WASTE

N° 6 The already small share of recycled materials is shrinking, but new circular industrial channels are developing

- Since 2018, the share of circular processes (recycling, composting, etc.) in global consumption of raw materials has continued to shrink: the growth in demand for virgin raw materials has overtaken the progress made by global circularity.
- Monitoring of the evolution of global waste production suffers from a lack of aggregated data, making it hard to precisely follow its destination: numerous waste items drop off the grid, move into informal circuits, or disappear in landfills.
- The closure of Chinese and other Asian borders to imports of recyclable waste in 2018, followed by the amendment of the Basel Convention on hazardous waste, have slowed and redirected international waste trade towards new countries. Landfilling and incineration, emitting CH_4 and CO_2, have gained ground.
- In Europe, and increasingly in North America, Extended Producer Responsibility (EPR) and deposit-return schemes are demonstrating their ability to organize and finance collection and recycling channels.

KEY FIGURES

Consumption of materials overrides the progress of circularity

- **2.01 billion tonnes solid municipal waste produced in 2016**, according to latest available global figures (World Bank, 2018).
- **7.2% in 2022**: the rate of global circularity, which has been continuously dropping since 2018 (9.1%) (Circle Economy, 2023).
- **48.3% of waste recycled or composted in the EU** in 2021, compared to 44.9% in 2015 (Eurostat, 2023) and 32.1% in the United States in 2018 (EPA, n.d.), while Japan reduced its waste production by 7% from 2015 to 2021 (MOE, 2022).

China has shifted the status quo on international waste trade

- **0 tonnes of plastic waste** imported into China in 2022, compared to 8.8 million tonnes in 2017; -98% imports of paper and cardboard waste... the National Sword Policy has slashed international waste processing (UN Comtrade, 2023).
- **72% of the 300 biggest global companies** have a target to reduce plastic pollution (Diana et al., 2022).

Multifaceted reorganization of local processing capacities

- 352.9 million people in 50 jurisdictions around the world lived an area with a container deposit return system. **The average rate of return is 74.2%** in the world, 90% in Europe (Reloop, 2023).
- 180,000t of battery recycling capacities per year in the world. <1% of lithium used is currently recycled (IEA, 2021).
- **+11% biogas production** in the European Union from 2015-2022, *i.e.* 8% of its gas consumption, as much as +114% in France, where the move to methanation is strongest (Enerdata, 2023).

FURTHER READING

TRENDS

- In Europe, the circular economy in textiles is being reinvented (2022)
- Recycling Lithium-ion batteries, the new frontier in the electrification of mobility (2021)

CASE STUDIES

KAMIKATSU • A social project beyond the zero waste objective (2022)

MENDOZA • Promoting a socially inclusive model of comprehensive waste management (2021)

BRITISH COLUMBIA • Operation EPR at the heart of "Zero Waste" and the Circular Economy (2021)

FLANDERS • The development of a comprehensive strategy for the bioeconomy (2021)

MOROCCO • Moroccan society's uneven response to the proliferation of waste (2020)

TRENDS
WASTE

The relocation of waste treatment: still linear, but different circularity strategies emerge

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ANTOINE GILLOD • Director of the Global Observatory of Climate Action, Climate Chance

After more than thirty years of exporting western waste to Asia, the international waste treatment system is changing shape. The closure of Chinese, then other Asian borders to imports has highlighted the weaknesses and shortfalls of local recycling capacities in high-income economies. Confronted with a backflow of waste accentuated by the Covid-19 crisis, companies and local authorities are finding themselves on the front line of the global reorganization of waste treatment.

Global circularity eclipsed by extraction of raw materials

Circularity index on a constant downward trend since 2018

The World Bank estimates that 2.01 billion (bn) tonnes of solid municipal waste[a] were produced in the world in 2016. Global waste is made up of 44% green and food waste, followed by paper and cardboard (17%), plastic (12%), glass (5%), metal (4%) and other sources (wood, rubber, etc.). The economic origin of this waste is fairly equally divided between high (34%), upper-middle (32%), and lower-middle income (29%) countries. Low-income countries generate much less waste (5%) (**FIGURE 1**).

The management of this solid municipal waste generates about 1.6 $GtCO_2e$, most of it emitted in the form of methane (CH_4) during decomposition. More than half of the waste produced in the world is buried or discharged in open dumps. Up to 75% of waste is sent to dumps in South Asia, while in Latin America, 68% of waste is buried. Only 13.5% of solid municipal waste is recycled.[1]

The global circular economy index even appears to have dropped over the last few years, according to Circle Economy.[b] Of the 100 billion tonnes of material that entered the economy in

a Solid municipal waste is only one component of total waste, which also includes building waste and wastewater, for example. Solid municipal waste represents 27% of the waste generated in the European Union (source: European Parliament)

