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REVIEW PAPER

North–South Waste Trade: Prime Example of the Circular Economy or Major Environmental Threat?

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Abstract

Traditional linear economic models have long since proven their unsustainability in our finite world. Consequently, recent years have seen a steady increase in calls for a transition to circularity. The implementation of the circular economy (CE) in production and consumption practices should allow for growth while preventing irreversible damage to the environment. However, in some sectors, this process hides drawbacks that, if not properly addressed, risk giving rise to problem displacement situations. Waste management is emblematic in this respect. While North–South trade in discarded goods and materials has the potential to powerfully drive a desirable paradigm shift, it also represents a major environmental threat to importing countries in the developing world. Against this background, this paper analyses the current state of affairs at a global level, through a literature review on the subject. It first frames the CE concept and subsequently examines the pros and cons of international waste trade, focusing on second-hand clothing, electronic waste, and plastics. A case study on China's recent waste import ban shows the repercussions of unrestricted waste imports and reflects on the future of the CE, both in the waste industry and more broadly.

Keywords Circular economy · North–South trade · Waste trade

Introduction

Sometimes, we think we have found the solution to a problem, only to discover that the same problem has simply been passed on to someone else. This assumption underlies the concept of "displacement", which Australian political theorist and professor John Dryzek used in his 1987 work, *Rational Ecology: Environment and Political Economy*, to refer to the human tendency "to export or displace ecological problems, rather than truly solve them" [28], p. 19). Environmental philosopher Val Plumwood developed this idea further in 2002. She argued that simply creating "remoteness" between oneself and a given

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problem does nothing but disturb feedback and disrupt the "connections and balances between decisions and their consequences" [77], p. 72). Around the same time, the University of Michigan professor Thomas Princen used the term "distancing" to refer to "the severing of ecological and social feedback as decision points along the chain are increasingly separated along the dimensions of geography, culture, agency, and power" (Princen, Maniates & Conca, 2002, p. 16).

In light of this view, this paper aims at demonstrating how international trade in waste risks becoming a clear example of problem displacement. Many trade routes from the Global North to the Global South are often promoted in the economic literature as pivotal for the transition to circularity. While this may be true in some cases, these routes also have a particularly damaging effect on the planet, and hold the potential to cause severe global disruption. To this end, the "Circular Economy" section presents a literature review on the subject, starting with the very concept of the circular economy (CE) and gradually moving towards an analysis of more concrete issues concerning the relation between cross-border flows and the environment. Waste trade between developed and developing countries, with its pros and cons, is the subject of the "Waste and Trade: the Global Scenario" section, which begins with a look at the current global picture of waste production and management. This section ends with three subsections, each dealing with a specific type of internationally traded waste: second-hand clothing, electronic waste, and plastics. These waste types were chosen due to the massive environmental impact of discarded products belonging to these categories on receiving countries.

The scope of the discussion then narrows through the presentation of a case study on China's recent waste import ban. The "China's Waste Import Ban: Background and Content" section aims at providing insight into the process by which China transformed from an essentially closed economy to the world's top exporter of consumer goods and—until 2018—largest importer of waste. After presenting a brief overview of previous Chinese legislation on the transboundary movement of solid waste, the section examines the reasons behind the local government's swift change of attitude towards this industry, culminating in the adoption of the ban. The "China's Waste Import Ban: Immediate Consequences and Long-Term Impact" section looks at the repercussions of the ban on international trade routes and provides examples of how different countries have reacted in their adaptation efforts. A concluding section outlines the key findings of the paper and reflects on the future of global waste management and trade, vis-à-vis the transition to CE models in our rapidly changing world.

Circular Economy

Current material and energy flow models based on the traditional "extract-produce-use-dump" paradigm have long proved their intrinsic unsustainability [34]. Global natural reproduction rates cannot keep pace with those of throughput flow. To avoid (or minimise) irreversible consequences, the mainstream approach to production must be radically changed.

In recent years, many scholars have started to advocate for a CE-type economic transition, reflecting "an approach to economic growth that is in line with sustainable environmental and economic development" [49], p. 37). Such a transition would aim at ensuring that resources retain the highest possible value and quality throughout their life cycle, thereby maximising efficiency. With a view to reducing energy and material consumption, the reuse, refurbishment, and repair of goods should be preferred. Should these options be non-viable, then remanufacturing and raw material utilisation may be valuable alternatives. Combustion for energy should be the second to last choice, preferred only to landfill disposal [49].

The CE does not yet perfectly match the ideal cradle-to-cradle concept of "eco-effectiveness", which describes a system that relies wholly on renewables and recycles every unit of output [49]. Nonetheless, even in its cascading understanding, it makes much more economic, environmental, and even social sense than linear "running-down" business models. Still, some theoretical and practical challenges stand out with respect to the full-scale implementation of the CE in modern society.

First and foremost, issues arise concerning path dependencies and lock-in phenomena. CE-type innovations must resist the pull of existing technologies, customs, and management models, in order to overcome dominant regimes [65]. It is a proven fact that business logics do not necessarily favour efficiency and overall superior quality. On the contrary, reluctance in favour of incumbent models is common to nearly all markets [6],see also [69].

Second, there are limits to the possibilities offered by thermodynamics. The laws of entropy make the achievement of net-zero side-products extremely complex in practice, irrespective of the activity performed. Until complete nature-economy-nature cycles become a reality, the physical scale of economic growth will always pose a concrete threat to nature's regenerative ability. Even assuming the achievability of perfect circularity via the exclusive use of fully renewable energy sources, only its organic application to the entire system in which it operates would allow for a condition of permanent sustainability. In other words, a true CE will be attained only when—and if—it acquires full global reach. Unfortunately, this is made difficult by the human tendency to displace and shift problems. Oftentimes, gains in local and regional contexts result, either directly or indirectly (i.e., through supply chains, value chains, product life cycles, and their networks), into issues in other locations [49].

To make things worse, despite sectoral advancements, the international community still lacks a global governance body—or even just a universally shared vision on the matter. The European Union (EU) represents a notable exception in this sense, due to its recent policy efforts to improve circularity and sustainability within the EU27. Owing to the so-called Brussels effect,[1] the CE concept is gradually gaining ground, even outside of Europe, and many national and local governments have started to perceive it as an important driver of growth and development. However, no major transition is completely free from downsides. While recognising the enormous environmental, economic, and social benefits that a full transition to CE models would bring, recent studies have also begun to shed light on its potential criticalities.

[1] The term "Brussels effect" refers to the process through which EU policymakers unilaterally influence international regulations and standards by de facto externalising EU laws outside EU borders via global commerce. For more on the Brussels effect, see Bradford [16].

