguing that an integrated policy approach that integrates environment and economic policy tools – supported by an enabling international framework – is needed to promote sustainable transformation of the plastics industry. Part 5 presents a summary of findings and research gaps. To conclude, Part 6 of the paper argues for a policy-oriented research agenda that focuses attention on information and analytical gaps in relation to: 1) political economy and drivers of the ongoing growth and dispersion of the global plastics economy; and 2) strategic international measures for improved global regulation and governance.

1. Evolving definitions of the ‘problem’ and solutions

1.1. An overview of the reframing of the plastics crisis

Heightened public consciousness about the scale and impact of plastic pollution has soared over the past 10 years, especially due to the efforts of powerful environmental advocacy groups and natural history broadcasters to show visually the shocking impact of “leakage” of plastic into the ocean. Scientists have underscored that in addition to larger pieces of marine debris and litter – from plastic bags and bottles to discarded fishing equipment and plastic pellets—much smaller plastic particles, known as microplastics, are also extremely damaging to marine biodiversity, ecosystems, wildlife and fisheries (GESAMP 2015; GRID-Arendal 2020; Jambeck et al 2015).¹ Key sources of microplastic pollution include washing of synthetic textiles (by households and industrial facilities), tyre abrasion and erosion of paint coatings, as well as the breakdown of larger plastic litter into smaller components (Boucher and Friot 2017).

This heightened awareness has also been accompanied by important evolutions in both perceptions and understanding of the nature of the world’s plastics crisis and appropriate solutions. In the policy arena, discussions have been reframed in several ways, as evidence

¹ There is a wealth of scientific and environmental literature on this topic, including Jambeck et al, (2015), estimating the scale and impact of marine pollution; Boucher and Friot 2017, on the danger of micro-plastic particles less than 5mm in size; Eriksen et al (2014) estimates there are 5.25 trillion plastic pieces floating in the ocean, or 720 pieces per person on the planet. Plastic debris of any size can be dangerous for marine ecosystems (Halpern et al 2008; UNEP 2016a).

and advocacy on the complexity of the challenges at hand have grown. Further, there are ongoing efforts to further shift the focus of the policy debates and responses.

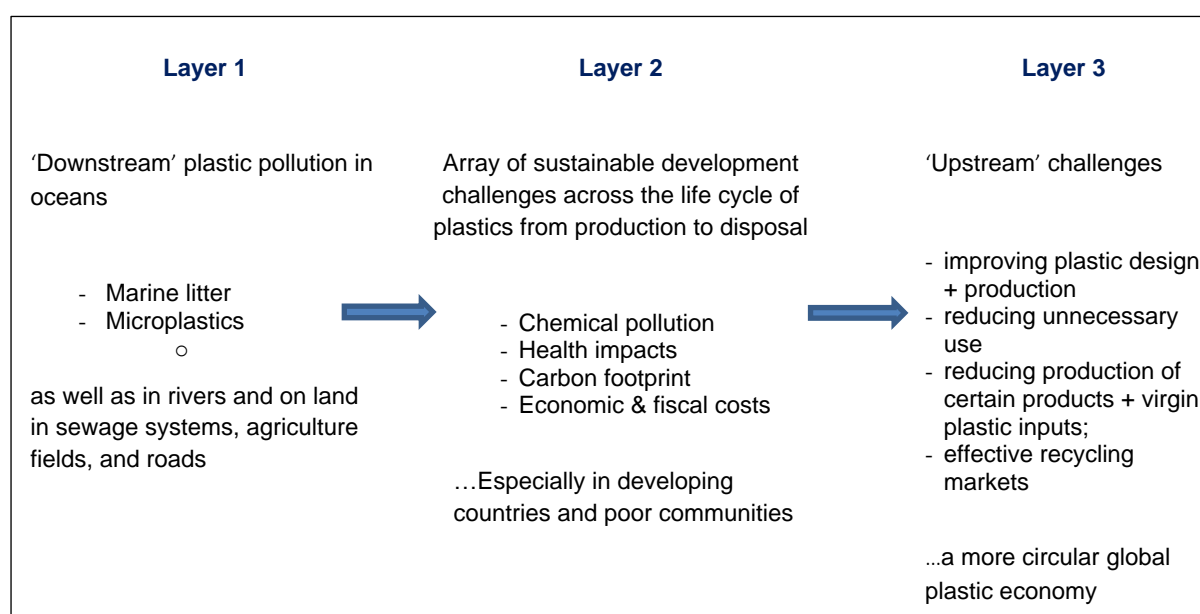
Broadly speaking, the framing of the plastic pollution problem over the past decade has expanded from:

- a concern focused tightly on marine plastic litter as well as microplastics at the 'downstream' end of the plastics life cycle toward a recognition of the land-based sources of ocean pollution, and the challenges of plastic pollution on land;
- toward a wider interest in plastic pollution across the life cycle and the range of sustainable development implications;
- and finally, toward challenges 'upstream' related to the production of plastics, including a new recognition of the contribution of plastics to carbon emissions and global warming.

There are also feedback loops between these debates and not all evolved sequentially. Moreover, some of these wider concerns have been on the table for decades (e.g., regulation of chemicals used in plastics). Nonetheless, the simplified framework in Box 1 provides a useful entry-point for understanding the layering of concerns in the mainstream media and political discussion. [The evolution of responses is addressed in part 1.3).

In terms of the 'downstream' concerns, a core aspect of the plastics problem is that as plastic production and use have grown, the world's capacity to manage the enormous volume of plastic waste generated has not kept up (WWF, 2019). Only a minor fraction – an estimated 10% – of all plastic waste produced has been recycled.¹ In 2015, of 141 million tonnes of packaging waste, only an estimated 10% of plastic packaging was effectively recycled, the majority of the rest was landfilled (40%), incinerated (14%) or leaked into the environment – that is, into fields, streets, rivers and oceans. Further, with growing plastic production and use, plastic waste generation is also still growing with an increase of 41% expected by 2030 (WWF 2019).

Box 1. Layering of frames about plastics pollution



Among the many campaigns about plastics, it is the impact of plastic pollution on the world's oceans and marine environment that has most captured the attention of the public, media

and policymakers over the past decade. Overall, conservative estimates are that 100 million tons of plastic have leaked into the world's oceans, and that an estimated one third of all plastic packaging leaks into the world's oceans (WEF 2017). Critically, between 80-90% of that marine plastic pollution comes from land-based sources and the rest from sea-based activities (Ocean Conservancy 2015; Ryan 2015; Gallo 2018).

The recognition of land-based sources of plastic pollution has spurred attention to the challenges many countries – especially developing countries – face with managing plastic waste. This has prompted a growing body of research on methodologies and strategies to identify sources of plastic waste and to prevent leakage into oceans and manage its multiple impacts on land as well (Boucher et al 2020; Qantis and EA 2020). It is well known that many developing countries, including the poorest and small island developing states, are engulfed by marine litter on beaches, and in their coastal environments and their fishing zones. Beyond the seas, many developing countries faced blocked sewage systems, clogged rivers and water ways, soil and air pollution due to mismanaged landfills and open dumping of plastic waste, as well as toxic emissions and by-products due to poor quality infrastructure for recycling and incineration. Vulnerable low-income economies are the least likely to have the resources and infrastructure to address these challenges.

Together, the leakage of plastic waste into the environment represents a huge loss of material value to the global economy. On the commercial side, the failure to recycle or recapture the value of plastic has been estimated to represent a loss of between \$80 and \$120 billion in value to the plastics industry annually (WEF 2017). The broader economic costs, including environmental and health costs of plastic pollution are much higher. For many developing countries, for instance, plastic pollution presents significant economic challenges and fiscal burdens arising from the need to address: i) the environmental and health impacts associated with landfill and incineration of plastic waste, as well as sewage and other infrastructure clogged with plastic; ii) damage to sewage system and infrastructure; iii) infrastructure and systems to improve waste management, including waste that can neither be recycled nor composted; and iv) threats to local tourism, agriculture, fisheries and shipping industries (Schröder 2017a, b, 2018a; GAIA & Greenpeace East Asia 2019; Williams et al 2019).

Alongside an enduring central preoccupation with these multiple downsides associated with plastic waste leaking into the environment, a growing array of environmental experts are presenting evidence on environment, health and development challenges present across the life cycle of plastics (Steensgaard et al 2017). Arresting as is the impact of plastic waste on the environment, the focus on plastic pollution in terms of volume of waste, they call for attention to linked environment, health and human rights impacts of chemical pollution across the life cycle of plastics – from the chemical safety aspects of food packaging, to toxic pollutants present in plastic waste, and the interactions of toxic chemicals and microplastics (Azoulay et al 2019). In addition to the visible aspects of plastic pollution, there is growing scientific evidence of toxic chemicals and additives (including persistent organic pollutants) present in plastic particles that pollute land and air, eventually making their way into the food chain. The growing body of scholarly work and evidence on the health and environmental impacts has been harnessed by the Break Free From Plastic civil society movement, in its framing of the plastics crisis as a global environmental justice issue, highlighting the environment, health and fiscal burden on poor communities, both in

developed and developing countries where plastic is produced, and developing countries used as a dumping ground for plastic waste.

A further critical issue element in the current framing of the plastics problem relates to the nexus between the climate and plastics crises in and beyond the world's oceans, and specifically to the contribution of the plastics sector to the climate crisis (Stoett and Vince 2019; Azoulay 2019). As more than 98% of plastic production relies on fossil fuel feedstocks, the sector's relevance to efforts to reduce climate emissions is clear. On the one hand, industry proponents highlight that plastics products have attributes that can contribute to reduction of climate emissions (e.g., light-weight plastic packaging can reduce emissions associated with transportation of goods; plastic components for motor vehicles to reduce their weight and fuel needs; and certain products, like plastic insulation, are important to energy conservation and save more energy than used for their production). On the other hand, amidst growing pressures for 'Green New Deals' national and globally, the plastics like all sectors of economic activity face pressure to adjust to contribute to efforts toward a carbon-neutral global economy (UNCTAD 2019). In Europe, for instance, the plastics industry is one of the top four largest sources of GHG emissions (the top four are steel, plastics, aluminium and cement) (Material Economics, 2018a: 3). Important to consider is that climate costs are present at each stage of the life cycle of plastic need to be considered: extraction and transport of fossil fuels for plastic production; refining and manufacturing;² waste management (such as in plastic waste incineration processes); and waste re-use and recovery (Azoulay 2019). In addition, the impacts of plastic pollution on ocean carbon sequestration are being studied. Across the plastics value chain, CO₂ emissions are expected to increase 50% by 2030 (WWF 2019, CIEL 2019c). If current trends in plastics usage continue as expected, the plastics sector will account for 20% of total oil consumption and 15% of the global annual carbon budget by 2050 (Barra et al 2018; WEF 2017; CIEL 2017).

1.2. Perspectives on sources of plastic pollution and root causes

As alluded to above, differences in definitions and perspectives on the scope of the 'plastics problem' lead to differences of opinion on root causes and reasons for plastics pollution, and thus also on appropriate responses (addressed in Part 1.3.)

Conventional explanations

The dominant explanation for plastic pollution, and specifically the leakage of plastic pollution into the marine environment, is that countries have insufficient waste management capacity to collect and sort waste, and then safely recycle, incinerate, landfill or reuse that waste. One challenge is that products are not designed in ways that make them easily sorted or cost-effectively recycled (e.g., they are mixed with cardboard, aluminium or different types of plastic), or that their chemical composition makes it difficult for them to be compostable, biodegradable or recyclable, or that the presence of toxic elements in plastics or the contamination of products makes them too dangerous to recycle. The key responses to such problems are financial and technical – to invest in waste management capacity, better design plastics and plastic products, to remove toxic chemical properties from

² In 2015, for instance, the refining and manufacturing of plastics was estimated to have contributed between 184 million to 213 million metric tons of greenhouse gases (equivalent to about 45 million vehicles driven for a year) (CIEL 2019c). Efforts to manage plastic waste, mostly via incineration, were estimated to have contributed a further 16 million metric tons of greenhouse gases in 2015 (CIEL 2019c).

plastics, and to ensure a higher market value for plastic waste – by ensuring profitable markets for recycled waste materials. A related challenge is that consumers are increasingly confused – if well-meaning – about the options for recycling plastics and recycling behaviour and rates vary widely between types of plastics (Henriksson et al 2010).

A subset of this story is that the core problem of plastic pollution relates to mismanagement of plastic waste by developing countries. In terms of the sources of plastic waste leaking into oceans, it is true that the top 6 sources of plastic pollution in the oceans are estimated to be, in order, China, Indonesia, Philippines, Vietnam, Sri Lanka, Thailand. Indeed, all of the top 20 countries sources of leakage are developing countries. Clearly, one aspect of the problem is that these countries lack the regulatory framework, institutional capacity and business infrastructure to safely manage the scale of plastic waste at hand. For some developing countries, the scale of the plastics problem they face has three dimensions: they import plastic products and products that contain plastics, which then become waste they can't manage; and they also produce plastic products domestically; and they also import plastic waste from other countries.

As developed country governments have struggled over the past decade to manage rising volumes of plastic waste produced and used within their borders, their exports of plastic waste have risen significantly. In 2018, the United States, Japan, Germany, Britain and Belgium were the main exporters of plastic waste, most of which was destined for developing countries, especially in Asia. Contrary to assumptions that such countries had a comparative advantage in processing waste, most were already struggling to manage the growing scale of mismanaged, domestic plastic waste. Still, the global waste trade was seen as a strong growth industry for waste management and recycling companies in developing countries, and was a lucrative industry for plastic waste traders and transporters who profited, sometimes through corruption, abuse and fraud, from the trade in plastic waste (Laville 2018).³ To give a sense of the financial stakes at hand, the global plastic waste management market was estimated to be worth some US\$32.6 billion in 2019 (Marketsandmarkets 2019). The export plastic waste also provided a solution for retailers and local authorities in developed countries under pressure to manage their waste – by shipping growing volumes to unseen destinations abroad.

This wider political economy of plastic pollution only became prominent in the public eye when, over the past two years when countries at the receiving end of (mixed and unsorted) plastic waste from foreign sources started refusing these problematic shipments. Until 2018, China imported over two-thirds of the volume of global plastic waste trade. In 2018, after China's 2018 'National Sword' policy introduced an import ban on most plastic wastes, this plastic scrap was redirected to less regulated countries such as Malaysia, Vietnam and Thailand, and then to Indonesia, South Korea, Taiwan, India and Turkey (GRID-Arendal 2019). Some of these countries too sought to implement import bans and other controls to limit the entry of plastic wastes they deemed themselves unable to effectively manage (including in some instances, sending unwanted plastic waste back to its country of origin). While a subset of developing countries may indeed be an immediate source of leakage due to inadequate waste management, attention to the global plastic waste trade and the unveiling of the myths of recycling have reveals that the root sources of marine plastic

³ Concerns are growing, for instance, about fraud related to waste export licenses and 'laundering' of plastics wastes, as exporters seek to arbitrage different rules in different locations, or even using third-locations and 'round-tripping' as a hide to commit fraud, as has occurred in the trade of other goods and services.

pollution lie elsewhere (Ananthalakshmi and Chow, 2019; Franklin-Wallis 2019). Restrictions on plastic waste imports have provoked a considerable decline in global trade flows in plastic waste over the past two years. On the one hand, this has forced policymakers in exporting countries to act swiftly on ways to reduce plastic waste, but there are also concerns that if not carefully managed it can reduce incentives for the collection of waste (if there is nowhere for it to go) and threaten global markets for recycling and recycled plastic materials (Staub 2017).

Changing plastics

As noted above, plastics is a catch all phrase for a variety of products that serve a variety of purposes and functions with different chemical properties. One argument is that it is not plastics that are the root cause of the problem per se, but the ways in which they are designed and used, and the absence of adequate capacity to clean up and re-use waste.

Here for instance, there is broad consensus that single use plastics, that are designed to be used only once over a short time span before being thrown away and that are found widely as pollution in the ocean environment, are especially problematic – as is the excessive and unnecessary use of plastic, such as in the case of much single-use plastic packaging, especially where it is not readily recyclable. There has been less public attention or concern, for instance, about plastics used in construction materials because these remain in use sometimes for several decades.

For some, the challenge is simply however to design plastics with different properties so that they do not persist as waste in the natural environment. Many major plastic producers and brands are now partnering with or buying firms engaged in bioplastics, recycling and recycled plastics as ways to ensure they have access to cutting edge materials to mix with or replace conventional plastics (WRAP 2019). While PET is mostly associated with plastic bottles, the fact that PET is more readily recyclable than other plastics is spurring efforts to use PET for a range of other plastics applications. Further, there has been much focus on biodegradable plastics and compostable plastics, or the use of recycled plastic materials to make new products out of recycled plastics. However, while there is considerable optimism about these innovations, and reports of edible plastics and of micro-organisms that can eat plastics, few provide the clear-cut solutions that proponents declare (Royte 2019). A 2015 UN Environment report on biodegradable plastics concluded that on the balance of current scientific evidence “the adoption of plastic products labelled as ‘biodegradable’ will not bring about a significant decrease either in the quantity of plastic entering the ocean or the risk of physical and chemical impacts on the marine environment...” (UNEP 2015). Amongst other factors, the report noted that the “complete biodegradation of plastics occurs in conditions that are rarely, if ever, met in marine environments,” and that the idea that an item may be biodegradable may mean users are more likely to discard it inappropriately.

In addition, as concerns about the climate impact of plastics have grown, there has also been growing interest and investment in “biorefineries” for so-called ‘bioplastics’ made from non-fossil fuel-based feedstocks (Bauer 2018; Marshall 2007). According to their proponents, some bio-based plastics offer features such as better compostability and renewability (in the sense that their feedstocks are renewable) than conventional plastics, but here too questions remain about the potential for the integration of bioplastics into conventional recycling processes (Alaerts et al 2018). As with other efforts to build the profile and legitimacy of new sustainable technologies, there are also questions about the degree to which the terminology of ‘bioplastics’ is misleading by overstating the green credentials of

these products (Bauer 2018; Krieger 2019; Krisna et al 2017). An example of a product that aims to address many of concerns about plastics is bio-based PET, that its promoters describe as a biomass-derived, fully recyclable, biodegradable, compostable, and renewable bioplastic material. However, the verifiability and robustness of such sustainability claims, the definitions of appealing terms such as ‘recyclable’, and the practical environmental implications of these technologies remain subject to debate.

Further, some argue that while it is important to minimize wasteful use of plastics, the fact of plastic waste is not a problem per se so long as it is kept out of the environment and reused or recycled. Here, three challenges emerge – first, recycling is a carbon intensive activity and associated with environmental and health hazards in many settings around the world; second, the scale of investment in recycling facilities required to meet the growing volume of plastic waste is enormous and this capacity will take decades to build around the world to keep up; and third, the price of virgin plastic is so low that recycled plastic inputs struggle to be competitive (CIEL 2019). Indeed, recycling industry faces a triple dilemma of cheap price of competing materials (virgin plastics), which limits demand, which in turn means that recyclers struggle to find buyers willing to pay for recycled plastics, thereby diminishing the economic incentives for collecting and processing plastic for recycling.

1.3. Mapping today’s policy landscape – evolving responses and approaches by governments, industry and civil society

Just as the framing of the plastics problem – and with it the different problems that stakeholders aim to solve - has become increasingly complex, so too has the question of appropriate responses and possible solutions. This section presents a conceptual framework that categorizes the range of responses and the policy landscape, starting with the key stakeholders involved, and concludes with some observations on challenges and shortcomings with current landscape of responses.

Efforts to address plastic pollution encompass:

- Government efforts at the national, regional or international level on a diverse landscape of topics that have a bearing on plastic pollution, reflecting the varied sources and pathways by which plastic becomes a problem.
- Voluntary efforts by companies include individual commitments to reducing plastic pollution (see Table 1), as well as participation in multi-stakeholder efforts to reduce plastic pollution.
- Citizen initiatives and NGO campaigns

Multi-stakeholder partnerships, some led by industry and others by UN agencies, NGOs or philanthropic foundations (see Annex 1). Looking across the efforts of these actors, it is possible to discern seven dominant goals driving responses (see Table 2): cleaning up, reducing waste leakage, reducing consumption, recycling and reuse; investing in alternatives and new markets for plastic waste, reducing production, and reducing pollution along life cycle.

To date, the dominant focus of attention has been on voluntary efforts by citizens and industry to prevent and clean up plastic waste in the marine environment and improve plastic waste management. In addition, Table 1 and Annex 1 highlight a growing range of private sector commitments, most of which focus on recycling, using recycled plastics and reducing use of single-use plastics.

