A circular plastic economy should account for all societal costs

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This peer-reviewed article has been accepted for publication but not yet copyedited or typeset, and so may be subject to change during the production process. The article is considered published and may be cited using its DOI.

10.1017/plc.2025.10019

Impact statement

Numerous policies and technological solutions are being developed and implemented to reduce plastic pollution. However, the majority of these do not touch on the fundamental drivers and societal foundations the governs the current plastic economy, and therefore fail to provide the disruptive changes that are needed for a sufficient transition of the plastic economy. In this letter we address the importance of two of these fundamental divers, in influx of monetary support for the linear plastic value chain through subsidies and the lack of inclusion of the cost of negative externalities. We argue that the UN plastics treaty should address these fundamental drivers, since a transition to a circular economy, which facilitate a regenerative and restorative plastic production and consumption, is not possible as long as these fundamental drivers provides such a strong foundation for the current socio-technical system. Since these conditions have not sufficiently been addressed in the treaty negotiations, we believe that it is vital to highlight them at this point in time.

Abstract

One of the fundamental challenges for the UN plastics treaty is to shift the current linear plastic economy into a more circular plastic economy. Transitioning to a circular plastic economy requires a profound transformation of socio-technical systems, and research suggests that disruptive policies must simultaneously destabilize the entrenched linear system and cultivate a new regime that supports circular business models. A major barrier to this transformation lies in the artificially low cost of primary plastics, maintained by substantial subsidies for fossil fuels and plastic production. These subsidies, alongside the failure to internalize negative externalities - such as extensive health impacts and environmental damage - mask the true cost of plastic use, thereby undermining the economic case for innovation in sustainable alternatives. The upcoming UN plastics treaty presents a unique opportunity to realign market incentives and drive the necessary transition toward a circular, regenerative plastic economy.

Graphical abstract

Introduction

A key challenge for the forthcoming plastic treaty is to facilitate a transition away from the current predominantly linear plastic economy. The linear plastic economy is a key driver behind the expanding plastic production, consumption and associated environmental impacts (Walker and Fequet 2023). The global plastic production and consumption has grown from a few tons per year in the 1950s to more than 450 million tons per year today, of which less than 10% were recycled, and business as usual forecasts predict consumption to triple by 2060 (OECD 2022). At the same time plastic pollution has grown and more than 20 million tons of plastic is lost to the environment each year (OECD 2024). Today plastics are omnipresent in all environmental compartments and a recent publication by Villarrubia-Gómez et al. (2024) highlights how plastic pollution has exacerbated all planetary boundaries and thus impacts all vital earth systems on the planet. Similarly, concerns for human health impacts of both plastic chemicals and plastic particles have been raised (Seewoo et al. 2024).

https://doi.org/10.1017/plc.2025.10019 Published online by Cambridge University Press

These conditions imply that fundamental changes to the plastic economy are essential to ensure that the future production and consumption of plastics becomes more sustainable. A transition to a circular economy has been suggested as the means to ensure that the future plastic economy can be sustainable (COM/2020/98 final). For such a transition to be sufficiently effective, it requires that changes are made along the entire value chain (Johansen et al. 2022). Even though significant efforts are being dedicated towards recycling, forecasts predict that this will not be enough to end plastic pollution (OECD 2024). This implies that a more holistic transition that is based on principles of a regenerative and restorative consumption (Morseletto 2020) is warranted, which again can be difficult to imagine without fundamental changes to the existing socio-technical regime (Geels and Schot 2007).

In order to understand and analyze how such a transition can be facilitated, it can be valuable to view the complex socio-technical systems that the global plastic economy is, as structured in different interconnected levels. Köhler et al. (2019) provides a research agenda for understanding such a transition, where changes in socio-technical regimes (such as the current plastic economy) are governed by socio-technical landscapes (such as political ideologies and macro-economic structures). This influence on the development of the socio-technical landscape is typically seen as a top-down process. On the other hand, niche technologies can challenge the existing regime, and if successful, can contribute significantly to the transition of the socio-technical regime, for example when products designed for higher longevity replace single use plastics (SUPs) and thereby facilitate a more circular plastic economy. However, within the existing regime, a combination of coalitions between established stakeholders, infrastructure and policy frameworks often preserves the regime, and create path-dependencies that inhibit technological change. Moreover, Kivimaa and Kern (2016) highlight that transitioning to a new socio-technical landscape requires both policies which ‘destabilize’ the ‘old’ linear plastic economy and policies which establish the ‘new’ circular plastic economy. They posit that the accumulation of both types of policies over time can act as a motor for a more sustainable transition.