Waste and Trade: the Global Scenario

Among the various issues, those linked with both established and emerging transboundary waste trade flows are particularly relevant. Our planet is naturally capable of absorbing waste and converting it into harmless or ecologically useful products, albeit only up to a certain threshold. Within the scientific community, this threshold is commonly referred to as the “waste-sink” capacity. As a rule, the greater the quantity of waste produced, the higher the likelihood of both biophysical and social constraints [93].

Unfortunately, global trends seem to be moving in this exact direction. According to a recent World Bank report, in the absence of urgent action, global waste is estimated to increase by 70% on current levels, by 2050. Furthermore, driven by exponential population growth, increasing urbanisation, and incremental income changes, annual waste generation is expected to jump from a little more than 2 billion tonnes in 2016 to roughly 3.5 billion tonnes over the next three decades [47]. Despite these trends, displacement strategies are consistently being adopted over long-term solutions, with many governments and local administrations disposing of excessive unwanted output where its unpleasant or harmful attributes can no longer be perceived. Of note, this solution creates a distance between consumers and garbage that is not only geographical, but also psychological. In fact, the mental dimension is arguably more detrimental, as it has the potential to negatively influence levels of awareness and responsibility [22].

Overproduction and the mismanagement of waste can pose significant risks to human health—first and foremost, by releasing toxic airborne chemicals and contaminating water sources with liquid runoffs. Unsurprisingly, a 2010 UN-Habitat study found that, on average, areas with poor collection services register twice as many cases of diarrhoea and six times as many of acute respiratory infection, compared to areas with better infrastructure [95]. Dumped waste can provide food and shelter for rats, mosquitoes, and other infectious disease–carrying animals [47]. Waste may also threaten human health by contributing to climate change via the CO_2; it generates when disposed in landfills lacking in appropriate gas capture systems. In this regard, it is estimated that solid waste–related emissions (excluding those associated with transportation) account for approximately 5% of global GHG emissions. These are expected to increase to 2.6 billion tonnes of CO_2-equivalent per year by 2050 [47].

The situation is particularly worrying when one considers the figures around waste collection and disposal. While waste collection rates in high-income countries are close to 100%, they are significantly lower in low- and low-middle–income countries, which register rates of 39 and 51%, respectively. Around the world, a mere 19% of waste undergoes material recovery through recycling and composting, and only about 11% is treated through modern incineration. Approximately 37% is disposed of in landfills and the rest—a whopping 33%—is burned or dumped in roads, open lands, or waterways [47].

Despite only accounting for 16% of the world’s population, rich developed countries generate more than one-third of the world’s waste [47]. Faced with waste-sink capacity problems, such countries have increasingly resorted to displacement strategies in the form of waste export, especially to the Global South. Increasingly demanding governmental waste recycling targets, rising landfill taxes, landfill bans, and lower labour costs and environmental standards in receiving destinations have long been amplifying this trend [73]. Even the evolution of international markets has played an important role. In particular, trade deficits between developed and developing countries (especially Asian countries, such as China, India, Vietnam, and Malaysia) have created asymmetric demand for shipping services in the two directions, thereby decreasing backhauling freight rates to countries of export. This situation, together with improvements in shipping efficiency due to the diffusion of containerisation, has significantly increased the North's arbitrage conditions for waste shipment to the South [48].

Undoubtedly very cost-effective according to the tenets of neoclassical economics, North–South waste trade seems prima facie just as desirable when considered within a CE frame. In fact, waste import represents a precious opportunity for industrialising countries, providing a much-needed source of low-cost raw materials to fuel economic growth. However, over time, the associated health and pollution problems have become ever more difficult to ignore, leading to less convenient trade-offs. When the social and environmental burdens of such trading become too unevenly distributed, waste trade stops being an asset and turns into a new form of colonial-like exploitation, usually referred to as "ecological imperialism" [25],see also [38, 93].

This is particularly true when hazardous waste is involved. It is therefore no coincidence that the most notable attempts to internationally regulate the sector have focused on this very category. Largely as a result of civil society campaigning, the last three decades have seen a considerable proliferation of multilateral agreements in this area, to the point of making it highly fragmented. Of the various existing treaties, three are commonly positioned at the institutional core: the 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal,[2] the 1998 Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade,[3] and the 2001 Stockholm Convention on Persistent Organic Pollutants.[4]

Although all of these treaties boast almost universal support among the international community (with 187, 165, and 185 members, respectively), none has been as effective in reducing toxic waste "imperialism" as proponents originally hoped. While the initiatives promote high ideals and goals, they are significantly flawed in their enforceability. The current system, which relies on lists and classifications laid down in numerous different annexes, clashes with the quintessentially long updating times of international law, making it difficult for conventions to keep pace with innovations in the field [79]. Vague or outdated provisions traditionally complicate the management of transboundary shipments, as they force countries to independently fill regulatory vacuums with domestic norms that oftentimes do not match those of other signatories [54]. Cross-national regulatory differences similarly undermine the fair functioning of the system, given that the vast majority of implementation and enforcement issues are left in the hands of individual governments [74]. Many experts also argue that among the reasons why the effectiveness of the entire regime has fallen short of expectations is the failure of the USA to ratify all three conventions. Given that this country is the largest producer of waste in the world [47] and one of the major exporters of hazardous substances, with a total of well over 10 million tonnes in the 2007–2015 period [88], its non-membership in the agreements causes a large part of the market to fall out of their intended regulatory scope. At the same time, signatories

[2] The text of the Basel Convention and its amendments are available at http://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.aspx (last accessed: 30/09/2022).

[3] The text of the Rotterdam Convention and its amendments are available at http://www.pic.int/TheConvention/Overview/TextoftheConvention/tabid/1048/language/en-US/Default.aspx (last accessed: 30/09/2022).

[4] The text of the Stockholm Convention and its amendments are available at http://www.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx (last accessed: 30/09/2022).

trading with the USA may have no incentive to fully commit to the values of the conventions, as Washington's non-party status allows them to apply a different set of rules to waste-related commercial transactions.

However, the greatest issue is arguably fraudulent shipping. According to UNEP, "[t]he global waste market sector from collection to recycling is estimated to be USD 410 billion a year, excluding a very large informal sector. In common with any large economic sector, there are opportunities for illegal activities at various stages of legal operations" [84]. The scale of the problem is such that another report on money laundering in environmental crimes estimated that illicit waste trafficking generates a total of USD 10–12 billion annually [33]. Unfortunately, neither Basel, Rotterdam, Stockholm, nor any other bilateral or multilateral agreement, has so far succeeded in putting an end to the illegal trafficking of hazardous waste. As a matter of fact, data shows that since the Basel Convention first came into effect, the black market for hazardous substances disposal has actually grown [93]. Although illegal dumping and under-the-table disposal contracts are now less common than in the past, hazardous waste is often still transported to developing countries through several illicit methods [62]. Limited international coordination in the fight against crime and significant disparities in enforcement resources only make the problem worse [62], especially in light of the high levels of resiliency displayed by traffickers. Tighter controls in one country, in fact, generally lead to nothing but an almost immediate shift of illegal shipments through and to neighbouring countries [84].

