

Beyond the Bin – The Plastic Recycling Challenge

In 2018, Singaporeans dropping plastic bottles into the blue recycling bins below their housing blocks had little reason to think that anything fundamental had changed.

Several times a week, blue recycling trucks would empty the recycling bins and take their contents to a Materials Recovery Facility for sorting, after which the recyclables would be on their way to recycling plants in Singapore or overseas – or so most people thought. In reality, some of those recyclables were headed for the incinerator.

“[The public waste collectors] don’t want to sort the recyclables because there’s no demand,” LHT Holdings project consultant Teri Neo told *CNA*. “They cannot sell it, so they burn it.”¹

Collectors were forced to do things differently when China’s “National Sword” policy came into force in 2018. The policy banned the import of most plastics and other types of solid waste into the country and cut the acceptable contamination threshold for imported plastic waste to just 0.5%. At that point, Singapore had been sending a large amount of its recycling abroad for years. The country’s land and labour scarcity made the local processing of low-value plastic expensive. Further exacerbating the issue was the reality that food and other non-recyclable items often contaminated plastic recyclables in Singapore, necessitating additional cleaning and sorting that shot recycling costs up further. As such, it made more economic sense to sort most of the plastic locally, and then send it to low-cost recyclers in other countries. China had been one of Singapore’s most important recycling destinations – but China was no longer an option.

Singapore was not alone in facing these challenges. China’s National Sword policy sent shockwaves through recycling systems that had depended on Chinese demand for decades. Prior to the ban, China had absorbed a cumulative 45%, or 106 million metric tonnes, of the world’s plastic waste since 1992.² China had been the largest destination for United States scrap exports by a wide margin, purchasing up to 40% of everything the U.S. sent abroad for recycling, including plastics.³ The United Kingdom had also felt a sharp reversal: in the first quarter of 2017, China received 40% of the UK’s exported plastic waste; post-National Sword in 2018, that number dropped to just 3%. Malaysia became the top destination for UK plastic waste exports by the first quarter of 2018.^{4,5}

¹ Aqil Haziq Mahmud, “‘Cannot sell...so they burn’: What’s next in the uncertain future for plastic waste in Singapore?” *CNA*, June 3, 2018, <https://www.channelnewsasia.com/singapore/china-bans-plastic-waste-whats-next-for-recycling-in-singapore-826421>.

² Amy L. Brooks, Shunli Wang, and Jenna R. Jambeck, “The Chinese Import Ban and Its Impact on Global Plastic Waste Trade,” *Science Advances* 4, no. 6 (2018), <https://www.science.org/doi/10.1126/sciadv.aat0131>.

³ “Institute of Scrap Recycling Industries – Voice of the Recycling Industry,” *Business View Magazine*, January 15, 2019, <https://archive.businessviewmagazine.com/institute-of-scrap-recycling-industries/>.

⁴ Ray Georgeson, “CRW0014 – Written Evidence Submitted by the Resource Association,” UK Parliament, Environmental Audit Committee, January 2018, <https://committees.parliament.uk/writtenevidence/86039/html/>.

⁵ Ida Lim, “Audit: Malaysia Top Destination for UK’s Plastic Waste in Q1 2018,” *Malay Mail*, July 24, 2018, <https://www.malaymail.com/news/malaysia/2018/07/24/audit-malaysia-top-destination-for-uks-plastic-waste-in-q1-2018/1655337>.

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The episode was a blunt reminder of the truth that someone, somewhere, always had to bear the cost of managing what others generated. It was an open question whether policymakers should focus on managing plastic waste through better processing and disposal, or whether they should prevent industry and residents from creating that waste in the first place.

This case study examines three governments that have tackled this question in different ways: Singapore, a land-scarce nation with a technically sophisticated, infrastructure-heavy waste disposal system; Taiwan, which went from “Garbage Island” to creating a recycling system with an unusually high degree of civic participation; and China, the originator of the National Sword shock and the world’s largest generator of plastic waste at the time of writing.

Singapore: Managing Waste in a Tiny City-State

Singapore’s entire territory was smaller than New York City. The country occupied a mere 734 km² of land, making it one of the world’s most land-constrained nations. An offshore enclosure of about seven kilometres perimeter located a few kilometres south of the island state was Singapore’s only landfill, Semakau. The landfill would hit full capacity in 2035.

“Singapore is facing a unique challenge that many other countries will not encounter: We will not have space for another landfill once Semakau reaches its full capacity,” Nanyang Technological University School of Civil and Environmental Engineering chair told *The Straits Times*.⁶

These geographical realities were not new for Singapore. Because of these constraints, the country had long treated waste management primarily as an infrastructure and engineering problem rather than a behavioural one. Singapore had optimised its waste management system to minimise the volume of waste requiring final disposal and to extract energy from that waste along the way. Recyclables went to Materials Recovery Facilities for sorting, after which the recyclables went onward to local and overseas recycling plants to be reprocessed into new materials or products. The bulk of the recycling went abroad to countries including Australia, China, India, Indonesia, Malaysia, South Korea and Thailand; after China’s National Sword policy came into force, more of Singapore’s recyclables had to be incinerated.⁷

Meanwhile, unrecyclable waste went to one of Singapore’s four waste-to-energy plants. The waste was incinerated and reduced to about a tenth of its former volume, while the heat from incineration generated electricity. The ash then went to Tuas Marine Transfer station to be unloaded onto barges before being transported 30 km by tugboat to Semakau Landfill.