Table 1. Sample of sustainability commitments by individual companies

Company Category	Company Name	Goals & Commitments
Consumer Products	Colgate Palmolive	<ul style="list-style-type: none"> • Commitments to reduce the use of plastic in packaging • Use 25% recycled content in plastic packaging • Make 100% of packaging recyclable
Food	Danone S.A.	<ul style="list-style-type: none"> • Circular economy of packaging • Goal is to make packaging 100% circular by 2025 • Investing also in private initiatives that strengthen circular infrastructure, especially in countries that lack formal collection systems or where there is a high risk of leakage of plastic waste into the environment • Aim to offer consumers bottles made from 100% bioplastic
Fashion and Textile	H&M Group	<ul style="list-style-type: none"> • To become 100% circular and renewable, taking a circular approach to whole value chain • Eliminating packaging that is not recyclable or compostable • Designing all packaging for recyclability and, where relevant, composability (still being a recyclable packaging) as well as by using recyclable materials • Compostable, non- recyclable packaging will only be used for specific targeted applications • Where relevant, the packaging will be designed for reusability • Has shifted the shopping bag from plastic to paper
Consumer Products	Johnson and Johnson	<ul style="list-style-type: none"> • Project Phoenix: a program that help people generate value from waste • Care to Recycle Program: increase consumer recycle of personal care products • 2025 plastic packaging commitment: select 2 new recyclable packaging design solutions for introduction by 2021
Food	Kellogg Company	<ul style="list-style-type: none"> • Sustainable Packaging, one of the three pillars on their global packaging strategy • Eliminate unnecessary plastic packaging by 2025 through priority programs, partnerships with suppliers, and engagement with other companies in platforms • Working towards 100% reusable, recyclable or compostable packaging by end 2025
Cosmetic	L'Oréal	<ul style="list-style-type: none"> • SPOT: an evaluation tool to assess the social and environmental performances of a product throughout its life cycle • SPICE Initiative: founded to share L'OREAL's SPOT-methodology with the industry to collectively shape the future of sustainable packaging
Food and Beverages	Nestlé	<ul style="list-style-type: none"> • Investment of up to CHF 2 billion to lead the shift from virgin plastics to food-grade recycled plastics, and to accelerate the development of innovative packaging solutions • Aim to have 35% recycled content in PET water bottled by 2025 • In the US, target of using 50% recycled PET in all water bottles by 2025 • In Europe, aim for minimum of 25% recycled content for polyolefin applications in non-food content applications, and the maximum possible level for polyolefin food contact materials
Food and Beverages	PepsiCo	<ul style="list-style-type: none"> • Design 100% of packaging to be recyclable, compostable or biodegradable by 2025 • By 2025, PepsiCo will reduce virgin plastic use across our beverage portfolio by 35%, equating to the elimination of 2.5 million metric tons of cumulative virgin plastic when taking into account business growth. • All in For Recycling challenge→ work to increase recycling rates
Beverages	The Coca-Cola Company	<ul style="list-style-type: none"> • Plan to collect and recycle a bottle or can for every one sold by 2030 • World Without Waste plan→ target of 100% recyclable packaging by 2025 • Coca-Cola Freestyle technology to re-imagine the role of packaging in how to deliver products to consumers, piloting refillable cup and bottle models
Consumer Products	Unilever	<ul style="list-style-type: none"> • Moving towards a circular economy • Less Plastic, Better Plastic, No Plastic • Investing in alternative models of consumption which harness refills and reusable packaging • Participation in Loop: an innovative new delivery model for durable packaging which is shipped directly to the consumer, returned and refilled
Supermarket chain	Walmart	<ul style="list-style-type: none"> • Design for recyclability for 100 percent of packaging by 2025. • Increase use of recycled content or bio-based materials by 20 percent by 2025. • Lessen the weight of packaging by 10 percent by 2020. • Switch from corrugate containers to reusable packaging containers (RPCs) to reduce damages by 20 percent by 2019.
Supermarket chain	Carrefour	<ul style="list-style-type: none"> • 100% recyclable packaging for its own-brand products by 2025 • Offering consumers the right to bring their own containers to the stores.
Supermarket chain	Waitrose	<ul style="list-style-type: none"> • Aim is to eliminate unnecessary plastic and make all own-brand packaging reusable or made out of widely recyclable or home-compostable material by 2023. • no longer provide disposable coffee cups in our stores, have stopped selling packs of disposable plastic drinking straws and have switched our plastic stem cotton buds to paper • Experimenting with new reuse and refill schemes for some of its products
Toys manufacturer	Lego	<ul style="list-style-type: none"> • By 2025 LEGO packaging should be renewable: 100% of LEGO boxes, bags, and special packaging are to be made from recycled or sustainably sourced plant-based materials

		<ul style="list-style-type: none"> • Efficient: ongoingly exploring ways to optimize packaging, balancing consumer appeal with environmental action • Recyclable: designing packaging that facilitates consumers to recycle in our major markets
Electronics manufacturer	Sony	<ul style="list-style-type: none"> • One Blue Oceans Project to reduce ocean plastic pollution by promoting reduced plastic usage worldwide and encouraging the collection and cleanup of litter from rivers, beaches and other locations around the world • Commitment to reduce its environmental footprint to zero by 2020
Car manufacturer	Volvo	<ul style="list-style-type: none"> • By 2025, at least 25% of plastics used in new Volvo car models will come from recycled materials • Volvo Cars pledges to remove single-use plastics from their offices, canteens and events across the globe by the end of 2019.

The dominant framing of the plastic pollution challenge is that at the heart of the plastic challenge is lack of adequate infrastructure and systems to collect and manage household and municipal waste; inadequate recognition in society of waste as a valuable resource, such as for recycled plastic; and the need to improve consumer behaviour with regard to recycling. The rise of corporate social responsibility initiatives and industry public relations campaigns is having a significant influence on the rise of this framing of the plastic problem and appropriate solutions (Clapp 2012; Clapp 2012; Clapp and Swanson 2009; Dauvergne 2018b; London-Lane 2018). The challenge is that many of the proposed solutions remain voluntary with limited accountability mechanisms, and rely on the good will and motivation of businesses and consumers (Rucevska and Villarrubia-Gómez 2020).

The Ellen Macarthur Foundation's Plastics Pact represents the current 'cutting edge' of efforts to push forward voluntary and government efforts, drawing together a network of local and regional stakeholder initiatives (engaging government, business and citizens) working toward a circular economy for plastic under a common platform with targets for reaching five goals⁴:

- Eliminate unnecessary and problematic plastic packaging through redesign and innovation
- Move from single-use to reuse where relevant
- Ensure all plastic packaging is reusable, recyclable, or compostable
- Increase the reuse, collection, and recycling or composting of plastic packaging
- Increase recycled content in plastic packaging

A number of governments – from the UK and South Africa to a group of European governments – are working on national or regional Plastic Pacts, and have joined the EMF's Plastics Pact network, which given the significant engagement from large companies in the plastics sector as well, makes it one of the most powerful initiatives defining the agenda and priorities for action on plastics pollution.

Prevailing Policy Strategies and Tools and Critique

Both developed and developing countries are implementing a broad array of policy efforts, albeit with widely different scope of ambition and targets. In the policy arena, the greatest focus of attention has been on government support and policies to boost better waste management of the land-based sources of plastic pollution (e.g., increase collection and improve sorting of plastics, support recycling, and improve the quality of incineration) as well as legal and fiscal frameworks relevant to waste management, recycling and reducing the use of single-used plastic and plastic packaging (Missing thus far, however, are systematic assessments of what kinds of measures have been most effective).

⁴ <https://www.newplasticseconomy.org/projects/plastics-pact>.

Table 2. Key goals driving responses to plastic pollution

Goal	Examples
Cleaning up	<ul style="list-style-type: none"> - Cleaning up existing pollution in landfill, public lands and marine and coastal environment.
Reducing waste leakage	<ul style="list-style-type: none"> - Reducing plastic waste leakage sub-national and local level efforts, including among cities, and along company supply chains; - improve end-of-life waste collection and management (including improved recycling rates), and introduction of more efficient waste management technologies (that are able, for instance, to better manage waste streams that combine mixed and dirty materials) (Ocean Conservancy 2017, WEF 2017). - improving the environmental performance of incineration and recycling facilities in developing countries. - Encouraging more efficient recycling practices by citizens - Limiting imports of plastic products and waste - Assessing plastics footprints and profiles to help determine where plastic pollution is being leaked into nature (e.g., Plastic Leaks Project).
Reducing consumption	<ul style="list-style-type: none"> - Reducing consumer use of certain single-use plastics, 'zero waste' initiatives and efforts to change consumer behaviour to reduce individual 'plastic footprints' - Reducing the overall amount of plastic and plastic packaging used by brands and retailers - disclosing plastic footprints of companies (UNEP 2014; EMF 2019a). - Consumer boycotts of certain products and retailers deemed irresponsible in their use of plastic packaging (Break Free from Plastic 2018). - Reducing import of plastics products that become plastic waste. A growing number of countries have been passing legislation and regulations to reduce use or ban use of certain of single-use plastics and/or certain microplastics, including Canada, India and Rwanda among others (See Box 2).
Increasing Recycling & Reuse	<ul style="list-style-type: none"> - Building markets for recycled plastic waste, re-use of plastic (e.g., 'upcycling') and the use of waste for energy generation (waste to fuel technologies)
Investment in alternatives and new markets for plastic waste	<ul style="list-style-type: none"> - investment, R&D, and scale-up of alternative plastics (such as biodegradable, bio-based, edible, compostable plastics), more easily recyclable plastics, and plastics with higher recycled content - technologies and scientific innovations that could reduce plastic waste (such as bacteria that can eat plastic) - more easily recyclable and less toxic types of plastics and plastic products - more efficient waste management technologies (that can deal with waste that includes mixed and dirty materials) - technologies that can boost recovery, recycle and conversion of plastic waste into new raw materials and new products (e.g., mechanical recycling and large-scale chemical recycling processes) - Investment in and testing of new business models that reduce or eliminate plastic use (aluminium cans for drinks, re-fill projects in supermarkets). - less toxic types of plastics and plastic products
Reducing plastic production	<ul style="list-style-type: none"> - Reducing global plastic production including by reducing the production of virgin plastic as well as the production and use of certain types of plastic, especially unnecessary and problematic single-use plastics (EIA 2019, CIEL 2019) - Reducing plastic use by ending use of problematic and unnecessary plastic packaging and single use plastics - including PVC and single-use plastic straws and carrier bags - Piloting or expanding business models that use less plastic, including reuse and refill schemes - Reduced production of some kinds of plastics, such as polystyrene and plastic products, such as microbeads
Reducing pollution across life cycle	<ul style="list-style-type: none"> - Reducing or removing toxic or harmful chemicals in plastics production processes and products. - Reducing use of virgin plastics

Governments are deploying and studying an array of policy tools to influence consumer and producer behaviour across the life cycle of plastics, albeit with different degrees of ambition, focus and decisiveness in terms of enforceability (see Table 3). These include, for instance,

policies that target financial incentives to change consumer behaviour, such as taxes and fees on certain types of plastics

Table 3: Conceptual framework of existing initiatives – by actor and degree of enforcement

Focus	Voluntary	Regulated and enforced
Disposal and end-of-life focused	<ul style="list-style-type: none"> - Clean up initiatives - Commitments to invest in waste management and recycling initiatives in developing countries. 	<ul style="list-style-type: none"> - Bans on imports of plastics wastes (China, Malaysia, Thailand, Vietnam and others) - Mandated producer responsibility for single-use plastics, including deposit refunds, product take-back and recycling targets
Consumer and retailer focused	<ul style="list-style-type: none"> - Commitment to convert to less plastic packaging and single use packaging - Commitments to trial and use less plastic-intensive business models - Commitments to use 'greener' plastics and substitutes - Zero waste initiatives 	<ul style="list-style-type: none"> - EU, Canada, India and Rwanda among others ban on retail use of single-use plastics, such as regulation on plastic bags - Taxes and consumer fees on single-use, take out containers and cups - Import bans on single use plastics
Producer focused	<ul style="list-style-type: none"> - Commitments to increase recycled content - Commitments to ensure products are recycled - Commitments to reduce plastic packaging 	<ul style="list-style-type: none"> - Bans on specific plastic products, materials or production levels, e.g., of plastic bags - Bans on production and use of microbeads in products - Regulation on chemicals and chemical inputs into plastics

Source: authors, based on annual reports, UN agreements and individual NGO and national publications.

(on the price consumers pay for take-out containers and cups for beverages), and incentives to participate in some specific forms of recycling. There are also policies that restrict the use of non-recyclable packaging, ban the disposal of certain kinds of plastics, require a certain percentage of recycled content, or define the kinds of waste management schemes that must be in place in different locations.⁵ Others include the use of rules, bans and restrictions on the sale, use or disposal of certain types of plastic, single-use plastics (such as plastic bags),⁶ and microbeads, as well as import bans or restrictions (Larcom et al 2017; Ritch et al 2009; UN Environment & WRI 2019).⁷ A number of developed countries are also including support for action in developing countries on plastics pollution within the overseas development policy and assistance. In 2019, for instance, the United Kingdom's 25-year Environment Plan included a pledge to demonstrate global leadership on MPP including by using UK aid to do more to help developing nations to take pollution and reduce plastic waste. The UK announced, for instance, that it would double its aid support for recycling

⁵ In Sweden, for instance, the Pant token system has been around for over three decades. Consumers return plastic bottles to recycling machines and receive a token (a pant) in exchange worth either 1 SEK for a small bottle or 2 SEK for a large one. The token can be used for charitable donations, go back into a PayPal account or offset against food shopping bills at supermarkets. England, for instance, plans to adopt a similar recycling scheme that would see consumers pay a deposit on all drink containers. See <https://www.theguardian.com/environment/2018/mar/27/bottle-and-can-deposit-return-scheme-gets-green-light-in-england>.

⁶ In line with its 2015 Plastic Bags Directive, supermarkets in many EU countries no longer give out free bags and nor do some clothing stores. In 2015, the EU's 1994 Directive on Packaging and Packaging Waste was amended to oblige Member States to take measures to achieve a sustained reduction in the consumption of lightweight plastic carrier bags. For a review of different policy approaches to the regulation of plastic bags, see Nielsen et al (2019).

⁷ By July 2018, for instance, 127 countries (of 192 reviewed) have adopted some form of legislation to regulate plastic bags, from outright bans in the Marshall Islands to progressive phase outs and laws that incentive the use of reusable bags.

projects, plastic ‘clean-up’ schemes and research into plastic innovations from £3m in 2018 to £6m in 2019.⁸

In a growing number of cases, governments are extending responsibility to producers for the collecting and managing the waste that they produce. The EU, Australia and India, for instance, have EPR laws that oblige producers to be financially or physically responsible for the clean-up or recycling of their products (taking into account impacts of a product in all stages of production, distribution, use, collection, re-use, recycling, reprocessing and disposal) and several governments are exploring ways to strengthen EPR measures that make companies responsible for collecting and recycling plastic products they put on the market (such as beverage bottles) (DEFRA 2019). Further, there are policies aimed at regulation of the transportation of plastics and the chemicals used therein, to reduce the risk of leakage of hazardous chemicals and plastic pellets during transportation.

Only in a limited number of cases have governments introduced measures directly designed to reduce production and manufacturing of plastic in the first place. In most instances, such measures on specific items, such as bans on the manufacture of plastic bags (UN Environment & WRI 2019), but there are also bans or restrictions on certain toxic chemicals used in plastics and plastic materials (such as polystyrene).

A key policy development has been the growing links made between efforts to reduce plastic waste and the ‘production’ side of the plastics economy through policies that aim to promote a more circular plastics economy. The focus of circular economy strategies is to move businesses from a one-direction (take-make-waste) business model to a ‘circular’ (take-make-take-make) business model, and thereby to value, capture and reuse the material resources used in production (see for instance Ocean Conservancy and McKinsey 2017; WASTE 2016; Ellen Macarthur Foundation and WEF 2017; EMF 2019b; OECD 2019b). Within this approach, there is recognition that tackling the waste end of the plastic cycle demands attention to root causes, including the design of plastics to prevent leakage into the environment and reducing the use of certain plastics (such as reducing the amount of plastic and recyclability of plastic used in packaging) (WRAP 2019). A core theme of the circular approach is to spur innovations in the design and manufacture of plastics and plastic products so that the value of plastic waste can be better captured and used a resource (for instance, in a closed loop systems, plastic bottles can be recycled into other plastic bottles) (Cripa et al 2019). The circular approach combines, for instance, a focus on making plastic products last longer and easier to reuse, recycle and collect, while also ensuring plastic waste has a commercial value so that it can be recycled or ‘upcycled’ to produce plastic-based fabrics and consumer goods (ranging from shoes to tables) and building materials (EMF 2019c; Packaging Insights 2020; OECD 2018b).

⁸ The scheme includes a project in Bangladesh that aims to create a market for recycled plastic fibres to be used in garment manufacturing; a scheme in Ghana focused on improving waste management and recycling infrastructure by leveraging private sector investment (Unilever Ghana, Dow Chemical Company and the Coca-Cola Bottling Company of Ghana are collaborating in the venture); and a drive to increase the amount of single-use plastic bottles recovered and recycled in Uganda. A crucial aspect of this scheme is better pay and working conditions for waste collectors living in Kampala, with all schemes required to focus on the improvement of social and economic conditions as well as local environments. DFID has additionally announced that it will match all funding raised through [Tearfund's](https://www.edie.net/news/5/UK-doubles-aid-support-for-plastic-recycling-in-developing-nations/) plastics appeal, which is now aiming to raise £3m after surpassing its £2m target ahead of schedule. The money will be used to set up plastic recycling “hubs” across Pakistan, with the aim of preventing 150 million plastic bottles from polluting marine and land habitats annually. <https://www.edie.net/news/5/UK-doubles-aid-support-for-plastic-recycling-in-developing-nations/>.

Europe has an especially most integrated policy package in regard to various aspects of plastic pollution and more circular plastics economy (see Box 2). In the context of Europe's 2015 Circular Economy Package (European Commission 2015), the EU adopted the world's first comprehensive [European Plastics Strategy](#) in 2018 (European Commission (2018a, b)). The strategy aims to raise consumer awareness and consumer behaviour with an eye to reducing the demand (and eventually supply) of some forms of plastic, starting with single-use plastics for which substitutes are easily available and affordable. For other products, the focus is on limiting their use through national reduction in consumption; on design and labelling requirements; and on waste management/clean-up obligations for producers. As noted above, in 2020, some 17 European governments, along with 90 business organisations (but only 3 NGOs) also announced the creation of a European Plastics Pact (2019b) (see Box 1 and Annex 1).

Over the past year, growing interest has emerged among a number of governments in introducing taxes on virgin plastic inputs into plastics manufacturing, although some appear to have been paused in the context of the Covid-19 pandemic (both the UK and Italy have such taxes under consideration). On the private sector side, the Sea the Future initiative hosted by the Mindaroo Foundation proposed a market-based approach to reducing virgin plastic production, whereby participating companies would agree to pay a fee on virgin plastic inputs as a way to support markets for recycled plastics and to boost incentives for recycling.

Box 2. Sample of European policy approaches to plastics pollution

Key components of Europe's Plastics Strategy and approach to plastic pollution include:

- Single-use Plastics Directive, which introduces a ban by 2021 of 10 forms of single-use plastics that represent the majority – 70 percent - of marine litter and for which alternatives are easily available and affordable (including straws, single-use cutlery, food and beverage containers made of expanded polystyrene and all products made of oxo-degradable plastic and other disposable plastics) and sets out the goal of ensuring all plastics packaging in Europe is recyclable by 2030 (European Commission 2018 a, b, 2019).¹
- An EU [Circular Plastics Alliance](#), bringing together key industry stakeholders from across the plastics value chain to spur efforts to reduce plastic littering, improve the functioning of EU markets for recycled plastics, increase the share of recycled plastics (as well as the economics and quality of plastics recycling) and stimulate market innovation. A first [assessment of the pledges](#) was presented in 2019.
- Further, in 2020, some 17 European governments and over 70 businesses committed to a European Plastics Pact (2020) through which they commit to a set of 2025 targets, including:
 - o Make all plastic packaging and single-use plastic products reusable where possible, and in all cases recyclable;
 - o Reduce the need for virgin plastic products and packaging by at least 20 percent;
 - o Increase the collection, sorting and recycling capacity of all plastics used in packaging and single-use products in participating countries by at least 25 percentage points;
 - o Boost the use of recycled plastics as much as possible, with an average of at least 30 percent recycled plastics across single-use plastic products and packaging.

The Pact members agreed to a cross-border approach with the aim of cooperating across the value chain on a European scale, including by harmonizing guidelines, standards, and national supporting frameworks.

From voluntary to mandatory – with a focus on root causes

To date, many of the efforts to reduce plastic pollution appeal directly to, and rely heavily on, individual consumers. However, the focus on changing consumption behaviour of individual consumers, while important, diverts attention from placing greater responsibility on industries and companies that produce and supply plastic products in the first place (Clapp 2012; Clapp and Swanson 2009). On this point, there is growing frustration among a number of civil society groups that the majority of policy initiatives are ‘adapting and managing’ initiatives that aim to better manage, recycle and reuse plastic waste, rather than responding to the root causes of expanding plastic production and sustainable development impacts across the plastic life cycle (Carlini and Kleine 2018; CIEL 2017, 2019; Dauvergne 2018a). Further, it is not yet clear how much the changes in consumer choices, voluntary commitments from business, and the introduction of governments restrictions impact overall demand for plastics, the relative use of virgin versus recycled plastics, and the proportion of conventional versus alternative plastics on the market.

Although companies have published an impressive array of targets and commitments and are investing resources in joint action plans with other companies, NGOs and governments, there are important challenges in regard to the accountability of voluntary efforts and assessing their impact. In early 2019, the Ellen Macarthur Foundation’s New Plastics Economy lead argued that the pledges made by companies that have joined its Global Commitment are still far “from truly matching the scale of the problem, particularly when it comes to the elimination of unnecessary items and innovation towards reuse models” and the scale of investments, innovation and transformation needed (Ellen Macarthur Foundation 2019a). Transparency remains nonetheless an important step forward. While some 31 global brands publicly disclosed their packaging volumes as part of the Global Commitment (including Coca-Cola, MARS, Nestlé, Unilever, Colgate Palmolive, and Carrefour), this represented only 20% of all the plastic packaging used globally. One first step would be for governments to make it mandatory for companies to disclose their plastic footprints as a baseline for reductions.

A further challenge is that while plastics producers introducing and promoting an array of eco-friendly initiatives and more environmentally friendly plastics, their array of sustainability claims are many and are difficult to verify. Beyond the circumstances under which a specific end-product is indeed biodegradable, for instance, there is also a need to look at the environmental impact across the life cycle, including how such waste is to be managed, carbon emissions, water emissions, and the safety of the product itself, as well as the environmental performance of supply chain partners (Rucevska et al 2020).

In addition, the expectation that stakeholders can be relied upon to voluntarily make the leap to alternatives to plastics – especially given the low and decreasing cost of traditional plastics – is highly questionable (UNEP 2015). Although there is indeed consumer demand for change, experience has shown that we cannot normally expect commercial stakeholders for example, to turn their back on well-tried processes and products that yield profits, in favour of new and experimental ones where the costs are likely to be high for a long time and profits uncertain. Typically, this kind of intervention needs to rely on integrated policy frameworks. As discussed in Section 5 below, this would involve the full panoply of tools for governance including industrial policy and financial sector mechanisms to guide credit towards an alternative paradigm.

The fact of ever-growing plastic production – and production capacity – is prompting calls for more radical action from citizens groups and some parliamentarians. There are mounting calls from the global Break Free From Plastics movement, consisting of over 1000 NGOs and millions of citizens worldwide, to phase-out the production and use of many types and applications of plastic altogether, including harmful plastic packaging (Waldersee 2019). GAIA argued “[c]ountries can tackle the plastic pollution problem while protecting the climate, by focusing on reducing plastics and shifting to Zero Waste systems free from dirty technologies like incineration or plastic-to-fuel” (see Break Free from Plastic, 2019). Zero waste initiatives by local governments and citizens’ organisations are also on the rise, calling into question the assumptions and claims about the need for plastic packaging, including by arguing for new approaches to thinking about claims that throw-away single-used plastic packaging is necessary to prevent food waste (Schweitzer et al 2018).

Environmental organisations also emphasise the need for greater attention to toxic chemicals used to make plastics, including additives to use plastics, arguing that this reinforces the need for extended producer responsibility and for producers to pay costs relate to handling and cleaning up toxic plastic waste. Importantly, the prevailing policy focus on greater recycling and recyclable plastics, diverts attention from the important challenges related to sorting and management of hazardous, toxic and contaminated plastic wastes that are not recyclable or for which the recycling process is associated with dangerous health and environmental threats (Leslie et al 2016). The Indonesian Zero Waste Alliance observes, for instance, that “[f]raming marine litter as only a waste management problem is nonsense when it is actually a reflection of the industry’s refusal to take responsibility for the plastic pollution crises... We can’t recycle toxic plastics and pretend that the marine litter chaos is a waste issue; it’s a toxic product issue” (BFFP 2019). Even more traditional environmental NGOs, like WWF, recognises the need to go beyond improved plastic waste management toward more systemic change, now calling for limiting or cutting plastic production (WWF 2019).