Apart from conventionally hazardous waste, three types of globally traded goods are particularly relevant to the CE: second-hand clothing, electronic waste, and plastics. The reason for this is twofold. First, products belonging to these categories follow almost exclusively one-way export routes from the Global North to the Global South. Second, owing to their intrinsic features, products in these categories pose significant environmental and social sustainability challenges. Both aspects are analysed in detail, below.

Second-Hand Clothing

Fashion is, by nature, limited in time and space. The constant drive of the fashion industry to innovate and substitute old trends with new ones inevitably leads to a large volume of unwanted items. Significant drops in prices [85] and the rapid spread of the so-called fast fashion[5] in developed economies have contributed to further encourage the overproduction of garments and "purchase-discard" consumption models (Marcello Falcone, Yılan & Morone, 2022), as confirmed by several studies. According to the European Environment Agency (EEA), between 1996 and 2012, the amount of clothing purchased per person in the EU grew by 40% [85]. Other estimates of global average consumption have reported a 60% annual increase since the turn of the century. Adding to this, consumers have been found to keep clothes about half as long as they did in the early 2000s (Remy, Speelman & Swartz, 2016), with the majority of garments being worn only once before being thrown away [29, 30],see also Global Fashion Agenda & The Boston Consulting Group, 2017).

World markets are not sufficiently large to absorb the volume of textile material that would come from recycling all discarded goods. As a result, over half of this discarded

[5] The term "fast fashion" refers to the relatively recent approach to the design, creation, and marketing of high volumes of cheap clothing, in line with quickly changing fashion trends. For more on fast fashion, see Bhardwaj and Fairhurst [13]. For a focus on the environmental impact of fast fashion, see Niinimäki et al. [67].

material is transferred to incinerators or landfills [85], oftentimes without undergoing any treatment (Marcello Falcone, Yılan & Morone, 2022). Perhaps surprisingly, household consumption is not the main contributor to the phenomenon. In fact, unsold and unworn goods (also known as "deadstock") currently account for a whopping 73% of disposed garments, and this number is expected to climb to 81% by 2030 (Global Fashion Agenda & The Boston Consulting Group, 2017).

While the focus of this paper is on waste, it is important to stress that the impact of the fashion industry on nature is by no means limited to the end-of-life phase of clothing items. On the contrary, pollution emerges from all stages of the garment life cycle, making the sector responsible for 8–10% of global CO_2 emissions [67]. Textile production is also known for being particularly water-demanding, consuming 93 billion cubic metres annually [29, 30]. Furthermore, the different types and mixes of fibres used in the manufacturing process can harm the environment in many ways. For example, cotton cultivation requires an enormous amount of water and is often associated with the use of toxic pesticides and fertilisers,wool contributes to GHG emissions via livestock breeding; silk is especially detrimental in terms of resource depletion [85],and synthetic fibres such as polyester and nylon (which, in 2010, represented 60% of global apparel fibre) are traditionally made from non-renewable fossil–based materials (European Environment Agency, 2014). The process of transforming raw materials into fabric and subsequently garments is notoriously energy-intensive. The same can be said for dyeing, which can involve the consumption of up to 150 L per kilogram of the final product. To make things worse, when production takes place in countries with poor environmental standards, unfiltered wastewater is commonly released into waterways (Global Fashion Agenda & The Boston Consulting Group, 2017). The impact of transport, delivery, and distribution through global supply lines must also be considered, in addition to collateral waste in the form of packaging [85]. It is the consumer use phase, however, that has the largest environmental footprint. Enormous quantities of water, energy, and chemicals are used in washing, tumble drying, and ironing. Moreover, these activities also release microplastics, which increase freshwater and marine toxicity (European Environment Agency, 2014).

Driven by a substantial increase in production [17] and—at least on paper—growing support for CE principles within the fashion industry, second-hand trade in clothing has recently proliferated (Marcello Falcone, Yılan & Morone, 2022). According to the UN, the reported value of global exports in second-hand clothing has been steadily rising, from USD 0.75 billion in 1990 to USD 1.53 billion in 2001 and USD 4.2 billion in 2018 [51]. In 2020, the top five exporters were the USA, China, the UK, Germany, and South Korea, whereas the top five importers were Ghana, Ukraine, Pakistan, the United Arab Emirates, and Nigeria. Despite the presence of Ukraine among the main destination countries, the trade flows for second-hand clothing have mostly been from the Global North to the Global South. Currently, shipments to Africa, in particular, account for almost one-third of the total share [70],however, scholars believe that official statistics might not be adequately capturing an even larger amount [17].

Debate over the desirability of the second-hand market has established two opposing factions. On the one hand, those who support this market claim that it improves living conditions both directly, through the provision of quality clothing at affordable prices, and indirectly, through the creation of job opportunities along the entire supply chain. On the other hand, those who criticise the second-hand market point out that it gives rise to several complex problems, especially in the countries that, in theory, should benefit from it the most [51].

It has been argued that reuse is always more beneficial than recycling, for both society and the planet. The same applies to recycling over disposal.[6] Given the high costs of the textile value chain (in terms of pollution and resource depletion), keeping final products “in the loop” for as long as possible seems a particularly sound CE strategy. Indeed, if supported by concerted multilateral initiatives and concrete, enforceable policies, trade in used clothes would undoubtedly make an extremely valuable contribution to global circularity efforts. Unfortunately, the current reality is different, and the North–South second-hand business often struggles to go beyond mere pollution shifting [59]. Approximately 80% of all garments collected are redistributed within the international market [5], and garments shipped to the least-developed countries are mostly low quality. High-quality items, in contrast, are typically acquired by charities (e.g., the Red Cross, the Salvation Army, Oxfam) and other commercial actors within the countries in which they are first donated (Ljungkvist, Watson & Elander, 2018). What remains following this acquisition of valuable apparel and accessories goes through a further selection process. Relatively higher-quality items are sold in retail shops in Eastern Europe, while lower-quality items are exported to Africa, Asia, and South America. Finally, those classified as non-reusable are traded in global recycling markets, either in their country of origin or abroad (primarily in Pakistan or India) [5].

