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IDENTIFYING SOLUTIONS TO THE PLASTICS CHALLENGE

A Practitioner's Briefing on Key Approaches

Introduction

The problem of plastic pollution and the ever-increasing masses of plastic waste is widely acknowledged. It is known to be based on very cheap as well as subsidised feedstock to produce plastic pellets, insufficient waste management, and on the fact that plastic items are too widely used and then too lightly discarded (United Nations Environment Programme (UNEP) 2021). The acknowledgement of the problem peaked at the United Nations Environment Assembly at its fifth session (UNEA 5.2) in Nairobi earlier this year (2022), when the global community issued a resolution to start an intergovernmental negotiation committee (INC) on plastic pollution, with the aim of arriving at a global, legally binding agreement. During the INC process, which is scheduled to be concluded within two years, states will need to decide how best to design an agreement that tackles the entire life cycle of plastics to prevent pollution. While others have written about what a global agreement would need to do and how it shall be designed (e.g., Raubenheimer & Uhro, 2020), this practitioner's brief will lay out more hands-on solutions to the plastics challenge.

In order to find solutions that tackle the entire life cycle of plastics, it is important to first understand how the current linear production model functions.

As the first step, plastics feedstock (usually from fossil sources) is extracted by the oil and gas industry, for whom the petrochemicals part of their business, and plastics in particular, will become ever more important with the world slowly turning away from fossil fuel use in energy production (Brigham, 2022). From the feedstock, plastic resin is produced, which is then used by plastic manufacturers to produce products as diverse as thin-foil packaging, car parts, children's toys, and textiles.

Plastic is an overall term for a broad range of polymers that have different properties and thus require different treatment. Even more diverse than the different polymers are the additives that are added to the resin in order to make the product softer, harder, more durable, more flexible, more colourful, or fit for a purpose. Unfortunately, these additives not only make the different products harder to recycle, they also often pose a threat to human health and the environment (Tekman et al., 2022: 14).

Manufacturers of plastics and businesses using and selling plastic products are often mis-termed "producers", leading to confusion when speaking about the two groups of actors in the upstream of the plastics life cycle. The final products are either sold directly or through retailers, thus reaching the consumer stage.

Plastic products that are used and discarded during the production process are termed pre-consumer products (European Commission (EC), 2021). Post-consumer plastic products, in a linear production model, become what is generally known as municipal solid waste. Such waste is ideally, but not always, collected; ideally, but currently, only a small percentage, is recycled. The minimum handling would be that collected waste is landfilled, or incinerated. Often, however, the plastic product is discarded, dumped or burnt in the open, each mode impairing environmental and human health in its own way. Plastics entering the waterways have been of particular concern, as they lead to clogging and flooding (IRP, 2021), and eventually end up in the sea where they harm the marine environment and wildlife. Owing to their extensive durability, plastics do not fully degrade in the environment (in particular the marine environment) – lasting up to hundreds of years. Thus, as macro plastics, they pose the risk of entanglement and as micro plastics of ingestion (Boucher et al., 2020).

While the challenge of plastic pollution becomes most obvious when it ends up at sea, this is the end point to a long journey, and many actors and structures enabling and allowing for this. It is widely acknowledged that actions are needed at much earlier stages, and that interpreting this as an immutable fact of today's life is unacceptable due to the harm it causes. . As a helpful mental image, it has been stated that if a sink is overflowing, one would not start by mopping up the water, but by turning off the tap (Von Wong, 2021). As such, beach clean-ups, though important for communities and for material-flow-analyses, as well as ocean clean-ups are probably the least promising

solutions to the plastics challenge. While the following section starts with measures that are the most agreeable for the majority of stakeholders, there should be no mistaking that the upstream measures are what is most needed to halt the flood of plastic entering the environment.

Thus, achieving a significant reduction of plastic waste is thought to be the number one priority of any action with regard to stemming plastic pollution. and there are several approaches to achieve it (UNEP, 2021).

