Cutting Plastic Pollution at the Source: The Case for Upstream Solutions

Key Points

- Measures to reduce plastic pollution can be applied at all points throughout the plastics' life cycle. While all approaches are important, particular attention and investment should be given to upstream measures that (1) reduce production, (2) simplify to reduce complexity (and costs downstream), (3) promote safe and sustainable design/innovation practices.
- Upstream measures target the extraction and processing of feedstocks (bio- and fossil-fuel based) and the production and processing of plastic monomers, polymers and associated chemicals.
- Without a significant reduction of primary plastics introduced into the global market, facilitating economically viable plastics circularity and eliminating plastic pollution are impossible. Only a significant reduction in production of primary plastic polymers (PPP) can increase the value of the materials and thus provide the needed incentive to a market shift towards more sustainable plastic consumption.
- PPP reductions are a necessary measure for significant decrease in plastic pollution. However, they are also synergistic with other measures, such as better waste management.

Upstream Measures: Tackling Plastic Production and Feedstock

The full life cycle approach for plastics is an important concept in the negotiations for an effective global plastics treaty. The full life cycle encompasses the upstream phase, or the extraction of the raw materials, as well as mid- and downstream phases, including product design and waste management, amongst others (see Figure 1).

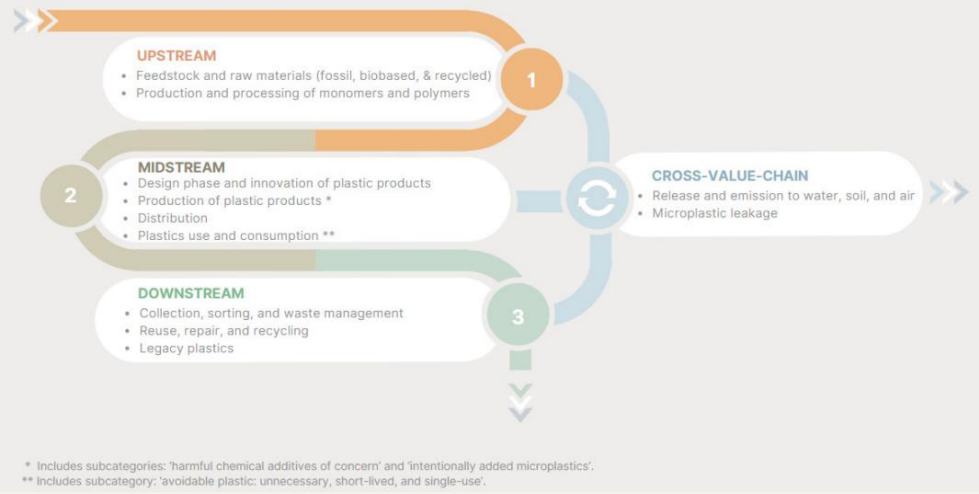

Figure 1: Dreyer et al. 2024, p. 11 [1].

Efforts to reduce the human health and environmental burden, as well as the burden across the plastics supply chain are reflected in supply chain management studies [2], [3], [4]. One of the particularities of the plastics supply chain is that there are very few companies involved at the levels of raw material and plastics production (upstream/supply side). However, a plethora of distributors are enrolled further down the supply chain. Post-consumption, a relatively few companies produce "recycled" plastics in a way that reconnects secondary plastics production with the primary plastics

petrochemical and other plastics producers upstream. These producers, by design, capitalise on the profits of plastics production while externalising the costs, including environmental, economic, and human health harms onto governments, municipalities and communities. Today, we know a small fraction of companies globally are responsible for plastic pollution: 56 companies contribute over 50% of branded plastics pollution [5]. This is a prime demonstration of companies deriving the economic benefits while externalizing the costs. The production of plastics and resins is expected to double in the next 25 years (see Figure 2).