The quality of second-hand clothes is not only relevant in terms of the usability of the clothes, themselves, but also with respect to less evident yet non-negligible environmental implications and the information asymmetry between exporting and importing actors [1]. Used apparel is shipped in bales weighing 45–450 kg each, with little to no information about their content. Players at the end of trade flows negotiate materials and prices with the supplier in the country of origin (or with one of the many intermediaries involved), but have no way of assessing the actual value of their order, prior to purchase. It is only when the bales reach their final destination that buyers can open them and see what they have acquired. In some cases, the clothes are in good condition and can be transported to local markets and neighbouring regions,but in other cases, they are totally unusable, due to poor quality or design features, and become waste mere minutes after their import. In fact, the odds of this latter scenario are surprisingly high, as evidenced by a recent case study of Ghana, which found that 40% of used clothing arriving to this country ended up in a landfill almost immediately [101].

In light of the above, it is fair to say that a significant share of second-hand textile products reaches developing countries from high-income economies in the form of waste. New and effective policies must be implemented at both ends of this trade, to avoid “green washing” or “circular washing”. Some countries, especially in sub-Saharan Africa, have already introduced import bans, and others are considering various restrictions (e.g., taxes, tariffs). However, these measures are unlikely to be effective without complementary regulations to counter black markets and cross-border smuggling activities [51], especially when smugglers can count on the complicity of companies in the Global North [17]. As for exporting countries, some improvements have already been made, most notably within the EU. However, despite the existence of several ambitious policy initiatives, many issues related to North–South second-hand clothing trade remain unresolved. Stronger and more comprehensive multi-stakeholder efforts are needed, especially with regard to environmental challenges.

[6] For a focus on the apparel industry, see Bubicz, Barbosa-Póvoa, and Carvalho [19].

Electronic Waste

Waste electrical and electronic equipment (WEEE, or e-waste) encompasses a vast and heterogeneous variety of product types (some believe up to 900) [99]. Generally, anything with a plug, electric cord, or battery fits into this category, regardless of its function or material composition (World Economic Forum, 2019). The intensive production and use of electronics caused by the information and communication technologies (ICT) revolution has led to an unprecedented increase in the generation of e-waste across the world, to the point that WEEE is one the fastest growing waste streams, globally [9],see also [91]. The phenomenon is most evident in high-income countries, which are estimated to generate five times as much waste than developing ones, with the total volume only increasing [47]. In the EU, alone, 12 million tonnes of WEEE were generated in 2019, compared to 11.6 million in 2014 [39]. What is worse, relentless technological progress, shrinking product lifespans,[7] and the scarcity of repair options have contributed to the problem by pushing discard rates even higher [20].

From a resource perspective, e-waste is a complex mixture of valuable materials. Metals cover the dominant material fraction, accounting for approximately 60% of total weight [39]. Furthermore, the presence of elements with high intrinsic value (i.e., gold, silver, palladium, copper, lithium, and cobalt, to name only a few) provides great economic incentive for recovery [50]. For context, it is estimated that as much as 7% of the world's gold may be contained in discarded electronic equipment, with electronic devices containing 100 times more gold per tonne than gold ore (World Economic Forum, 2019). In monetary terms, WEEE is worth at least USD 62.5 billion per year, which is more than the GDP of approximately 120 countries [8]. However, despite these potential benefits, only a mere 15% of global e-waste is properly recycled. Research shows that a significant proportion of the remaining resources are squandered due to low collection rates and low-efficiency processing practices [41]. This threatens both human health and the environment, given that most electronic products also contain hazardous substances that, when not properly managed, end up polluting surrounding soil and groundwaters [43].

Once again, major issues are associated with transnational trade flows. Part of the literature on the subject frames WEEE trade as "a story of development rather than dumping" [93], p. 252). Indeed, some studies seem to suggest that shipments to low- to medium-income countries—which are estimated to receive 70–80% of all WEEE [2]—are not necessarily packed with unusable goods [90]. Rather, they would be rich in items that are either fully functional or usable after basic repair [60]. People in emerging economies would thus be granted access to equipment that they would otherwise not be able to afford, while benefiting in terms of technological innovation and job creation. However, numerous activist groups feel otherwise. They question the motives of studies sponsoring e-waste trade, suggesting that they are intended to protect the interests of powerful technology companies [81]. In fact, refurbished electronics have an extremely short lifespan and typically wind up in landfills not long after their recovery. Moreover, they are frequently deposited in landfills under unsafe conditions, as it is not uncommon for the countries of destination to lack the infrastructure to adequately manage WEEE in an environmentally

[7] Shrinking product lifespans can often be traced back to the so-called "planned obsolescence" phenomenon. In economics and industrial design, this term refers to the strategy of planning or designing a product to ensure that its latest version becomes out of date or useless within a known (usually short) period of time. For more on planned obsolescence, see Bulow [20].

sound manner. With this in mind, it is fair to say that trade in e-waste risks evading strict regulations by disguising waste dumping as a CE effort.

A significant share of exported WEEE violates transboundary shipment frameworks [41], and the volume of hazardous substances arriving in developing countries through valueless digital devices is likely much higher than that which is suggested by official data [93]. Statistics on WEEE import/export are notoriously inadequate or completely lacking for many countries [2], and grey areas between what constitutes a second-hand product and what is an unsalvageable item make it difficult to distinguish legal from illegal shipments [84]. Under the Basel Convention, hazardous waste should be reduced to the minimum and disposed in the member state in which it was generated. Nonetheless, illicit operations and legal loopholes have often been used to bypass national and international regulations. A study conducted on Ghana, one of the main recipients of WEEE globally, suggests the extent of the problem: in 2009, 70% of electronic appliances sent to the country were labelled as functional second-hand goods,yet many were in a near- or end-of-life condition and had no practical use whatsoever, leading to a considerable amount being classified as waste and dumped immediately [4].

Once WEEE is sent to dumping sites, it is usually processed by informal operators and their families, children, and pregnant women included [7],see also [92]. Most of the necessary processes are carried out manually and with relatively crude techniques. Metals and chips are recovered by melting electronic boards on an open fire, burning cable wires, or using solvents and acids to get rid of unwanted materials [2]. Prolonged exposure to toxic substances such as lead, mercury, and cadmium is associated with a greater incidence of health issues among individuals and communities living close to where these activities take place [41].

Apart from these obvious justice concerns, e-waste is particularly worrying for its environmental consequences. Electronic equipment discards account for approximately 70% of the heavy metals found in landfills [76], and many polluting byproducts of informal recycling are notorious for their tendency to escape processing sites and leak into ecosystems [89],see also [106]. In this scenario, it is easy to understand why WEEE-related widespread pollution in air, soil, and water is emerging as one of the most pressing issues, both regionally—throughout Southeast Asia, sub-Saharan Africa, and Latin America—and globally [2]. Owing to its magnitude, the electronics industry is also a significant contributor to climate change. It is predicted that, by 2040, the manufacturing and use of electronic devices could account for 14% of global carbon emissions, if no substantial measures are taken [11]. However, the source of the problem might also contain a germ of its own solution, given that, according to recent findings, mining WEEE for valuable materials may produce up to 80% less CO_2 than mining the same materials from the ground (World Economic Forum, 2019). While this is just one example, it demonstrates that the application of an actual, unquestionable CE approach to e-waste may provide tremendous environmental and economic benefits to all parties. Hopefully, together with resource scarcity and price fluctuations for precious minerals, this will incentivise the Global North to cease WEEE dumping to the Global South.