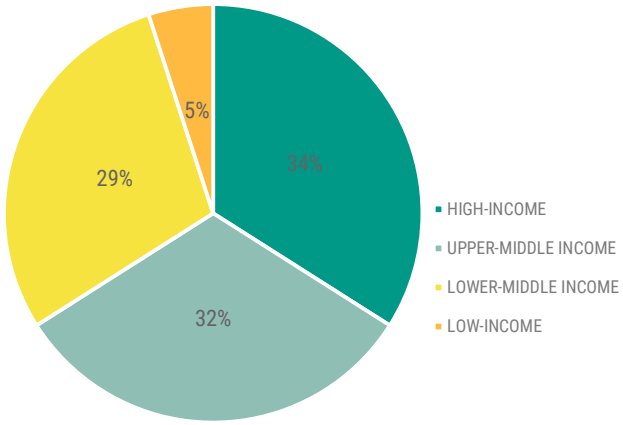
b Created by Circle Economy, the circular economy index is a ratio that measures the mass of secondary material incorporated into the economy compared to the total quantity of material consumed over a year. Published for the first time at the Davos Forum in 2018, the Circularity Gap Report measures the evolution of the index annually. The authors recognize the limits of the measure, which does not take into account the composition, value or quality of the secondary material, and does not capture slower processes, such as the extended life of products, or limited use of material.

2022, only 7.2 billion were the result of circular processes. This rate was 8.6% in 2020 and 9.1% in 2018. The reason is that the extraction of virgin materials is rising faster than the progress made by circularity: raw material extraction has tripled since 1970, and doubled since 2000.[2]

FIGURE 1

GLOBAL WASTE PRODUCTION ACCORDING TO INCOME LEVEL

Source: World Bank, 2018



Production of material constantly rising

The global production of the main plant crops (cereals, sugar cane, vegetables, oilseed, fruit, tubers and roots) amounted to 9.3 billion tonnes in 2020, a 52% rise since 2000 (6.1 bn tonnes). Over the same period, the volume of meat production increased by 45%, reaching 377 million tonnes (Mt) in 2020.[3] 14% of global food production is lost during industrial and logistical processes.[4] In 2019, food waste taking place during sales or distribution amounted to 931 million tonnes, which is 17% of food production.[5] This type of waste, which is rich in methane, represents almost 40% of the potential emissions of methane from landfills in the United States.[6]

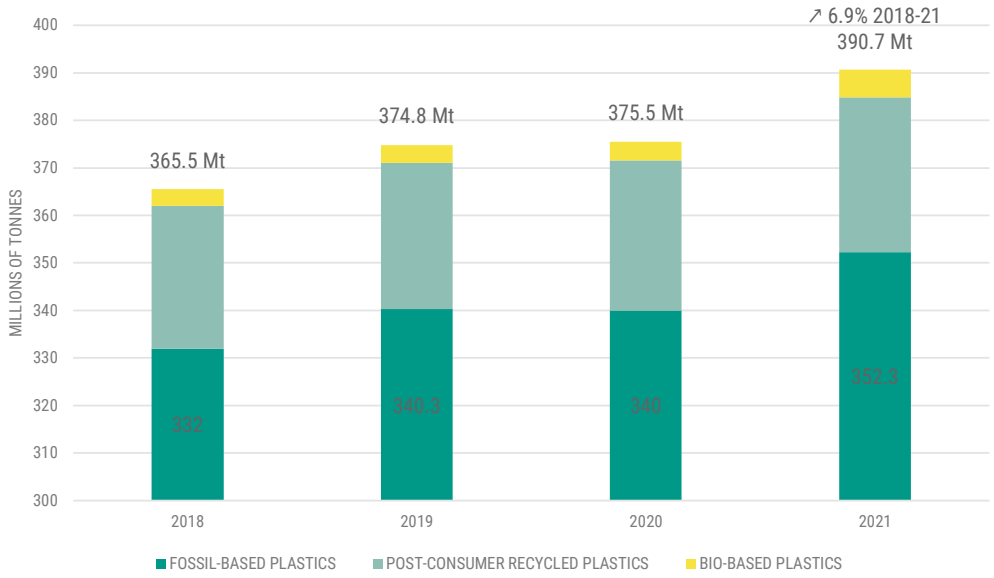
Global paper and cardboard production went from 402.8 Mt in 2013 to 412.7 Mt in 2018, over half of which incorporated recovered fibres (50.24%). The production of recovered fibres is contingent on the trade of industrial waste, for which the volumes traded amounted to 56 Mt in 2018. Asia concentrates 61.8% of imports of recovered fibres and 72% of processes for incorporating recycled material.[7]

From 2018 to 2021, global plastic production rose by 7%, and the vast majority of it was produced from fossil energies (FIGURE 2).[8] In particular, the production of single-use plastics from fossil energy rose by 6 Mt from 2019 to 2021 (137 Mt), with only 2% resulting from recycling. In total, 230 Mt of polymers were produced in the world in 2021. Although a little slower than during the previous two decades, demand could push up the production of single-use plastics by 17 million tonnes by 2027.[9] Once used, where do these plastics end up? From 1950 to 2015, only 9% of the plastic produced in the world annually was recycled, 12% was incinerated, while 79% accumulated in landfills or the natural environment.[10] The natural environment has already accumulated 710 million tonnes of plastic, including 11 million tonnes discharged into the sea.[11] Recent studies estimate the level of greenhouse gases emitted by the plastic industry as between 1.7 and 2 $GtCO_2e$ throughout the lifecycle.[12, 13, 14]