Notably, a number of companies and industry collaborations now acknowledge the need to reduce the virgin plastic feedstocks in production, though few commitments exist in this respect. To date, there is no legislation specifically targeting a reduction in the production of virgin plastic feedstocks, although there are some efforts to limit expanding production of plastics, including recently proposed legislation in US Congress supported by the Break Free From Plastics movement. Similarly, some British MPs are urging policymakers to implement laws to stop the UK from “[passing the plastic buck](#)” to the world’s poorest communities – including by introducing a national “[plastics budget](#)” that would introduce ever-stricter legally binding goals to reduce plastic production.

A number of plastic divestment campaigns target institutional investors have also emerged (Break Free From Plastic 2018). However, the resolutions still focus largely on the waste management end of the problem, missed any calls for reducing the production of plastics or other chemical materials, thus largely setting aside the significant role the plastic products and consumer goods industry will need to play in preventing plastic pollution and marine litter (CIEL 2019b). Campaigns aimed at corporations that are directly or indirectly responsible for marine plastic pollution, for example soft drink producers who use non-returnable plastic bottles, supermarkets who provide customers with free plastic bags, and other companies located in less public view in supply chains (see, for instance, Greenpeace 2019; GAIA 2019). At the same time, there are also calls for the financial sector to step up to

invest in accelerating what is estimated to be a multi-billion dollar transition of the plastics economy, demanding investment new business models, materials, and technologies (EMF 2019a).

Environmental advocates are increasingly calling on governments to put greater responsibility on plastics producers for plastic pollution internationally. The idea is to go beyond voluntary efforts by companies to take firmer regulatory action through, including, for instance, through civil liability of commercial and individual polluters for plastic pollution (precedents for such liability exist in regard to oil pollution damage),⁹ the creation of plastic super funds, and laws that demand international extended producer responsibility (EPR) (OECD 2018a). In 2019, WWF announced that it would promote the use of EPR to put pressure on the private sector and more major producers of plastic products to take greater responsibility for reducing waste and implementing waste management protocols across the world, including by promoting EPR legislation in developing countries to help scale-up and increase the effectiveness of waste reduction, collection, re-use and recycling (WWF 2019). These efforts to turn the responsibility onto global supermarkets, retailers and providers of packaged goods are particularly important as they expand their presence in developing country markets. Notably, the call for international extended producer responsibility is not new – this has been discussed (but not adopted) in the context of the Global Partnership on Marine Litter's 2011 Honolulu Strategy and more recently in discussions on marine plastic pollution in the UNEA context.

1.4. Missing development dimensions

To date, there has been limited attention to the national economic and industrial frameworks necessary to transform the plastics economy in developing countries. Socio-economic dimensions, especially those relevant to developing countries, are only just beginning to receive the attention they deserve in discussion, analyses and policy proposals on international action on plastic pollution and the circular economy (Schröder 2018a, b, 2020; Williams et al 2019).

Although there is growing interest in the environmental potential and economic development opportunities that stronger waste management industries and plastics alternatives and substitutes could present for developing countries (Ettinger 2015; Van de Klundert & Lardinois 2017; Schröder 2017a,b, 2018), systematic study of the development constraints on their adoption and on national and international policies that could spur transformation is only nascent (Vince and Hardesty 2017).

Efforts to reduce plastic use in developing countries also call for attention to development dimensions as well. In addition to plastic waste imported from abroad, developing country markets are increasingly deluged with plastic waste generated through national consumption. Rising incomes and consumption increases demand for products packaged in plastic and the availability of cheap plastic has made it a dominant material also for use in local markets. Global value chains and imported retail companies and products have pushed out local industry and business models that used less plastic. In addition, inadequate local infrastructure, such as for the provision of fresh water, has also spurred growing used of clean water packaged in plastic bottles. In some cases, developing countries have become major converters and manufacturers of plastic products – for both the domestic and

⁹ See the CLC Convention on Civil Liability for Oil Pollution Damage, for instance, which entered into force in 1975.

international market – and also have economic and employment interests tied to incineration and recycling businesses. Indeed, the latter can also be important foreign currency income-earning businesses. From a political economy perspective, there are also important special interests at hand - plastic waste brokers and traders, for instance, have significant commercial stakes – and may resist efforts to reduce plastic waste trade. Many countries also have significant informal economic activity linked to the collection, sorting, re-use and management of plastic waste, albeit often with significant health impacts for local populations dealing with collection and treatment of plastic (Dias 2016; Gutberlet 2019). Local waste pickers, for instance, may resist modern waste management practices that threaten their livelihoods. Retailers in local markets may have become dependent on plastic to sell their produce and for consumers to transport it home.

The recent experience of India is instructive. In 2019, legislation introduced in India to stop plastic bags and single-use plastics stumbled, due to push back from local businesses and citizens (Phartiyal and Jadhav 2018). As many as 4 million people are estimated to be employed in the sector in India, the sudden change was considered untenable economically and politically led India to retreat from its new policy (BBC 2019; Staub 2019). This experience highlights the need, as argued in this paper, for a concerted system of policies to address the just transition effects of weaning off plastics, as well as the transformative ones (See Part 5). Even if change is voluntary, in the sense of being sparked by changes in consumer demand, or – more likely – induced by regulations or trade rules, serious policy attention will be needed to the package of policies needed to facilitate sustainable transformation and transition.

A further factor relates to the export interests of developing countries. A number of developing countries are actively engaged in production of primary plastics (e.g., Brazil) as well as their manufacture and conversion. In some instances, they are major players on the global scale (e.g., Brazil), and in other instances, while not globally significant, plastics manufacturing remains significant to the national economy, export earnings and national employment. In addition, over 25 developing countries derive important merchandise export earnings from fossil fuels, which are increasingly destined for plastics production, with some countries (such as Iraq, Venezuela, and Nigeria) deriving over 90 percent of their export revenues from oil and gas alone (IEA 2020). A further factor that warrants consideration is that as developing countries work to move into more value-added processing, diversity exports of food and other fresh products to international markets, plastic packaging is currently a vital part of their business model and necessary to comply with regulations in export markets (such as phyto-sanitary rules).

Finally, there are opportunities for developing countries to produce plastic substitutes (and alternative feedstocks for bio-based plastics) using cellulose-based and natural fibre alternatives such as jute, abaca, coir, kenaf, sisal (known collectively as JACKS), bamboo fibre, hemp, milk casein and pineapple as well as wood-based packaging, such as paper and cardboard. These may not necessarily replace all plastics use but can be used strategically, especially in areas where some of the properties of plastic are dispensable (Material Economics 2018b). The fact this is seen already as a budding business opportunity is reflected in the numerous business start-ups that are emerging to respond to consumer demand for alternatives to plastic products (Excell 2019). However, there is a long way to go before these and other products are likely to be widely seen as direct substitutes for plastics but the interest from both consumers and suppliers is growing. Further, although

offering lower CO2 emissions than conventional plastics, there are concerns about sustainable production of such inputs too (Chang 2013).

2. Mapping the economic landscape for plastics production and waste – scale and economic drivers

Today's crisis of plastic pollution stems from the extremely rapid growth of plastics production and its presence in so many global value chains for an enormous range of products and services. The expansion of plastic production and consumption highlights both the utility and versatility of plastics for a vast array of applications.

Overall, plastic production has increased 20-fold since 1950, when it was less than 5 million tons and distributed across a population of some 2.5 billion people - and continues to grow (WEF et al 2016, GRID-Arendal 2019). In 2016, global production of plastic reached 415 million tonnes, combining plastic resin pellets (335 million tonnes), synthetic rubber (15 million tonnes) and synthetic textile fibres (65 million tonnes) (Billard and Boucher 2019).

Despite growing global concerns about the world's inability to manage the waste generated by prior and current levels of plastic production, business-as-usual projections forecast annual global production of plastic to grow by 40% by 2030, creating a volume of some 600 million metric tons (Ryan 2015; WEF 2017; WWF 2019).¹⁰

This section aims to map the political economy landscape for expanding plastics production and waste. It begins by underlying the diversity of purposes and characteristics of plastics, as well as of plastic products produced and used. It then reviews the market structure, stakeholders of the plastic life cycle, focusing attention on neglected upstream dimensions, and continues with a preliminary analysis of political economy factors that explain the expanding plastics economy.

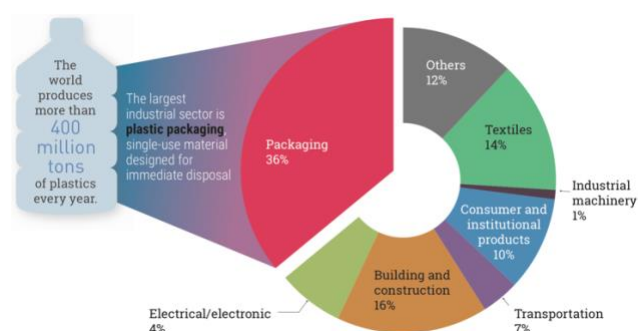
2.1. Plastics and plastic products are many

Plastic can serve many useful purposes. The number and diversity of products in the global marketplace that contain plastics is immense. Plastic is everywhere in our daily lives – in personal hygiene products, cars, buses and trains, computers, phones, household appliances, construction materials, clothing, office equipment and furniture, medical devices, hospital equipment, and in pervasive plastic packaging. Figure 1 breaks down global plastic production by sector, highlighting the prominence of plastic packaging, building and construction materials, and synthetic textiles, followed by consumer and institutional products. Notably, as much as one quarter of total plastic production is for plastic packaging, much of it single use. In 2018, for instance, companies produced an estimated 5 trillion plastic bags (WRI and UN Environment 2019), many of which are used just the once.

Although the word 'plastic' is widely used as a catch-all term, the plastics industry makes over 30 main different types of plastic polymers, which have distinctive properties, applications, and potential for recycling, reuse, biodegradability and composability. Some plastic products are in use for a very short time (especially single use plastics such as packaging), while others (such as household insulation) can remain in use over several decades.

¹⁰ Assuming global population growth up to 8 billion people by this time, that means an additional 33 billion tonnes of plastic will have accumulated around the planet by 2050. See CIEL (2019c), Geyer et al (2017), PlasticsEurope (2018).

Figure 1. Global plastic production by industrial sector (2015)



Source: UNEP (2018) *Single-use Plastics: A Roadmap for Sustainability*, UNEP, Geneva, p.4., adapted from Geyer et al (2017).

The most common plastic polymers produced in 2016 were high and low density polyethylene (or polythene) (PE) (36%), polypropylene (21%), and polyvinyl chloride (PVC) (12%), followed by polyethylene terephthalate (PET),¹¹ polyurethane, and polystyrene (<10% each) (Geyer et al 2017). Other well-known examples of plastic polymers include nylon (i.e., polyamide - PA), polypropylene (PP), acrylic (i.e., polyacrylonitrile -PAN), teflon (polytetrafluoroethylene (PTFE), and polycarbonate (PC). Across the global plastics economy, numerous individual companies hold patents and related intellectual property rights to a vast number of proprietary types of speciality plastics too numerous to list here. In addition, bio-based plastics (derived from cellulose-based, non-fossil fuel feedstocks) are a minor (less than 1%) but growing component of overall plastic production (e.g., bio-derived PET, polylactic acid (PLA), polybutylene succinate (PBS), starch-based plastics, and polyolefin elastomer (PE)).

In terms of their physical properties and uses, plastic polymers can be divided into three groups:¹²

- thermoplastics - such as PE, PVC, PP, PS and PET, which are often used for clothing, containers and packaging, and which can be recycled under certain conditions);
- thermosetting plastics - such as epoxy, silicon, polyester and phenolic resins, and polyurethanes, which cannot be reshaped by heating, and which are used for car parts and construction, as well as for toys, varnishes, boat hulls and glues. These polymers cannot be recycled but can sometimes be reused in other applications; and
- elastomers - rubbery polymers that can be used to make products such as tyres, rubber bands, and sealing rings.

The diversity of plastic polymers, products and the many combinations of plastics with other materials impact on their life-span; the types and scale of pollution associated with their production, use and disposal; and the presence of toxic and other hazardous chemicals, as well as range of possible options for waste management, recyclability and reuse. Together, these factors underscore the need for tailored approaches.

¹¹ More than 60% of the world's PET production is for synthetic fibres (in textile applications, PET is usually referred to as polyester), while plastic bottles account for around 30%. See <https://www.plasticsinsight.com/resin-intelligence/resin-prices/polyethylene-terephthalate/>.

¹² Some materials, such as polyester, can occur in both thermoplastic and thermoset versions. Whereas the components of thermoplastics are generally stored as pellets, the components of thermoset polymers are stored in liquid form, usually in large tanks or containers. All three types may also take the form of fibres.

2.2. The plastics life cycle: market structure, stakeholders and global supply chains

Analysis of the political economy of the plastics economy requires attention to the market structure and stakeholders across the plastics life cycle.

Table 4 presents a basic overview of 9 steps in the plastics life cycle, focusing attention on the neglected ‘upstream’ dimension of the plastics economy – that is, its production or supply side. Whereas the downstream of the plastics economy (steps 7 to 9) along with oil & gas extraction (step 1) have been studied in considerable detail elsewhere, our focus is on building understanding of and responses neglected ‘upstream’ dimension of the plastics economy – that is, the production or supply side described in steps 2 to 6.

For the purposes of this preliminary overview, we do not distinguish in Table 4 between the different forms of plastics, although this will be an important issue for future discussion of appropriate policy levers. (We also do not visually depict feedback loops, such as between recycled plastics and their insertion into the manufacturing phase.) Importantly, Table 4 highlights that there are many stakeholders and the complexity of factors to consider when attempting to reduce plastic pollution, transform the plastics industry and promote transition. Indeed, across the life cycle of plastics, a huge industry has emerged around the life cycle of plastics involving a broad set of commercial stakeholders – from major global companies to MSMEs – and millions of employees and informal sector workers across the world (see Box 3 for a snapshot of actors with a commercial stake in the sector). Among and within these categories, individual firms have different capacities and interests in supporting change, alternatives, and market pressures.

Box 3. Stakeholders in the global plastics economy: A sample of relevant players

- Oil and gas industry (supplying fossil fuel-based feedstocks for virgin plastic)
- Bio-based raw material producers
- Petrochemical and chemical sector (conversion) (suppliers to plastic manufacturing industry producing convention and alternative plastics);
- Manufacturers of different plastic products and applications (including packaging producers;
- Brands and product suppliers that use plastic to package their goods (packaged goods companies);
- Durable goods producers (e.g., household goods, construction materials, medical equipment, + car parts)
- Retailers and hospitality companies;
- Distributors that use plastic;
- Transporters across the value chain;
- Waste management companies, including collection, sorting and recycling industries;
- Plastic waste traders;
- Informal waste sector; and
- Plastic recycling and incineration firms.

Table 4 illustrates that plastic most often begins as a by-product of the extraction of fossil fuels (Step 1) and then refining components of crude oil or natural gas through a ‘cracking process’ to produce hydrocarbon monomers such as ethylene and propylene (Step 2). For both Steps 1 and 2, the major industry stakeholders are oil and gas companies, and in some instances, petrochemical companies through joint ventures or business integration (discussed below).

Table 4. Steps in the plastic life cycle and key stakeholders

Steps in Plastic Life Cycles	1. Discovery, extraction, and provision of feedstocks	2. Refining and production of feedstocks	3. Conversion - production of plastic polymers	4. Plastic manufacturing - intermediate	5. Plastic manufacturing – final applications	6. Plastic Use	7. Collection & transportation of plastic waste	8. Plastic waste treatment	9. Plastic reuse
Description of activity	<ul style="list-style-type: none"> - Extraction, storage and transport of fossil fuels (oil and gas) - Growth and provision of bio- or plant-based feedstocks 	<ul style="list-style-type: none"> - Refining components of crude oil or natural gas through a 'cracking process' produce ethylene and propylene - Refining of bio-based feedstocks - Production of chemical additives used for plastics 	<ul style="list-style-type: none"> - Production of virgin plastic (from refined fossil fuels) and bio-based plastics, in the form of resin pellets and fibres through polymerisation 	<ul style="list-style-type: none"> - Manufacture of diversity of intermediate plastic products 	<ul style="list-style-type: none"> - Manufacture of diversity of final plastic products 	<ul style="list-style-type: none"> - Use of plastic products, products with embedded plastic, products packaged in plastic, and plastic packaging by final consumers, brands, institutions, retailers, distributors 	<ul style="list-style-type: none"> - Collecting and recovering disposed plastic waste - Sorting waste - Transporting waste 	<ul style="list-style-type: none"> - Treatment of sorted plastic wastes - Landfill - Incineration - Chemical or mechanical recycling - Dumping 	<ul style="list-style-type: none"> - Reuse of plastic after reprocessing waste into a secondary material (e.g., recycled plastic) or use in waste to fuel processes
Examples of stakeholders	<ul style="list-style-type: none"> - Oil and gas companies - Transportation companies that ship crude and refined oil and gas products - Commodity traders 	<ul style="list-style-type: none"> - Oil and gas companies - Petrochemical companies - Chemical companies - Producers of bio-based feedstocks - Transportation companies that ship feedstocks - Commodity traders 	<ul style="list-style-type: none"> - Petrochemical and chemical companies, - Oil and gas companies that rely on sales to chemical companies - Transportation companies that ship plastic pellets and fibres - Companies who make the machinery and equipment for polymerisation 	<ul style="list-style-type: none"> - Companies involved in the 'intermediate' moulding and preparation of plastics for further manufacturing - Companies involved in the 'intermediate' spinning, drawing & cutting of synthetic fibres (PP, PA & PET fibres) 	<ul style="list-style-type: none"> - Companies involved in manufacture of final applications for packaging, transportation, construction consumer products, electrical/electronic, personal care products, coatings and markings, etc - Companies producing non-plastic materials that can be combined plastic during production process 	<ul style="list-style-type: none"> - Producers of packaged household goods - Wholesale & retail companies, including supermarkets & online retailers - Building and construction companies - Clothing companies - Institutional consumers of packaged foods, beverages and consumer 	<ul style="list-style-type: none"> - End consumers - Local or national authorities - Waste management companies, - Transport companies - Plastics converters - Informal waste pickers & street cleaners 	<ul style="list-style-type: none"> - Local and national government - Waste management authorities - Plastics producers and converters - plastic converters, informal waste pickers (including children). 	<ul style="list-style-type: none"> - Plastics recyclers and converters - Secondary waste traders - Manufacturers and users of upcycled plastic goods (plastic bricks and road surfaces) - Waste to fuel companies - Informal economy (including artists that reuse plastics etc).

				<ul style="list-style-type: none"> - Companies producing non-plastic materials that can be combined plastic during intermediate process - Companies involved in the provision of machinery 		<ul style="list-style-type: none"> goods – airlines, hotels, Individual end-consumers - Governments that procure plastic products – from paints for road markings to hospital equipment & packaged beverages/food - Distributors and transporters of goods (including couriers) - Producers of fruit and vegetables packaged to access foreign markets 			
Enablers	<ul style="list-style-type: none"> - Investors, banks, insurance companies, development banks, and governments are key enablers across the life cycle of plastics, playing a central role in provision of finance, subsidies, loans, tax incentives and insurance. - Companies engaged in storage, transport and associated logistical enterprises of plastic inputs, machinery and products. 								

Source: Authors derivation, expanding on WWF (2019) and UNEP (2018c).

In Step 3, fossil fuel (99%) feedstocks are then transformed (usually through polymerization) into different forms of ‘primary’ plastics or plastic polymers that generally take the form of resin pellets (sometimes referred to as nurdles) and fibres. Primary plastics that are derived from fossil fuel feedstocks are widely referred to as ‘virgin’ plastic polymers. Looking at closer detail, Step 3 involves the conversion of ethylene and propylene to produce monomers such as styrene, vinyl chloride, ethylene glycol, terephthalic acid and many others. These monomers are then chemically bonded into chains called polymers. This process involves different combinations of monomers and the incorporation of a range of chemical additives (for properties such as flexibility and heat resistance) and colorants to yield an array of different plastic polymers with distinctive characteristics and features.¹³

The business that are the world’s largest producers of virgin plastic polymers are primarily headquartered in the United States followed by Germany, as shown in Table 5 below, although this does not necessarily mean that all of their production takes place in those countries (van Doorn 2020). The Brazilian petrochemical company, Braskem, which is a top thermoplastic resins producer in the Americas, has over 35 industrial plants spread across Brazil, the United States, Mexico and Germany. Notably, the Table also shows that the share of plastic production in Asia (primarily in China) and the Middle East is growing, which although largely for domestic markets also represents a growing portion of world trade. Only around 1% of global plastic production is derived from ‘bio-based’ feedstocks.¹⁴

Key stakeholders in Step 3 of the plastics value chain include chemical companies focused on petrochemicals production (which can include plastics, high value chemicals, or agricultural chemicals) as well as oil and gas companies (Bridge 2020). Relationships between the fossil fuel (oil and gas), petrochemical and chemical sectors are becoming increasingly important (e.g., through shared knowledge bases, integrated conglomerates, joint ventures and collaborations), as evidenced by growing ties between Saudi Aramco (extraction) and SABIC (petrochemicals) (Bennett 2007, 2012; Bridge 2020, Diapola 2018). Of particular relevance to the plastics sector is the growing forward integration of oil and gas producers into petrochemicals and the production of virgin plastics as a key anticipated source of future growth (e.g., long-established players such as Exxon as well as China’s rising giant Sinopec) as well as the backward integration of petrochemical producers into oil and gas production (e.g. INEOS) (Tullo 2019, Bridge 2020).

While the countries and firms involved in the manufacture of plastics in a primary form (e.g., pellets and fibres) are frequently linked with oil and gas extraction, the manufacturing sector of final plastic products and products that contain plastic are more dispersed – both geographically and in terms of concentration – because the plastic resins and fibres are transported to other countries and manufactured into plastic products there.

The converting phase has two components – an intermediate stage (step 4) and a final application stage (step 5). Step 4 involves the production of plastic sheet, rod, tube, film, resin, pipe, fittings and valves as well as those involved in their fabrication (by bending, machining, welding or bonding stock plastic as well as those engaged in film conversion (which involves includes fabricators, machine shops and film converters). It also involves the spinning, drawing and cutting of synthetic fibres. In addition, it involves companies that Table

¹³ See Hahladakis et al (2017) for a detailed review of the chemical and industrial processes related to the use of additives. On the impacts of plastic additives in the marine environment, see Hermabassiere et al (2017).

¹⁴ <https://www.european-bioplastics.org/bioplastics/>.