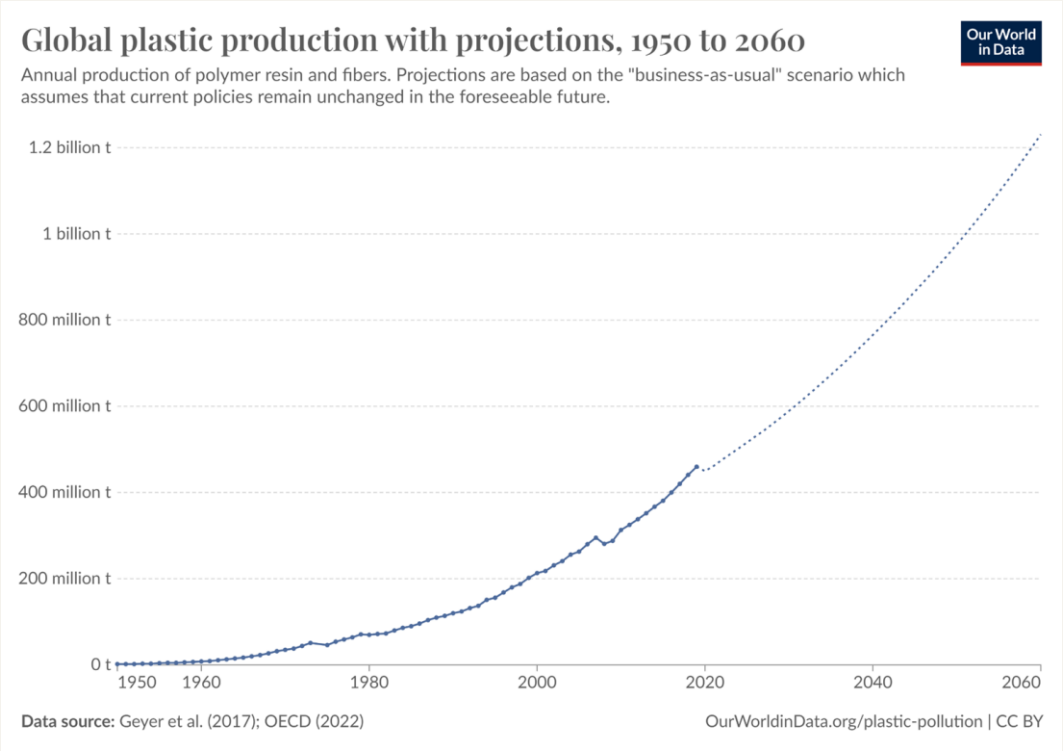

Figure 2: OurWorldinData.org/plastic-pollution.

Furthermore, current plastic production costs with PPP is kept artificially low due to fossil fuel subsidies. This prevents a shift towards a more circular plastic economy, since it reduces competitiveness of currently unsupported (lack of investment and subsidisation of) plastic free and reuse/refill, repair, repurpose, remanufacture materials, products, technologies and systems, but also the competitiveness of recycled plastics, diminishes the incentive to increase longevity of plastic products, and removes economic incentives to increase end-of-life handling beyond merely discarding products after use. Given this context, producers of both, plastics pellets and plastics products, are key stakeholders [6]. It is essential to establish transparency criteria for other companies to be able to safely recycle and reuse plastic products. That can only happen once the (hazardous) ingredients are known. Efforts to establish transparency regarding material composition on a voluntary basis failed.

Therefore, in order to optimize transparency in the supply chain [7] the companies along the life cycle must be globally regulated: plastics composition, quantity of production, and plastics trade. Downstream and midstream stakeholders, including consumers, have a small role to play compared to the responsibility of upstream producers at the beginning and end of the plastics life cycle. The further upstream you go, the easier it is to be transparent in the supply chain, traceability, transparency, and chemical simplification are easier.

Reducing Primary Plastics: The Key to a Sustainable Economy

Scientific evidence suggests that the cost of damages through plastic pollution far exceeds the costs of action [8]. It would be cheaper, and more effective, to deal with plastic pollution by implementing upstream measures, rather than relying on downstream, clean-up, measures. These costs of inaction do not currently include the costs to human and environmental health (due to a lack of data). Furthermore, current solutions are insufficient to tackle the expected growth of PPP [9].

Plastics worsen climate change, as they emit CO_2 throughout their life cycle with as much as 70% of fossil fuel input being consumed upstream as feedstock [6]. About 75% of the greenhouse gas emissions from producing primary plastics occur during the early stages before the polymerisation. If plastic production grows at a modest rate of 2.5% per year, these emissions would more than double to 4.75 gigatonnes of CO_2 equivalent by 2050, consuming 21-26% of the remaining global carbon budget needed to keep global warming below 1.5°C [10]. Thus, to effectively address and limit the growth of CO_2 emissions linked to plastics, it is imperative to reduce plastic pollution by implementing upstream measures.

Beyond Recycling: Why Upstream Action is Essential

Recycling is often proposed as the solution to plastic pollution. However, the recycling process is usually over-simplified, taking for granted that all plastics and chemicals can be (easily) recycled. On the contrary, many types of plastics cannot be recycled with the available technologies or design and thus not be re-entered into the economy. Global recycling rates of plastics are around 10% despite that 82% of investments go to recovery and recycling [11]. Recycled plastics are predominantly down-cycled into products of lower value than the parent product and can only be recycled a few times, before being discarded. Furthermore, accumulation and/or increased spread of hazardous chemicals during recycling pose a threat to human health [12, 13]. Increasing the recycling rate of plastics can be one of the measures against plastic pollution, but it must be accompanied by upstream measures limiting the production of PPP, including simplification of the composition of plastics (safe chemicals) .

A Global Treaty Focused on Upstream: A Path to Lasting Change

We need to cut production because supply-side measures play a crucial role in managing market dynamics. Markets often artificially create demand, especially when expensive infrastructure and extraction processes are involved. Once these investments are made, companies face pressure to maintain or expand production to recoup costs, even if demand is not naturally present. This leads to a cycle where supply drives demand, often fueled by lock-in mechanisms, making it difficult to reduce output. Cutting production helps breaking this cycle, ensuring more sustainable market practices. Establish a baseline and an ambitious global reduction target, reflected in national targets for production and consumption by polymer, against which progress can be monitored and an eventual phase-out schedule implemented [14].

To effectively combat the global plastics crisis, upstream measures must take center stage, as they address the problem at its source and create the necessary market incentives for sustainable alternatives. By cutting primary plastic production and increasing transparency, we can pave the way for an effective plastics treaty that safeguards both the environment and human health.

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