Plastics

The word "plastic" comes from the Greek πλαστικός (*plastikos*), meaning "capable of being shaped or moulded". This property, together with low density, low electrical conductivity, transparency, and toughness, makes plastic an extremely versatile material that can be manufactured into countless cheap and sanitary products. Since it was first developed in the nineteenth century, plastic has found applications in a number of sectors and contributed to major technological advances, as well as financial savings.

True mass production of plastic began after the Second World War, and it has been increasing ever since. Global annual production has grown from 2 million tonnes in 1950 to 380 million tonnes in 2015. It is projected to double by 2035 and almost quadruple by 2050 [10]. It is estimated that the total amount of plastic ever produced is approximately 8300 million tonnes [35]. Currently, China is the world-leading producer, with a 28% share. The rest of Asia accounts for 21%, North America (namely the USA, Canada, and Mexico) for about 19%, Europe for 18%, and the rest of the world for the remaining 14% [10]. When it comes to consumption, however, the picture is much different. Almost half of all plastic waste is generated in OECD countries, with the US registering the highest per capita rate, at 221 kg [72].

Despite their increased capacity for recycling and recovery, the waste management facilities of richer economies are still unable to treat the massive volume of plastic waste generated by both households and businesses. As a result, they often resort to international markets in an attempt to ease economic and environmental pressure on their national systems. The extent of this phenomenon is such that, in 2016, nearly 50% of exported plastic originated in G7 countries. Equally emblematic is the fact that, during the period 1998–2016, the EU was responsible for almost one-third of global plastic exports. As is often the case, waste trade flows tend to extend in a North–South direction, driven by the willingness of developing economies to sacrifice social and environmental conditions in exchange for a boost in industrial growth. Lower environmental standards and favourable tax regimes represent further incentives [27].

In most cases, the plastic waste trade represents yet another example of problem displacement, as it does nothing to actually address the serious CE challenges posed by the current overuse of synthetic materials. Indeed, according to a recent report, close to 90% of historical global plastic waste exports consist in single-use food packaging (Brooks, Wang & Jambeck, 2018)—the recovery of which is made particularly difficult by the multiplicity of polymer groups, resins, and additives commonly used in their production. This, together with high sorting costs and overall lower quality dictated by the lack of widespread standards, means that demand for secondary plastics remains relatively low (Material Economics, 2018). Moreover, the plastics that do get salvaged are mostly recycled into lower-value applications that do not allow for further recovery. As a result, recycling rates for waste plastics are far lower than those of paper (58%) and iron and steel (70–90%). It is likely that, without significant changes in design and material structure, almost one-third of plastic packaging will never be reused or recycled [30]. According to a 2017 study, "[m]ore than 40 years after the launch of the first universal recycling symbol, only 14 per cent of plastic packaging is collected for recycling", so that, "[t]oday, 95 percent of plastic packaging material value, or USD 80–120 billion annually, is lost to the economy after a short first use" [30], p. 12).

Furthermore, the expenditure of low-income countries on waste management systems is only one-third of that of high-income ones [103]. Therefore, once plastic waste reaches its country of destination, it is likely to be mismanaged: "left uncollected, openly dumped, littered, or managed through uncontrolled landfills", due to the inadequacy of local infrastructure [27], p. 21). When not properly managed in a controlled treatment facility, plastic waste risks compromising the wider environment, polluting land and water ecosystems. A 2018 study found that ten rivers in Asia and Africa carry more than 90% of global plastic waste into the oceans. The Yangtze, alone, pours approximately 1.5 million tonnes into the

Yellow Sea each year [86]. With 60–70% of all plastic produced since the 1950s lying in landfills or already released into nature [35], plastic waste (and its trade) represents one of the greatest environmental threats of our time.

Plastics can harm humans, flora, and fauna in several ways. Much of its great popularity stems from the fact that it is very durable, and in fact, most plastic objects do not biodegrade at all. They are nonetheless subject to wear and tear, which causes them to break down into minuscule particles that contaminate air, soil, and water sources. Their extremely small size makes the so-called "micro" (< 5 mm) or "nano" (< 0.0001 mm) plastics particularly difficult to detect and remove from the environment, where they accumulate. Over time, they release toxic chemicals, including persistent organic pollutants (POPs), linked with cancer and other neurological, reproductive, and developmental diseases. Micro- and nano-plastics can also directly enter the human body via the food chain or through packaging [40]. This is all the more worrying when one considers that packaging and other single-use products make up roughly 50% of global plastic manufacturing output [42].

Both the production and the incineration of plastic release a handful of pollutants into the atmosphere. In the USA, alone, the plastic industry is responsible for at least 232 million tonnes of CO_2 emissions each year—an amount equivalent to that of 116 average-sized coal-fired power plants. As the petrochemical infrastructure continues to expand, the contribution of plastics to climate change is expected to outpace that of coal by the year 2030 (Beyond Plastics, 2021). While GHG emissions are known to exacerbate global warming, lesser-known toxic particles can be just as harmful, due to their tendency to settle on crops, degrade nearby water bodies and aquifers, and directly affect human health by increasing the risk of heart and respiratory diseases [103].

Litter, itself, poses numerous threats. The impact on wildlife and biodiversity is surely one of them, but trashed plastic items can also be dangerous to maritime transport. In fact, a study estimated the cost of plastic debris damage to commercial shipping in the Asia–Pacific Economic Cooperation (APEC) region at approximately USD 279 million per year (McIlgorm, Campbell & Rule, 2008). Finally, discarded plastic goods—and especially bags—can choke sewers and clog drainpipes. This has been found to intensify the effects of floods and other natural disasters [45], as well as to increase the incidence of vector-borne diseases by providing breeding grounds for mosquitoes and other pests [68].

As is the case for many types of waste, the cross-boundary shipment of plastic waste or scraps for disposal or recycling is regulated by national and international policy frameworks. However, plastic waste still manages to make its way out of developed countries through "port-hopping",[8] the bribery of customs authorities, misdeclaration, concealment, and other illegal methods [27]. To complicate matters, most illicit trade in waste—and not only in plastics—is run by licit businesses, and the fine line between legal and illegal practices in such a complex global scenario makes it difficult to prosecute potential criminals [36],see also [84].