By 2025, Singapore had reached an unprecedented peak in trash production. The country had disposed of about 3.36 million tonnes of waste in 2025, a record high that had occurred alongside economic and population growth.⁸ Roughly a quarter of that waste was plastic. Meanwhile, Singapore’s overall recycling rate was down: 52% in 2025 versus 59% in 2019, with the domestic recycling rate having fallen from 17% to 11% and the non-domestic recycling rate having fallen from 73% to 67%.⁹ The 2015 Sustainable Singapore

⁶ Ang Qing, “New Research Centre Set to Turn Landfill Trash into Treasure,” *The Straits Times*, June 18, 2026, <https://www.straitstimes.com/singapore/environment/new-research-centre-to-turn-trash-on-singapores-sole-landfill-semakau-to-treasure>.

⁷ Trang Chu Minh, “Five Facts about Unsustainable Waste Management in Singapore,” *Eco-Business*, January 11, 2021, <https://www.eco-business.com/opinion/five-facts-about-unsustainable-waste-management-in-singapore/>.

⁸ Ang Qing, “Zero-Waste Masterplan to Be Reviewed as Singapore Recycles Less, Disposes More,” *The Straits Times*, June 18, 2026, <https://www.straitstimes.com/singapore/environment/zero-waste-masterplan-to-be-reviewed-as-singapore-recycles-less-disposes-more>.

⁹ Janil Puthuchear, “Catalyst 2026 – Dr Janil Puthuchear” (speech, Ministry of Sustainability and the Environment, Singapore, June 17, 2026), <https://www.mse.gov.sg/latest-news/catalyst-2026---dr-janil-puthuchear/>.

Blueprint had aimed for 30% and 81% domestic and non-domestic recycling rates respectively by 2030.¹⁰ Plastic had one of the lowest recycling rates of any waste stream at 4%, compared to ferrous metal at 99%, food waste at 18% and paper and cardboard at 31%.¹¹

For the four-fifths of Singaporeans who lived in public housing (colloquially known as Housing & Development Board or HDB blocks), plastic and other recyclables entered the waste management system through blue recycling bins found at every HDB block. These bins were commingled, so residents could deposit paper, glass, plastic and metal together. This system lowered the burden on individual households and helped improve the recycling rate, but raised the risk of contamination of the recyclables. Around 40% of what entered the blue bins could not actually be recycled because of contamination by food, liquid or non-recyclable items (Figure 1), a rate that had remained mostly unchanged for years despite repeated public education campaigns such as #RecycleRight.^{12,13} Researchers described the blue bins as being “routinely ‘polluted’ with rotting food and dripping liquids”, noting that in the course of their research they found items such as used sanitary napkins and diapers in the recycling bins.¹⁴



Figure 1: A contaminated recycling bin in Singapore.

Source: "Feeling Blue: A Critical Commentary on Singapore's Household Recycling Practices", Asia Research Institute, NUS.

In 2019, the NEA launched the country's first Zero Waste Masterplan, organised around the classic "3R" framework of Reduce, Reuse, Recycle. The masterplan set a target of a 70% overall recycling rate – 30% domestic and 81% non-domestic, just as in the 2015 blueprint – and a 30% reduction in per-capita waste sent to the landfill, both by 2030 "in order to extend Semakau Landfill's lifespan beyond 2035".¹⁵ That same year, Singapore passed the Resource Sustainability Act (RSA), a framework law aimed at pushing Singapore toward a "Zero Waste Nation" as part of its broader Zero Waste Masterplan.^{16,17} This act created Singapore's

¹⁰ Ministry of the Environment and Water Resources and Ministry of National Development, "Sustainable Singapore Blueprint 2015," Singapore, 2014, <http://www.mewr.gov.sg/ssb/files/ssb2015.pdf>.

¹¹ National Environment Agency (Singapore), "Annex A: Waste Statistics and Overall Recycling Rate," June 2026, <https://www.nea.gov.sg/docs/default-source/default-document-library/annex-tables-and-charts.pdf>.

¹² "Feeling Blue: A Critical Commentary on Singapore's Household Recycling Practices", Asia Research Institute, NUS, <https://ari.nus.edu.sg/ariscopes/feeling-blue-a-critical-commentary-on-singapores-household-recycling-practices/>.

¹³ "The Big Read in Short: Singapore's Household Recycling Blues," CNA, <https://www.channelnewsasia.com/today/big-read/big-read-in-short-singapores-household-recycling-blues-5883791>.

¹⁴ "Feeling Blue: A Critical Commentary on Singapore's Household Recycling Practices".