Table 5. Who produces primary plastics and their inputs? A sample of top 20 major primary plastic producers (2018)

Ranking	Company	Headquarters	Chemical sales 2018 (\$ million)	Change from 2017 (%)	Chemical operating profit (\$ million)	Ownership
1	DowDuPont	US	85,9	37.6	8,4	Private
2	BASF	Germany	74,06	2.36	7,4	Private
3	Sinopec	China	69,2	22.4	3,9	Public
4	SABIC	Saudi Arabia	42,1	12	9,5	Public
5	Ineos	UK	36,9	2.07	4,2	Private
6	Formosa Plastics	Taiwan	36,89	11.6	4,02	Private
7	ExxonMobil	US	32,4	13.01	4,16	Private
8	LyondellBasell	Netherlands	30,7	8.7	5,6	Private
9	Mitsubishi Chemical	Japan	28,7	7.15	2,38	Private
10	LG Chem	South Korea	25,6	9,67	2,04	Private
11	Reliance Industries	India	25,16	37.3	4,7	Private
12	PetroChina	China	24,8		1,18	Private
13	Air Liquide	France	24,3	2.83	2,3	Private
14	Toray Industries	Japan	18,6	8.66	1,3	Private
15	Evonik Industries	Germany	17,7	4.2	2,078	Private
16	Covestro	Germany	17,2	3.38	2,9	Private
17	Bayer	Germany	16,8	49	3,7	Private
18	Sumitomo Chemical	Japan	16,08	8.68	1,18	Private
19	Braskem	Brazil	15,8	17.7	2,2	Private
20	Lotte Chemical	South Korea	15,05	4,22	1,79	Private

Source: Chemical and Engineering News, <https://cen.acs.org/business/finance/CENs-Global-Top-50-chemical/97/i30>, July 2019.

provide machinery for these activities, as well as stocking and wholesale distribution for use in further manufacturing. The manufacture of these intermediate products is more dispersed and involves a broad range of companies.

Next, these polymers are manufactured (Step 5) into a vast range of final plastic applications or products, ranging from plastic films and packaging, household and consumer goods, industrial goods, car parts, adhesives, foams, paints, coatings and sealants, as well as a range of synthetic fibres (such as polyester and polypropylene) and rubber tyres. A growing percentage of recycled plastics are also added into plastic production processes during this

step. In final products, plastic components are also often combined with other materials. Plastic packaging, for instance, is often coupled with cardboard and aluminium. As in Step 4, the manufacture of different plastics products and applications in Step 5 involves a broad range of companies.

Within Europe, for instance, the conversion sector is by far the largest sector in terms of the number of employees and companies, and also in terms of turnover (although it is less dominant in this respect), with its own set of industry associations with expert groups.¹⁵ Whereas less than 8% of employees in the European plastic industry and 2000 companies are engaged in plastics production/manufacture, some 90% of employees in the sector (1.6 million people) are employed by some 50,000 companies active in the conversion industry (EPDA 2018).

Step 6 encompasses the final use of plastic products, products with embedded plastic, products packaged in plastic, and plastic packaging by final individual consumers, brands, institutions, retailers, distributors. This can include the use of plastics by brands and product suppliers to package their goods, and by individuals to do their shopping. Here, four of the largest users of plastic packaging in the food and beverage sector together use over 6 million tonnes of plastic per year: Coca-Cola (3 million tonnes, including 1/5 of the world's annual PET bottle output), Nestlé (1,700,000 million tonnes), Danone (750,000 tonnes) and Unilever (610,000 tonnes) (Heinrich Böll and Bund 2019:3).¹⁶ Other major uses of plastics packaging are brands that sell personal care products such as Johnson, Colgate-Palmolive, and Procter & Gamble (Ellen Macarthur Foundation 2019). A diversity of retailers (such as supermarket, retail chains, and online retailers) use plastics as part of their business model. Some of these have their 'own brands' but also use plastic to facilitate the sale and conservation of products, and in their home delivery services.

Steps 7 to 9 – the 'downstream' side of the global plastics economy – concerned with the collection, management, recycling and reuse of plastic waste also engage a diverse set of globally-distributed businesses, from waste management companies to plastic waste traders, as well as recycling and incineration firms. These steps also involve a vast informal sector of waste gatherers, pickers and sorters in developing countries. Notably, Step 9, represents a growing and increasingly dynamic segment of the global plastics economy as investors and innovators focus on the role that secondary waste markets can play as sources of feedstocks for plastics (e.g., recycled plastics), as inputs for a diversity of products (from construction materials to shoes), and in waste-to-fuel or energy from waste technologies (Gregson and Crang 2019). Importantly, as explored later in this paper, the emphasis on reducing plastic pollution and improving circularity in the plastics economy is increasingly highlighting and promoting links between the downstream and upstream of the plastics economy. For instance, the effort to promote recycling is linked to initiatives to boost the upstream use of recycled content in plastic production.

Finally, there are key enablers across the life cycle of plastics, including investors, banks, insurance companies, development banks, and governments that, play a central role in

¹⁵ In Europe, for instance, industry associations in this sub-sector include the European Plastic Fuel Tanks and Systems Manufacturers Association (PlasFuelSys), Plastic Recyclers Europe, Vinyl Films and Sheets Europe, European Singly Ply Waterproofing Association (ESWA), PET Sheet Europe, Plastic Sheet and Films Association (IVK Europe), European Plastics Films (EUPF), Engineering Polymer, MedPharmPlast, and European Engineered Thermoplastic Sheet Extrusion (EPEX).

¹⁶ Other major companies in the food and beverage sector also have a significant plastic footprint, such as the MARS Corporation, but have not publicly disclosed this.

provision of finance, loans, tax incentives, and insurance.¹⁷ Extensive government subsidies to fossil-fuels industry in key producing countries, for example, are a significant enabler because they keep the price of plastic feedstocks artificially low (Skovgaard and van Asselt 2019). Further, across these stages in the plastics economy and the life cycle of plastics, companies engaged in storage, transport and associated logistical enterprises are also relevant.

Indeed, across the life cycle of plastics, from Step 1-8, the plastics economy is global. In addition to globally distributed production, markets for plastic inputs and products, as well as and waste. Although international trade in plastic waste has attracted particular attention over the past two years, international trade plays a central role in global supply chains across the plastic life cycle – from production and consumption to disposal (see Box 4). Preliminary estimates of the value of plastics trade are in the order of hundreds of billions of dollars for just one year (2018) even for just the categories of primary plastics, synthetic textiles, and waste – e.g., excluding plastics used for packaging and in manufactured goods or construction, which can also be assumed to have considerable value (Barrowclough et al, forthcoming). This fact underscores the importance too of further research to better understand cross-border trade, investment and supply chains – and related policy frameworks – to understanding the status quo and how we can change it.

Although clearly a global affair, the geography of the plastics economy varies across the plastics life cycle in terms of the geographical location of productive activity, ownership, intensity of consumption, waste generation and waste accumulation. Whereas Europe and North America long dominated global plastic production – from primary forms through to final products – both now face significant competition from developing countries, and especially Asia. Overall, for instance, the world's largest producers (by volume and value) of primary plastics production in 2018 were China (between 25 and 30% of the total) followed by Europe, and North America (US, Mexico and Canada, with around 1/5th each, followed by other Asian countries and the Middle East (Plastics Europe 2019). As the developing country share of overall plastics production, which includes converting, processing and manufacturing, grows so too is number of direct and indirect jobs associated with the plastics sector.

Box 4. International trade flows across the life cycle of plastics

International trade is significant across the plastic life cycle and global supply chains. This includes trade flows in:

- fossil fuel feedstocks
- chemical additives
- primary plastics (resins + fibres) (where exports represent 42% of annual global production)
- plastic packaging
- plastic final products (huge diversity)
- synthetic textiles
- products containing plastic
- products packaged in plastic
- products transported in plastic
- synthetic textiles (where exports represent 60% of the value of annual global production)
- plastic conversion and manufacturing machinery
- plastic waste
- secondary waste products, including recycled material

¹⁷ On the role of insurance in the plastics industry, see Client Earth (2018) and UNEP (2019b).

2.3. Explaining expanding production

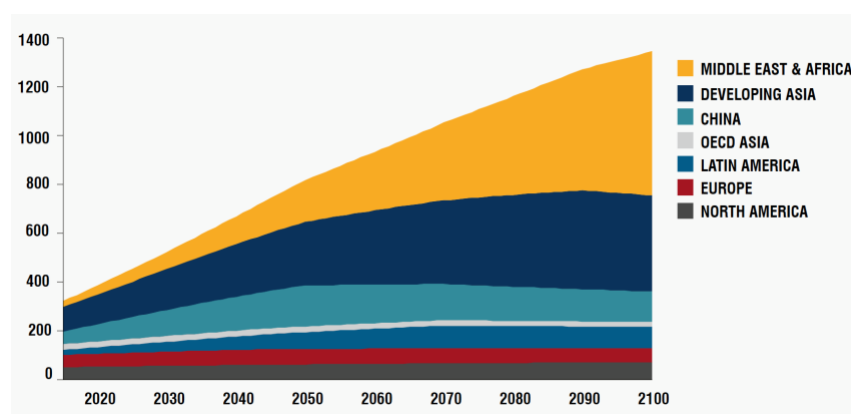
How can we explain the fact there is no sign of a reduction ahead, despite the growing concerns about plastics pollution and the efforts already underway at the consumer level and by many governments and companies?

The first reason is that the cost of the core feedstocks for plastics – ethylene and propylene – is low and could still get cheaper. Shale fracking in the United States has resulted in a boom in low-cost natural gas. In China, optimism about the potential of coal-to-olefins technology to convert underused coal is spurring investment there too (CIEL 2017).¹⁸ More recently, the falling price of oil in response to the COVID-19 crisis is also reducing the price of virgin plastic (International Commodity Intelligence Services 2020, CIEL 2020). As by-products of the oil and gas refining, direct and indirect government subsidies to the oil and gas sector contribute to low price of feedstocks for plastics (Tobin 2012). Subsidies to the fossil fuel sector were estimated to be over 5 trillion US\$ in 2017, according to the latest estimates by the IMF (IMF 2019).

The second reason is that projected demand remains high and growing (Figure 2). While developed countries account for more than half of total plastic consumption, the developing country share is growing (already accounting for 44% in 2016) (UNEP 2018d). Annual per capita consumption of plastic in developing countries (estimated at 27kg), although currently lower than in North America (139kg) and Europe (136kg), is growing rapidly due to rising incomes, urbanisation, and changing consumer behaviour. Business as usual predictions are for increasing demand from growing populations in developing countries in the Middle East and Africa, as well as in developing Asia (Material Economics 2018).

A third reason is that investment in the petrochemical sector is expanding by private and public actors. Moreover, investors are actively supporting new, expanded capacity for plastic-related production around the world, often with government support (American Chemical Council 2018; CIEL 2017b,d; Gourmelon 2015, The Guardian 2018). Just as oil and gas companies, like Saudi Aramco, have been expanding into petrochemicals, private finance from banks and sovereign wealth funds, for instance, that have existing interests in oil and gas are expanding their investments to the petrochemicals sector as well.

Figure 2. Projected increased in plastics demand by region (Mt per year, 2015-2100)



¹⁸ Once new production facilities, such as ‘cracker plants’ are built, they spur ongoing demand for new fracking to provide continuing supplies of feedstock (CIEL 2017).

Although data has not yet been systematically compiled and analysed, there is also important evidence of a broad array of direct and indirect public financing for the petrochemicals and plastics industry – from subsidies to fossil fuel exploration, extraction and refining to plastic conversion and manufacturing. Such subsidies can include direct financing and investment (e.g. from national oil companies and other partially or fully state-owned enterprises), financial support in the form of loans (on favourable rates) or guarantees, from governments, multilateral development banks or development agencies. A key consideration is that public subsidies can be key to leveraging larger amounts of private finance, since the presence of a public investment or loan will decrease the risk of private investment, especially if the public investment takes on a larger share of the risk.

A fourth reason is the failure to internalize environmental costs. In addition to the low price of fossil fuel inputs, the failure to internationalize the myriad of environmental costs associated with the life cycle of plastics helps explain the low price of plastics.

A fifth reason is that the production of products and services provided generate significant revenues and profits, supported by significant investments and sunk costs in business infrastructure, facilities and equipment. Entire communities, cities or regions may be wedded to and economically dependent on activities from plastics production to waste picking. Taking simply the issue of employment – in Europe more than 1.45 million people are working in 60,000+ companies (mainly small and SMES) involved in the business of converting nurdles into plastic products. Their turnover is some \$350b per annum (Plastics Europe and EPRO 2018). In the United States, the plastics industry is the third largest manufacturing sector and the plastics products industry is the 8th largest industry overall. In 2017 it employed around 1 million people in the United States, and earned over \$432 b in revenues (Plastics Industry Association 2019). Similarly in China, estimates are that there are already some 15,000 plastic manufacturing companies, with total sales revenues US\$366 billion in 2018 (Bühning 2018).

A final factor relates to the political strategies and influence of those with a commercial stake. Included among the key producers of plastic are some of the world's most powerful commercial interests with significant sunk investment costs, as well as state-owned enterprises (e.g., in China and Saudi Arabia). A first glimpse at the commercial politics of plastics reveals that, like firms in other sectors of the economy, firms in the chemical and petrochemical industries (Hurel 2015; Corporate Europe 2018), as well as in the plastics conversion and distribution sectors, are working hard to protect existing investments and to maintain potential for growth in plastic production and plastic product markets, including of more so-called 'sustainable plastics' (Fernandez-Pales and Levi 2018). In some instances, including where the companies involved as state-owned enterprises, the public policy goals of petrochemical and related fossil fuel industries are linked to wider strategic economic, geopolitical and security interests of governments (e.g., around production and supply of oil and gas outputs).

Table 6 presents a snapshot of the vast array of industry associations focused on the performance of the plastics distribution supply chains, bringing together companies that distribute, manufacture, and recycle plastics among others, in some instances with affiliated or linked expert groups or research centres. For many of these, the policy goals of

companies and industry associations are to ensure a regulatory context conducive to sustained, and preferably, expanded markets for their products (Romer & Foley 2011).

Table 6. Sample of lobbying associations associated with plastics industry across life cycle

Fossil fuel industry	Primary plastics producers, manufactures and distributors	Retailers/Brands	Recyclers
American Petroleum Institute, National Propane Gas Association	Plastics Europe, Plastics Industry Association (US), British Plastics Association, Canadian Plastics Industry Association, the American Chemistry Council, European Plastics Distributors Association, Association for Rubber Products Manufacturers (US), International Institute of Synthetic Rubber Producers (IISRP), National Association of Manufacturers, Association for Plastics Processors (US), World Plastics Council, International Association of Plastic Distribution (IAPD).	EuroCommerce (which brings together European retail giants such as Tesco, Lidl, Carrefour and Metro), National Retail Federations and Associations	European Association of Plastics Recycling and Recovery Organisations (EPRO), Institute of Scrap Recycling Industries (a business association largely comprised of waste brokers)

Both Table 1 and Annex 1 provides an overview of the impressive emphasis that companies across the plastics economy are making in their communications and marketing strategies to address – and be seen to address – plastic waste. Already in 2011, for instance, 75 plastics organisations and allied industry associations issued a joint [Declaration of the Global Plastics Associations for Solutions on Marine Litter](#). Since then, the array of industry initiatives by individual companies and through stakeholder partnerships has multiplied. Importantly, the stakes and responses vary according to the location of companies within the wider plastics economy.

Major brands and retailers that directly face consumer pressure may be more open to reducing plastic use in their products, such as through reduced plastic packaging, more recycled content in their packaging, the use of substitutes, and experimentation with new business models that use reusable, durable packaging. Unilever, Nestlé and Procter & Gamble, for instance, are working with Loop, a shopping service that uses durable packaging that can be returned and refilled.¹⁹

For companies invested in plastic production, the focus may be on persuading brands and retailers they can supply more sustainable alternatives to conventional plastics – such as those deemed to be more recyclable or biodegradable – or looking to new markets, such as in developing countries where consumer awareness may not be so strong. For many companies, engagement in voluntary initiatives to address plastic pollution reflects both a view that market-based, private solutions are more efficient and effective than regulatory solutions, and a broader view that voluntary action may help them avert binding regulatory or legislative agendas, which they consider more likely damage their business or be counterproductive to the achievement of the intended environmental goals (Forrest et al 2019; Packaging Insights 2019).

¹⁹ <https://www.greenbiz.com/article/loops-launch-brings-reusable-packaging-worlds-biggest-brands>.

Stepping back and to summarise, Table 7 presents an illustrative sample of the multiple sources of systemic failure at all stages of the plastics life-cycle and value chain that contribute to the over-production of plastics in the first place, the excess production of single-use plastic in particular, and limited success in efforts to collect and re-cycle plastic at its life-end, which have led to the current plastic pollution crisis. Moving beyond the prevailing focus on plastic waste collection, treatment and secondary waste markets, it highlights that system failures across the life cycle mean transition will be a challenge – there are significant interests and economic ecosystems vested in the status quo, creating inertia and large costs for change – and underlines that an array of policy levers and intervention points will need to be brought into play.

3. The evolution of the international policy environment

Concern about marine plastic pollution has spurred a number of scholarly studies that survey the range of relevant international processes, institutions and legal frameworks, as well as the evolving state of partnerships, national policies and regional efforts that could be supported through improved international cooperation. At the national level, government policies on plastics vary widely in terms of the degree of ambition and scope, are unevenly spread across the world, do not reach critical parts of the plastics value chains, and are poorly coordinated across countries and regions. There is a lack of transparency across the patchwork of efforts and as yet there is no single global framework that draws together the many dimensions of the plastics problem and multilayered governance responses in an integrated and coordinated fashion.

This section sketches out key moments over three phases in the emergence and evolution of an international policy framework for the growing concerns about plastic. Although important strides have been made over the years, it shows that international efforts, legal arrangements and policy frameworks to address plastic pollution remain both inadequate and piecemeal (Villareubia-Gómez et al 2018; Xanthos & Walker 2017; RECIEL 2018). There is no overarching legal regime or framework, but rather a collection of international laws, commitments and initiatives that address different aspects of plastics pollution, especially marine plastics pollution and single use plastics (Xanthos & Walker 2017). At the international level, the core thrust of existing intergovernmental efforts, public private partnerships, industry efforts, and environmental advocacy remain on: 1) building cooperation on cleaning up marine plastic pollution; 2) building capacity to support waste management and recycling; 3) supporting the push for a more circular plastics economy – with a primary focus on more recycling and on the design and use of plastics that are more readily recyclable; and 4) voluntary commitments rather than regulatory obligations.

There is no international legal framework – nor ongoing inter-governmental mandate to create one – that addresses concerns about the environmental and climate change impacts of plastics production, consumption and waste across their life cycle. The greatest hope on this front appears to be the rise of discourse and policy action around the ‘circular economy,’ although much of the practical implementation remains mostly focused on recycling and recyclability, and on national and regional efforts rather than a framework for more circularity globally. Stemming the tide in plastics production, or “turning off the tap”, is still far from centre stage – although recognition of the need to reduce production and reliance on virgin plastics is growing and is attracting growing attention in circular economy discussions.

Table 7: Examples of system failures – and potential targets for policy

1. Discovery, extraction, and provision of feedstocks	2. Refining and production of feedstocks	3. Production of plastic polymers	4. Plastic conversion and manufacturing - intermediate	5. Plastic Manufacturing – final applications	6. Plastic Use	7. Collection & transportation of plastic waste	8. Plastic waste treatment	7. Secondary Waste Markets and plastic re-use
<p>Low prices of fossil fuel-based feedstocks, including due to new sources (e.g., from fracking)</p> <p>Prices do not reflect true value (environmental externalities)</p> <p>Fossil fuel feedstock production is supported by subsidies – latest estimated worth \$5 trillion (IMF 2019)</p>	<p>Governments subsidies for construction and operation of infrastructure for refining, cracker plants, and virgin plastic feedstock production</p>	<p>Low price of virgin plastics does not reflect negative externalities to the environment.</p> <p>Large chemical companies benefit from preferential costs of capital compared to smaller or experimental companies.</p> <p>Development Banks are under-financed for risk-taking</p> <p>IP rules do not encourage sharing or technology transfer of new innovations among countries</p>	<p>Companies trying to invent/promote plastics alternatives and substitutes (cellulose packaging) typically find it more difficult to borrow on capital markets, face higher costs of capital, short loan maturities.</p> <p>IP for new alternatives may not be available.</p> <p>Technology transfer of alternative products is not occurring.</p>	<p>Existing manufacturers may find it difficult to finance transformation to new and unknown processes.</p> <p>Individual manufacturers are part of global value chains and cannot readily exit existing processes.</p>	<p>Consumers do not face the true price of plastics' environmental externalities.</p> <p>Consumers do not receive full information (about chemical composition, additives, recyclability, environmental footprint, etc).</p> <p>Collective action problems – consumers are many & not as organised as are plastics suppliers to intervene in regulatory and policymaking processes.</p>	<p>Consumer confusion about waste sorting, management and recycling options for many plastics</p> <p>Low collection rates and limited waste sorting in many regions</p> <p>Waste sorting is complex as plastic waste may be mixed or contaminated.</p> <p>Unrecyclable waste exported to those countries that will still accept it</p>	<p>Low recycling rates and waste mismanagement in many countries and for different types of plastics</p> <p>Inadequate investment and access to technology for efficient recycling and incineration with high environmental performance</p>	<p>Failures in the waste collection and recycling processes create inferior quality or low value secondary material.</p> <p>Market price of recycled plastics not high enough to spur expanded recycling at scale & cost needed to compete with virgin primary plastics.</p> <p>High costs of re-using or upscaling plastics products compared to low cost of virgin plastic.</p>

Phase I – first awakenings to marine litter and emergent responses (1972-2012)

The first international efforts to address plastics pollution occurred 40 years ago, inspired by the first reports of the impact of marine plastic debris on marine species (see Table 8). Numerous international agreements, resolutions, action plans and stakeholder initiatives emerged over the subsequent decades to address aspects of the marine litter problem. None of these, however, addressed the growing scale of marine litter, or its land-based sources (see Simon 2017; Raubenheimer & McIlgorm 2018; Ocean Plastics Initiative 2018).

Two of the earliest and most significant international frameworks relevant to marine plastic pollution were the 1972 London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, and the 1982 UN Law of the Sea, which was the first international convention to draw attention to marine pollution from land-based sources, focusing on the release of toxic harmful substances (although without specifically mentioning plastic).

Table 8. Phase 1 – Evolving Policy Frameworks on Marine Litter: Sample of Example

Year	Event
1969	Creation of Joint Group of Experts on Scientific Aspects of Marine Environmental Protection (GESAMP): it's an advisory body that advises the UN system on scientific aspects of marine environmental protection.
1972	London Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter : one of the first global conventions to protect the marine environment from human activities. The convention was replaced in 1996 by the London Protocol, to regulate the dumping of wastes at sea.
1973	International Convention for the Prevention of Pollution from Ships (MARPOL) prohibits discharging plastics by ships into the sea and obliges governments to ensure adequate port reception facilities to receive ship waste.
1974	Launch of UN Environment's Regional Seas programme for the protection of marine and coastal environments includes marine debris within its work. Numerous regional sea Conventions administered by UN Environment include references to pollution from land-based sources (including framework conventions protecting the marine environment in the Caspian Sea, Caribbean, North-east Atlantic, Middle East, Baltic Sea, Mediterranean, Black Sea, Central and West Africa).
1982	UN Convention on the Law of the Seas includes legal requirements to "prevent, reduce and control pollution of the marine environment from any source" (Article 194.1).
1989	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention) aims to reduce movements of hazardous waste between nations, and to prevent transfer of hazardous waste from developed to less developed countries.
1995	Over 100 governments launch the UN Global Programme of Action for the Protection of the Marine Environment from Land-based activities (GPA), to respond to the issue of land-based pollution.
1998	African Union's Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa (Bamako Convention), to regulate the import of hazardous wastes into the African continent.
2004	UN General Assembly delivers its first resolution specific to marine debris. Since then, the issue of marine litter has been addressed annually by the General Assembly.
2011	The Honolulu Strategy , a framework document catalysed by the 5 th International Marine Debris Conference to prevent and manage marine debris, with technical support from NOAA and UNEP.