To counter the detrimental effects of unrestricted waste imports, many emerging economies have introduced unilateral trade bans and waste control legislation. Based on the above considerations, some insiders believe—perhaps pessimistically—that such bans will likely have low success rates if not accompanied by more stringent inspections and enforcement strategies. Although relatively new, this phenomenon has already spawned extensive

[8] The term "port-hopping" refers to the practice whereby illegal waste exporters avoid frequently inspected transport hubs in favour of ports with weaker controls and regulations. For more on port-hopping, see Rucevska et al. [84].

academic literature. The presence of China in the list of countries that have decided to stop the flow of plastic waste to their ports has generated great interest in the scientific community. The following section analyses the measures imposed by the Chinese government and reviews some of the most recent research findings on the contribution of these measures to the global transition to CE models.

China's Waste Import Ban: Background and Content

Prior to the late 1970s, China's trade system was heavily centralised. National objectives were pursued almost entirely via economic planning, to the extent that more than 90% of all imports were determined by the State Planning Commission [53].[9] Export rules were just as cumbersome. Foreign trade was conducted by only a handful of state-owned—and tightly controlled—trade corporations, which typically dealt in a narrow range of commodities, for which they were assigned sector-specific concessions [52].

Far from encouraging domestic growth, these top-down statutory restrictions on both the volume and the composition of trade often undermined the efficiency of domestic resource allocation. This limited China's economic expansion by impairing its financial ability to import innovative products and technological equipment from developed countries. It was only under the rule of Deng Xiaoping that the system began to be gradually dismantled. By the end of the century, it had almost completely given way to economic reform based on the theories and policies of the well-known "socialism with Chinese characteristics".[10] Import substitution lists were abolished, and the state authorised tens of thousands of companies to engage in foreign trade transactions.

These measures were followed almost immediately by a phase of further economic development and significant improvement in living standards. As a result, the demand for raw materials increased manyfold, particularly with regard to plastics. In a short amount of time, the demand for both plastic feedstock and finite products rose by an average of 21% per year [97]. At the turn of the twenty-first century, China had become one of the world's largest plastic producers,[11] second only to the USA. However, despite simultaneous efforts to expand the petrochemical and plastics industries—which were growing by 11% annually—national production was unable to meet the surge in domestic demand. Nonetheless, the Chinese plastic cycle was still highly dependent on the international market. At a time when rising oil prices were causing significant increases in the price of virgin plastic, petroleum went from being one of China's main export commodities (30 million tonnes in 1985) to a scarce resource to be purchased from overseas. Between 1990 and 1994, the country's crude oil imports soared by 147%, and Beijing became a net importer of oil-based products shortly after [97]. To ease the resulting economic pressure, companies sought to keep costs down by importing large quantities of waste plastic materials for

[9] Currently known as the National Development and Reform Commission of the People's Republic of China (NDRC), the former State Planning Commission and State Development Planning Commission is a macroeconomic management agency under the State Council, with broad administrative and planning control over the economy of mainland China.

[10] The term "socialism with Chinese characteristics" refers to the approach of the Communist Party of China (CPC) to govern the country in line with a heavily revised version of traditional communist doctrines. For more on socialism with Chinese characteristics, see Boer [14].

[11] NB: China is currently the world's top plastic producer, responsible for 32% of global plastic production. See Liu et al. [55].

recycling [104]. While in 1995, waste plastic imports were estimated to amount to just over half a million tonnes [97], in less than a decade's time (2004), this volume had risen to over 4 million tonnes [104].

Beijing's heavy reliance on external input to satisfy its ever-growing need for plastic materials soon turned the country into the leading global importer. As shown by the first official reports, China imported a staggering 106 million tonnes of plastic waste in the period 1992–2016. Unsurprisingly, it accounted for 45.1% of all cumulative plastic waste import, or 72.4% when also considering Hong Kong's share (for a time, after the 1997 handover, the city continued to act as a separate gateway for mainland China, due to its special status). At the same time, major shipping countries became almost dependent on this trade, as it allowed them to preserve their national solid waste management infrastructure (Brooks, Wang & Jambeck, 2018). The USA, Taiwan, and Japan were initially the dominant partners, accounting for more than 80% of total exports in waste plastic [97]. However, it did not take long for the EU to catch up. Germany, Belgium, and the Netherlands became particularly active in this regard, but significant outbound traffic was also observed in France, Italy, Spain, and the UK [104].

At the initial stage of the Chinese economic boom, legislation on the transboundary movement of solid waste was virtually non-existent. The country needed raw materials and the developed world was more than willing to supply them. It was only in 1991 that the Chinese government began to discipline foreign waste flows. However, the introduction of increasingly strict standards and limitations did not stop the volume of imports from growing. In addition to the abovementioned 4 million tonnes of imported plastics, a further 12.3 million tonnes of used paper, 10.22 million tonnes of scrap iron, 3.95 million tonnes of copper scrap, and 1.2 million tonnes of aluminium scrap were recorded by official customs data, in the year 2004, alone. The scope of these earlier measures was in fact quite limited, at first. Unsurprisingly, the number of cargo ships from all over the world unloading enormous quantities of falsely labelled prohibited materials in Chinese ports also grew, as waste smuggling attempts increased in number and magnitude [104].

It was only in 2013 that Beijing launched a series of government efforts to implement previous norms on the quality of imported plastics via direct container inspections [98]. Similar policies aimed at enforcing recently introduced dispositions, including an import ban on 24 kinds of solid waste, such as post-consumer plastics, unsorted mixed paper, textiles, and select trace metals [105]. The ban was first notified to the WTO on 18 July 2017 and implemented on 1 January 2018. Despite immediately receiving strong reactions, it was shortly followed by an even stricter one, scheduled to take effect on 1 March of the same year. This second ban added 32 other types of solid waste to the previous list. Finally, in July 2018, the Chinese Ministry of Ecology and Environment proposed a full ban on solid waste, which has remained in force since January 2021. Technically speaking, China does still accept some forms of scrap. However, its standards for the cleanliness and purity of materials are so high (99.5%) that it is virtually impossible for any exporter to meet them [15].

The reasons behind such a swift and drastic U-turn are manifold. Politically, the new policy approach aligned with the "Beautiful China Initiative" (BCI), President Xi Jinping's "five-in-one" development strategy for economic, political, cultural, social, and ecological progress aimed at guiding the country towards the realisation of the Two Centenary Goals and the fulfilment of the UN's "Agenda 2030" [32].

The ban also makes sense from an economic standpoint. First and foremost because, when it comes to pollution, prevention is always cheaper than restoration. Second, because China currently has a solid waste treatment backlog of 60–70 billion tonnes [75], and given the increasing costs of labour over the past decade [26], the use of imported waste requiring prior processing to bolster national production no longer seems profitable.[12] The realisation that most waste resources can now be sourced domestically has led to greater efforts to improve the country's collection and recycling system [27]. The closure of borders to all inbound waste streams has certainly dealt a blow to the informal waste treatment industry, but data show that it has also triggered significant advancements in national recycling schemes, while benefiting related industries [57],see also [58].