Downstream approaches

Improved waste management systems

Probably the least-contested part of the solution to prevent plastics from entering the environment is to improve waste management systems, in particular in fast-developing countries where an increase in plastic consumption that goes hand-in-hand with economic development, has outpaced the development of waste management systems (UNEP, 2019).

Improving waste management systems includes increasing collection rates; separation of waste either by the consumer or post-collection; disposal of plastic waste at managed landfills (least favourable); incineration; and thermal, chemical or mechanical recycling (the latter being the most favourable). It should also be noted that incineration (be it controlled or uncontrolled, or to recover energy) is connected with emissions of greenhouse gases, particulate matter, persistent organic pollutants (POPs) and heavy metals (UNEP, 2021)

However important the improvement of waste management systems is for many countries and for many reasons, it is impossible for current end-of-pipe solutions (concentrating first and foremost on waste management) to keep up with the ever-increasing production of virgin plastics that will inevitably end up as waste (Simon et al., 2021)

Recycling

While many (businesses in particular) speak of recycling as the most promising option to deal with plastic pollution, the underlying technology is not there, nor has it been used at scale. Together with factors such as plastic products' overall non-recyclability, this shows that further development along the life cycle of plastics is most needed (UNEP, 2021)

Compared with recycling rates of paper (close to 60%), iron (70%) and steel (98%), the recycling rate of plastics (less than 10%) is almost negligible. In addition, the vast majority of plastic that is recycled does not retain its initial value and is therefore "downcycled". As long as virgin plastic is inexpensive and remains subsidised, recycled material will not be able to compete. This renders it highly unattractive to enter the market for plastics recycling (ibid.). One measure to improve the value of recycled plastic is to increase its demand by prescribing recycled content for newly manufactured products. The EU, for example, in its Strategy for Plastics in the Circular Economy, aims for 30% recycled materials in PET bottles by 2030 (ibid.). However, this does not change the growth trajectory, as inherent in a recycling content provision is the assumption that plastics will still be available for recycling.

Not all plastics, however, are equally recyclable. For example, not all polymers can be reheated and reformed and many of them are contaminated by more or less hazardous chemical additives, such as phthalates (ibid.). Although applicable to more types of polymers, chemical recycling is highly energy-intensive and therefore usually connected with vast greenhouse-gas emissions. Indeed, when relying on fossil energy feedstocks, chemical recycling emits up to 110% more greenhouse gases than mechanical recycling and even 9% more than landfills (ibid.).

Therefore, focusing on waste management and recycling alone while continuing with the production of virgin plastics as before, will still increase plastic leakage into the environment by 65% (compared to 2016 levels). To reach a reduction of 80% compared to a business-as-usual approach would therefore require systemic interventions across value chains and the life cycle of plastics (ibid.).

Reuse

A better alternative to recycling is the reuse of products multiple times because it is usually less energy intensive. Although consumers should be incentivised to reuse products, the greater share of responsibility lies with manufacturers and designers of products, as well as on their delivery models. The majority of polluting products are so-called single-use items, which means that they are designed for a single use after which they reach the end of their life, and are discarded or at most disposed of. Such items are difficult and usually economically unfeasible to recycle, although industry has been quite generous in labelling several single-use items, such as packaging, as "recyclable". In order to move away from single-use, changes need to occur at the design stage in order to produce products and packaging that can be used multiple times. A different approach that businesses can take to promote reuse is to engage in new business models, for example, by selling the use of a product over a certain number of times (e.g., by renting or leasing), and building in product durability instead of planned obsolescence (PEW Charitable Trusts and Systemiq, 2020).

Upstream approaches

If there are no measures set in place, plastic production is projected to further increase, and it is certain that waste management systems – inadequate as they are today – will not be able to keep up with the ever-increasing masses of plastics produced and discarded. As focusing solely on downstream measures is insufficient to solve the problem of plastic pollution, upstream measures would need to complement these efforts. There are several ways to target the production and/or design stage. These include limiting the amount of virgin plastic by regulations (e.g., through a global agreement), banning certain types of plastic products, and shifting to alternatives, be they different sorts of plastics or different materials altogether).