¹⁵ Singapore Zero Waste Masterplan

¹⁶ "The Resource Sustainability Act," Ministry of Sustainability and the Environment, Singapore, July 30, 2020, <https://www.mse.gov.sg/latest-news/resource-sustainability-act/>.

¹⁷ Resource Sustainability Act 2019 (Singapore), <https://sso.agc.gov.sg/act/rsa2019>.

first Extended Producer Responsibility (EPR) framework.

The RSA rolled out in stages. An EPR scheme for electronic waste took effect in mid-2021, requiring producers to bear the responsibility for funding a licensed operator to collect and recycle their end-of-life electronic devices. The RSA also introduced a Mandatory Packaging Reporting framework in 2021, requiring producers of packaged products with a turnover exceeding S\$10 million to report the type (e.g. plastic, paper, metal, glass) and volume of packaging they placed on the market, alongside their plans to reduce, reuse or recycle it. Policymakers designed this reporting requirement as groundwork for a fuller EPR regime for managing packaging waste, which the NEA targeted to have in place no later than 2025. One of the first phases of this scheme was the Beverage Container Return Scheme, which passed into law in 2023 and commenced in April 2026. This scheme placed a refundable 10-cent deposit on pre-packaged beverages sold in plastic and metal containers, redeemable at designated return points such as supermarkets. Eligible containers would display a Deposit Mark (Figure 2). Table 1 summarises the rollout.



Figure 2: The Deposit Mark placed on eligible plastic and/or metal beverage containers (left); Beverage containers displaying the deposit mark (right).

Source: National Environment Agency. “Beverage Container Return Scheme.” Accessed July 24, 2026.

<https://www.nea.gov.sg/our-services/waste-management/beverage-container-return-scheme>.

Year	Milestone
2019	Zero Waste Masterplan launched; Resource Sustainability Act passed
2021	EPR for e-waste takes effect; Mandatory Packaging Reporting begins for large producers
2023	Beverage Container Return Scheme passed into law
2025	Beverage Container Return Scheme (first phase of packaging EPR) set to commence
2026	Beverage Container Return Scheme actually commences after request from producers for more time
2030	Target: 70% overall recycling rate; 30% reduction in per-capita waste sent to landfill

Table 1: Singapore’s rollout of the Resource Sustainability Act.

Source: Author’s compilation based on Singapore’s Zero Waste Masterplan, Resource Sustainability Act 2019, the National Environment Agency “Beverage Container Return Scheme” and the National Environmental Agency’s guidance on “Where to Recycle E-Waste”, accessed August 27, 2026, <https://www.nea.gov.sg/our-services/waste-management/3r-programmes-and-resources/e-waste-management/where-to-recycle-e-waste>.

Singapore’s approach was well-resourced and technically sophisticated, and policymakers had set clear goals and statutory deadlines. These qualities distinguished Singapore’s approach to plastic recycling from that of many peer economies. Yet the core of Singapore’s system still centred on waste management rather than waste prevention: consumer plastic packaging remained pervasive, and contamination continued to erode the value of recyclables that could be collected. The country’s principal response to unrecyclable plastic was to burn it for energy rather than eliminate it at the source. Whether the phased introduction of EPR for

packaging – still in its infancy at the time of writing – would shift this balance toward upstream prevention remained an open question.

Taiwan: From “Garbage Island” to Circular Ambitions

If you lived in Taiwan (at the time of writing), you might be very familiar with the classical music composition “Für Elise” – but not for reasons you might expect.

The melody was a “Pavlovian call to action” for Taiwanese residents, according to *The New York Times*.¹⁸ When residents heard the tune outside their windows, they would likely think “time to take the trash out” and run out of their apartments with their trash bags to the yellow garbage trucks on the street that would collect trash, recyclables and organic waste. They might also use the trash disposal as an opportunity to catch up with their neighbours – the shared responsibility and ritual of residential trash collection had become a type of community building in Taiwan. This system contrasted with the more common arrangement in developed countries of residents depositing their trash into a larger bin, often on wheels, outside their living area for garbage collectors to pick up.

“Whenever I hear the music, I always think that I need to hurry up to take out the garbage,” a Taipei resident, Ms Chen, told *The Guardian*.¹⁹

Thanks to the residential garbage disposal trucks, Taipei’s household waste had decreased by about two thirds.²⁰ This decrease was part of the transformation that reshaped Taiwan’s recycling story, whose beginnings were messy and humble. In 1979, Taiwan was producing 8,800 metric tonnes of municipal solid waste daily, a number that climbed to 18,800 and 21,900 metric tonnes in 1990 and 1992 respectively.²¹ Of the massive amounts of trash collected, 90% would go to landfills that were unsanitary and at capacity. By the mid-1990s, two-thirds of the island’s landfill sites were full or close to it and, in the absence of adequate disposal capacity, uncollected waste piled up in the streets. The trash collection rate was only 70%, and recycling was almost nonexistent as a practice.²² Public unrest, including protests and blockades against proposed incinerator and landfill sites, grew as residents suffered from increasing air and groundwater pollution as well as generally unpleasant surroundings. The trash disposal crisis became so severe that Taiwan was christened the region’s “Garbage Island”.