2011	Declaration of the Global Plastics Associations for Solutions on Marine Litter signed by 75 plastics organisations and allied industry associations in 40 countries.
2012	65 governments plus the European Commission agreed to the Manila Declaration , to develop policies to reduce and control wastewater, marine litter and pollution from fertilizer.
2012	Rio+20 conference included attention to reducing marine debris and litter, and strong statements were presented in favour of a “Blue Economy” approach.
2012	Governments committed to a UN Global Partnership on Marine Litter , seeking to protect human health

In 2005, the prominence of the marine plastic litter reached the UN General Assembly, which delivered its first resolution specific to marine plastic. For much of the subsequent decade, the primary concern was on the scale marine litter and how to better manage waste, rather than dealing with their sources. The periodic meetings of the UN's Regional Seas Conventions and Action Plans continued to highlight marine litter as a priority issue and continue to work to strengthen laws preventing both individuals and industrial actors from dumping waste into the seas. Even as recently as 2012, for instance, the focus of Rio+20 was on reducing marine debris and litter. Only with the UN's 2012 Global Platform on Marine Litter's (GPML) Honolulu Strategy did an explicit focus on economic related factors, calling on actors to “promote resource efficiency and economic development through waste prevention e.g. 4Rs (reduce, re-use, recycle and re-design) and by recovering valuable material and/or energy from waste.”²⁰

Phase 2 – Intensified and wider focus on plastics pollution (2014 to 2017)

As it became increasingly clear that gaps in legal frameworks were facilitating the growing crisis in marine plastic litter, and that voluntary measures were not sufficient to stop marine plastic pollution, intergovernmental efforts to boost cooperation intensified (see Table 9).

Table 9: Intensified and broadening focus on plastics pollution: 2014 to 2017

Year	Event
2014	2014 – Marine plastic pollution on the agenda of the first UN Environment Assembly (UNEA), resulting in a resolution of UNEA-1 (Resolution number 1/6), which encourages governments, NGOs, industry and other relevant actors to cooperate with the Global Partnership on Marine Litter on the implementation of the Honolulu Strategy.
2015	The fourth session of the International Chemical Management (ICCM4) endorsed an implementation plan for meeting the 2020 goal on sound chemical management, assisting the work of the Strategic Approach to International Chemicals Management (SAICM) framework..
2015	UN Sustainable Development goals include marine pollution targets in SDG 14.1.
2015	G7 Action Plan to Combat Marine Litter
2016	UNEA, 2 governments issue resolution on marine plastic and microplastics
2016	UN Open-ended Informal Consultative Process (ICP) on Oceans and the Law of the Sea (created to facilitate annual review of developments in ocean affairs) focuses on marine debris, plastics and micro-plastics.
2016	UN Global Partnership on Waste Management launched as part of implementation efforts related to the UN SDGs, including marine litter as one of its 6 themes.

²⁰ <https://www.unenvironment.org/explore-topics/oceans-seas/what-we-do/addressing-land-based-pollution/global-partnership-marine>.

Following a first UNEA resolution on plastics in 2014, efforts to spur international action in the form of binding targets on plastic waste increased. Numerous commitments on marine litter were made in the context of the UN's 2015 Sustainable Development Goals (SDGs), and in particular in SDG Target 14.1 (to conserve and sustainably use the oceans, seas and marine resources for sustainable development), which calls on states to “prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution” by 2025. Alongside, various UN agencies and platforms issued a mounting range of publications to inspire action and guide policymaking to reduce marine litter (UNEP 2014, 2016a). In 2016, a global partnership on waste management, which included marine litter as one of its six themes, was launched in the context of efforts to advance implementation of the UN SDGs (UN 2016).

Alongside concern about plastic litter in the marine environment, international attention to the contribution of microplastics to ocean pollution grew (GESAMP 2015), as reflected in a 2016 UNEA Resolution on marine plastic and microplastics (UNEP 2016b) and the focus of the 2016 Informal Consultative Process on Oceans and the Law of the Seas on marine debris, plastics and microplastics (Lebada 2016).

In parallel to processes primarily concerns about oceans and marine litter, there was increasing concern about the noxious and harmful chemicals present in plastics, and their impact on the marine environment and public health. The UN's Chemicals and Waste platform (which brings together UNEP, BRS Secretariats and FAO to facilitate access to information on implementation of international conventions on chemical and waste) and Strategic Approach to International Chemicals Management (SAICM) (2014), for example, each launched work on chemical pollution aspects of marine plastic pollution, including their impacts on human health (WHO 2016).

Phase 3 – Widening focus on plastic pollution, growing concerns about production and action on plastic waste trade (2017-present)

Only in 2017 did the need to address the *production* of plastics appeared explicitly on the international policy agenda, and even then, it was not a central focus (Table 10). In June 2017, the final declaration “Our Ocean, Our Future; Call for Action” of the Ocean Conference (a UN Conference to support the implementation of SDG14) included some 178 intergovernmental commitments to act on marine plastic pollution. Although one of these commitments makes reference to the wider goal, embodied in the SDGs, of the need to “develop sustainable consumption and production patterns” (UN 2017),²¹ it is somewhat lost in the multiple references and concerns about marine litter and waste management.

²¹ The document calls on countries to: (i) Accelerate actions to prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including marine debris, plastics and microplastics ... and abandoned, lost or otherwise discarded fishing gear; ii) Promote waste prevention and minimization, develop sustainable consumption and production patterns, adopt the 3Rs- reduce, reuse and recycle - including through incentivising market-based solutions to reduce waste and its generation, improving mechanisms for environmentally-sound waste management, disposal and recycling, and developing alternatives such as reusable or recyclable products, or products biodegradable under natural conditions; and (iii) Implement long-term and robust strategies to reduce the use of plastics and microplastics, particularly plastic bags and single use plastic (UN 2017).

Table 10. Phase 3 – An emerging widening to plastic pollution

Year	Event
2017	Declaration of UN Ocean Conference Our Ocean, Our Future, Our Action includes need to address consumption patterns and their impact on marine pollution, including mentioning plastics and microplastics.
2017	Ad hoc Open Ended Expert Group created on eliminating plastic pollution of the ocean, but without being mandated for action. Third meeting of this group highlights the need for a life-cycle approach to plastics use and production. Calls for efforts to incentivise consumers and producers to change their behaviours.
2017	17 African countries signed the Abidjan Convention to reduce marine waste. This was then extended to 38 countries.
2018	UNEA Expert Group presents options for monitoring and international governance of plastics but has still not tried to reduce the production of plastics in first place, nor is there support for legally binding constraints.
2018	The International Maritime Organization (IMO)'s Marine Environment Protection Committee adopted an action plan to enhance existing regulations and introduce new supporting measures to reduce marine plastic litter from ships (IMO 2018).
2018	G7 Ocean Plastic Charter : G7 countries committed to take action towards a resource-efficient lifecycle management approach to plastics in the economy.
2019	Interpol decided that pollution is crime, because the criminal disposal of waste illegally can pollute the air we breathe, the water and the soil
2019	Regional Action Plan on Marine Litter 2019 , to consolidate, coordinate, and facilitate cooperation, and implement the necessary environmental policies, strategies and measures for sustainable, integrated management of marine litter in the East Asian Seas region.
2019	UNEA Group considers life-cycle governance of plastics but did not agree on proposals for this; did not accept proposals to phase out single use plastic, nor to consider a legally binding instrument on marine pollution, but did agree to extend the work of the Group.
2019	The Basel Convention's 2019 'plastic amendments' where 187 governments agreed to add plastic waste to the Convention's list of controlled substances. Contaminated and unrecyclable plastics, along with certain other types of plastic waste, will require prior consent from importing countries before they can be exported. Countries also agreed to a partnership on plastic waste to mobilise companies, civil society and other stakeholders in support of implementing the new Basel decision.
2019	Implementation Framework for Actions on Marine Plastic Litter Action : it will complement the UN Environment Programme's work on marine litter and single-use plastics and it aims at facilitating further actions on marine litter while taking into account national policies, approaches and circumstances
2019	UN Decade of Ocean Science for Sustainable Development (2021-2030), to support efforts to reverse the cycle of decline in ocean health and gather ocean stakeholders worldwide behind a common framework that will ensure ocean science can fully support countries in creating improved conditions for sustainable development of the Ocean.

Six months later, UNEA-3 issued a further, non-binding, resolution on marine litter and marine plastics, which contained ten articles calling on states to take action of various kinds on marine pollution and marine plastics.²² In the resolution, governments underlined the importance of long-term elimination of plastics going into the ocean, establishing an Ad Hoc

²² Notably, UNEA-3's Ministerial Declaration 'Towards a Pollution-free Planet' included the objective of a pollution-free ocean within its aim of a pollution free planet, but did not specifically mention marine litter.

Open-Ended Expert Group on the subject, but did not take up calls for an international agreement on legally-binding reduction targets for reduced ocean plastic (due to opposition from US, China and India, among others (Embury-Dennis 2017, CIEL et al 2018)).²³

In 2017, the Ad Hoc Open-Ended Expert Group called upon members to take a whole life-cycle approach, highlighting the importance of efficiency in resource use as well as pollution (UNEP 2018a). It recommended the development of indicators for reporting on the potential adverse effects of plastic pollution on human health, and the creation of a multi-stakeholder platform within UNEP as a repository of assessments and guidelines, including on technical and scientific information. Of particular interest for the broader, life-cycle perspective highlighted in this paper, it requested the elaboration of guidelines on plastic use and production, including information on standards and labels that could inform consumers and help them change their behaviour, and also incentivise businesses and retailers to adopt sustainable practices and products (UNEP 2018a, para 10). The Expert Group also called for governments to promote the use of information tools and incentives to foster more sustainable consumption and production. These remain working group recommendations, however, and have not yet been taken further in formal intergovernmental processes. In its subsequent 2018 report, the Expert Group presented options for monitoring and international governance, emphasising the importance of multi-layered governance (UNEP 2018b).

Meanwhile, among the many ongoing efforts to address plastic pollution through the work of UNEP and other international initiatives noted in Table 11,²⁴ were efforts to update the Stockholm Convention, which aims to eliminate or restrict the production and use of Persistent Organic Pollutants (POPs), with important links to both the production and disposal of plastics. The updates aim to address a range of POPs relevant to plastics, including chemical additives used in the plastics industry, such as flame retardants and polychlorinated biphenyls (PCBs), as well as dioxins emitted from the burning of plastic waste and polychlorinated dibenzofurans resulting from the production of PCBs and incomplete combustion during waste incineration.

Further, in May 2018, amidst growing evidence of plastic waste trade to countries with inadequate waste management capacity, and following a proposal spearheaded by Norway, the Conference of the Parties to the Basel Convention on the control of transboundary movement of hazardous waste and their disposal agreed to establish an Open-ended Working Group (OEWG) to consider options available under the Convention to address marine plastic litter and micro-plastics, and develop proposals for possible further actions. International attention to the issue spiked in July 2018 with China's ban imports of most plastic wastes. By September 2018, the OEWG had adopted a suite of decisions on marine plastic litter, including a proposed new partnership on plastic waste (focused on public private cooperation and at source measure to minimise and more effectively manage plastic waste), and proposed possible amendments to Annexes of the convention to assist countries to better minimise and control transboundary movement of plastic waste (Wingfield

²³ Instead, Article 2.2 of the resolution calls on all actors to "step up actions" by 2025, to prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution" and encouraged members to "prioritise policies" that avoided marine litter and micro plastics entering the marine environment.

²⁴ For instance, the subject of plastic pollution remained high on the agenda of UN Environment, including through its Clean Seas initiative, the GPML, and the Regional Seas programmes, as well as Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP).

2018).²⁵ Finally, in May 2019, more than 180 countries (with the notable exception of the United States) agreed to: a) amend the Basel Convention to help regulate and improve transparency of plastic waste exports, focusing specifically on contaminated, mixed, and unrecyclable plastic waste (BRS 2019);²⁶ and b) establish a new 'Partnership on Plastic' to help mobilise stakeholders to assist in implementing the new measures and to share tools, best practices, technical and financial assistance.²⁷

Further, there were several important moves in the wider UN Environment framework in 2019. First, at UNEA-4, governments approved four resolutions that directly considered or referred to plastic pollution (primarily in regard to marine plastic litter and microplastics) and also agreed to extend the work of the Ad Hoc Open Ended Expert Group.²⁸ The UNEA-4 resolutions also included commitments to develop inventories of plastics litter sources, which reflect recognition of the need to address sources of the problem, and invited governments to 'reduce the discharge of microplastics through phase-out of products that contain microplastics, where possible,' thus pointing toward the importance of the reduction of production of certain products.

Blocked by the United States, backed by a handful of countries such as Saudi Arabia, governments did not, however, agree to proposals to begin formal consideration through the UNEA process of a legally-binding instrument on marine plastic pollution (which had been proposed by Norway, Japan and Sri Lanka) or a global agreement on the phase-out of single-use plastics (which had been proposed by India). Although these proposals reflected a growing recognition of the need to address plastic across its whole life-cycle – from production to disposal; to move from voluntary and ad hoc initiatives to a binding and coordinated international framework; and to reduce the production of plastics in the first place, these have not yet achieved support as a core policy objective by the most powerful governments and are resisted by a sub-set of prominent and influential industry groups and individual companies (CIEL et al 2018). Meanwhile, the existence of the Open-ended Expert Group keeps open the possibility of a legally binding instrument in the future. Indeed, the Nordic Council of Environmental Ministers has commissioned work on what the possible approaches and elements of such a new global agreement might be (Nordic Council 2019). Notably, although the end-goal is to stop plastic litter from land and seabased sources from entering the oceans, the Council have called for an approach that would address the whole lifecycle of plastics.

²⁵ The 2019 BRS Conference of the Parties also yielded a new [Household Waste Partnership](#) under the Basel Convention, aiming for an integrated approach for household waste management (acknowledged as one of the key challenges related to waste management faced by national governments, particularly in developing countries); enhanced cooperation with [World Customs Organisation](#) to strengthen the Harmonized Commodity Description and Coding System (used by customs authorities to improve the control of wastes crossing borders); finalisation of the draft [Manuals on Extended Producer Responsibility](#), which when completed can assist Parties with concrete actions for promoting the life-cycle approach in the manufacturing of products through to recycling.

²⁶ The amendments, originally proposed by Norway, require exporters to obtain the prior consent of receiving countries before shipping most contaminated, mixed, or unrecyclable plastic waste, bolstering the right of countries to refuse unwanted or unmanageable plastic waste.

²⁷ Implementation of the amendment will rely on encouraging states to designate general plastic waste as 'hazardous' within the domestic laws. The amendment will effectively act as an export ban for the EU because EU legislation bans exports of waste included under the Convention to developing countries. The implications of US opposition for plastic waste trade will demand further study as it is not a party to the Basel Convention.

²⁸ They agreed that the Group's work should, building on existing work, include taking stock of existing activities and actions; identifying technical and financial resources or mechanisms; encouraging partnerships; and analysing the effectiveness of existing and potential responses at all levels. The Group is to report to UNEA-5 in February 2021.

4. Strategic debates and new directions for global governance of plastics and plastic pollution

4.1. International environmental negotiations

Recent scholarly work has offered numerous proposals to address the gap in international cooperation on marine plastic pollution – ranging for action plans for improved ocean governance, to a new international environmental agreement, and appeals to make better use of instruments such as the UN Law of the Sea (Haward 2018; Simon 2017; Raubenheimer & McIlgorm 2017, 2018; RECIEL 2018; Tiller and Nyman 2018). There are different views among environmental experts too on the most efficient and effective way forward.

One focus of proposals is on a proposed new international environmental treaty to address land-based and sea-based sources of marine plastic pollution (Simon 2017; Raubenheimer & McIlgorm 2018). Here, the focus is squarely on international cooperation around marine plastic pollution, with attention to supporting national efforts for plastic clean-up and remediation efforts; improved waste management systems and technologies to prevent plastic waste entering the ocean; and boosted incentives for innovations in more environmentally sustainable and recyclable plastics. Much of the focus is on modalities for cooperation, financing and technical assistance, monitoring, and sharing of information and best practices. Meanwhile, there is considerable work to be done related to the implementation of the Basel Convention's plastic amendments and their ultimate impacts on the plastic waste trade, plastic production and recycling markets are not year (GRID-Arendal 2019; Brook et al 2018).

Among those calling for greater use of existing provisions in international law, Client Earth, for instance, argues that while a new convention might demand more specific action, the political energy needed for a new international agreement could be put to better use, such as through the launch of disputes calling on countries to adhere to existing obligations in international law (such as those included in UNCLOS). This approach seeks to focus political pressure primarily on those countries from which the majority of plastic leaks into the ocean (rather than the source countries of plastic production or pollution).²⁹

In addition, there are also proposals to integrate plastic into negotiations launched in 2017 for a new international instrument on the protection of biodiversity in areas beyond national jurisdiction (BBNJ). Rather than waiting for a treaty that is plastics specific, proponents argue for incorporating plastic into the BBNJ negotiations, since plastic is interwoven as a substantial stressor to biodiversity in all areas of the ocean (Tiller and Nyman 2018).³⁰

²⁹ See for instance proposals for an *Ocean Plastic Legal Initiative* (2018). Also see <https://www.bbc.com/news/science-environment-43115486>.

³⁰ In 2015, the UN General Assembly adopted UNGA resolution 69/292,2 on 'Development of an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction' (BBNJ). Under the resolution, the General Assembly decided to "develop an international legally-binding instrument under the Convention on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction ... [N]egotiations shall address the topics identified in the package agreed in 2011, namely the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, in particular, together and as a whole, marine genetic resources, including questions on the sharing of benefits, measures, such as area-based management tools, including marine protected areas, environmental impact assessments and capacity-building and the transfer of marine technology."

Others argue that a binding global agreement on marine plastic pollution should tackle plastic pollution at its roots by including explicit targets and legally-binding measures both for reducing plastic leakage into oceans and also, critically, by reducing waste generation at source by putting caps on certain kinds of production of plastic. Here, some scholars call for a new treaty modelled on the successful Montreal Protocol on ozone-depleting substances (that aimed to reduce and replace use of CFCs) (Raubenheimer & McIlgorm 2017).

Further, there are proposals that any new treaty should address plastic pollution more broadly and address the whole plastics lifecycle, including its production in the first place. A key international network of civil society groups associated with the Break Free From Plastics movement has, for instance, called for an international agreement that would identify and address sources of plastic pollution across the life cycle of plastic and stop the development of new petrochemical and plastics production infrastructure (CIEL 2019). Underpinning their approach is a conviction that while important, the international community should not rely on voluntary initiatives from business but must also deploy the enforcement powers of regulations and law. Here too, there are questions on, whether the ongoing efforts to produce a marine plastics treaty could be harnessed and enlarged to address these goals, including through protocols on specific technical issues; whether complementary international processes and legal frameworks could be used; or whether a completely new framework is needed (and viable).

In our view, an essential and complementary next step is to situate the plastic problem within the wider political economy of its production, trade and consumption, with a stronger focus on how economic tools and instruments can play a role in promoting transformation and transition of the global plastics economy to reduce plastic pollution across the plastic life cycle. Attention to how a multi-layered framework for international cooperation based in UN Environment and its multilateral environmental treaties – can include and link to approaches that tackle the political economy of the plastics sector and the kinds of economic policy tools needed to promote and incentivize transformation.

4.2. Vital complementary approaches: international approaches to reducing plastics at source

Pulling out of excessive and problematic use of plastics will need a multi-faceted and integrated approach that addresses all actors and stakeholders in the plastics economy. We need to ensure that attention to the downstream dimensions of the plastics pollution and in the marine environment are complemented by strategic integrated policy efforts to address underlying ‘upstream’ causes of plastic pollution across the life cycle and support structural change required across that life cycle.

To reduce plastics pollution, it is vital that we amplify attention to how we can slow plastic pollution at the source by:

- reducing the production and use of excessive, unnecessary and problematic plastics, most obviously non-essential single-use plastic items which can simply be discontinued or substituted by other materials or business models; and
- ensuring more sustainably designed plastics where plastic use is necessary and unavoidable within a broader net zero circular economy framework that includes phasing out the use of virgins plastics and increasing effective recycling measures and re-use in ways that environmentally credible and meaningful.

On both fronts, this approach demands attention to industrial, financial and trade policies – and enabling development and global policy frameworks – necessary to promote structural transformation toward a more sustainable plastic economy and to ease the transition for those that will suffer during the process. This entails greater attention to the technical, financial and economic aspects of structural transformation as well as the political economy aspects relating to the institutional geometry between business and government that is needed for successful transformation (Barrowclough and Kozul-Wright 2017). Table 11 presents a preliminary framework for considering the range of policy tools required in an integrated framework to achieve those ends.

Critically, the economic constraints and trade-related challenges in regard to transforming the plastic economy may differ in developing countries from those in more advanced economies, or where the plastics industry has been longer invested. There is particular need for attention to the financial and industrial policy environment necessary for the growth of innovative and environmentally friendly “sunrise” industries (Barrowclough 2020) that reduce the use of plastic and in particular plastics waste, while producing economic opportunities for developing countries.

Table 11. Transforming the global plastics economy: Integrated policy framework for sustainable transformation and a just transition

Promoting <i>sustainable transformation</i> across the life cycle of the plastics economy	Ensuring a <i>just transition</i> to support the process of transformation
<ul style="list-style-type: none"> - Policies, rules and regulations to require and enforce change toward more sustainable production (including taxes, charges and extended producer responsibility). - Trade policies to support national efforts to reduce unsustainable plastics production and consumption and to encourage alternatives – including targets for reducing trade in certain plastics; boosting trade in more sustainable plastics and substitute products or delivery modes. - Correct pricing of plastics and environmental impacts, disciplines on subsidies or other incentives that sustain/boost harmful production. - Financial and industrial policy levers to give incentives for industry to adapt production and use of existing processes and products in favour of reduced plastic use, more sustainable plastics and non-plastics alternatives. - Support for development banks and institutions to finance transformative leaps away from plastics by firms and investors; <ul style="list-style-type: none"> ▪ Incentives and disincentives related to ownership of technologies and related IP; ▪ Incentives for producers to adapt existing process and products; and ▪ Boosted demand and supply of alternatives through procurement policies at national and regional level. - Sustainability standards for products and production methods; certification of environmental standards. 	<ul style="list-style-type: none"> - Support for research, technical assistance and Aid for Trade to support developing countries active in GVCs involving plastics. - Technology transfer for developing countries to adapt existing methods and introduce new ones (consideration of ownership of alternative & substitute technologies as well as opportunities for MSMEs from developing countries needed). - Capacity building and support for domestic production and trade in waste management services and technologies. - Clear sun-set periods for removal of existing incentives for the production of (single-use) plastics. - Social policies, including Incomes support for temporarily displaced workers, social services for permanently displaced works, and transitional support for removal of subsidies. - R&D, education and skills policies for re-training in use of new processes and products. - Cooperation with other international organisations and processes. - Information-exchange, monitoring and assessment (e.g., on trade-related measures on plastic pollution).