FIGURE 2

EVOLUTION OF GLOBAL PLASTIC PRODUCTION

Source: Plastics Europe, 2022

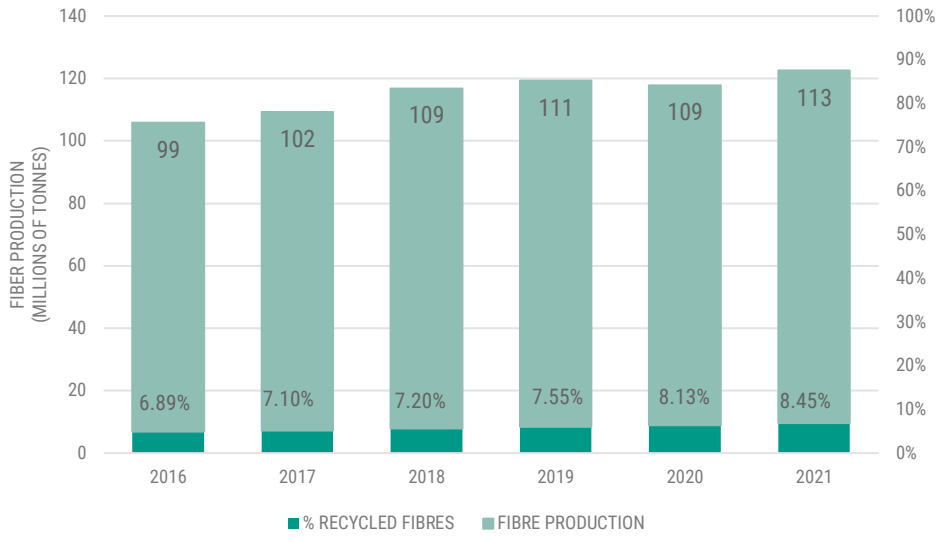


The production of textile fibres amounted to 113 million tonnes in 2021 – a figure that has doubled in the space of twenty years and could reach 149 Mt in 2030. According to Textile Exchange – a body that brings together the textile industry to target a 45% reduction in greenhouse gas (GHG) emissions by 2030 – growth is driven by the production of virgin raw materials, which went from 100 to 103 Mt from 2020 to 2021. In particular, the production of virgin fibre from fossil material increased by 3.4 Mt in a year. Synthetic fibres now make up 64% of production – led by polyester (54%), followed by cotton (24%) and manmade cellulosic fibres (MMCF – 6.4%). The recycling rate of all fibres was estimated at 8.45% in 2021, a slight increase since 2016 (6.89%) (**FIGURE 3**).[15]

FIGURE 3

GLOBAL PRODUCTION OF TEXTILE FIBRES (MT), INCLUDING THE SHARE INCORPORATING RECYCLED MATERIAL

Source: Textile Exchange, 2022



Globalized processing of domestic waste is losing steam

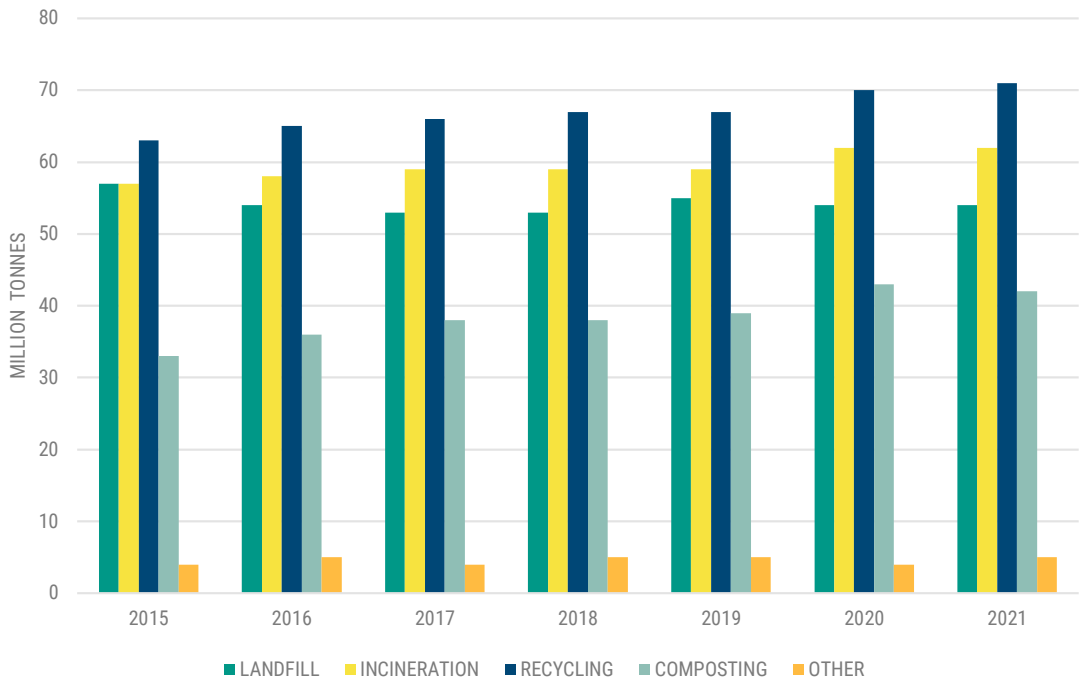
High-income countries are choosing to recycle... but also to incinerate