But as of September 2026, remarkably, Taiwan produced among the lowest household trash per capita in the world.²³ The country also had one of the world’s best household and commercial recycling rates at 55%. The trash crisis and the community activism over overflowing landfills and street garbage had helped catalyse a turning point for Taiwan, and pushed the government to consider alternative options apart from building more incineration plants and creating more landfill sites in Taiwan.

¹⁸ “In Taiwan, When You Hear Beethoven, It’s Time to Take Out the Trash,” *The New York Times*, February 8, 2022, <https://www.nytimes.com/2022/02/08/world/asia/taiwan-waste-management-beethoven.html>.

¹⁹ Helen Davidson and Chi Hui Lin, “Classical Trash: How Taiwan’s Musical Bin Lorries Transformed ‘Garbage Island,’” *The Guardian*, December 26, 2022, <https://www.theguardian.com/world/2022/dec/26/classical-trash-how-taiwan-musical-truck-transformed-garbage-island>.

²⁰ Davidson and Lin, “Classical Trash.”

²¹ Hope Ngo, “How getting rid of dustbins helped Taiwan clean up its cities,” BBC, May 26, 2020, <https://www.bbc.co.uk/future/article/20200526-how-taipei-became-an-unusually-clean-city>.

²² Marcello Rossi, “How Taiwan Has Achieved One of the Highest Recycling Rates in the World,” *Smithsonian Magazine*, December 28, 2018, <https://www.smithsonianmag.com/innovation/how-taiwan-has-achieved-one-highest-recycling-rates-world-180971150/>.

²³ Jane Rickards, “From ‘Garbage Island’ to a Model of Recycling,” *Taiwan Business TOPICS*, October 23, 2019, <https://topics.amcham.com.tw/2019/10/garbage-island-to-recycling-model/>.

“Trash is an obvious, visual problem, and the people felt they could do something, and they did, so they came together,” waste researcher Nate Maynard told the *BBC*.²⁴

The financial and institutional backbone of this turning point was the 4-in-1 Recycling Programme. The programme’s “4-in-1” name referred to the four groups it wove together into a single system: community residents, local government, licensed recycling enterprises and a dedicated recycling fund. The fund was the programme’s real engine, drawing money from fees that manufacturers and importers of designated products paid under Taiwan’s EPR scheme, then using those fees to pay collectors and processors for handling items that would otherwise be worth too little to bother recycling, such as a discarded television or broken-down motorcycle. By making it profitable to reclaim materials that had no real resale value on their own, the programme gave businesses a reason to keep collecting and processing waste rather than letting it pile up.

Here was an example of how the programme might have worked: An old refrigerator is dumped in a remote area. It might cost NT\$200 (S\$8) to move it and another NT\$200 to break it down into spare parts that might ultimately sell for only NT\$300 (S\$12). From the fund, the government recycling fund will subsidise the company with another NT\$300 to match the resale price, enabling it to earn a profit and providing the incentive for it to remain in business.²⁵

Taiwan also increased residents’ responsibility for trash disposal. Some local governments introduced “pay-as-you-throw” systems, under which residents were required to purchase specially marked, government-issued trash bags to dispose of non-recyclable general waste, which they would then bring to collector’s trucks directly together with their recyclables. In Taipei, these were distinctive blue bags whose price bundled in the disposal fee. By contrast, recyclables required no special bag; residents could place them in any bag or container, which created a direct financial incentive to sort the trash. Fines provided a further reason to do things properly: those who did not sort their garbage correctly risked fines of NT\$1,200 to NT\$6,000 (S\$48 to S\$240).

The initial iteration of the “pay-as-you-throw” scheme had its hiccups, as people started “cheating” by throwing their household trash away in public bins. Taiwan responded by getting rid of most of its bins, and the musical garbage collection system took root instead. At the time of writing, there was about one bin to every 1,500 residents in Taipei.²⁶

“Today it’s hard to see any trash or even garbage bins while walking through Taipei,” journalist Marcello Rossi wrote.²⁷ Some felt that the relative inconvenience of a lack of bins, which necessitated people holding on to their waste until they got home, made people more mindful of their trash generation.

Though Taiwan had created one of the world’s most effective systems for capturing and processing waste, the country still generated a lot of plastic trash. The country’s annual demand for plastic was about 13 million tonnes.²⁸ The COVID-19 pandemic of the early 2020s had increased demand for single-use plastic containers as well as for online shopping, which led to more discarded plastic packaging. Single-use cup

²⁴ Ngo, “How Taipei Became an Unusually Clean City,” *BBC*.

²⁵ Rickards, “From ‘Garbage Island’ to a Model of Recycling.”

²⁶ Ngo, “How Taipei Became an Unusually Clean City,” *BBC*.

²⁷ Marcello Rossi, “How Taiwan Achieved One of the Highest Recycling Rates in the World,” *Ensis*, December 18, 2018, <https://ensia.com/features/taiwan-recycling-upcycling/>.