Nonetheless, rising awareness of both the human and the environmental cost of waste imports is arguably the main factor driving this shift [105]. China's enormous size and former tendency to accept almost all sorts of waste revealed the consequences of unrestricted trade on nature. With time—and following exponential increases in income levels—the Chinese public grew more aware of the issue and started calling for more ambitious environmental protection policies [55],see also [87].

China's Waste Import Ban: Immediate Consequences and Long-Term Impact

Although somewhat anticipated by the escalation in environmentally oriented policy interventions during the last two decades of Chinese politics, the first ban caught the international community by surprise. China had been handling approximately half of the world's recyclable waste for almost a quarter century, and the country's sudden decision to refuse any further intake had immediate and widespread repercussions [46]. Deep-rooted dependency on China had long been discouraging exporting countries from modernising their waste management infrastructure and developing adequate domestic markets for recycled materials. Collective unreadiness soon snowballed into near-crisis scenarios.

Many advanced economies struggled to cope with the immense volume of waste displaced by the ban. This is not surprising, considering that 70% of the plastics collected for recycling in the USA, and a staggering 95% in the EU, had previously been routinely shipped to Chinese processors. As a result, in the absence of more cost-effective solutions, large quantities of garbage were dumped in landfills or incinerated. Australia, for instance, was forced to deal with a 1.3 million tonne stockpile of recyclables that it otherwise would have shipped in a "business as usual" situation. In the USA, many states and local governments had to curtail or halt their recycling programmes. Philadelphia resorted to burning the bulk of the waste generated by its 1.5 million inhabitants at a waste-to-energy plant, raising obvious concerns about air pollution. The same held true in England, where the government burnt close to 11 million tonnes of waste in 2019—665,000 tonnes more than the previous year [46].

Apart from its environmental and logistic consequences, China's ban also triggered economic issues. In 2016, 1.42 million tonnes of scrap plastics left American shores, heading towards China, for a total estimated value of USD 495 million [23]. The abrupt closing of this unparalleled revenue stream and the subsequent significant downsizing of the US waste export sector is believed to have directly affected 40,000 jobs and indirectly affected up to 94,000 [44].

[12] Indeed, according to D'Amato et al. (2019, p. 24): "Together, collecting and sorting constitute approximately 40 per cent of recycling costs".

Still, after the initial phase of shock, the Global North found yet another way to shift responsibilities, risks, and burdens to the Global South by rerouting shipments to new destinations, especially in Southeast Asia [25]. Since 2016, many countries in this region (including Malaysia, Thailand, Vietnam, and India) have increased their plastic waste import rate by well over 100% [100], with discarded polyethylene imports in Thailand recording 875% growth [94]. In the first quarter of 2018, US waste exports to Malaysia rose by 330%, to Thailand by 300%, to Vietnam by 277%, and to India by 165% [44]. The statistics for EU exports over the same period are even more impressive. The year the ban came into force, China and Hong Kong received 96 and 73% less plastic waste than in 2015. Meanwhile, countries like Indonesia and Turkey recorded rather unsettling three- and four-figure percentage increases (i.e., 485 and 1295%, respectively) [27]. In fact, in the space of only 5 years, Turkey went from being a minor player in the global waste trade to Western Europe's export destination of choice (Morone, Yılan & Encino-Muñoz, 2022).

The post-ban scenario has presented several new CE challenges and opportunities, for both the developed and the developing world. Many countries have started to accept foreign waste in the hope of replicating China's road to economic prosperity. However, frequently, these countries have lacked the infrastructure to adequately manage their own domestic output and, in some cases, they have struggled to transition from dumping to landfilling and incineration [27]. Undoubtedly, the piling-up of garbage in emerging economies has gone hand in hand with higher leakage rates that, in turn, have ended up undermining any good intentions of local governments.

With their waste management systems under overwhelming stress and faced with serious environmental problems, several Southeast Asian countries have had to scale back their initial plans and take measures to reduce or stop waste streams from overseas [27]. The said measures have ranged from stricter quality standards to strengthened border controls and from taxation schemes and limits on waste import licenses to partial or complete bans along the lines of those adopted in China [44]. Nevertheless, the actual implementation of these policies has been questionable at best, and, in several instances, bans have been lifted or postponed soon after deliberation in order to protect business opportunities arising from the waste processing industry. In times of frequent financial crisis, national and local leaders have often prioritised the generation of revenue and employment over the preservation of environmental and public health. Indonesia, Thailand, and Turkey are just some of the countries that have softened their stance, despite initial bold statements to the contrary [36].

On the bright side, however, the Chinese ban may also trigger a long-overdue re-examination of waste management practices. Indeed, despite placing tremendous strain on many economies, this new set of measures is providing unprecedented incentives for exporting countries to develop and expand their internal waste treatment markets. Even when domestic recycling is not possible, such constraints may lead to significant reductions in consumption levels and support product redesign with an eye to higher value retention (Brooks, Wang & Jambeck, 2018). Consequently, it does not come as a surprise that Extended Producer Responsibility (EPR)[13] principles have recently been drawing the attention of numerous scholars and policymakers. Although the actual degree of effectiveness of existing EPR programmes is still a matter of academic debate [21], especially with regard

[13] The term "extended producer responsibility" refers to a policy approach whereby producers are given considerable levels of financial and/or physical responsibility for the treatment or disposal of post-consumer products. For more on "extended producer responsibility", see OECD [71].

to the impact of WEEE exports to developing countries [24], little doubt exists as to their potential to become some of the most promising tools for achieving CE objectives and targets [78]. A growing number of governments are starting to consider the prospective benefits of "non-trading", which include both environmental and economic gains. It is estimated that a scale-up of high-quality recycling processes for plastic packaging could generate an additional USD 30–40 per tonne collected, amounting to USD 0.3–0.5 billion within OECD member states [30]. According to a 2021 study, recycling and remanufacturing create more than 50 and 30 times as many jobs, respectively, as landfills and incinerators [83].[14] A recent report even suggested that the expansion of advanced plastic recycling and recovery operations in the USA could result in 48,500 new jobs, generating nearly USD 13 billion in economic gains per year: USD 4.3 billion in direct outputs and USD 8.6 billion in additional supplier and payroll-induced impacts (American Chemistry Council, 2022).[15] There is definitely room to expand plastic recycling in Europe, as well. In fact, Beijing's new policies have contributed to a significant reduction in the total extra-EU exports of plastic waste, while intra-EU volumes have remained virtually stable. This suggests that at least some of the waste that would have previously been exported is now being retained for management within the EU27. While investments in additional waste incineration capacity have also been announced across the region, efforts to further enhance plastic recycling capacity could provide substantial secondary material resources for European manufacturing. In addition, they could provide net economic benefits similar to those illustrated above, and stimulate the development of extensive know-how and expertise in this sector [27]. Lastly, the great distress caused by the Chinese ban in the globalised world should—and likely will—push the international community to reach more comprehensive agreements on waste generation, trade, and disposal (Brooks, Wang & Jambeck, 2018).