As noted above, some developing countries have comparative advantages in bio-based feedstocks for plastics as well as in the production of non-plastic substitutes (UNCTAD, forthcoming), such as from cellulose products that can be produced locally, assuming

relevant technology is shared and intellectual property not a barrier. Some countries already plastic substitutes as a development opportunity and have ambitions to expand production of non-plastic products, especially in regard to packaging. However, developing country businesses working on plastic alternatives and substitutes face many challenges and obstacles compared to the large and well-known businesses, with proven credit and profit histories.

Addressing constraints to such technological shifts and bringing about structural transformation will need the careful and strategic use of industrial policies and financial sector policies, as well as new government and industry regulations, and wider global governance measures and international rules, including on trade. Much can be learned from the examples where this has been successfully achieved in other sectors – indeed there is no case in history where a country has achieved the structural transformation of moving from subsistence agriculture to industrialisation without the use of such policies, and even today they are still greatly used by many countries, if not most, for the move to revolutionary new technologies such as solar power, the internet and the iphone (Mazzucato 2013, 2018; UNCTAD 2017).³¹

Constraints to transformation may also be related to intellectual property rights and licensing for alternative plastics and non-plastic technologies, for instance, or to subsidies that support fossil fuel production. Industrial policies will be needed to promote the research and development into new forms of plastics alternatives because these are unlikely to emerge from the market without some form of government support or incentives.

Financial policies will be needed to help create capital and guide it to new uses. Without this, there will be little incentive for plastics manufacturers or users in the private sector to take the leap involved, moving away from tried and tested markets and choosing rather the unknown and risky. The tricky part is in balancing the rents that are created, and those that are taken away; also in ensuring that the privileges of receiving support are temporary, and that incentives do not continue to be paid to those that do not meet the performance targets agreed (Barrowclough and Kozul-Wright 2017). The transition phase is important too because such changes bring about winners and losers through the periods of leaving one phase and starting another, and some of these may be long-lasting and even permanent.

On the finance side, promoting a move away from plastics will require that an articulated and supportive system ideally starting at the head, with Central Banks, and filtering down to the various specialist banks can finance plastics-related loans and investments to firms. Here, the move away from plastics can actually be seen as one specific element of the wider calls for a Global Green New Deal, with similar financing needs (UNCTAD 2019; Barrowclough 2020). Central banks may be required to revisit their more engaged stances as in the past, creating credit and guiding it to the more desired plastics alternatives and substitutes, rather than privileging – even if unintentionally – the very large and long-standing petro-chemical companies that make plastics or the large brands and retailers that use it. In Europe, for instance, the European Investment Bank (the EU's regional bank) is playing a supporting role in the transition to a circular economy by providing both financial and advisory support, which can also be harnessed for the plastics economy. Credit rating firms will also need to

³¹ In this view, a move away from dependence on plastics and towards the creation and use of different kinds of product or processes is an example of the process of "creative destruction" identified by Schumpeter as characteristic of transformation.

pave the way forward. Already in 2019, a leading international credit rating firm observed that the credit ratings of European Packaging firms were under threat due to public concerns about plastic packaging (Moody's 2019). A related, supportive move will be required from insurance companies to signal the reputational risk to investors and companies from over-exposure to plastics in the context of public concern about environmental impacts and the potential for stronger international regulation in this field. In 2019, UN Environment led the way for future research with a first study examining plastics-related risks to insurance and investment portfolios (UNEP 2019b).

At the same time, in a fully articulated system of finance, well financed and suitably experimental development banks at the national and regional levels will also be needed to provide preferential finance for sectors and activities that can help to identify, research and develop alternative plastics and substitutes. Regional development banks can, for example, pool finances and help to lend money for inter-regional projects as well as reducing costs for individual countries. In some countries this is already occurring with respect to greening investments, although not yet for plastics in particular.

Returning to the theme of political economy and governance in the title of this paper, it will also be essential that countries have sufficient national policy space for such policies – and this will need to be supported at global level.

Here, trade policy has an important role to play as part of an enabling international policy environment. As the pressure for a carbon neutral and circular global economy grows, interest in the intersection of trade and sustainability issues is rebuilding. At present, trade-related gaps in international cooperation on plastics pollution exist on several fronts:

- Transparency – there is no common platform for publicly accessible data, monitoring and analysis of trends in global plastic production, trade flows and supply chains, as well as on their implications for the design of trade policy measures to reduce plastic pollution.³² In addition, there is poor transparency of trade-related measures and sustainability standards relevant to plastics and plastic pollution, their economic impacts and environmental implications;
- Policy coherence – trade policy frameworks are not well aligned with domestic measures to reduce plastic pollution or with the WTO objective of sustainable development;
- Dialogue and cooperation – national approaches to trade and plastic pollution are being developed in an uncoordinated, piecemeal and disjointed manner, which diminishes their effectiveness. Innovative companies and exporters are at risk of increasingly complex and diverging regulatory frameworks across global supply chains;
- Development dimensions – there is inadequate attention to the trade-related challenges and opportunities for developing countries related to reducing plastic pollution;
- Cooperation among international organisations – there is no process to promote cooperation among international organisations on trade-related issues that arise in efforts to reduce plastic pollution; and
- Research and analysis – challenges and opportunities at the intersection of trade flows, trade policy and plastic pollution, as well as the international trade policy frameworks needed to spur the transformation and transition necessary to reduce plastic pollution.

At present, there is also no clear venue for addressing the trade dimensions of the global plastics economy and plastic pollution. A core strategic question is where to pursue such action. In the past year, the trade dimension of the plastic waste crisis has spurred not only

³² Although market analysis firms gather important information on global plastic markets, such data is not freely available in the public domain.

the Basel Convention's Plastic Amendments but also growing interest at the WTO.³³ China's ban on imports of non-industrial plastic waste, for instance, was raised for discussion in the WTO's Committee on Technical Barriers to Trade (WTO, 2018f)³⁴ and recent meeting of the WTO Committee on Trade and Environment have touched on plastics and marine litter. The trade and plastics intersection has also been underlined by the growing number of notifications by governments to the WTO of trade restrictions they have put in place related to plastics (Deere Birkbeck 2020a, b). Further, China and Fiji have attracted the interest of a group of 20+ developed and developing countries in launching a plastic initiative at the WTO to explore and advance options for using trade policy to support other international efforts to reduce plastic pollution and promote a more sustainable plastics economy. In principle, action on trade and plastic at the WTO could support a multi-layered approach anchored at UN Environment.

At the same time, governments and stakeholders can and should also explore the range of possible international processes and mechanisms – global, regional and national - for harnessing trade policy for these goals and assess the prospects of meaningful outcomes through different approaches (Deere Birkbeck 2020a, b).

5. Summary of key findings and research gaps

This paper has highlighted the need for greater understanding of the political economy dimensions of reducing plastic pollution and giving closer attention to the range of international economic tools and strategies available for transforming the global plastics economy. In so doing it has underlined that the dominant framing of the 'plastics' problem around solving challenges associated with marine plastic pollution, is being challenged by a framing that incorporates concerns for a wider set of development, environmental and health challenges related to plastic pollution across the entire plastic life cycle.

In addition to efforts to reduce leakage of plastic pollution – such as improving waste collection, management and recycling – addressing the root causes and 'upstream' challenges of plastic pollution demands attention to the drivers of the expanding scale of plastic production and use.

- Addressing plastic pollution demands attention to the global political economy of plastic production and the factors enabling its expansion, as well as the regulatory behaviour of key commercial actors. Without an understanding of the political economy dynamics of the plastic industry and global value chains – market structure and concentration, location of production, investment and trade flows, and employment – we cannot identify effective solutions.
- Addressing plastic pollution will demand well-crafted industrial policies focused on structural transformation aimed at greater sustainability, targeting multiple economic sectors and stakeholder groups. Promoting change demands attention to technical, socio-economic and institutional aspects of structural transformation. In developing countries, the constraints and challenges may be different from those in more advanced countries where the plastics industry has been invested for longer.

³³ Exports of domestically prohibited goods, in particular hazardous waste, have long been a subject of discussion at the WTO and in its predecessor the GATT, as developing countries sought to limit 'dumping' of toxic wastes.

³⁴ Notably, exports of domestically prohibited goods, in particular hazardous waste, has long been a subject of discussion at the WTO and in its predecessor the GATT, as developing countries sought to limit 'dumping' of toxic wastes.

- Addressing plastic pollution demands attention to the international economic regulatory environment and policy frameworks relevant to the production of plastics and their substitutes, alongside hard and soft law instruments for international environmental cooperation.

Our review of literature and policy landscape on plastic pollution reveals research gaps in the following five areas.

- Global political economy of global value chains in the plastics economy. Although several studies on global trade and value chains in plastic waste exist, the dynamics and composition of global trade in plastic inputs, such as feedstocks, additives, pellets/nurdles, and global trade in final plastic products have received little attention outside the industry itself. Further, there has thus far been no focused analysis of 'hidden trade' in plastics – that is in the multitude of internationally traded products that contain some plastic or are packaged or transported in plastic. Key outstanding questions include: What are the trends in investment and trade flows in the global plastics economic? Which countries and companies are the main players in the global value chains for plastics and what is the market structure along supply chains? Where could the most strategic policy interventions along supply chains could be made?
- Drivers of plastic production. What are the key factors driving expanding plastic production on the demand and supply side? How is demand for plastic – from industry and from consumers – changing? Who are the key investors in the plastic industry and what forms does their financing take?
- The political economy of the policy and regulatory framework for the plastic economy. Which are the key firms and industry groups active vis-à-vis key global and national policymaking and regulatory processes relevant to plastic? What are their key priorities with regard to the plastic pollution crisis, and how is this shaping their regulatory and voluntary responses?
- Policy frameworks for structural transformation of the plastic economy. What are main constraints and opportunities that developing countries face? What is the policy environment necessary for the growth of innovative and environmentally friendly “sunrise” industries that reduce plastic production, use and waste, and improve waste management? Can lessons be learned from how some countries became global leaders in wind and solar power products, having started at zero or low base? What transition factors are going to be most important, such as with respect to employment?
- The global regulatory environment. How does the international economic regulatory framework shape the plastics industry? What international economic instruments and policy tools could help transform it, including by reducing production and trade of virgin plastics and certain plastic products? How these could be integrated into relevant international legal frameworks in the economic and/or environmental arena?

6. Policy-relevant research agenda

On the basis of analysis in this paper, priorities for a policy-relevant research agenda on transforming the global plastics economy, with a “development dimension” should include the following three areas:

Global Political Economy: Key Trends, Drivers and Actors

- An analysis of global trends in the value and volumes of international trade in key plastic inputs and outputs along the plastics value chain – from plastic feed-stocks, plastic materials used in manufacturing, final plastic products, plastic waste, waste by-products

and secondary waste – identifying key countries and stakeholder groups with an economic stake.

- An analysis of financial trends and drivers of expanding plastic production, conversion and use, along with an identification of key financial flows and actors (including governments, companies, investors and insurers) in global value chains for plastics and their interests.
- A review of the evolving demand side for plastic production, conversion and use.
- A critical review of the regulatory and lobbying strategies and influence of key commercial actors across the lifecycle of the plastics industry as well as their responses to public concerns about plastic pollution.
- A review of trade policy and border measures undertaken to limit inflows of some kinds of plastic and plastic waste, such as in China, Malaysia, Vietnam and Rwanda.

Spurring Change: Industrial policy for sustainable transformation

- Exploration of industrial policy measures – national and global – that could promote sustainable transformation of the global plastics economy. This should include consideration of economic opportunities and constraints that developing countries face in trying to ‘make the leap’ to produce and use alternative plastics and non-plastic substitutes, as well as analysis of where a sample of developing countries are currently located – and could potentially be located – in global value chains in the plastics economy (such as in plastic conversion and recycling) and how plastic packaging is relevant to key global value chains in which they participate (such as in fresh fruit and vegetables). This effort should also include a focus on the financial sector, in particular the role of national and regional development banks and other public banks or public financial assets, and how these can better intersect with the private sector to incentivise and finance the move to a more sustainable, circular plastics economy. Finally, it should also explore how efforts to build waste management capacity with strong environmental performance could better address the socio-economic context in developing countries and strengthen local employment opportunities.

Effective Global Regulation and Cooperation

- Analysis of how the current global regulatory and policy environment shapes the growth of the plastics economy and prospects for transformation. This should include a typology of legislation and policy frameworks at the national level in the United States, China and the European Union (key players in the plastics industry) that could address the production, conversion and use of plastic, including, for instance, caps and bans on the production and use of certain types of plastics; legislation on chemicals; rules in regard to taxation, subsidies and government procurement, intellectual property and technology transfer; supply chain certification and ‘placing on market’ restrictions; standards; investment requirements related to disclosure of investments in plastic and sustainable finance; and international extended producer responsibility.
- A review of how trade policies are and could be used to address some aspects of the plastic crisis, including a review of trade policy and border measures taken to limit imports or exports of some kinds of plastic and plastic waste.
- A typology and inventory of international economic policy and regulatory instruments – in international trade, investment, finance and development finance – that could be deployed to address plastic pollution.

By producing new evidence and solutions, work on this research agenda would help advance international cooperation to reduce plastics pollution and promote a more sustainable, circular plastics economy.

Annex 1. Sample of corporate social responsibility efforts and partnerships on plastics

Partnership	Launched	Organizer	Purpose	Examples of Participating Companies
Waste Free Oceans	2011	European Plastic Converters	<ul style="list-style-type: none"> Dedicated to transforming ocean plastics By mobilising fisheries, recyclers, manufacturers and policy makers, WFO aims to reduce, reuse and ultimately recycle marine litter, mitigating the impact on both the environment and natural resources It is committed to cleaning not only the oceans, but also the beaches, by organising beach clean-up events regularly around the world, together with local organisations 	Airbus, Alpla, Baume, biodermic, eco modus, pielleitalia, packed, Prowin international
Operation Clean Sweep	2012	American Chemistry Council and The Plastics Industry Association	<ul style="list-style-type: none"> It is a campaign dedicated to helping every plastic resin handling operation achieve zero pellet, flake and powder loss By signing this, companies make a commitment to adhere to best practice and implement systems to prevent plastic pellet loss 	Balmoral Tanks, Basell UK Ltd, Coveris, Data Platics, Energystore Ltd, Epwin Group, Luxus, Logoplaste, Palagan, Skymark Renew ELP, Solent Composites, Viridor
Bioplastic Feedstock Alliance	2013	WWF and eight of the world's leading consumer brand companies such as Nestle	<ul style="list-style-type: none"> It provides thought leadership on the responsible sourcing of bioplastics, and the role of bioplastic in circular systems. It aims to ensure bioplastics ultimately contribute to a more sustainable flow of materials, to create lasting value for present and future generations 	CocaCola Foundation, Danone, Ford, Nestle, Unilever, P&G, Lego
World Plastics Council	2014		<ul style="list-style-type: none"> It works to promote the ethic of sustainability and the responsible use of plastics It works with leaders in the Asia-Pacific region, where ocean plastic inputs are the highest, to catalyse investment in municipal solid waste collection and recycling programs It works with the UN to provide technical expertise and a range of commitments under the Global Partnership on Marine Litter 	Shell Global, Borealis, ExxonMobile, Total, Sibur, SCG, Kolon, Chevron Phillips, Braskem
The Ocean Cleanup	2014	CEO is Boyan Slat	<ul style="list-style-type: none"> Aim is to clean up 90% of ocean plastic pollution Development of advanced technologies to rid the ocean of plastic: for example, The Ocean Cleanup has developed the first scalable solution to efficiently intercept plastic in rivers before it reaches the oceans 	Maersk, Deloitte, Latham and Watkins, Macquarie, AkzoNobel, BCG,
NaturALL Bottle Alliance	2017	Danone, Nestlé Waters,	<ul style="list-style-type: none"> To accelerate the development of innovative packaging solutions made with 100% sustainable and renewable resources 	Danone, Nestlé Waters, Origin Materials, PepsiCo

		Origin Materials	<ul style="list-style-type: none"> • The Alliance also provided a progress report in its goal of developing and launching a PET plastic bottle made from bio-based material • The Alliance uses biomass feedstocks, such as previously used cardboard and sawdust, so it does not divert resources or land from food production for human or animal consumption→ the Alliance aims to make this technology available to the entire food and beverage industry 	
Clean Seas Campaign	2017	UNEP	<ul style="list-style-type: none"> • Campaign to engage governments, the public and the private sector in addressing the root-cause of marine litter by targeting the production and consumption of non-recoverable and single-use plastic. • The campaign contributes to the goals of the Global Partnership on Marine Litter. 	60 governments + collaboration with the Volvo Ocean Race + Volvo Cars.
Close the Plastic Tap	2017	IUCN	<ul style="list-style-type: none"> • Program focused on seeking solutions to close the plastic tap and tackle plastic pollution at its source • It involves the mobilisation of a wide range of stakeholders (governments, industries and society) • It also involves enhancing our understanding of the problem through research and the compilation of the latest science and data on the issue 	Coca-Cola Foundation, NORAD
ISWA Marine Litter Task Force	2017	ISWA	<ul style="list-style-type: none"> • The Marine Litter Task Force is an international partnership led and facilitated by ISWA, with the aim of exploring and clearly establishing the link between efficient waste management and the prevention of plastic waste reaching our oceans • The main aims of the Litter Task Force are: <ul style="list-style-type: none"> - Prevent the littering and dumping of waste items - Develop and implement practices for sound collection, treatment and disposal of municipal waste - Identify and demonstrate realistic best practices - Promote a global evolution of efficient resource management - Promote the value of secondary plastics as part of a resource efficient circular economy 	ARA, ASCON, BGE, IFAT, Expra, VEOLIA, INECO.
Next Wave Plastics	2017	Dell and Lonely Whale	<ul style="list-style-type: none"> • It is a consortium of multinational technology and consumer brands gathering in the spirit of collaboration and transparency to rapidly decrease the volume of plastic litter entering the ocean by developing the first global network of ocean-bound plastic supply chains. • Member companies pursue this vision through the development of commercially viable and operational supply chains and the integration of non-virgin plastic material into products and packaging • Member companies are committed to diverting a minimum of 25,000 metric tons of plastic—the equivalent of 1.2 billion single-use plastic water bottles—from entering the ocean by the end of 2025. 	Ikea, HP, Dell, HermanMiller, Interface, TREK

Circular Plastics Alliance	2018	European Commission	<ul style="list-style-type: none"> Signatories voluntarily pledge to 'take action to boost the EU market for recycled plastics up to 10 million tonnes by 2025. 	209 companies and industry associations. For the full list, see: https://ec.europa.eu/docsroom/documents/40583
Global Plastic Action Partnership	2018	World Economic Forum	<ul style="list-style-type: none"> Global platform for plastic action that enables public, private and civil society leaders and their initiatives to come together The goal is to drive the transition towards a circular plastics economy while helping to restore natural systems and creating growth opportunities. 	Supporters include Pepsico, Nestlé, the Dow Chemical Company, and the Coca-Cola Company
Friends of Ocean Action – World Economic Forum	2018	World Economic Forum and World Resource Institute	<ul style="list-style-type: none"> The mission of Friends of Ocean Action is to use our knowledge, means and influence to help the international community take the urgent steps needed to “conserve and sustainably use our ocean, seas and marine resources for sustainable development Plastic Pollution Action: stop growth in plastic pollution by demonstrating ‘investible and scalable’ circular economy solutions in three coastal economies by 2020, ready to be adapted and implemented globally 	Supporters include the Coca-Cola Company, The Dow Chemical Company, PepsiCo Foundation
The New Plastics Economy Initiative	2018	Ellen MacArthur Foundation and UN Environment	<ul style="list-style-type: none"> Aims to overcome the limitations of today's incremental improvements and fragmented initiatives, many focused solely on downstream solutions It is based on the vision of Eliminate, Innovate and Circulate The initiative is based on 5 elements: <ul style="list-style-type: none"> Dialogue mechanism→ Cross-value chain collaboration to solve challenges that no organisation can address on its own The Global Commitment→ Aligning stakeholders with a common vision and set of concrete targets The Plastic Pact→ Driving the implementation of the common vision in a concerted way around the world Innovation→ Continuously developing the knowledge that underpins the initiative and catalysing innovation to redefine what is possible Outreach and stakeholder engagement→ Engaging with the key stakeholders to learn, inform, and amplify what works 	Nestle, Pepsico, Unilever, Target, Walmart, Keurig Dr Pepper, Tupperware, Graham Packaging, Berry Global Inc., Danone, L'Oreal, Carrefour, Colgate Palmolive, MARS, Coca-Cola Company
New Plastics Economy Global Commitment	2018	Ellen MacArthur Foundation and UN Environment	<ul style="list-style-type: none"> Through the Global Commitment, businesses and governments commit to change how we produce, use, and reuse plastic. They will work to eliminate the plastic items we don't need; innovate so all plastic we do need is designed to be safely reused, recycled, or composted; and circulate everything we use to keep it in the economy and out of the environment Targets include to: eliminate problematic or unnecessary plastic packaging and move from single-use to reuse packaging models; innovate to ensure 100% of plastic packaging can be easily and safely reused, recycled, or composted by 2025; and circulate the plastic produced, by significantly increasing the amounts of plastics reused or recycled and made into new packaging or products. Improve transparency of the plastic footprints, calling on signatories to publish annual data on their progress. 	Signatories include major global consumer brands such as Apple, Barilla, Tetra Pak, and L'OCCITANE; Danone, H&M Group, L'Oreal, Mars, Incorporated, PepsiCo, The Coca-Cola Company, and Unilever; major packing producers such as Amcor; plastics producers including Novamont, and resource management specialist Veolia, as well as the Government of Rwanda and the cities of São Paulo (Brazil) and Ljubljana (Slovenia) in addition to 26 financial institutions with USD 4.2. trillion worth of assets under their management to help finance the