²⁸ “Plastics Resources Circular Treatment,” Ministry of Environment (Taiwan), published August 9, 2023, updated August 16, 2024, <https://www.moe.gov.tw/en/env-affairs/resource-circulation/circular-treatment/plastics-resources-circular-treatment/3234.html>.

consumption ran into the billions every year, and the average person in Taiwan went through roughly 700 plastic bags annually.²⁹

At 40%, Taiwan's plastic recycling rate was lower than the country's overall recycling rate of 55%. Different plastic types recycled at different rates: Taiwan recycled 95% of its polyethylene terephthalate (PET) containers,³⁰ for example, but other types of plastic such as polystyrene (PS/Styrofoam) and mixed or multi-layer plastics were harder to recycle. These plastics were low-value, low-density, contained hazardous additives or were difficult to separate for reprocessing, traits that made them economically unviable for processing. Most of the roughly 1.6 million tonnes of plastic that did not get recycled ended up incinerated for energy recovery, rather than landfilled or lost to the environment. Taiwan's collection and sorting infrastructure ensured that very little of Taiwan's plastic waste escaped the system uncounted.

But an efficient recycling and recovery system was not the same as reducing plastic use in the first place. Taiwan's plastic waste generation kept climbing, and policymakers had to reckon with that gap. Taiwan's plastics regime continued to evolve over the year 2025. The Ministry of Environment moved to broaden the scope of plastic flat packaging subject to its producer recycling levy, a revision originally scheduled for 1 May 2025 and pushed back two months to give businesses more time to comply.³¹ The Ministry also introduced discounted EPR rates for containers made with recycled plastic content or content that followed certain "green" design standards.³²

At the same time, Taiwan scaled back its broader single-use-plastics policy. Officials had pledged in 2018 that by 2030 Taiwan would no longer use four single-use plastic items: straws, beverage cups, shopping bags and disposable tableware, all of which were ubiquitous on the island. In late 2025, it became clear that Taiwan would not meet this target. The Ministry of Environment then set more modest single-use plastic reduction goals of 5% and 10% versus 2024 levels by 2030 and 2035 respectively, and also widened the regulated categories from four to six by adding retail and e-commerce packaging to include some of the country's fastest-growing waste streams.

China: A Former Dumping Ground Conducting a Rapid Buildout

The National Sword policy described at the opening of this case was not an isolated act in China's broader tightening of recycling imports. The policy followed the Operation Green Fence of 2013, a crackdown on low-quality material entering the country that intensified enforcement of existing contamination standards such as a 1.5% contamination limit on recyclables including plastics, paper, metal, textiles and rubber.

Policymakers designed Green Fence as a time-boxed enforcement campaign that ran between February to November 2013.³³ The 1.5% limit had existed for years prior, but had been loosely and inconsistently enforced; after years of relatively lax checking, officials were now applying the standard for real. Customs officials began opening and inspecting bales and rejecting shipments that exceeded the 1.5% threshold instead of waving contaminated shipments through as had often happened before. The operation shocked the plastic recycling industry, which had nowhere else that could take in its waste at the same volumes as

²⁹ Taejun Kang, "Taiwan Shifts Plastic Policy Away from Bans, Sets New Reduction Targets," *Eco-Business*, January 5, 2026, <https://www.eco-business.com/news/taiwan-shifts-plastic-policy-away-from-bans-sets-new-reduction-targets/>.

³⁰ Steven Crook, "Environmental Impact Assessment: Reducing Taiwan's Virgin Plastics," *Taipei Times*, May 25, 2022, <https://www.taipeitimes.com/News/feat/archives/2022/05/25/2003778766>.

³¹ Yake Liu, "Taiwan Delays Implementation of Expanded Recycling Levy Scope for Plastic Packaging," *Envilience ASIA*, June 11, 2025, https://envilience.com/regions/east-asia/tw/report_13704.

³² Beatriz Santos, "Taiwan Introduces Discounted EPR Rates for Recycled Plastic Containers," *Plastics News*, January 7, 2025, <https://www.plasticsnews.com/news/taiwan-introduces-discounted-epr-rates-recycled-plastic-containers/>.

³³ Katie Earley, "Could China's 'Green Fence' Prompt a Global Recycling Innovation?," *The Guardian*, 2013, <https://www.theguardian.com/sustainable-business/china-green-fence-global-recycling-innovation>.

China had. But the inspection intensity didn't last after the campaign duration and tapered off as attention moved elsewhere.