It will be inevitable that the production and use of plastics will need to be reduced, in order to avoid the collapse of waste management systems, and further leaking of plastics into the environment.

The question remains: What to reduce and how?

While some scholars have recommended a broad overall cap on virgin plastic production (Simon et al., 2021), the action that is most likely to be taken seems to follow a more selected or targeted approach. This is due to the nature of international negotiations, and national regulations, which often seek a balancing of interests; in this case, the interest of both fossil industry and plastic manufacturers and sellers to continue producing plastics (and waste) are often skilfully lobbied and therefore considered. The focus thus lies on narrowing plastics use cases, for example by banning certain products or types of products, mainly single-use items, such as plastic bags, cups, cutlery and earbuds. However, while banning of certain plastic products or product ingredients has its merits, these actions alone will not solve the plastic pollution crisis (UNEP, 2021)

Others have focused on developing plastics that are made from non-fossil feedstock and/or plastics that biodegrade. It is noteworthy to mention that these two attributes are not necessarily found in the same products, that is, a product made from non-fossil feedstock is not necessarily also biodegradable and vice versa. Neither product line has experienced a breakthrough yet. The problem with current forms of biodegradable plastics is that the needed biologically enabling or other conditions necessary for their composting are barely reached in most composting facilities, let alone in the environment. Thus, according to the United Nations Environment Programme (2019): "biodegradable plastics are currently not a viable solution to marine plastic pollution". The so-called

bio-based plastics, on the other hand, face the challenge that their feedstock, not unlike the feedstock for bio-fuels, competes with food-production (UNEP, 2021).

Another solution, or at least a contribution to solving the problem, is the idea of elaborating sustainability standards, either at the national level (Raubenheimer & Urho, 2020) or even at the international level (Rognerud et al., 2021). The idea is to set certain criteria for sustainable plastics that need to be fulfilled in order to create a level playing field, in which actors who leap-frog towards using, for example, more expensive recycled materials, are no longer at an economic disadvantage compared to those using virgin material (ibid.). Such standards could determine the abovementioned design for making a product reusable, or at least easy to recycle, while they could also extend to other sustainability aspects, depending on what can be agreed either at the national or international level (Raubenheimer & Urho, 2020).

Shifting towards a circular economy

In order to bring upstream and downstream measures together in a coherent fashion, one would need to rethink the prevailing linear model of production and instead work towards a circular economy.

In a circular model of production, the feedstock for the production of plastic resin would not predominantly come from fossil sources. Instead, recycled materials would be used, thereby closing the loop and the gap between the former "end-of-life" solution and the upstream. The recycled material would then re-enter the value chain and be further manufactured. While reuse of products has priority over recycling, a circular plastics economy would require that products are designed to be recyclable (i.e., ensuring purity of materials and a ban on hazardous additives) (Simon et al., 2021).

With the predominantly linear mode of production, the increasing production of virgin plastics is a concern in itself (e.g., because of greenhouse gas emissions and increased fossil-material use), but the design and manufacturing stages of the life cycle add to the problem by not designing products or materials in a way for them to be safely reused or even recycled (ibid.).

A shift towards a circular economy is proposed by many scholars who argue that, if implemented at a global scale, it would lead to a reduction in resource use and in greenhouse gas emissions, reduction in waste and thus in pollution (Cowan & Tiller, 2021). However, a shift towards a circular economy will not come about by itself. It requires an extensive, systemic and societal change that tackles the way we design, produce and use plastic products (ibid.). Such systemic change will no doubt require a substantial initial investment, but the cost of inaction by sticking to the predominantly linear model of plastics production, is estimated to be far higher than moving towards a more circular economy (PEW Charitable Trusts and Systemiq, 2020). These costs include economic costs (missing out on economic benefits of a circular economy) as well as environmental and socio-economic costs (Busch et al., 2022). Moreover, costs and benefits of a move to a circular plastics economy can be more evenly distributed, if all stages of the plastics life cycle are aimed for (Simon et al. 2021), and new jobs are created in a circular plastics economy (Busch et al. 2022). Not the least, shifting towards a circular economy would improve living and working conditions of people working in the informal waste sector (ibid.).