Very few statistics are available to precisely follow the progress made in waste treatment since 2015. In the European Union (EU), where waste production increased by 9% from 2015 to 2021, volumes of solid municipal waste put in landfills dropped 5% between 2015 (for a share of 26.6% in the means of treatment) and 2021 (23%), while incineration went up 9% (26.5%). Over that period, the rate of recycled and composted waste rose from 44.9% to 48.3% (**FIGURE 4**).[16] In the United States, the data published by the Environmental Protection Agency (EPA) stops at 2018; the rate of recycling and composting of solid municipal waste was 32.1% for that year, compared to 25.7% in 2015, while more than 50% still went to landfill.[17] In Japan, a comparison of annual reports by the Ministry of the Environment indicates a 7% decrease in waste production from 2015 to 2021. The landfill rate dropped by 18%, while the recycling rate stagnated at around 20%.[18] However, none of these countries provide figures that differentiate waste recycled in the country from exported waste, whose trace is lost once abroad.

FIGURE 4

EVOLUTION OF MEANS OF WASTE TREATMENT IN EUROPE (EU-27), 2015-2021

Source: Eurostat, 2023



Globalized treatment of paper, plastic, metal, and textile waste

According to the World Customs Organization (WCO), the volume of globally traded waste increased almost fivefold between 1992 (45.6 Mt) and 2012 (222.6 Mt),[19] triggering large, very lucrative illicit flows in its wake, worth more than $10 billion a year.[20]

Thus, in 2019, 73.3% of exports of recovered paper and cardboard fibres came from the European Union and the United States, and Asia represented almost two-thirds of imports. During the 2010-2020 decade, China received 60% of plastic imports in the world. Germany, the United States and Japan made up the three leading plastic waste exporters, while six of the ten main importers were Asian countries. For exporting countries, competitive treatment costs encouraged this outsourcing of plastic treatment rather than local recycling.[21] For Chinese companies, the trade was a way of accessing better-quality plastics than those present in domestic waste. However, in 2010, an estimated 76% of Chinese plastic waste was not managed correctly and ended up in landfill.[22]

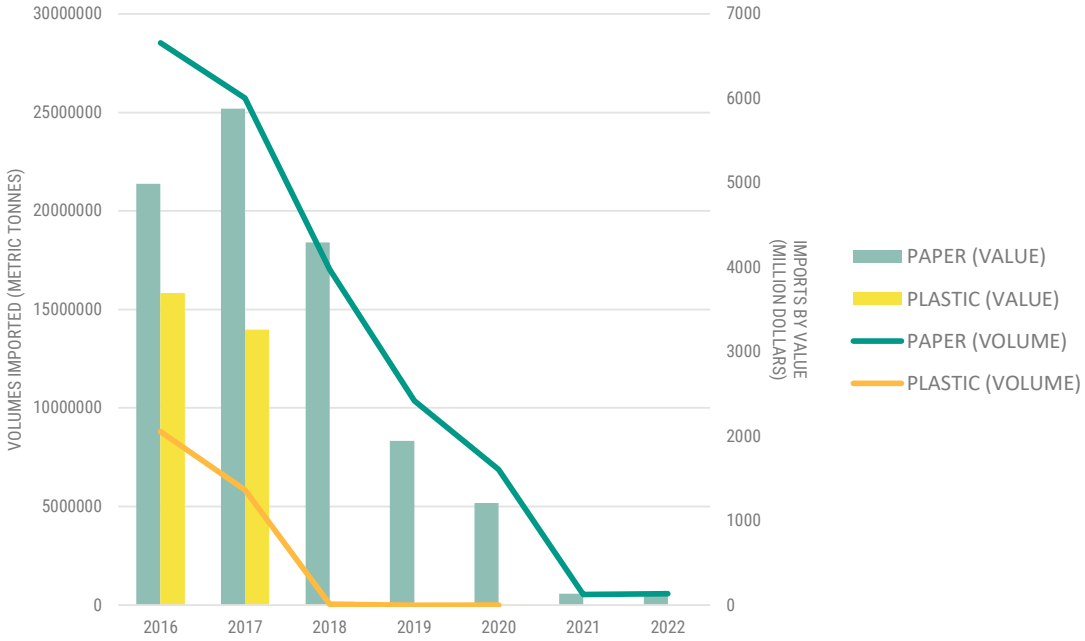
Restrictions on transborder trade have reshaped the world waste market

In February 2017, China took repressive action against uncontrolled transborder waste trade by adopting its National Sword Policy, which banned imports of 24 types of waste, including several forms of non-industrial plastic, mixed papers, textiles, and even vanadium slag, a rare metal.[23] The prohibition took the form of a standard aimed at limiting the "contamination" rate of recyclable materials, in other words the rate of mix with other non-recyclable waste, to between 0.3% and 1% – a rate that is almost unreachable, immediately disqualifying numerous cargoes destined for China.[24] The impact was immediate: imports of plastic waste (-99%) and recovered paper (-33.8%) plummeted starting from 2018.[25] The Chinese government then extended the list, before prohibiting all imports of solid waste in January 2021. **According to data from UN Comtrade, Chinese imports of plastic waste are almost down to zero, dropping from nearly $3.7 billion and 8.8 Mt in 2017 to only $180,000 and 310 tonnes in 2020; imports of paper and cardboard waste have been slashed by almost 98% in volume** (FIGURE 5).