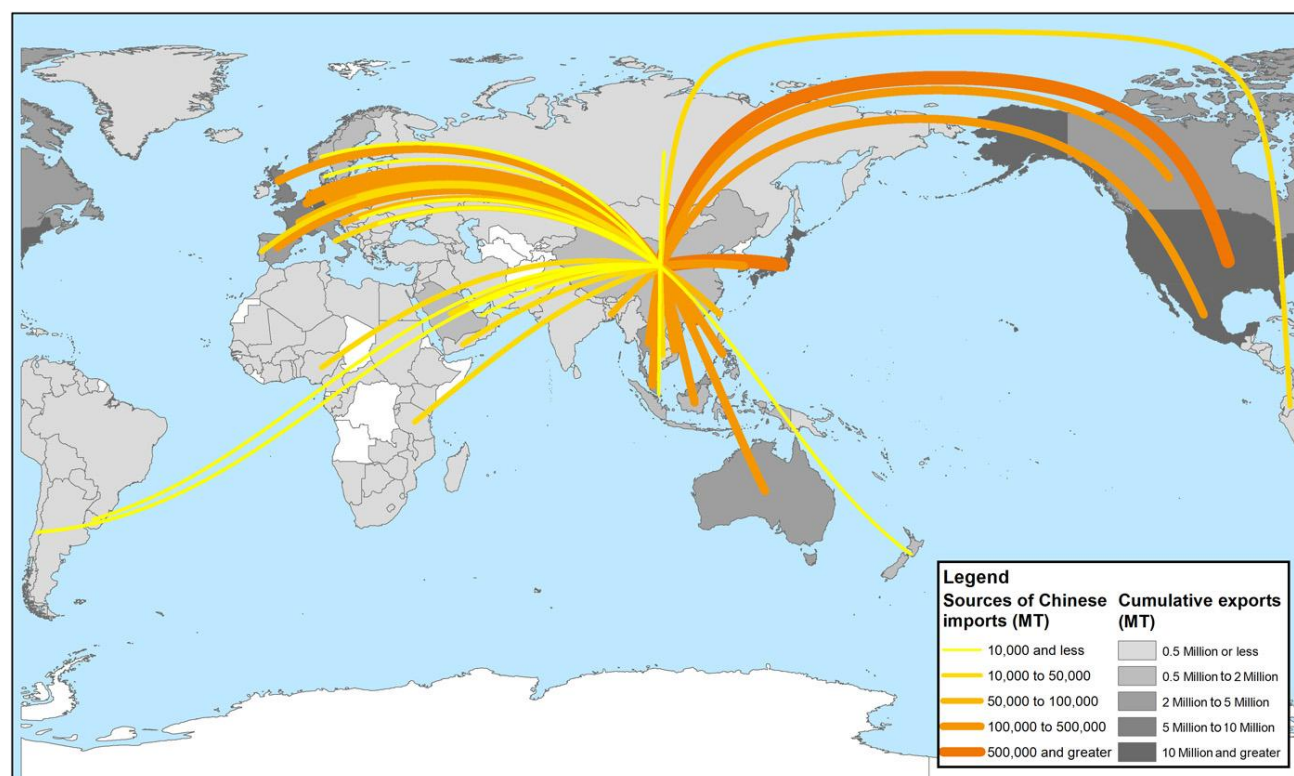


Figure 3: Sources of Chinese plastic waste imports in 2016, prior to the National Sword Ban, and cumulative plastic waste exports (in million metric tonnes) from 1988-2016. White areas represent countries with no reported plastic waste export numbers.

Image and caption adapted from Brooks, Wang, and Jambeck, "Chinese Import Ban."

It was the National Sword policy that actually created new rules that would truly affect business as usual. Announced in 2017, the policy completely restructured China's solid waste imports, banning 24 categories of solid waste as well as implementing a 0.5% contamination threshold, which was 20 times lower than the previous maximum threshold. The move was a real blow to higher-income countries that had relied on sending their plastic waste to East Asia for years.

Researchers estimated that the policy would shift around 111 million metric tonnes of plastic waste out of its previous disposal pathway by 2030, an amount equivalent to 47% of all imported global plastic waste since 1988, the year record-keeping began.³⁴ The same analysis cautioned that, by restricting what had previously been a large legal trade, the ban created a new incentive for displaced volumes to move through informal or illegal channels rather than disappearing from the global waste stream altogether. Subsequent reporting would later substantiate this risk. Countries sending waste abroad often disguised it as something else, allowing recycling companies to sneak it into the region undetected.³⁵ Malaysia, which became the world's new destination for plastic waste almost overnight after the ban, repatriated nearly 4,000 metric tonnes of scrap plastic to countries including the United States, the United Kingdom, Canada, France, Spain and Japan.³⁶

³⁴ Brooks, Wang, and Jambeck, "Chinese Import Ban."

³⁵ Aarushi Jain, "Trash Trade Wars: Southeast Asia's Problem with the World's Waste," Council on Foreign Relations, May 8, 2020, <https://www.cfr.org/articles/trash-trade-wars-southeast-asias-problem-worlds-waste>.

³⁶ Angus McNeice, "Malaysia Refuses to Be World's 'Garbage Dump,'" *China Daily*, January 21, 2020, <https://www.chinadaily.com.cn/a/202001/21/WS5e265851a3101282172726e6.html>.

"Our position is very firm...we want to communicate the message that Malaysia is not the dumping site of the world," Malaysian Environment Minister Yeo Bee Yin said in the wake of Malaysia's sudden recyclables inundation.³⁷



Figure 4: Plastic waste at an illegal recycling factory in Malaysia.

Source: McNeice, "Malaysia Refuses to Be World's 'Garbage Dump.'"