The forthcoming UN plastics treaty is therefore a unique possibility for the global society to challenge the structures that are sustaining the current linear plastic value chain, and thereby facilitate a transition to a sustainable circular economy. This letter highlights the importance for the UN plastics treaty to regulate subsidies that support primary plastic production and further account for all environmental externalities related to plastics production and consumption.

The current linear plastic economy

One of the most important aspects of UNEA Resolution 5/14 is the acknowledgement that plastic pollution cannot be eliminated if the treaty does not account for the full life cycle of plastic (UNEP 2022). Plastic waste pollution is mainly a function of the vast consumption of single use and short-lived plastic products and packaging materials, as e.g. reflected in the EU Single-Use Plastics (SUP) Directive (Directive (EU) 2019/904). SUPs account for 60-95% of global marine plastic pollution (Schnurr et al., 2018). Reducing consumption levels of SUPs and improving waste management will be a vital component of a transition away from the linear plastic economy. A common reasoning for the use of plastics is that plastics are cheap, lightweight and versatile (e.g. Almohano et al. 2022). Whereas the latter two aspects

https://doi.org/10.1017/plc.2025.10019 Published online by Cambridge University Press

relate to the inherent material properties, the cheap pricing of plastics is maintained by policy frameworks that include large-scale subsidies (IMF et al. 2022) and excludes externalities in the pricing of plastic products and packaging (Erkins and Zenghelis 2021). This is central to the discussion on how a transition to a circular economy can be facilitated, since the artificially low price of plastics are central to the growing production of SUPs such as packaging.

Artificially low plastic prices also stifle economic innovation that could beneficially replace SUPs. A variety of business models exist that can deliver goods and services without relying on SUPs. These include reuse/refill businesses; zero waste shops; reusable packaging for direct-to-consumer shipping; rental and cleaning of durable goods (e.g., tableware) to replace SUPs. These businesses are examples of a nascent, new socio-technical regime; but they often struggle to scale up as the transition is hindered by plastic-based competitors' incumbent advantage and artificially low prices.

Several legislations across the different UN regions currently aim to regulate production of SUPs and/or provide room for reuse products to take up market shares. These include bans on plastic bags (Nielsen et al. 2019), bans on most polluting SUP products and requirements for categories of products to have a certain amount of reuse products (Xanthos and Walker 2018; Schnurr et al. 2018). While all these regulations can shift the production somewhat they do not change the fundamental drivers behind the vast consumption of single use and short lived products - the artificially low price of primary plastic (e.g. Sicotte 2020). For the UN plastics treaty to fundamentally transition the dominating socio-technical regime, a change of the market mechanisms that provide a steady supply of low price primary plastics is required. Two policy areas stand out as fundamental for this transition. First, subsidies for both fossil fuel extraction and plastic production keep the price of primary plastic artificially low (QUNO & Eunomia 2024). Secondly, the price of negative externalities such as impact on human health, global warming and environmental degradation are excluded from the price of plastics, and instead paid for by society.

The importance of subsidies

More than 99% of the 460 Mt plastic produced in 2022 were made from fossil-based sources such as oil and gas (Holmberg et al. 2024). This implies that subsidies for fossil fuel extraction indirectly support plastic production, by lowering the price of the feedstock and energy used for primary plastic production. According to the International Energy Agency (IEA) fossil fuel subsidies amounted to more than USD $1 trillion in 2022 (IEA 2023). While this cannot be seen as a 1:1 direct support for plastic production, the link between extraction of fossil fuel and production of plastics are well established (Tilsted et al. 2023). In a recent report, plastic production subsidies were grouped into feedstock subsidies, energy subsidies and a broader "other subsidies" group (QUNO & Eunomia 2024). The report estimates plastic production subsidies in the 15 largest producing countries to amount to USD $43 billion in 2024, with Saudi Arabia's USD $38 billion by far contributing with the largest subsidies.