FIGURE 5

CHINA SUDDENLY CLOSED ITS BORDERS TO A WASTE MARKET WORTH BILLIONS OF DOLLARS

Source: Climate Chance, based on data from UN Comtrade



Starting in 2018, Malaysia, the Philippines, Vietnam and Thailand became the new outlets for plastic waste from the United States, Japan and the EU.[26] Exports of recovered paper were immediately redirected towards India (+15%), Indonesia (+8.33%), Vietnam (+14.28%), and Thailand (+40%).[27] Exports of plastic waste to the region also increased by 171% from 2016 to 2018.[28] However, these new destinations went on to adopt their own legislation to limit the entry of waste into their territories, and rapidly started to refuse whole containers of waste that did not comply with contamination rules.[29]

These sovereign decisions accelerated the strengthening of international legislation on waste control. In May 2019, 187 countries adopted a series of amendments to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. The Convention, which applies to all OECD countries, now requires previous agreement from the importing state to receive cargoes of plastic waste, some of which have been requalified as "hazardous".[30]

The impact of these measures is indisputable: volumes of plastic exported by OECD member countries, which generate 89% of the world's plastic waste exports, halved between 2017 and the end of 2021. China's share of imports, which still amounted to 7% in 2018, fell to 1.2% in 2021. In particular, flows of plastic waste from OECD to non-OECD countries have taken a nosedive: transfers and treatment are now much more regionalized.[31]

The trend is visible in the European Union's export figures.[c] The EU still exported 33 Mt of waste in 2021, which is 77% more than in 2004. While cargoes travelling to China plummeted from 10.1 to 0.4 Mt between 2009 and 2021 (including a more recent drop for plastic and paper), Turkey has become the leading destination for European waste: 14.7 Mt have been transferred to the country (45% of exports), far ahead of India (1.9 Mt), Egypt (1.2 Mt), Switzerland (1.7 Mt) and the United Kingdom (1.5 Mt). Ferrous metals are the most exported waste by far (19.5 Mt), followed by paper and cardboard (4.4 Mt).[32]

Nevertheless, treatment capacities of receiving countries are not necessarily more virtuous, and statistics have had to be revised to take into account dependence on exports. In the United States, for example, plastic waste exports plunged from 2.3 Mt in 2015 to 1.2 Mt in 2018, then 0.6 Mt in 2021.[33] Yet since the Chinese ban, 23.2% more plastic ends up in landfills, according to one study,[34] while recycling rates remain steady at 5% to 6%.[35] In Europe, the recycling rate of plastic packaging was re-evaluated from 41% in 2019 to 38% in 2020 after accounting rules were made stricter.[36] Japan, which announced a figure of 84% reuse of plastic waste in 2018, in fact only recycles 23%, most of it being recovered in the form of energy, notably through incineration.[37] According to Interpol, these restrictions have also boosted the trafficking of plastic waste: transfers of illicit waste cargoes to other destinations, unauthorized dumping, illegal incineration, and administrative fraud are among the alternatives pursued in the absence of domestic recycling capacities in countries formerly dependent on China.[38]

Lastly, importing countries have also been hit by the measures. Since the volumes of waste imported to China dropped by 30% from 2015 to 2019,[39] local industries have lost important sources of "secondary raw materials". In 2020, the Chinese cardboard packaging leader, Nine Dragons, opened new factories producing virgin and recycled paper in Maine, Western Virginia and Wisconsin; these new factories have the dual advantage of maintaining local employment in the United States and bringing Nine Dragons closer to its recycled paper supply sources.[40] Shanying International began investing in an old paper factory in Kentucky in 2018, then in 2019 announced that it was investing another $200 million in developing an on-site recycling facility.[41]

Local actors spearheading action against waste

Top-down regulation: single-use plastics targeted by prevention policies

The waste crisis has revealed the structural weakness of collection and sorting capacities, obsolete recycling infrastructures, and a lack of awareness that prevents exporting countries from efficiently managing their waste domestically. In the hierarchy of waste treatment methods, as recommended by Zero Waste and adopted by the European Union, prevention is the primary lever to reduce waste production at source, and can include varied approaches, ranging from banning single-use products to taxation and recycling regulations.

Plastics, especially single-use, are the main target. An emblematic symbol of the linear economy, their degradation into microplastics generates considerable damage to biodiversity. Microplastics range in size from 1 µm to 5 mm and result from the degradation of bigger items abandoned in the natural environment. Their accumulation in ecosystems, in proportion with the exponential production of virgin plastics over decades, is increasingly documented. While in 2014, researchers evaluated the number of pieces of plastic floating in the ocean at 5 trillion,[42] a study based on withdrawals using finer nets in the Gulf of Maine (USA) and the English Channel estimated that the total is probably closer to 125 trillion.[43] Concerning the climate, reusable food packaging (beverage containers, sushi boxes, burger boxes, etc.) almost systematically has a much lower carbon footprint than disposable plastic alternatives.[44]