Having shut its doors to imported waste, China turned its regulatory focus to its own domestic plastic waste stream, which was also substantial. The pre-ban imports had contributed 10% to 13% of additional waste to China's domestic load, which was 60.9 million metric tonnes in 2016.³⁸ China was one of the world's largest absolute generators of plastic waste, thanks in large part to a burgeoning e-commerce industry worth \$1.8 trillion in 2021.³⁹

Plastic product consumption in China nearly doubled from 2008 to 2017, going from under 40 million tonnes to over 75 million tonnes. In 2019, production exceeded consumption by five million tonnes, and China became the world's biggest generator of plastic waste.⁴⁰ In January 2020, China's National Development and Reform Commission and the Ministry of Ecology and Environment jointly issued an "Opinion on Further Strengthening the Control of Plastic Pollution" laying out a phased, multi-year roadmap for phasing out and restricting various single-use plastics while simultaneously building up the country's recycling and alternative materials infrastructure. By 2020, it called for banning and restricting the production, sale and use of certain plastic products in key regions and cities, alongside a push for alternatives; by 2022, these bans and restrictions should expand to more cities and sectors nationwide; by 2025, a full management system covering production, distribution, use, recycling and disposal of plastics should be in place.

China paired the restriction order with an industrial policy push into biodegradable plastics as a substitute material, with mixed results. Major retailers such as Carrefour, Hema and Bianlifeng switched to

³⁷ McNeice, "Malaysia Refuses to Be World's 'Garbage Dump.'"

³⁸ Brooks, Wang, and Jambeck, "Chinese Import Ban."

³⁹ Chang Che, "Is the 'Strictest Plastic Ban in History' Working in China?," *The China Project*, April 6, 2021, <https://thechinaproject.com/2021/04/06/is-the-strictest-plastic-ban-in-history-working-in-china/>.

⁴⁰ Au Shion Yee, "Managing Plastic Waste in the People's Republic of China," *ADB Briefs*, no. 249 (Manila: Asian Development Bank, June 2023), <https://www.adb.org/sites/default/files/publication/891876/managing-plastic-waste-prc.pdf>.

biodegradable shopping bags, while big restaurant chains and delivery platforms such as Heytea began using biodegradable straws and packaging. But small roadside shops and fruit stands were still largely using regular plastic bags, mainly because biodegradable bags cost about 10 times more per unit than these bags – roughly 0.2 yuan vs 0.02 yuan. Some vendors said they would make the change once existing plastic bag stocks ran out.⁴¹

As demand for biodegradable plastics increased in the wake of the restrictions, the industry scrambled to keep up and companies rushed to build new production capacity for biodegradable material. Production capacity for biodegradable materials like PLA and PBAT raced ahead of actual market demand, leaving China with a fragmented industry that would need to consolidate around stricter quality standards that the state had put in place in response to complaints about misleading claims and poor product quality.⁴²

Meanwhile, China had invested heavily into the disposal side, building what was at the time of writing easily the world's largest fleet of waste-to-energy incinerators. Nearly half of the world's waste-to-energy incinerators were located in China, creating a combined daily processing capacity exceeding 1.1 million tonnes – the world's highest.⁴³ The goal was for incineration to handle nearly one third of the country's household waste by 2030. The buildout had been so rapid that the incinerators were reported to be running at only 60% capacity in 2025.⁴⁴ And the expansion had not been without friction: lawsuits and protests, some of them violent, had accompanied waste facility siting decisions across the country for years over concerns about environmental contamination, health risks and more.

Three Models, One Problem

There was no single template for managing plastic waste. Each of Singapore, Taiwan and China took approaches that hinged on factors such as land availability, administrative capacity, culture, wealth and more, and landed on very different solutions to the same problem (Table 2).

Indicator	Singapore	Taiwan	China
Primary policy lever	Infrastructure and incineration; EPR	Producer-funded recycling fund; civic enforcement	Import bans; domestic consumption restrictions; large-scale recycling and incineration
Recycling rate	~12% domestic, ~52% overall (2023)	58% general waste, 85% industrial waste (2023)	31% of waste plastics recycled (2021)
Disposal default	Recycling where feasible; incineration; Semakau Landfill for incineration ash and non-incinerable waste	Recycling and incineration; landfill role much reduced from prior years	Recycling, incineration and landfill

⁴¹ Jingyuan Guo and Yong Yuan, "可降解塑料制品市场调查：行业规模小而散，面临产业升级挑战" [Market Survey of Biodegradable Plastic Products: Small and Scattered Industry Scale, Facing Industrial Upgrade Challenges], *Economic Daily*, repr. Sina Finance, April 6, 2021, <https://finance.sina.com.cn/tech/2021-04-06/doc-ikmxzfmk4552708.shtml>.

⁴² "New Market Analysis: Bio-Based and Biodegradable Plastics Industries in China," *Renewable Carbon News*, May 31, 2024, <https://renewable-carbon.eu/news/new-market-analysis-bio-based-and-biodegradable-plastics-industries-in-china/>.