A transition away from using fossil energy and feedstock in industrial facilities will not occur without targeted measures (Vogl, 2023). Despite growing calls to mitigate climate change, the fossil fuel dependent plastics and petrochemical industry has only recently begun to

https://doi.org/10.1017/plc.2025.10019 Published online by Cambridge University Press

develop decarbonisation or net-zero roadmaps. These roadmaps reveal a fragmented approach that emphasizes technological supply side measures such as switching energy sources or increasing the use of biomass, recycled or carbon dioxide-based feedstocks. However, they largely ignore scope 3 emissions and demand side measures such as reduced use or production (Kloo et al. 2024). Addressing the fossil fuel subsidies that maintain and exacerbate the current plastics crisis is thus an important action to transition away from an overproduction of SUPs.

Societal cost of externalities

Trasande et al. (2024) estimated that endocrine-disrupting chemicals used in plastics cost the U.S. an estimated USD $250 billion in increased health care costs in 2018 alone. In another study, Cropper et al. (2024) assessed the economic consequences of insufficient regulation of hazardous chemicals in plastics in 38 countries, containing one third of the global population. They concluded that the societal cost of premature deaths and loss of IQ points of USD $ 1.5 trillion could have been saved, if legislation in 2003 had the same protection level as later imposed in 2015.

The environmental toll is similarly profound. A conservative global estimate of the economic impacts of marine plastics by Beaumont et al. (2019) were a staggering USD $2.5 trillion per year, which excludes economic impacts on land or in communities. Clean-up and mitigation impose immense public costs, often borne by municipal and national budgets and often have unintended negative environmental impacts, offering only limited and short-term band-aid solutions (Falk-Andersson et al. 2023).

If these externalities were priced into plastic products, current consumption patterns would be economically unsustainable. Incorporating full-cost accounting into policy frameworks—via taxes, sufficient extended producer responsibility, and elimination of subsidies—would realign market incentives, correct the price signal, and support the transition to a circular and regenerative plastic economy

Placing a price on the human health and environmental costs of plastic pollution is very complex. Particularly regarding the long-term, often invisible health effects, non-market environmental damages, and global-scale intergenerational impacts due to the persistence of plastics in nature (Beaumont et al. 2019). Quantifying the full economic cost of plastic pollution is further complicated by uncertainty driven by data gaps, inconsistent methods, and ethical concerns around discounting future harms and ensuring human rights of vulnerable communities (Beaumont et al. 2019).

Importance of the UN plastics treaty

As demonstrated in this letter subsidies and inadequate pricing of externalities have a major role in sustaining the current linear plastic economy, and thus preventing a needed transition towards a more circular economy, which focus on reducing consumption of plastics, phasing out SUPs and provide a pathway towards a more regenerative and restorative plastic economy. While such changes seem essential, they are also extremely complex, both due to the global and complex industrial ecosystem that constitutes the plastic economy, and because it is in reality impossible to explicitly quantify all impacts and their associated costs.

https://doi.org/10.1017/plc.2025.10019 Published online by Cambridge University Press

As mentioned in the introduction, policies can “destabilize” socio-technical regimes and thus provide foundation for needed transition. The UN plastics treaty can provide such a political foundation for transition, by addressing this pricing failure through three distinct avenues. First, it should include, as part of the mandatory obligations to all Parties, a requirement to phase out all production subsidies for plastics and their feedstocks. Second, it should impose a polymer production fee that is calibrated to the externality costs of plastic production, as determined by an independent scientific body. Finally, the UN plastics treaty should enable a phaseout of SUPs, to minimize plastic pollution and associated externalities. Reporting requirements and regular review of these obligations will be required to ensure compliance and progress toward the goal of facilitating a transition to a new plastic economy, where societal costs are sufficiently accounted for.

Author contribution:

Financial support: The work of KS and EP was supported by the Velux Foundation

Conflict of interest statement: All authors declare no conflicts of interest

https://doi.org/10.1017/plc.2025.10019 Published online by Cambridge University Press

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https://doi.org/10.1017/plc.2025.10019 Published online by Cambridge University Press