In March 2022, 175 countries agreed to negotiate a legally binding UN treaty on plastic, due for adoption at the end of 2024.[45] The legal scope and level of legal constraint of this treaty remain uncertain: a High Ambition Coalition to End Plastic Pollution, comprising 58 countries, is calling for binding targets to reduce plastic production, while other countries, led by the Gulf States, would like to restrict discussions to waste treatment.[46] Within the C40, 21 cities

c The latest federal data for the United States, published by the Environmental Protection Agency (EPA), stops at 2018 and does not give a precise idea of the evolution of flows. It is worth noting that the United States is not a signatory of the Basel Convention; yet as a member of the OECD, it must nevertheless comply with its standards.

have already committed to reduce their per capita household waste production by at least 15% by 2030 compared to 2015.[47]

The latest global review on anti-plastic regulations and legislation dates from 2019. A report by the UN Environment Programme and the World Resources Institute at the time estimated that in July 2018, 127 countries out of the 192 examined had adopted some type of regulation on plastic bags.[48] Africa was at that point the continent with the highest percentage of countries with legislation on single-use plastic, with 34 countries out of 54.[49] When the report was published, 27 countries had established a total or partial ban of some products (plates, cups, cutlery, etc.) and single-use plastic materials. Since 2021, the European Union has prohibited the sale of a dozen single-use products (cutlery, straws, cotton buds, etc.),[50] followed by Canada[51] and New Zealand in 2022, then the United Kingdom in October 2023.[52] A 2022 study deplores the limited success of plastic bag bans, due to states' incapacity to control and ensure respect of prohibitions, while the black market is booming and the industry has found ways of getting round restrictions.[53]

The unreliability of the data gathered makes it difficult to draw clear conclusions in most of the countries analysed by research. A recent study by the University of Portsmouth reports that over 50% of the 100 plastic-related policies evaluated by the authors presented little or no proof of their effectiveness.[54] The authors nevertheless identify conclusive results of policies prohibiting plastic bags in Antigua and Barbuda, Kenya, and the city of San Francisco. Several success factors are highlighted: strong political backing, clearly identified objectives spread over time, strict sanctions, stakeholder commitment, public awareness-raising, and the existence of industrial alternatives to the products targeted.

According to the UNEP report, in 2018, 27 countries taxed the production and manufacture of plastic bags, and 30 had set up a consumer tax. Since the report, the EU definitively adopted a tax on non-recycled plastic waste in 2021. Every kilo of non-recycled plastic packaging waste costs 80 cents of a euro to the country concerned, or €800 per metric tonne. States can pay the cost of the tax directly through their national budget, or finance it by taxing the private sector. To date, France, Germany, Ireland, Luxembourg and Slovakia have chosen the former option, but intend to shift the cost to companies in the long term.[55] In 2019, a study review estimated that the tax measures applied to plastic bags had led to a 66% reduction in their usage in Denmark, 90% in Ireland, 74% to 90% in South Africa, Hong Kong and the United Kingdom, and 50% in Botswana and China.[56]

Strongly established in Europe, Extended Producer Responsibility is being taken up in North America

In 2022, a study estimated that 72% of 300 of the biggest global firms in terms of income (Global 500 index) analysed from 2015 to 2020 had established plastic pollution reduction targets. Companies committed to voluntary environmental initiatives (67%) are four times more likely to establish targets that are measurable and have a clear timeline, and tend to effectively focus on recycling more than other stages in the plastic lifecycle.[57] **Recycling is in fact a lucrative industry: the Bureau of International Recycling (BIR) evaluates the recycling market at 200 billion dollars**.[58]

In 2022, for the fifth consecutive year, Coca-Cola was identified as the worst polluting brand, ahead of Pepsico and Nestlé, according to a list established by the Break Free From Plastic movement. Since 2018, BFFP, which gathers 2,700 organizations around the world, makes an annual analysis of plastic waste to identify the companies that generate the most plastic pollution. In five years, almost 207,000 volunteers have analysed over 2,125,000 plastic items in 87 countries.[59]

Paradoxically, Coco-Cola also comes out top in the ranking established by the US shareholder advocacy organization, As You Sow. The scorecard focuses on the plastic pollution prevention and management practices of companies in the beverage, fast food, consumer packaging and large retailer sectors. The report published in 2021 ranks 50 companies applying grades from A to F through 44 metrics on 6 pillars: 1) packaging design, 2) reusable packaging, 3) recycled content, 4) public data transparency, 5) supporting recycling, and 6) extended producer responsibility (EPR). No company received the highest score, and only Coca-Cola was awarded a B-, compared to 17 Cs, 18 Ds, and 14 Fs.[60]

Extended producer responsibility (EPR) programmes precisely shift the financial or operational responsibility of collecting and treating waste onto the companies responsible for putting it onto the market. According to a UNEP report, in 2018, 43 countries had included elements on extending producer respobsibility. Already very common in Europe, EPRs are now being implemented in the United States. Maine was the first State to vote in favour of an EPR in July 2021, followed by Oregon, Colorado, New Jersey, Washington and California.[61] The latter state requires that by

2032 some types of packaging must be recyclable or compostable, along with an absolute reduction of plastic packaging by 25%, and recycling of 65% of single-use packaging. The law establishes the participation of producers in a common fund to cover waste management costs.