⁴³ Zhao Yusha, "China's Advanced Waste Treatment Technology Boosts Green Transition at Home, Abroad," *Global Times*, July 9, 2025, <https://www.globaltimes.cn/page/202507/1337989.shtml>.

⁴⁴ Zhao, "China's Advanced Waste Treatment Technology."

Indicator	Singapore	Taiwan	China
Key constraints	Land scarcity; small domestic market and limited domestic reprocessing capacity	Dependence on high civic participation	Uneven enforcement outside major cities; enormous scale of domestic plastic waste

Table 2: Different policy levers and constraints of Singapore, Taiwan and China in plastic recycling. Note that recycling rate definitions differ across jurisdictions.

Source: Author's compilation based on the National Environment Agency's "2023 Waste Statistics and Overall Recycling Rate Table", accessed August 27, 2026, https://www.nea.gov.sg/docs/default-source/media-files/news-releases-docs/annex-b_2023-waste-and-recycling-statistics.pdf; Taiwan Ministry of Environment's "Recycling rate of municipal waste" and "Industrial Waste Reuse Rate" (both translated), accessed August 27, 2026, https://smmdb.moenv.gov.tw/SMM_MF/WasteRecycling; https://smmdb.moenv.gov.tw/SMM_MF/BusinessWasteRecycling and China National Development Reform Commission's "What Does It Mean for China to Rank First Globally in Waste Plastic Recycling? An Interview with Wang Yonggang, Secretary-General of the Recycled Plastics Branch of the China Association of Circular Economy (Resource Recycling Association)" (translated), accessed August 27, 2026, https://www.ndrc.gov.cn/xwdt/ztlz/slwzlxzd/202206/t20220625_1328705.html.

At their core, all three systems were downstream-oriented. Each had invested heavily in managing plastic waste after generation, whether through sorting or incineration, rather than in substantially reducing how much plastic entered the picture in the first place. Singapore's EPR framework for packaging, still in its early phase at the time of writing, has yet to be tested at scale. Taiwan's producer fees had funded an effective collection and recycling infrastructure, but had not obviously reduced Taiwanese plastic consumption. China's restriction order targeted specific single-use categories, but left the big-picture question of national plastic production largely untouched.

Together, the three cases suggested that behaviour was easier to change through system design than through persuasion alone. Singapore had run its #RecycleRight campaign for years, but contamination of recyclables in Singapore remained high; public messaging alone could not compete with a commingled collection system that made sorting low-stakes and "out of sight, out of mind" for households. Taiwan's far higher recycling participation relied on the design of a system that made it costly for people to not recycle, as well as a collection ritual in the form of musical trucks that made sorting a visible, socially observed act. Taiwan had built a system in which actually caring about recycling was not required for the desired behaviour to occur. Meanwhile, China's policymakers changed the choices available to consumers, restricting the production, sale and use of selected single-use plastics as well as expanding recycling and alternative materials infrastructure. In each case, the system design influenced behaviour, but through different mechanisms: Singapore largely sought to make recycling convenient, Taiwan turned recycling into a financially consequential and socially visible endeavour and China sought to restrict what consumers could access in the first place.

As at September 2026, the plastics recycling story was still evolving in all three countries, with none of their policies staying still as each continued to learn lessons about their waste. Singapore had pushed its beverage container deposit scheme back multiple times after concluding that producers and retailers needed more preparation time, while Taiwan had replaced its 2018 pledge to eliminate straws, beverage cups, shopping bags and disposable tableware by 2030 with more modest targets. China was phasing in its restriction order by city tier and experiencing the growing pains of inconsistent enforcement in each locality. None of the three governments had truly solved plastic recycling, and each faced constant negotiation between the governments' ambitions and the pace at which households, business and infrastructure could actually change.

Discussion questions

1. What obligations, if any, do wealthy waste-exporting countries have towards the countries that import and process their waste?
2. The three cases presented here suggest that it may be more effective to redesign systems around people so that the desired behaviour becomes the easiest one, rather than to actually change people's behaviours around waste. To what extent can concepts from behavioural science, such as nudges, help explain the successes and limitations of the approaches that Singapore, Taiwan and China have taken? Singapore's contamination rate has hovered around 40 percent for years despite public education campaigns. How might policymakers make systems design changes to reduce it? What would those changes cost?
3. Are there conditions under which public education campaigns are still the right tool, even if redesigning the system is generally more effective?
4. Taiwan's recycling model depended heavily on civic buy-in. Would such civic buy-in be easy to cultivate in Singapore or China, or in your home country? How would you go about cultivating it?
5. Imagine you are advising a mid-sized, middle-income country with limited waste infrastructure and no existing EPR framework. Which specific policies from this case would you recommend adopting first, and which would you avoid? Justify both choices.
6. Singapore's waste generation hit a record high in 2025, five years away from the Zero Waste Masterplan's 2030 deadline. Taiwan's plastic consumption kept climbing even under one of the world's most effective collection systems. Does rising plastic waste generation, even alongside strong collection and processing systems, count as a policy failure?