			<ul style="list-style-type: none"> • The vision of the Global Commitment has six points: <ul style="list-style-type: none"> - Elimination of problematic or unnecessary plastic packaging through redesign, innovation, and new delivery models is a priority - Reuse models are applied where relevant, reducing the need for single-use packaging - All plastic packaging is 100% reusable, recyclable, or compostable - All plastic packaging is reused, recycled, or composted in practice - The use of plastic is fully decoupled from the consumption of finite resources - All plastic packaging is free of hazardous chemicals, and the health, safety, and rights of all people involved are respected 	transition to a circular economy for plastics (Ellen Macarthur Fund 2019: 17).
Cutting River Plastic Waste	2018	Benioff Ocean Initiative and Coca-Cola Foundation	<ul style="list-style-type: none"> • Partnership to provide \$11 million to empower dedicated and collaborative problem-solvers combating the flow of plastic waste from rivers to the oceans 	Coca-Cola Foundation
Alliance to End Plastic Waste	2019		<ul style="list-style-type: none"> • Develop, deploy, and bring to scale solutions that will minimize and manage plastic waste and promote post-use solutions • Emphasis is on recycling, reusing and repurposing of plastic to keep it out of the environment • Promote higher standards for responsible plastic waste management • Awareness raising, its key goals are to Infrastructure development to collect and manage waste and increase recycling; innovation to advance and scale up new technologies that make recycling and recovering plastics easier and create value from post-use plastics; clean-up of concentrated areas of plastic waste in the environment, particularly the major conduits of waste, such as rivers, that carry land-based waste to the ocean • Financial commitment: investing \$1.5 billion over the next 5 years 	BASF, Berry Global, Braskem, Chevron Phillips Chemical Company LLC, Clariant, Covestro, CP Group, Dow, DSM, ExxonMobil, Formosa Plastics Corporation USA, Henkel, LyondellBasell, Mitsubishi Chemical Holdings, Mitsui Chemicals, NOVA Chemicals, OxyChem, PolyOne, Procter & Gamble, Reliance Industries, SABIC, Sasol, Shell, Suez, SCG Chemicals, Sumitomo Chemical, Total, Veolia, and Versalis (Eni)
The Plastics Leak Project	2019	Quantis and EA	<ul style="list-style-type: none"> • Created a methodology with which businesses have a standardized, science-driven way to map, measure and forecast plastic (including microplastic) leakage across their value chains→ The Plastic Leak Project (PLP) Guidelines • The PLP guidelines provide businesses at all stages of the value chain with a robust, standardized method for calculating and reporting estimates of plastic and microplastic leakage at both the corporate and product level. Based on a leading-edge life cycle assessment approach, the guidelines lay out the sources and pathways of plastic leakage across the globe. With a plastic leakage assessment, companies can locate hotspots, understand how much leakage is occurring and identify the factors contributing to plastic pollution across their value chains. 	Adidas, Arla Foods, Braskem, CITEO, Cotton Incorporated, Cyclos, Decathlon, DOW, Eastman, Enel X, European Bioplastics, European Tyre & Rubber Manufacturers' Association, International Wool Textile Organization, Mars, Incorporated, McDonald's Corporation, PlasticsEurope, RadiciGroup, Sympatex Technologies and The Woolmark Company
Basel Convention's	2019	Secretariat of the Basel,	<ul style="list-style-type: none"> • Established to mobilise business, government, academic and civil society resources, interests and expertise to improve and promote the 	

Plastic Waste Partnership		Rotterdam and Stockholm Conventions	<p>environmentally sound management of plastic waste at the global, regional and national levels and to prevent and minimize its generation</p> <ul style="list-style-type: none"> Activities include: <ul style="list-style-type: none"> Identify the gaps and barriers to the prevention, minimization, collection and environmentally sound management of plastic waste and identify best practices, lessons learnt and possible solutions to the same; Promote the development of policy, regulation and strategies on the prevention and minimization of plastic waste 	
Sea the Future	2019	Minderoo Foundation	<ul style="list-style-type: none"> The initiative aims to raise \$20 billion annually for global recycling, collection and environmental remediation Market-based strategy calls for a voluntary contribution payable on plastics produced from fossil fuels to drive demand for recycled plastics, as a cheaper alternative, throughout the value chain and turning plastic waste into a cashable commodity. 	AGC Chemicals Europe, INEOS, Inovyn, Victrex, Vynova, ELIX Polymers, Arkema, BASF, Covestro LLC, Lanxess, Lyondell Bassell
No Plastic Waste Pledge	2019	Minderoo Foundation	<ul style="list-style-type: none"> The aim is to create a circular economy where plastic is considered a commodity, rather than waste after its first use: the solution needs to be market-driven Promoting awareness of the issues of rising plastic waste, advocating for an industry response and action to address this crisis, and supporting innovative technologies that will bring forward the transition to a circular economy 	AGC Chemicals Europe, INEOS, Inovyn, Victrex, Vynova, ELIX Polymers, Arkema, BASF, Covestro LLC, Lanxess, Lyondell Bassell
Clean Cities, Blue Ocean (CCBO)	2019	USAID	<ul style="list-style-type: none"> The program works globally to target ocean plastics directly at their source, focusing on rapidly urbanizing areas that contribute significantly to the plastic that flow into the ocean each year It promotes and provides support for strategies to reduce, reuse, recycle, and better manage solid waste It enhances policy and governance for increased effectiveness It builds partnerships with the private sector for maximal impact and sustainability It has a grant program, designed to identify and implement locally led, sustainable solutions and approaches that support the program's objectives and combat ocean plastics pollution directly at the source 	
Global Tourism Plastics Initiative	2020	UNWTO	<ul style="list-style-type: none"> It aims to articulate, support and scale-up action by tourism stakeholders and is building a global alliance to fight plastic pollution. The Initiative requires tourism organization to make a set of concrete and actionable commitments by 2025, such as eliminate problematic unnecessary plastic packaging and items by 2025 and take action to move from single use to reuse models by 2025 	ABTA The Travel Association, ACCOR, Butterfly Tourism, Considerate, Hostelling International, Iberostar Group, International Tourism Partnership, Monty's Bakehouse, PATA, RADISSON HOTEL GROUP

European Plastics Pact	2020	WRAP	<ul style="list-style-type: none"> • Reusability and recyclability: Design all plastic packaging and single-use plastic products placed on the market to be reusable where possible and in any case recyclable by 2025; • Responsible use of plastics: Move towards a more responsible use of plastic packaging and single-use plastic products, aiming to reduce virgin plastic products and packaging by at least 20% (by weight) by 2025, with half of this reduction coming from an absolute reduction in plastics; • Collection, sorting and recycling: Increase the collection, sorting and recycling capacity by at least 25 percentage points by 2025 and reach a level that corresponds to market demand for recycled plastics; • Use of recycled plastics: Increase the use of recycled plastics in new products and packaging by 2025, with plastics using companies achieving an average of at least 30% recycled plastics (by weight) in their product and packaging range. 	17 European governments, 70 businesses, 13 business-related organisations and 3 NGOs.
---------------------------	------	------	--	---

Bibliography

- Aftalion, F. (2001) *A History of the International Chemical Industry*, Philadelphia: Chemical Heritage Press.
- Alaerts, L, Augustinus, M, & Van Acker, K. (2018) "Impact of bio-based plastics on current recycling of plastic," *Sustainability*, 10, 1487.
- American Chemistry Council (2018), "US Chemical Industry Investment Linked to Shale Gas Reaches \$200 billion", available at: <https://www.americanchemistry.com/Media/PressReleasesTranscripts/ACC-news-releases/US-Chemical-Industry-Investment-Linked-to-Shale-Gas-Reaches-200-Billion.html>
- Ananthalakshmi, A. and E. Chow (2019), "Malaysia, flooded with plastic waste, to send back some scrap to source", Swissinfo.ch, 21 May 2019, available at : <https://www.swissinfo.ch/eng/reuters/malaysia--flooded-with-plastic-waste--to-send-back-some-scrap-to-source/44979092>.
- Ansari, D. and F. Holz (2020) "Stranded assets and green transformation: fossil-fuel-producing developing countries toward 2055," *World Development* 130, 1094947.
- Azoulay D., P. Villa, Y. Arellano, M. Goron, D. Moon, K. Miller, and K. Thompson (2019), *Plastic and Health: The Hidden Costs of a Plastic Planet*, CIEL: Geneva.
- Barra et al (2018), *Plastics and the circular economy*, Scientific and Technical Advisory Panel to the Global Environment Facility, Washington, DC.
- Barrowclough D (2020), *Financing the shift from plastic – the role of public banks and the Green New Deal*. UNCTAD Research Paper, UNCTAD: Geneva.
- Barrowclough D., and R. Kozul-Wright (2017), "The institutional geometry of state-business relations in sustainable development," in M. Yülek (ed.) *Industrial Policy and Sustainable Growth*, Springer.
- Bauer, F. (2018) *Innovation for biorefineries – Networks, narratives, and new institutions for the transition to a bioeconomy*, Lund University Faculty of Engineering, Lund, Sweden.
- BBC (2019), *India shelves crackdown on single-use plastic*, BBC, 5 October, available at: https://www.bbc.com/news/video_and_audio/headlines/49911306/india-shelves-crackdown-on-single-use-plastic.
- Beaumont, N. J. et al (2019) "Global ecological, social and economic impacts of marine plastic," *Marine Pollution Bulletin*, 189-195.
- Bennett, S. (2012), "Implications of Climate Change for the Petrochemical Industry: Mitigation Measures and Feedstock Transitions," in Chen, W.-Y., Seiner, J., Suzuki, T., Lackner, M. (eds), *Handbook of Climate Change Mitigation*, Springer US, New York, NY, pp. 319–357.
- Bennett, S. J. (2007) "Chemistry's special relationship," *Chemistry World*. Vol. 4(10): 66-69.
- Billard G., and J. Boucher (2019), "Challenges of Measuring Plastic Pollution", *The Veolia Institute Review – Facts Reports*, Veolia Institute.
- Böll Heinrich and Bund-Friends of the Earth Germany (2019), *Plastic Atlas: Facts and figures about the world of synthetic polymers*, in Heinrich Böll Stiftung and Bund Friends of the Earth Germany: Berlin
- Boucher J., and D. Friot (2017), *Primary Microplastics in the Oceans: A Global Evaluation of Sources*. Gland: IUCN.
- Boucher, J., Dubois, C., Kouninana and Puydarrieux, P. (2019) *Review of plastic footprint methodologies: Laying the foundation for the development of a standardized plastic footprint measurement tool*, IUCN: Gland.
- Boucher, J., Billard, G., E. Simeone and J. Sousa (2020) *The Marine Plastic Footprint: Toward a science-based metric for measuring marine plastic leakage and increasing the materiality and circularity of plastic*, IUCN: Gland. <https://portals.iucn.org/library/node/48957>.
- Break Free From Plastics (2019) UN decides to control global plastic waste dumping, BFFP Press Release, 13 May 2019. <https://zerowasteurope.eu/2019/05/un-decides-to-control-global-plastic-waste-dumping/>.
- Bridge, G. (2020) "The geography and political economy of oil and its implications for petrochemicals," presentation at Workshop on Upstream plastic policymaking – Challenges and Opportunities, Fossil Fuels,

Production Growth, Climate Change and Geopolitics, hosted by Lund University and Sustainable Plastics and Transition Pathways (STEPS), 4 February 2020.

Brook, A., Wang, S., and J. Jambeck (2018) "The Chinese import ban and its impact on global plastic waste trade," *Science Advances*, 20 Jun 2018: Vol. 4, no. 6, DOI: [10.1126/sciadv.aat0131](https://doi.org/10.1126/sciadv.aat0131).

BRS (2019), "Governments Agree landmark decisions to protect people and plant from hazardous chemicals and waste, including plastic waste", BRS press release, 10 May, available at: <http://www.brsmeas.org/?tabid=8005>

Bühning, J. (2018), *Plastics and Molds Industry Report*, April 12, Intrepid Sourcing, available at <https://intrepidsourcing.com/industry-reports/plastics-industry-report/>.

Carlini G., and K. Kleine (2018) "Advancing the international regulation of plastic pollution beyond the United Nations Environment Assembly resolution on marine litter and microplastics" *Review of European, Comparative & International Environmental Law*, 27 (3), 234-244.

Chang K (2013), *Policy developments affecting jute and hard fibres markets and their implications for production and trade*, FAO, Rome.

CIEL (2017a), *Fossils, Plastics and Petrochemical Feedstocks*, CIEL: Washington, D.C.

CIEL (2017b), *Fuelling Plastics: New Research Details Fossil Fuel Role in Plastics Proliferation*, CIEL: Washington, D.C.

CIEL (2017c), *Fuelling Plastics: Plastic Industry Awareness of the Ocean Plastics Problem*, CIEL: Washington, D.C.

CIEL (2017d), *How Fracked Gas, Cheap Oil and Unburnable Coal are Driving the Plastics Boom*, CIEL: Washington, D.C.

CIEL (2019a), *Major Plastic Waste Producers Must Get Consent Before Exporting their Toxic Trash to Global South*, Press Release, May 10, available at: <https://www.ciel.org/news/un-decides-control-global-plastic-waste-dumping/>.

CIEL (2019b), *Tyranny of the minority slows international progress on addressing plastic pollution UNEA 4 agreement does not deliver at scale and urgency needed*, CIEL Press Release, 15th March.

CIEL (2020) *Pandemic Crisis, Systemic Decline: Why Exploiting the COVID-19 Crisis Will Not Save the Oil, Gas and Plastic Industries*, April 2020, Center for International Environmental Law: Washington, D.C. <https://www.ciel.org/reports/pandemic-crisis-systemic-decline/>

CIEL et al (2018) *Joint Position Statement First Meeting of The Ad Hoc Open-Ended Expert Group On Marine Litter And Microplastics*, The Women's Major group, Worker's Major Group, NGO Major group, and undersigned organizations submitted to the 1st meeting of the Ad Hoc Open-Ended Expert Group on Marine Litter and Microplastics, May 2018, Nairobi.

Clapp J. (2012), "The rising tide against plastic waste: Unpacking industry attempts to influence the debate" in S. Foote and E. Mazzolini (eds.), *Histories of the Dustheap: Waste, Material Cultures, Social Justice*, MIT Press.

Clapp J., and E. Helleiner (2012), "International Political Economy and the Environment: Back to the Basics?", *International Affairs*, Vol.88, No.3.

Clapp J., and L. Swanston (2009), "Doing away with plastic shopping bags: international patterns of norm emergence and policy implementation", *Environmental Politics*, 18:3.

Client Earth (2018) *Risk Unwrapped: Plastic pollution as a material business risk*, Client Earth, UK.

Dauvergne P. (2018a) "The power of environmental norms: marine plastic pollution and the politics of microbeads," *Environmental Politics*, DOI: [10.1080/09644016.2018.1449090](https://doi.org/10.1080/09644016.2018.1449090).

Dauvergne P. (2018b), "Why is the global governance of plastic failing the oceans?", *Global Environmental Change*, 51, July.

Deere Birkbeck, C. (2019a) *A Ministerial Declaration on Environment and Trade at the 2020 WTO Ministerial Conference*, Global Governance Centre Brief 2019/1, Global Governance Centre, the Graduate Institute, Geneva.

Deere Birkbeck, C. (2019b) *Environment and Trade 2.0*, Hoffmann Centre for Sustainable Resource Economy, Chatham House.

Page 59 of 67

Transforming the Global Plastics Economy: The Political Economy and Governance of Plastics Production and Pollution – Diana Barrowclough and Carolyn Deere Birkbeck
© April 2020 / GEG WP 142

Deere Birkbeck, C. (2020a) "Strengthening international cooperation to tackle plastic pollution: Options for the WTO," *Global Governance Centre Brief 20/1*, Global Governance Centre, The Graduate Institute.

Deere Birkbeck, C. (2020b) "[Here's How the WTO Can Help Address Plastic Pollution](#)," *WEF Forum – World Economic Forum Annual Meeting 2020*, 09 January.

Deere Birkbeck, C. (2020c) "Trade-related measures on plastics: A typology and review of current measures," *GGC Brief*, Global Governance Centre, the Graduate Institute, Geneva.

Barrowclough, D., Christen, J. and Deere Birkbeck, C. (forthcoming, 2020) "Trade Flows in the Plastics Sector", Swiss Network of International Studies Working Paper, Geneva.

DEFRA (2019) *Consultation on reforming the UK packaging producer responsibility system*, London: Department for Environment and Rural Affairs.

Dias, S. M. (2016) "Waste pickers and cities," *Environment Urban*, Vol 28, pp. 375-390.

Dipaola, A. (2018) Saudi looks to petrochemicals for its next big projects, Bloomberg, available at: <https://www.bloomberg.com/news/articles/2018-10-10/saudis-look-past-crude-with-100-billion-in-downstream-projects>.

Edie (2019), *UK doubles aid support for plastic recycling in developing nations*, edie, 12 March, available at: <https://www.edie.net/news/5/UK-doubles-aid-support-for-plastic-recycling-in-developing-nations/>.

EMF (2019a), *New Plastics Economy Global Commitment June 2019 Report*, Ellen Macarthur Foundation.

EMF (2019b), *Plastics Pact*, Ellen Macarthur Foundation.

EMF (2019c) *Reuse – Rethinking Packaging*, Ellen Macarthur Foundation.

EMF and UNEP (2019) *The New Plastic Economy Global Commitment*, available from: <https://www.ellenmacarthurfoundation.org/assets/downloads/GC-Report-June19.pdf>.

EMF and WEF (2017), *The New Plastics Economy: Rethinking the Future of Plastics & Catalysing Action*, Ellen Macarthur Foundation.

Environmental Investigation Agency (EIA) (2019), *Toward a Regulatory Approach to Plastic Pellet Loss*, Working Document, March.

Eriksen M., et al. (2014), "Plastic Pollution in the World's Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea," 9(12) *PLoS ONE*, available at: <https://doi.org/10.1371/journal.pone.0111913>.

Escobar-Pemberthy, N., Ivanova, M., and Bueno, G. (2018) "The International Chemicals Regime: Protecting Health and the Environment in B. Török and T. Dransfield (ed), *Green Chemistry*, Elsevier. pp. 999-1023.

Ettinger J. (2015), "Plastic Waste Turns into Currency in Developing Countries", *EcoSalon*, 8 February.

European Commission (2015), *Closing the loop: Commission adopts ambitious new Circular Economy Package to boost competitiveness, create jobs and generate sustainable growth*, Press Release 2 Dec., available at: http://europa.eu/rapid/press-release_IP-15-6203_en.htm.

European Commission (2018a) *A European Strategy for Plastics in a Circular Economy*, European Commission: Brussels.

European Commission (2018b), *Plastic Waste: a European strategy to protect the planet, defend our citizens and empower our industries*, Press Release 16 Jan, available at: http://europa.eu/rapid/press-release_IP-18-5_en.htm.

European Commission (2018c), *Changing the way we use plastics*, EC: Brussels, available at: <https://op.europa.eu/en/publication-detail/-/publication/e6f102e3-0bb9-11e8-966a-01aa75ed71a1/language-en>

European Commission (2019), *Parliament Seals Ban on Throwaway plastics by 2021*, <https://www.europarl.europa.eu/news/en/press-room/20190321IPR32111/parliament-seals-ban-on-throwaway-plastics-by-2021>.

Excell, C. (2019) "127 countries now regulate plastic bags. Why aren't we seeing less pollution?" UN Environment and World Resources Institute, 11 March 2019. <https://www.wri.org/blog/2019/03/127-countries-now-regulate-plastic-bags-why-arent-we-seeing-less-pollution>

Fenichell S. (1996) *Plastic: The Making of a Synthetic Century*, Cahnerns Books.

Page 60 of 67

Transforming the Global Plastics Economy: The Political Economy and Governance of Plastics Production and Pollution – Diana Barrowclough and Carolyn Deere Birkbeck

© April 2020 / GEG WP 142

- Fernandez-Pales, A., Levi, P. (2018) *The Future of Petrochemicals: Towards more sustainable plastics and fertilisers*. Paris: International Energy Agency.
- Forrest, A. et al (2019) "Eliminating Plastic Pollution: How a Voluntary Contribution from Industry will Drive the Circular Plastics Economy," *Frontier Marine Science*, 6.
- Frankel S. (2011), *Plastic: A Toxic Love Story*, Houghton Mifflin Harcourt.
- Franklin-Wallis, Oliver (2019) "Plastics Recycling is a Myth: What Really Happens to your Rubbish?" *The Guardian*, 17 August 2019.
- Gabrys, J., Hawkins, G., & Michael, M. (Eds.) (2013), *Accumulation: The material politics of plastic*, Oxford, England: Routledge.
- GAIA (2019) *Plastics Exposed: How Waste Assessments and Brand Audits are Helping Philippine Cities Fight Plastic Pollution*, GAIA: Manila.
- GAIA and Greenpeace East Asia (2019a) *Waste Trade Stories*, Global Alliance for Incinerator Alternatives (GAIA) and Greenpeace East Asia.
- Gallo F., et al. (2018), "Marine litter plastics and microplastics and their toxic chemicals components: the need for urgent preventive measures", *Environmental Sciences Europe*, 30(1):13.
- GESAMP (2015) *Microplastics in the ocean: A global assessment*, United Nations Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP), Working Group 40, gesamp.org.
- Geyer R., J. Jambeck, and K. Law (2017), "Production, use, and fate of all plastics ever made", *Science Advances*, 19 Jul, available at: <https://advances.sciencemag.org/content/3/7/e1700782>.
- Gourmelon G. (2015), *Global plastic production rises, recycling lags: New Worldwatch Institute analysis explores trends in global plastic consumption and recycling*, World Watch Institute: Washington, D.C.
- Greenpeace (2019) *Packaging Away the Planet: U.S. Grocery Retailers and the Plastic Pollution Crisis*, Greenpeace USA. <https://www.greenpeace.org/usa/reports/packaging-away-the-planet-2019/>
- Gregson, N., & Crang, M. (2019), "Made in China and the new world of secondary resource recovery," *Environment and Planning A: Economy and Space*, 51(4), 1031–1040.
- GRID-Arendal (2019), *Controlling Transboundary Trade in Plastic Waste*, GRID-Arendal, available at: <https://www.grida.no/publications/443>.
- GRID-Arendal (2020) *Plastic Waste Baseline Report*, <https://www.dropbox.com/s/8zfn47ftxhzbvql/UNEP-CHW-PWPWG.1-INF-4.English%283%29.pdf?dl=0>
- Grosz M. (2011), *Sustainable Waste Trade Under WTO Law: Chances and Risks of the Legal Frameworks' Regulation of Transboundary Movements of Wastes*, Leiden: Martinus Nijhoff.
- Gutberlet, J. (2019), 'Waste picker social economy organizations addressing the Sustainable Development Goals: Draft paper prepared in response to the UNTFSSSE Call for Papers', United Nations Inter-Agency Task Force on Social and Solidarity Economy, https://unsse.org/wp-content/uploads/2019/06/199_Gutberlet_Waste-picker-social-economy_En.pdf (accessed 12 Mar 2020).
- Hahladakis, J. et al (2017), "An overview of chemical additives present in plastics: Migration, release, fate and environmental impact during their use, disposal and recycling", *Journal of Hazardous Materials*, Vol. 344, 179-199.
- Halpern B. S., et al (2008), "A Global Map of Human Impact on Marine Ecosystems" *Science* 319, DOI: 10.1126/science.1149345.
- Harrabin R. (2018), Ocean plastic tide 'violates the law', BBC, 20 February, available at: <https://www.bbc.com/news/science-environment-43115486>.
- Haward M. (2018), "Plastic Pollution of the World's Seas and Oceans as a Contemporary Challenge in Ocean Governance", *Nature Communications*, 9 (667).
- Hawkins, G. (2018), "The skin of commerce: Governing through plastic food packaging," *Journal of Cultural Economy*, 11, 1–18.