While consumers become more aware of the problem of plastic pollution, politicians and businesses are already taking initial steps to make plastics production and use more circular (UNEP, 2021). One example of an initiative taken by different stakeholders is the New Plastics Economy Global Commitment, led by the Ellen MacArthur Foundation and UNEP who, together with its more than 500 multi-stakeholder members, promote circularity of plastic products. Similarly, the Global Plastics Alliance of 74 plastic associations has initiated the Marine Litter Solutions framework aimed at preventing plastics leakage (UNEP, 2021), though it does not focus on circularity.

Economic incentives

In order to bring about systemic changes to transform the prevailing linear production model into a functioning circular plastics economy, different interventions from different sectors and stakeholders will be necessary. All stakeholders (policy makers as well as businesses and civil society) will need to take actions at a global, regional, national and local level (UNEP, 2019). At the same time, actions need to be coordinated so that they complement, and not contradict, each other. In the case of recycling for products where no alternatives are available (e.g., medical use), for example, actions need to ensure that products and waste systems are designed for it; there also needs be a market for recycling products, like recycling content provisions. (ibid.).

Economic reasons in terms of enabling optimal societal outcomes, both nationally and globally, and for moving towards a circular plastics economy are plentiful: Negative externalities of plastic packaging alone were estimated to be between 40 billion and 139 billion USD in 2015, but are projected to almost double by 2024 (ibid.). Such externalities are currently not added to the price of virgin plastics, thereby rendering alternatives unable to compete (UNEP, 2019). Moreover, plastic that is discarded and not recycled is lost to the economy. The value of the lost material for the packaging industry alone is estimated to be about 120 billion USD annually , while the natural capital cost of using plastics in the consumer industry is estimated at 75 billion USD (ibid.). Plastic pollution, in particular in the marine environment, also directly affects different economic sectors and was estimated to have reached 19 billion USD in 2018 (ibid.). Regarding just transition aspects, moving away from fossil-based feedstock (oil, coal, and gas) would favour developing countries, who could become a large supplier of possible alternative material feedstock for alternatives to plastics, which could provide them with new economic opportunities (Busch et al., 2022), thereby redressing past harms.

In terms of business cases, In fact leapfrogging might pay off for companies: If states agree to increase the internalisation of costs, such as waste management costs or through taxes, these costs may cause an annual financial risk of 100 billion USD (Busch et al., 2022).

In spite of all the current plastics regime's negative economic effects , the current linear production model is beneficial to many powerful stakeholders. The production of polymers is rather concentrated, with more than 50% of the single-use plastic products, and therefore, waste being produced by merely 20 companies; with Exxon, Dow, Sinopec, Indorama Ventures, and Saudi Aramco being the top five polymer producers in 2019 (Minderoo, 2020). Asset managers and banks also play their role by holding hundreds of billions worth of shares and by lending tens of billions of USD to polymer producers (UNEP, 2021), and do mostly not engage with polymer producers or consumer goods companies on the potentially material risks regarding liabilities for clean-up and restitution. In light of this, there seems to be an overall agreement that economic incentives will be required to make sustainable solutions more appealing than the use of fossil-based throw-away plastic products.

Some of the economic incentives include fiscal instruments, such as "taxes, fees, deposit-refund schemes, tradable permit schemes and subsidies" (ibid.). All these fiscal instruments require regulations at the national or subnational level.

- **Taxes** are a common instrument to increase prices of products or services the consumption and production of which one wishes to disincentivise (such as tobacco). A positive side effect is that it generates revenue for the state. It is important to ensure that taxes do not have adverse effects. Taxes on landfill or incineration may be well-intentioned but if the tax for a little desired action (e.g., landfilling) leads to even less desired actions in order to avoid such tax (dumping or open burning), it becomes not just useless but harmful.
- The same holds true for **fees, levies or charges** that function similar to taxes but the revenue from which is bound to the cause for which they were collected. For example, if a levy is paid to a waste management facility, that money will be used to pay for the costs of running the facility.