The means of implementing EPRs differ widely from one country to the next. Most often, companies make a financial contribution which is collected by a third party, and then paid via a government agency to municipalities to refund all or part of their collection and recycling costs. During 2020, the Quebec government announced the transformation of its financial EPR – which is based on a financial contribution paid to an ecological body responsible for waste prevention and management – into an operational EPR. In this system, from 2025, companies will be responsible for residual matter throughout the lifecycle of waste, from the market launch of the product up to its treatment, in order to oblige them to develop a circular economy on the Quebecois territory to reach the new mandatory recycling targets.[62]

In a report on five EPR programmes set up close to coastal areas in Australia, Canada (British Colombia), the European Union, South Korea and Tunisia, GIZ concluded that EPR programmes are effective in avoiding marine pollution, provided that they are precisely designed, truly implemented, and continuously monitored and developed.[63]

Multifaceted reinforcement of local collection and treatment capacities has environmental and social stakes

According to the World Bank's "What a Waste 2.0" report, about 70% of waste management services come under local jurisdictions; in low-income countries, the task can take up to 20% of the municipal budget. On a larger scale, the world's 27 biggest megacities (with over 10 million inhabitants) represented 13% of waste flows in 2015.[64] Local and regional governments therefore play a key role in organizing waste collection and treatment, while dealing with their own particular problems.

In late 2022, over 352.9 million people in 50 countries, states and provinces in the world had a deposit return system (DRS) for single-use beverage containers (bottles, cans, etc.). Taking together the different DRS bills identified, 745 million people in 70 jurisdictions could be concerned in 2026, according to Reloop, a European thinktank that analyses these systems.[65] The average return rate of bottles around the world is 74.2%; the figure is 90% in the 13 European countries that have set up a deposit system, and as much as 98% in Germany (**FIGURE 5**). Malta and Latvia are the latest countries to have adopted a DRS in 2022, while the Swedish system dates back to 1984, and even 1971 in Oregon. Cities in the United Kingdom and Portugal have recently tested digital deposits: consumers scan a code printed on the container before throwing it into a recycling bin. Once it arrives at the recycling centre, an operator scans the code again; the person then receives a deposit refund on a digital account.[66]

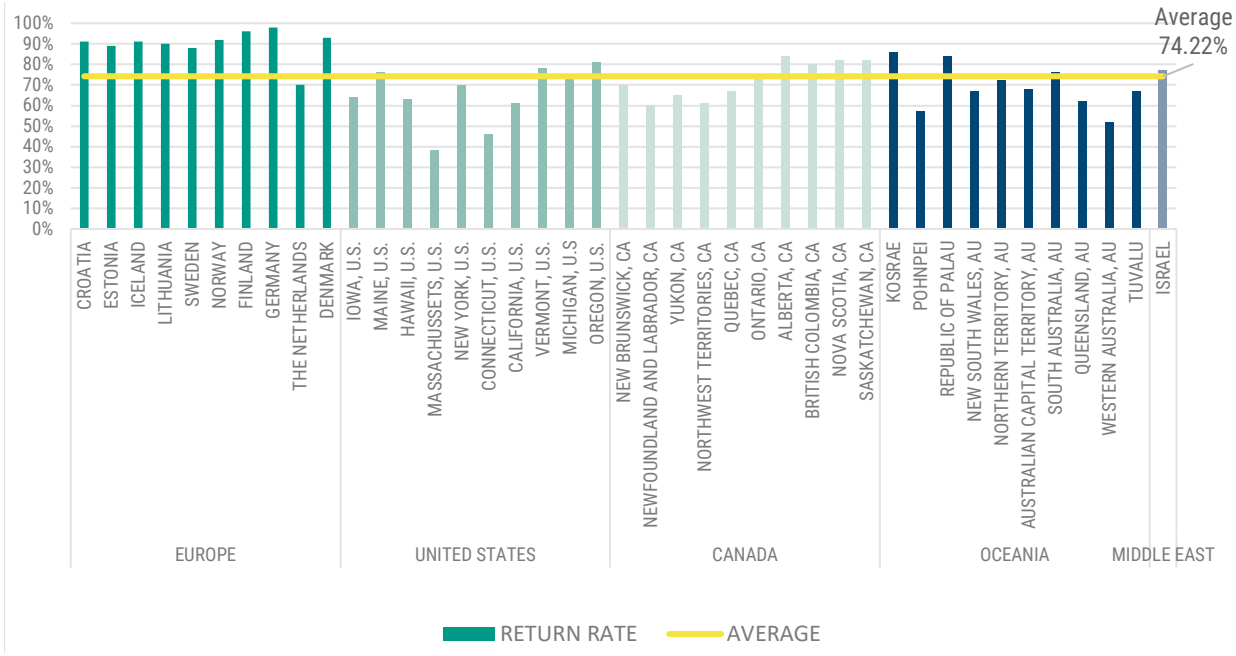
Other models exist that encourage recycling through incentive mechanisms. The cities of Curitiba in Brazil and Istanbul in Turkey for example propose reductions on school text books, transport tickets, and food.[67] In India, the city of Ambikapur has set up a café in which people can receive a meal in exchange for plastic waste[68] as part of a plan to modernize the city's collection through mobilization, including recognized employment for women's self-help groups.[69]