The fifth session of the United Nations Environment Assembly (UNEA-5.2) of the UNEP invited governments and other stakeholders to "put in place an ambitious, improved enabling framework to address the sound management of chemicals and waste beyond 2020, reflecting a life cycle approach and the need to achieve sustainable consumption and production" [96], par. 4). It also urged them to "take further action to reduce or eliminate the risks associated with [these] issues" [96], par. 18). This call not only validated current policies, but it also encouraged new efforts to minimise waste. EU policymakers recently approved a marketing ban on single-use plastics (albeit limited to goods for which alternatives are readily available) that also introduces EPR schemes, separate collection procedures, and awareness-raising measures.[16] As of June this year, India, the world's second most populous country, prohibited the production, import, stocking, distribution, sale, and use of select ubiquitous items such as disposable cups, plates, cutlery, straws, and ear swabs. More than 60 other countries on all continents have some form of tax or regulation in place to combat single-use plastic waste, although in some cases inadequate enforcement has undermined the effectiveness of these policies [100]. Great Britain has started taxing the producers and importers of plastic packaging containing less than 30% recycled

[14] NB: The figures indicated in this report might be influenced by biases and the economic interests of their promoters.

[15] NB: The figures indicated in this report might be influenced by biases and the economic interests of their promoters.

[16] European Parliament and European Council (2019). DIRECTIVE (EU) 2019/904 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 on the reduction of the impact of certain plastic products on the environment.

materials. Norway recently adopted a system that requires plastic bottle manufacturers to meet criteria that facilitate recycling and to pay an “environmental levy” that decreases as the return rate for their products increases [46]. In Taiwan, a government fund has been established to encourage recycling. Production and importation are now subject to a fee based on the estimated cost of collection and recycling whose proceedings are then distributed to recycling companies by a specialised executive agency [105]. Japan has allocated a budget of JPY 5 billion for research on the production and end-of-life disposal of bioplastic products. Finally, several North American cities, including Seattle, San Francisco, and Vancouver, have introduced or tightened restrictions on plastic waste [100]. Meanwhile, the production and remanufacturing of plastic articles in China is moving from a plethora of small, unregistered facilities with no operational rules, quality standards, or environmental controls to a handful of larger state-owned plants subject to regular monitoring [105]. Private actors seem to have started to react to the domino effect initiated by the Chinese ban. Large multinationals such as Unilever, The Coca-Cola Company, PepsiCo, Starbucks, L’Oréal, and Marks & Spencer have pledged to either abolish single-use packaging or replace it with reusable or compostable alternatives [100].

Conclusion

Ever-increasing production and consumption, along with an unprecedented boom in waste generation, has made waste management a major global issue. North–South waste trade may have both positive and negative consequences for the environment. Ideally, countries—especially in the developed world—will adopt sustainable strategies aimed at reducing manufacturing volumes to minimise adverse impacts. In this respect, the implementation of true CE principles and practices appears desirable.

First and foremost, policymakers should tackle overconsumption in their respective countries. Government initiatives around the world have mainly focused on consumption quality, rather than quantity. Although it is arguably very important to address both, gains in quality can be quickly eroded by rising levels of consumption. Systemic efficiency should be pursued through efforts to ensure that resources retain as much value as possible throughout their life cycle. With this in mind, landfilling, combustion for energy, and even recycling should be considered viable options only when reuse, refurbishment, repair, and remanufacturing are not feasible.

Contrary to this logic, there has been an increasing trend for countries in the Global North to send their waste to the Global South, taking advantage of extremely convenient arbitrage conditions resulting from less stringent environmental standards and lower handling and disposal costs. Steadily growing trade liberalisation, coupled with significant improvements in shipping efficiency and favourable freight rates, has made this form of problem displacement more convenient than ever. Initially, it was a win–win business for all parties. Exporters relieved the pressure on their domestic waste-sink capacity, while importers obtained raw materials to fuel national growth. Nevertheless, poor waste management and ill-equipped infrastructure in destination countries have meant that the vast majority of waste is disposed of in an environmentally unsafe way, leading to dangerous levels of contamination. Second-hand clothing, electronic waste, and plastics have been found to have particularly detrimental effects on air quality levels, as well as the health of aquatic and terrestrial ecosystems.

The case of China is emblematic of waste-related ecological harm. Having gone from an almost autarkic model to the largest importer of waste (and especially plastics) in just over two decades, the country ultimately acknowledged the long-term unsustainability of this practice. In light of lower profits and greater negative environmental and health impacts, Chinese authorities introduced a series of measures that culminated in a total ban on waste imports in 2021. Unsurprisingly, this move caused immediate and significant challenges for the global recycling industry, bringing the recycling systems of major developed economies to near collapse. Some governments resorted to incineration, while many sought out new destinations for their waste, especially in Southeast Asia. However, these countries also began imposing import restrictions, shortly after their systems became overwhelmed.

The Chinese ban sure triggered widespread chaos, but it also drew long-overdue attention to the dynamics of international trade and its criticalities. Many experts agree that, in the long run, the positive consequences of Beijing's new policies might extend well beyond its borders. For the first time, high-income countries are being forced to reconsider their own waste management systems. The majority have already drawn up plans to enhance national treatment capacities and reduce dependence on overseas shipments. Several multinational companies have also pledged to adjust their business models to meet the needs imposed by the new scenario. Still, there remains a risk that China will simply be replaced as the world's dumping ground by one or more emerging economies. The strong desire of such economies to replicate the Chinese path to development might facilitate and support efforts in the Global North to persist with "business as usual" routines.

To truly reap the CE benefits offered by the new situation, a collective comprehensive response to the waste problem is required. Global interdependence means that strategies based on "distancing" are no longer viable. It could be argued that, as a society, we have made significant leaps forward in terms of our awareness of the consequences of poor waste management. However, most economies and cultures are still deeply tied to linear "extract-produce-use-dump" models. In spite of supposedly ambitious efforts at both national and supranational levels, the incidence of circularity remains relatively low. Several CE initiatives have turned out to be mere instruments for countries in the North to create "remoteness" between their disproportionate consumption levels and the ecological and social costs of their consumption. As a result, serious action to prevent future global crises is often postponed, while the benefits of production and the costs of transboundary waste disposal remain unevenly distributed. The international community must come together to develop appropriate policy frameworks to address the issue in terms of environmental and social sustainability. Arguments in favour of North–South waste trade may be sound from the perspective of neoclassical economics, but are they worth the future of the planet and its inhabitants?

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