- **Deposit refund systems** aim at incentivising collection of products that would otherwise likely end up in the environment. They also help in sorting different material flows. In such a system, a deposit is paid on the item when it is purchased. After its use, the consumer (or an informal waste picker) can return the product to retrieve the deposit. Such container deposit regulations are estimated to decrease plastics entry into the coastal environment by ~40% (Cowan & Tiller, 2021).
- **Subsidies** are another way of directing producers and consumers towards choosing more sustainable products and ways of production. Subsidies are almost the opposite of taxes (and indeed they can be paid by offering tax-exemptions). However, before deciding to subsidise a mode of production, a material or a product line, the state should first cease to subsidise or invest in chemical (and thus plastic) production that is based on the use of fossil fuels. Other harmful subsidies include fossil fuel subsidies that artificially reduce the price of virgin plastics even beyond just not accounting for externalities (UNEP, 2021).

Other market-based solutions include extended producer responsibility (EPR) schemes that place the legal responsibility of providing for a circular (plastics) economy on those who economically profit from producing and trading plastic products (i.e., producers, manufacturers and importers). In addition to forcing industry to pay their share in waste management, EPR schemes are said to force industry to take responsibility for their products from the design stage to the end of their lives (Cowan & Tiller, 2021). The Organisation of Economic Cooperation and Development (OECD) is well-known for proclaiming EPR schemes that are an important way of financing waste management systems in its member countries, thereby taking this responsibility away from municipalities or other state institutions responsible for waste management (UNEP, 2021). The Single-use Plastics Directive of the European Union (EU) foresees EPR schemes that cover fees for the recovery of cigarette butts and fishing gear (Simon et al.. 2021).

While in theory a company under an EPR could set-up its unique system to collect and recycle its products, in reality this responsibility is handed-over to a third party that undertakes these tasks on behalf of several producers. The producer, manufacturer or importer who places the product on the market that is covered by the EPR also needs to pay a fee to the third party. The amount that needs to be paid usually depends on the volume and the kind of material that is used, so as to incentivise those responsible for the design of a product or packaging to switch to more sustainable materials (Ellen MacArthur Foundation, 2021).

While EPR schemes are broadly discussed at the national level, Raubenheimer and Urho (2020) have illustrated their idea for an EPR scheme at the global level. This would require a set of sustainability criteria similar to the sustainability standards described above, to which a particular industry would be required to adhere.

Other non-financial incentives include recycling quotas, such as in the EU strategy for Plastics in the Circular Economy, that mandates increasing recycled plastics content and measures to aims at reducing waste (UNEP, 2021). Similarly, the issue of transparency about the contents of products is important across the value chain, not only for consumers but also for recyclers and for enterprises with the aim to use recycled materials (Cowan & Tiller, 2021).

While most industry-led partnerships, such as the Alliance to End Plastic Waste (AEPW) or “Sea to the Future” focus predominantly, if not solely, on downstream measures, other initiatives and actions, such as “Think Beyond Plastics” set out to curb the growth in fossil-fuel-based virgin plastic production by promoting bio-based materials. Other private – public partnerships also focus on downstream measures (UNEP, 2021). This highlights the need for concerted upstream measures that could be pushed forward and harmonised by the international legally binding instrument (ILBI), which is currently being negotiated.

Elements for the International Legally Binding Instrument (ILBI)

It has been widely acknowledged that the existing plastic governance system is a patchwork of initiatives, practices and regulations (UNEP, 2021), and that legally binding global solutions will need to be implemented and adapted at the regional, national and local level where circumstances differ vastly (Cowan & Tiller, 2021). It will be important for the ILBI to target the entire life cycle of plastics, as this has been found to be a major gap in the existing policy landscape; most existing agreements focus on the waste stage, which is important but by no means enough (Simon et al., 2021).