In numerous developing countries, improved collection conditions and the diversion of waste sent to landfill play a crucial social role in integrating informal collectors. **Around 15 million informal waste pickers around the world collect 15% to 20% of waste, including in landfills, often enduring very precarious social, economic and health conditions**.[70] In Latin America and the Caribbean, one-third of waste ends up in fly-tips or in the natural environment.[71] Some cities have made great progress in integrating these informal waste pickers. For example, in 2019 the provincial government of Mendoza (Argentina), studied by the Climate Chance Observatory in 2021, launched the "integrated urban solid waste management project" (PGIRS), attaining a treatment rate of 100% in the metropolitan area of Mendoza and the Uco Valley, with two outcomes: protection of the environment, and social inclusion of informal workers in the sector. The civil association of urban waste pickers of the province of Mendoza (ACRUM), which gathers six waste picker cooperatives, was granted a subsidy of $1.8 million in early 2020 from a Mendoza trust fund to improve its equipment, technical capacities and work infrastructure.[72] In Ghana, from 2016 to 2018, the inclusion of workers from the informal sector led to an increase in collection rates from 58% to 90%.[73]

FIGURE 6

LATEST KNOWN RETURN RATES OF SINGLE-USE BEVERAGE CONTAINERS IN DEPOSIT RETURN SYSTEMS (%)

Source: Reloop, 2023. Reporting years ranging from 2017 to 2022.



The treatment of organic waste generated by food loss and waste raises specific treatment challenges. Humidity makes food waste difficult to handle with technical equipment, notably producing high quantities of leachate that can drown machines. This is a great problem in developing countries, where organic matter makes up a very high proportion of waste volumes. Seoul has been pioneering in this area: the South Korean capital has succeeded in reaching 95% recycling of food waste, mainly thanks to the availability of compost bins and urban gardens.[74] In Brazil, Sao Paulo has adopted strategies to divert the 100,000 tonnes of organic waste produced annually, such as towards decentralized compost parks, and integrate them into the city's circular agriculture programme.[75] In Morocco, analysed by the Observatory in 2020, the organic waste rate is 70%, and two options are being tested: combining methanation units with treatment plants, and transforming waste into solid recovered fuel. After being shredded then dried, non-recycled waste is simply used to produce energy by incineration.[76] According to one study, European cities equipped with a "door-to-door" collection system for biodegradable waste also facilitate the best recycling rates of other, dry waste (glass, metal, paper, plastic, etc.).[77] Ljubljana (Slovenia), which has an ambitious intermediate sorting target of 75% by 2025, collects biodegradable waste in this way, mostly for composting.

In Europe, the production of biomethane from anaerobic digestion of organic waste has accelerated in recent years. The REPowerEU plan has set a target to produce 30 bcm in 2030, compared to 3 bcm currently. According to Enerdata statistics, biogas production amounted to 15.2 Mtoe in the European Union in 2022, against 13.7 Mtoe in 2015. Germany produces almost 50% of European biogas, principally to supply its electricity production. With 7.62 Mtoe produced in 2022, the country is even the world leader, ahead of China (7.42 Mtoe), the United States (3.55 Mtoe) and the United Kingdom (2.92 Mtoe). Although far behind, Italy (2.13 Mteo in 2022) has increased its production by 11% since 2015, mainly for use in transport. The strongest momentum is undoubtedly in France, which more than doubled its annual production from 2015 to 2022, from 0.69 to 1.48 Mtoe, opting to transform this biogas into biomethane for injection into the natural gas grid. However, the installation of biogas plants is also the subject of debate: in France, where 80% of the 1,300 methanation units installed are agricultural, methanation offers farmers a unique economic opportunity, at the risk of converting food farming activities to produce gas, which is more profitable. It can also lead to an intensification of animal farming and crops to optimize unit yields.[78, 79]

Batteries, textiles: the new industrial frontiers of recycling

The recycling of lithium-ion batteries used for electric mobility and the electrification of numerous uses turns out to be the poor relation of transition value chains. According to the International Energy Agency (IEA), the global recycling capacity was 180,000 t/ year in 2021, half of which is identified in China. According to the World Bank, the recycling rate of minerals rarely exceeds 70%; in the case of lithium, it is even less than 1%.[80] In addition, the most common method for recycling batteries, using pyrometallurgy, gives low returns on investment, generates polluting residual matter, and relies on complex processes. The province of Quebec (Canada) is at the avant-garde of lithium-ion battery recycling thanks to considerable public support for research and development of the sector. The start-up Recyclage Lithion opened its first pilot factories in the province to test recycling of lithium-ion batteries using hydrometallurgy, a patented process that is able to recuperate and process up to 95% of battery components, according to the company.[81]

In the textile industry, the new frontier is called chemical recycling. Highly popular with industrials, this technique involves dissolving fibres made up of natural polymers (linen, latex, cotton, etc.) or synthetic ones (PET, acrylic, etc.), and then separating the monomers of the fibre. This process can be used to create a new recycled polymer with the same properties as a virgin polymer. Most fibres contained in clothes are cotton, polyester or elastane mixes; polyester and elastane are polluting agents that make recycling or reuse almost impossible, in particular due to their complex chemical compositions.[82] One example is the CE-PET project, coordinated by the company Carbios and co-funded by the French state from 2018 to 2023, which has validated a pilot process for the enzymatic recycling of PET to produce white textile fibres from coloured plastic.

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