Hawkins, G., Potter, E., & Race, K. (2015) *Plastic water: The social and material life of bottled water*, Cambridge, MA: MIT Press.

Henriksson, G., Åkesson, L., & Ewert, S. (2010), "Uncertainty regarding waste handling in everyday life," *Sustainability*, 2(9), 2799–2813.

Hermabessiere, L., Dehaut, A., Paul-Pont, I., Lacroix, C., Jezequel, R., Soudant, P., & Duflos, G. (2017), "Occurrence and effects of plastic additives on marine environments and organisms: A review," *Chemosphere*, 182, 781–793.

Hough P. (1998), *The Global Politics of Pesticides: Forging Consensus from Conflicting Interests*, Earthscan: London.

Hurel S., (2015), *A Toxic Affair: How the Chemical Lobby Blocked Action on Hormone Disrupting Chemicals*, Corporate Europe Observatory: Brussels.

Independent Commodity Intelligence Services (ICIS) (2020) *ICIS Chemical Business: Making Sense of Chemical Prices*, 27 March – 2 April,

<http://edition.pagesuite.com/html5/reader/production/default.aspx?pubname=&edid=f6aa671e-f344-41f9-9a2b-3d73a8f43776>.

IEA (2020) "Oil and gas exports as a share of total trade and oil and gas revenue as a share of fiscal revenue in selected countries, 2017," <https://www.iea.org/data-and-statistics/charts/oil-and-gas-exports-as-a-share-of-total-trade-and-oil-and-gas-revenue-as-a-share-of-fiscal-revenue-in-selected-countries-2017>, updated 16 March 2020.

IMF (2019), Global Fossil Fuel Subsidies Remain Large – an Update based on Country Level Estimates, Working Paper, 2 May 2019. Available at <https://www.imf.org/en/Publications/WP/Issues/2019/05/02/Global-Fossil-Fuel-Subsidies-Remain-Large-An-Update-Based-on-Country-Level-Estimates-46509>

IMO (2018), *Addressing marine plastic litter from ships – action plan adopted*, IMO Press Briefing, 30 October, available at: <http://www.imo.org/en/MediaCentre/PressBriefings/Pages/20marinelitteractionmepc73.aspx>

INEOS Trading & Shipping, *Shipping*, available at: <https://www.ineos.com/businesses/ineos-trading-shipping/>

Jambeck R. et al. (2015), "Plastic waste inputs from land into the ocean", *Science*, Volume 347, Number 6223, 768-71.

Karlsson T., et al. (2018) "The unaccountability case of plastic pellet pollution," 129(1) *Marine Pollution Bulletin*, 52–60.

Khan S. (2016), "E-products, E-waste and the Basel Convention: Regulatory challenges and impossibilities of international environmental law", *Review of European, Comparative & International Environmental Law* (RECIEL), 25(2), 248-260.

Khan S., and T. Honkonen (2017), *Chemicals and Waste Governance Beyond 2020: Exploring Pathways for Coherent Regime*, Nordic Council of Ministers.

Kishna, M., Niesten, E., Negro, S., & Hekkert, M. P. (2017) "The role of alliances in creating legitimacy of sustainable technologies: A study on the field of bio-plastics," *Journal of Cleaner Production*, 155, 7–16.

Krieger, A. (2019) "Are bioplastics really better for the environment: Read the fine print," <https://www.greenbiz.com/article/are-bioplastics-really-better-environment-read-fine-print>

Landon-Lane, M. (2018), "Corporate social responsibility in marine plastic debris governance," *Marine Pollution Bulletin*, 127, 310–319.

Lange, G, Q Wodon and K Carey (2018), *The Changing Wealth of Nations 2018: Building a Sustainable Future*, World Bank, Washington, DC.

Larcom S., L. Panzone, and T. Swanson (2017), "Follow-the-leader? Measuring the internalisation of law", [The Journal of Legal Studies](#), University of Chicago Press, vol. 48(1), pages 217-244.

Lebada, Ana Maria (2016), *ICP-17 Discusses Marine Debris, Plastics, Microplastics and Role in SDG 14 Review*, IISD, 20 June, available at: <https://sdg.iisd.org/news/icp-17-discusses-marine-debris-plastics-microplastics-and-role-in-sdg-14-review>.

Leslie, H. A., Leonards, P. E. G., Brandsma, S. H., De Boer, J., & Jonkers, N. (2016), "Propelling plastics into the circular economy – Weeding out the toxics first," *Environment International*, 94, 230–234.

Liboiron, M. (2016), "Redefining pollution and action: The matter of plastics," *Journal of Material Culture*, 21(1), 87–110.

Marketsandmarkets (2019) Plastic Waste Management Market – Global Forecast to 2024, <https://www.marketsandmarkets.com/PressReleases/plastic-waste-management.asp>

Marshall, J. (2007) "Biorefineries: Curing our addiction to oil," *New Scientist*. Vol. 195(2611): 28-31.

Material Economics (2018a), *The Circular Economy: A Powerful Force for Climate Mitigation*, Material Economics: Stockholm.

Material Economics (2018b) Sustainable Packaging – the role of materials substitution, Material Economics: Stockholm.

Matus K., et al. (2012), "Barriers to the Implementation of Green Chemistry in the United States", *Environmental Science & Technology*.

Minter A. (2015), *Junkyard Planet: Travels in the Billion-Dollar Trash Trade*, Bloomsbury Press.

Moody's Research Announcement, European Packaging firms' credit quality under threat as calls to cut plastic waste intensity, March 2019.

Nielsen, T., Hasselbalch, J., Holmberg, K., Strippel, J. (2020) "Politics and the plastic crisis: A review throughout the plastic life cycle," *WIREs Energy Environ.* Vol 9:e360.

Nielsen, T., Holmberg, K., & Strippel, J. (2019), "Need a bag? A review of public policies on plastic carrier bags – Where, how and to what effect?" *Waste Management*, 87, 428–440.

O'Neill, K. (2018) "The new global political economy of waste," in P. Dauvergne & J. Alger (eds.), *A research agenda for global environmental politics*, Cheltenham, UK and Northampton, MA: Edward Elgar, 87-100.

Nordic Council of Ministers for the Environment and Climate (2019) *The Nordic ministerial declaration on the call for a global agreement to combat marine plastic litter and microplastics*, 10 April 2019, <https://www.norden.org/en/declaration/nordic-ministerial-declaration-call-global-agreement-combat-marine-plastic-litter-and>

Ocean Conservancy (2015) *Stemming the Tide: Land-based strategies for plastic-free ocean*, Ocean Conservancy.

Ocean Conservancy and McKinsey Center for Business and Environment (2017), *Stemming the Tide: Land-based Strategies for a Plastic-Free Ocean*, Ocean Conservancy and McKinsey.

Ocean Plastic Legal Initiative (2018) *International Law and Marine Plastic Pollution: Holding Offenders Accountable*, available at: <http://www.apeuk.org/OPLI/>

OECD (2018a), Extender producer responsibility, available at: <http://www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm>.

OECD (2018b), *Improving markets for recycled plastics: Trends, prospects and policy responses*. Paris: OECD.

OECD (2019a), *Business Models for the Circular Economy: Opportunities and Challenges for Policy* | 3 April 2019, OECD: Paris.

OECD (2019b) *Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences* | 12 February 2019, OECD: Paris.

Packaging Insights (2019) <https://www.packaginginsights.com/news/a-whos-who-of-companies-investing-in-plastic-production-is-the-alliance-to-end-plastic-waste-hypocritical.html>

Packaging Insights (2020) Out of isolation: European Plastics Pact joins MacArthur Foundation's global network to ignite worldwide circularity, April 9. Available at <https://www.packaginginsights.com/news/out-of-isolation-european-plastics-pact-joins-macarthur-foundations-global-network-to-ignite-worldwide-circularity.html>

Pellow D. (2007), *Resisting Global Toxics: Transnational Movements for Environmental Justice*, MIT Press.

Phartiyal, S. and Jadhav, R. (2018), 'Indian state softens plastic ban after industry lobbying', Reuters, 3 July 2018, <https://www.reuters.com/article/us-india-plastic-ban/indian-state-softens-plastic-ban-after-industry-lobbying-idUSKBN1JT1H4> (accessed 20 Feb. 2020).

Plastics Europe (2019) Plastics – the Facts 2018: An analysis of European latest plastics production, demand

Page 63 of 67

Transforming the Global Plastics Economy: The Political Economy and Governance of Plastics Production and Pollution – Diana Barrowclough and Carolyn Deere Birkbeck

© April 2020 / GEG WP 142

and waste data 2018, Plastics Europe.

Plastics Europe (2020) Plastics – the Facts 2019: An analysis of European Plastics, production, demand and waste data, 2019, Plastics Europe.

Plastics Europe & EPRO (2018), *Plastics – the Facts 2017*, Plastics Europe and the European Association of Plastics Recycling and Recovery Organisations (EPRO), Brussels.

Plastics Industry Association (2019), 9 January 2019, Jobs in US Plastic Industry increase, available at: <https://www.plasticsindustry.org/article/jobs-us-plastics-industry-increase-according-2018-size-and-impact-report>

Plastics Insight, *Polyethylene Terephthalate (PET): Production, Price, Market and its Properties*, available at: <https://www.plasticsinsight.com/resin-intelligence/resin-prices/polyethylene-terephthalate/>.

Qantis and EA (2020) *Plastic Leak Project Guidelines*, <https://quantis-intl.com/report/the-plastic-leak-project-guidelines/>.

Raubenheimer K., and A. McIlgorm (2017), “Is the Montreal Protocol a model that can help solve the global marine plastic debris problem?” *Marine Policy* 81, 322-329.

Raubenheimer, K. & McIlgorm, A. (2018), “Can the Basel and Stockholm Conventions provide a global framework to reduce the impact of marine plastic litter?”, *Marine Policy*, 96 285-290.

RECIEL (2018), “Special Issue on Plastics Regulation”, *Review of European, Comparative and International Law*, Volume 27, Issue 3.

Ritch E., C. Brennan, and C. Macleod (2009), “Plastic bag politics: Modifying consumer behaviour for sustainable development”, *International Journal of Consumer Studies*, Vol.33(2), pp.168-174.

Romer, J. & Foley, S. (2011) “A wolf in sheep's clothing: The plastics industry's public interest role in legislation and litigation of plastic bag laws in California,” *Golden Gate University Environmental Law Journal*, 5(2), 377–438.

Royte, E. (2019), ‘Eat your food, and the package too’, *National Geographic*, August 2019, <https://www.nationalgeographic.com/environment/future-of-food/food-packaging-plastics-recycle-solutions/> (accessed 10 Mar. 2020).

Rucevska, I and P. Villarrubia-Gómez (2020) Inventory of Global, Regional and National Plastic Waste Initiatives, GRID-Arendal, <https://www.dropbox.com/s/6wrtll67expdh48/UNEP-CHW-PWPWG.1-INF-5.English%282%29.pdf?dl=0>

Ryan P. (2015), “A brief History of Marine Litter Research” in Bergman et al. (eds.), *Marine Anthropogenic Litter*, Springer.

SAICM (2014), *Report on cooperation and coordination between the Secretariat of the Basel, Rotterdam and Stockholm conventions and the Chemicals Branch of the United Nations Environment Programme*, note by the secretariat. SAICM/OEWG.2/INF/8.

Schönmayr D. (2017), *Automotive Recycling, Plastics, and Sustainability - The Recycling Renaissance*, Springer International Publishing.

Schröder P. (2017a), *Ocean plastic pollution - what role can social science play?*, 29 November, available at: <https://www.ids.ac.uk/opinions/ocean-plastic-pollution-what-role-can-social-science-play/>

Schröder P. (2017b), *Smoke Screen: Why the UK Must Turn its Back on Incineration and Embrace the Circular Economy as a Solution to the Global Waste Crisis*, Tearfund and the Institute for Development Studies.

Schröder P. (2018a), “Circular Economy and Power Relations in Global Value Chains: Tensions and Trade-Offs for Lower Income Countries”, *Resources, Conservation and Recycling* 136.

Schröder P. (2018b), “How can development cooperation address ocean plastic pollution?”, *Institute for Development Studies Opinion*, 23 Jan.

Schröder, P. (2020) *Promoting a Just Transition to an Inclusive Circular Economy*, Energy, Environment and Resources Programme, April 2020, Chatham House: London.

<https://www.chathamhouse.org/sites/default/files/2020-04-01-inclusive-circular-economy-schroder.pdf?fbclid=IwAR0lNgvlsPUJ77PwmxQ8olAFc-apCnileeW60FKO0RdlIVXmOUbO2xYlaA>

Schweitzer, J. P., Gionfra, S., Pantzar, M., Mottershead, D., Watkins, E., Petsinaris, F., ... Janssens, C. (2018), *Unwrapped: How throwaway plastic is failing to solve Europe's food waste problem (and what we need to do instead)*, Institute for European Environmental Policy (IEEP). A study by Zero Waste Europe and Friends of the Earth Europe for the Rethink Plastic Alliance.

Selin H. (2010), *Global Governance of Hazardous Chemicals: Challenges of Multilevel Management*, MIT Press

Simon N. (2017), *Stopping Global Plastic Pollution: The Case for an International Convention*, Heinrich-Böll-Foundation.

Skovgaard, J., van Asselt, H. (2019) "The Politics of Fossil Fuel Subsidies and Their Reform: Implications for Climate Change Mitigation," *Wiley Interdisciplinary Reviews: Climate Change*, 10(4).

Staub, C. (2017) China ban causes programs to cut plastics collection, Plastic Recycling Update: A Resource Recycling Inc. Publication 2017.

Staub, C. (2019) "India confirms scrap plastic ban will be delayed," Plastic Recycling Update: A Resource Recycling Inc. Publication 2019.

Steensgaard, I. M., Syberg, K., Rist, S., Hartmann, N. B., Boldrin, A., & Hansen, S. F. (2017), "From macro- to microplastics – Analysis of EU regulation along the life cycle of plastic bags," *Environmental Pollution*, 224, 289–299.

Stoett, P. & Vince, J. (2019), "The plastic–climate nexus: Linking science, policy, and justice," in P. Harris (Ed.), *Climate change and ocean governance: Politics and policy for threatened seas* (pp. 345–361). Cambridge: Cambridge University Press.

Swanson T. (1995), *Regulating Chemical Wastes: Alternative Policies and Approaches*, Report to the Commission of the European Community.

The Guardian (2018) \$180bn investment in plastic factories feeds global packaging binge, 26 December 2017, <https://www.theguardian.com/environment/2017/dec/26/180bn-investment-in-plastic-factories-feeds-global-packaging-binge>

The White House, President Barack Obama (2015), Annex to the G-7 Leaders' Declaration, 8 June, available at: <https://obamawhitehouse.archives.gov/the-press-office/2015/06/08/annex-g-7-leaders-declaration>.

Tiller R., and E. Nyman (2018), "Ocean plastics and the BBNJ treaty—is plastic frightening enough to insert itself into the BBNJ treaty, or do we need to wait for a treaty of its own?", *Journal of Environmental Studies and Sciences*, 8:411–415.

Tobin, D. (2012), "Pricing Reforms and Capacity Constraints in China's Petrochemical Sector," *Oxford Energy Forum*. Vol 88: 15-17.

Tullo, A. (2019), "The future of oil is in chemicals, not fuels," *Chemical & Engineering News*. Vol 97(8): 26-29.

Tuncak, B. & Ditz, D. (2013), *Paths to Global Chemicals Safety: The 2020 Goal and Beyond*, CIEL.

UN (2016), *Global Partnership on Waste Management (GPWM)*, #SDGAction7462, available at: <https://sustainabledevelopment.un.org/partnership/?p=7462>

UN (2017) Our Ocean, Our Future: Call to Action, Declaration from the UN Ocean Conference, A/RES/71/312, available at <https://oceanconference.un.org/callforaction>.

UN Environment and World Resources Institute (2019), *Legal Limits on Single-use Plastics and Microplastics*, UN Environment, available at: <https://www.unenvironment.org/resources/report/legal-limits-single-use-plastics-and-microplastics>

UNCTAD (forthcoming 2020). *Trade in plastics, sustainability and development*, United Nations Conference on Trade and Development (UNCTAD): Geneva

UNCTAD (2019), "How to finance a green new deal," 7 Nov, UNCTAD, available at: <https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=2229>.

UNCTAD (2017), *Beyond Austerity: Towards a Global New Deal*, Trade and Development Report 2017, UNCTAD: Geneva.

UNEP (2014) *Valuing Plastic: The Business Case for Measuring, Managing and Disclosing Plastic Use in the Consumer Goods Industry*, United Nations Environment Programme, Nairobi.

UNEP (2015), *Biodegradable Plastics and Marine Litter, Misconceptions, Concerns and Impacts on Marine Environment*, United Nations Environment Programme, Nairobi, available at: https://wedocs.unep.org/bitstream/handle/20.500.11822/7468/-Biodegradable_Plastics_and_Marine_Litter_Misconceptions_concerns_and_impacts_on_marine_environments-2015BiodegradablePlasticsAndMarineLitter.pdf.pdf?sequence=3.

UNEP (2016a), *Marine plastic debris and microplastics – Global lessons and research to inspire action and guide policy change*, United Nations Environment Programme, Nairobi.

UNEP (2016b), *Marine Plastic litter and microplastics*, UNEP/EA.2/Res.11, available at <https://www.google.com/search?client=safari&rls=en&q=UNEP/EA.2/Res.11&ie=UTF-8&oe=UTF-8>.

UNEP (2017a), Draft resolution on marine litter and microplastics UNEP/EA.3/L.20. United Nations Environment Assembly of the United Nations Environment Programme. <https://papersmart.unon.org/resolution/index>.

UNEP (2017b), Resolution on marine litter and microplastics, UN Environment Assembly, UNEP/EA.3/Res. 7, available at: <https://undocs.org/UNEP/EA.3/Res.7>

UNEP (2018a), *Putting the environment at the heart of people's lives*, Annual Report 2018, United Nations Environment Programme, available at: https://wedocs.unep.org/bitstream/handle/20.500.11822/27689/AR2018_EN.pdf?sequence=1&isAllowed=y.

UNEP (2018b), *Combating Marine Plastic Litter and Microplastics: An Assessment of the effectiveness of relevant international, regional and subregional governance strategies and approaches – Summary for Policy Makers* (updated 18 May 2018), UNEP/AHEG/2018/1/INF/3.

UNEP (2018c) *Legal Limits on Single-use Plastics and microplastics: A global review of national laws and regulations*, UNEP.

UNEP (2018d) *Mapping of global plastics value chain and plastic losses to the environment (with a focus on the marine environment)*, UNEP: Nairobi. p. 30

UNEP (2019a) Terms of Reference for the Basel Convention Partnership on Plastic Waste and workplan for the working group of the Partnership on Plastic Waste for the biennium 2020-2021. UNEP/CHW.14/UNF/16/rev.1

UNEP (2019b) *Unwrapping the risks of plastic pollution to the insurance industry*, UNEP FI – Finance Initiative and Principles for Sustainable Insurance (PSI), November. UNEP. <https://www.unepfi.org/publications/insurance-publications/psi-unwrapping-the-risks-of-plastic-pollution-to-the-insurance-industry/>

Van de Klundert, A. and I. Lardinois (2017), "Plastics Recycling in Developing Countries: A Booming Business?", the Netherlands.

Van Doorn, P. (2020), 'These companies have the most at stake when the world clamps down on plastic pollution', MarketWatch, 6 February 2020, <https://www.marketwatch.com/story/these-companies-have-the-most-at-stake-when-the-world-clamps-down-on-plastic-pollution-2020-02-04> (accessed 12 Mar. 2020).

Villareubia-Gómez, P, Cornell, S.E. and Fabres, J. (2018) "Marine plastic pollution as a planetary boundary threat – the drifting piece in the sustainability puzzle," *Marine Policy* 96, pp. 213-220.

Vince, J. & Hardesty, B. (2017), "Plastic pollution challenges in marine and coastal environments: From local to global governance," *Restoration*, 25(1), 123–128.

Vince, J. & Hardesty, B. (2018) "Governance solutions to the tragedy of the commons that marine plastics have become," *Frontiers in Marine Science*, 5, 214.

Vince, J. & Stoett, P. (2018) "From problem to crisis to interdisciplinary solutions: Plastic marine debris," *Marine Policy*, 96, 200–203.

Waldersee, V. (2019) Most Brits support ban on harmful plastic packaging, yougov.co.uk online 2019.

WASTE (2016), *Plastic Waste: Turning A Problem into a Resource*, Waste: The Netherlands.

WEF, Ellen Macarthur Foundation, McKinsey & Co (2016), *A New Plastics Economy: Rethinking the Future of Plastics*, Ellen Macarthur Foundation.

WHO (2016) *The Public Health Impact of Chemicals: Knowns and Unknowns*, World Health Organization (WHO): Geneva.

Williams, M. et al (2019) *No Time to Waste: Tackling the Plastic Pollution Crisis before its Too Late*, Tearfund,

Fauna & Flora International (FFI), WasteAid and the Institute of Development Studies (IDS)

WRAP (2019) Defining Whats Recyclable and Best in Class Polymer Choices for Packaging, Wrap: Oxford.
<http://www.wrap.org.uk/sites/files/wrap/Polymer-Choice-and-Recyclability-Guidance.pdf>

WTO (2018), China - Chinese Environmental Protection Control Standards for Imported Solid Waste as Raw Materials: Statement by the United States to the Committee on Technical Barriers to Trade 21 and 22 March 2018, G/TBT/W/468, WTO: Geneva.

WWF (2019), *Solving Plastic Pollution Through Accountability*, WWF: Gland, available at:
http://d2ouvy59p0dg6k.cloudfront.net/downloads/solving_plastic_pollution_through_accountability_eng_singles.pdf.


Xanthos, D., & Walker, T. (2017), "International policies to reduce plastic marine pollution from single-use plastics (plastic bags and microbeads): A review," *Marine Pollution Bulletin*, 118(1–2), 17–26.


The Global Economic Governance Programme was established in 2003 to foster research and debate into how global markets and institutions can better serve the needs of people in developing countries. The program is co-hosted by University College and the Blavatnik School of Government.


The three core objectives of the Programme are:


- ◇ to conduct and foster research into international organizations and markets as well as new public-private governance regimes
- ◇ to create and develop a network of scholars and policy-makers working on these issues
- ◇ to influence debate and policy in both the public and the private sector in developed and developing countries

To find out more:

 www.geg.ox.ac.uk

 geg@bsg.ox.ac.uk

 [GlobalEconomicGovernanceProgrammeOxford](https://www.facebook.com/GlobalEconomicGovernanceProgrammeOxford)

 [@GlobalEconGovce](https://twitter.com/GlobalEconGovce)