According to Raubenheimer and Urho (2020), the ILBI will need to include actions on waste management, bans on certain products, provisions to use fewer or no hazardous substances, and for the sustainable management of products (see also: Cowan & Tiller, 2021). Overall, the ILBI will need to promote a level playing field through promoting legislation and/or by promoting binding technical standards established by the ILBI (Simon et al., 2021). The fact that states have agreed to develop a legally binding agreement is of utmost importance and must not be watered down, since voluntary approaches have proven to be inefficient as well as ineffective (UNEP, 2021). In this regard it is critical to ensure the enforcement of the ILBI so as to ensure compliance (Tessnow-von Wysocki & Le Billon, 2019).

As mentioned above, often-named solutions at the national level that should be facilitated through the ILBI include banning or phasing-out of specific products, EPR schemes or, more generally, a transition away from linear production models towards a circular plastics economy (UNEP, 2021).

To promote these solutions, the ILBI will need to consider different national circumstances and allow for targeted approaches. In this regard, it will be important that the ILBI sets ambitious goals and targets but also requires member states to develop their own national action plans that will be carefully monitored. Ideally, such national action plans should abide by the principle of common but differentiated responsibilities and capabilities (Simon et al., 2021). These take account of existing waste streams and production hotspots, which differ among member states and therefore warrant different sets of actions (Cowan & Tiller, 2021).

What is broadly acknowledged to be a prerequisite for the success of the ILBI is sufficient financial support and capacity building provisions. In this regard, a dedicated fund (either a new fund or managed through GEF) to help developing countries fulfil their commitments would be beneficial (Simon et al., 2021). In fact, experiences from other multilateral environmental agreements (MEAs) have shown that funding mechanisms make MEAs more successful in bringing about change in society and behaviour (Cowan & Tiller, 2021). At the national level, financial incentives from government are vital but should not lift responsibilities from the industry (UNEP, 2021).

Other provisions in the ILBI should consider the establishment of a science-policy interface (Cowan & Tiller, 2021; Busch et al., 2021), since there is a need for increased sharing of and providing access to data and knowledge (UNEP, 2021).

Modelled after two well-known international agreements, namely, the Montreal Protocol and the Paris Agreement, Simon et al. (2021) argue for a cap on the production and consumption of virgin plastics. They argue that this would incentivise innovative approaches across the value chain and the plastics life cycle to reduce virgin plastic needs through reusing products and recycling materials. Such a cap on plastic production would need to be accompanied by provisions to phase out (hazardous) chemicals and to increase transparency along the value chain. Both would be facilitated by binding technical standards established by the ILBI (ibid.).

Conclusion

In summary, it is important to note that solutions to the plastics challenge exist but they require changes and incentives across the entire life cycle of plastics. It cannot be stated often enough that the most effective and therefore most important levers lie in the upstream measures, which should be accompanied by downstream measures. It is equally important to acknowledge that powerful actors lobby for continuing fossil-based plastic production, at the detriment of human and planetary health. It will therefore be of utmost importance that the ILBI sets the scene and direction for a systemic change, beginning at the design and production stage of plastic products, while being aware that downstream measures cannot be neglected, in particular in developing countries, where waste management (not only of plastic waste) is often insufficient and warrants improvement.

Several approaches and ideas about how such change could be facilitated and incentivised already exist. These range from regulations to economic incentives for business and industry. It will be up to the members of the INC to carefully consider their merits and downsides, and to decide how to include them in the ILBI. Meanwhile, states and stakeholders should not hesitate to take the initiative in making the switch from an extractive economy where a product's price does not signal externalities like waste and pollution, and they must be borne by society, rather than producers, to a circular, regenerative economy. Urgent action is needed now – as it becomes clearer that due to climate change impacts, iresource scarcity and inflation; limiting fossil-based products, and keeping valuable materials inside the economy is bound to be beneficial – for business, the environment and society at large.

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