



Closing the loop or widening the gap? The unequal politics of Thailand's circular economy in addressing marine plastic pollution

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1. Introduction

In January 2022, the government of Thailand introduced its most ambitious plastics reform plan to date. Framed within the globally trending circular economy model, Thailand's "Roadmap on Plastic Waste Management" ushered in a nationwide ban on four types of plastic waste: thin plastic bags, polystyrene (Styrofoam) food containers, plastic straws, and single-use plastic cups (World Bank, 2022). The roadmap came into effect four years after plastic pollution was declared a national priority in 2018 amidst international condemnation of Thailand's global ranking as the sixth worst marine plastic polluter (Jambeck et al., 2015) and one of Asia's highest consumers of single-use plastic products (Singh, 2019). These poor performance ratings, combined with public outrage over the deaths of whales and dugongs from plastic ingestion and the discovery of several kilometre-long garbage islands off the coast of Southern Thailand, catalysed government responses to deal with the marine plastic pollution problem (Marks et al., 2020). Despite this culmination of (geo)political pressures, Thailand's roadmap was effectively diluted four months after its inauguration; by April 2022, political leaders had already begun to replace their language about banning these four types of plastic with softened rhetoric about its reduction ("Enforce the plastic ban," 2022).

What do these developments tell us about the political economy of Thailand's sustainable plastics transition and the circular economy model that underpins and legitimises it? The circular economy seeks to replace unsustainable forms of waste management (for example, landfills or incineration) with systems that are as closed as possible in reducing litter and reusing, recycling and recovering post-consumer

products (Arsova et al., 2022). Although circularity has been interpreted and applied very differently within and between national contexts (Ncube et al., 2022; Rótolo et al., 2022), at its core, it rests on three principles of eliminating waste and pollution, keeping products and materials in use, and regenerating natural systems (Ellen Macarthur Foundation, 2021). Introduced as a sustainable business model, it has been taken up by corporations and governments alike as a lucrative opportunity to turn the crisis of marine plastic pollution into potential profit (Mah, 2021).

What is largely lacking from circular economy studies, however, is analysis of the complex social realities that shape environmental (in) justice and social-ecological outcomes (Schröder et al., 2020). In particular, little is known about how existing inequalities affect the ability of circular economy regimes to reduce the generation of plastic waste (Valenzuela-Levi, 2020). A nascent literature on the geopolitical dimensions of circularity has directed attention toward inequalities between wealthy, waste-exporting countries and low and middle-income waste-importing countries, to the generalisable detriment of the latter (Corvellec et al., 2022). Within waste-importing countries, too, informal waste pickers who play a substantial role in circular activities of recycling, reusing and repairing plastic products are excluded from official policy discourses (Dhokhikah and Trihadiningrum, 2012; Dias, 2012) but disproportionately exposed to petrochemical pollutants that have implications for future generations (Valenzuela and Böhm, 2017). The considerable influence of corporate agendas over plastic reform policies (Dauvergne, 2018) and the attendant rise of the circular economy as a "dominant corporate sustainability concept" (Mah, 2021: 121) have seen its zero-waste claims become actively

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de-politicised in policy circles to safeguard capital-driven growth (Valenzuela and Böhm, 2017). For example, plastic producers have pushed this model while continuing to produce plastics at high rates. Political economy approaches to understand the anthropogenic (largely land-based) drivers and transboundary (including marine and coastal) issues posed by plastics pollution are similarly lacking (Marks et al., 2020), as are (geo)political assessments of the governance options for regulating, responding to, and reducing global plastic waste flows (Barrowclough and Birkbeck, 2020).

Our political economy analysis contributes to this emerging literature by answering two questions: (1) How are structural inequities and social inequalities embedded in, and perpetuated, by the circular economy model? (2) How do these inequities/inequalities compromise the model's overall objectives? The study analyses the terrestrial origins of marine plastic pollution in Thailand, a middle-income, waste-importing country characterised by a widening wealth gap and political fragmentation that leaves disunited and underfunded state agencies prone to capture by profitable but polluting industries (Marks and Breen, 2021). Despite its initiation of a number of ambitious policies and strategic plans aimed at combatting marine plastic pollution, Thailand remains a major polluter of the global oceans (Pucino et al., 2020). A World Bank (2022) study found that less than one-quarter (21%) of Thailand's aggregate plastic is reutilised, totalling material value losses of around US\$3.6 to US\$4 billion annually (World Bank Group, 2021). The progression of the COVID-19 pandemic has added to these transboundary flows of marine pollution through the consumption and disposal of single-use face masks, takeaway food containers and other packaging (Miller et al., 2022). Depressed global oil prices during the pandemic-induced recession have additionally reduced demand for recycled plastics by 50% in Southeast Asia as oil firms have heavily invested in producing cheaper, fossil fuel-derived plastics (Brock, 2020).

The political economy approach we use seeks to address power asymmetries and institutional imbalances in the circular economy model, building upon recent calls for a "circular humansphere" or a "human-embedded circular economy" that goes beyond the elimination of plastic waste to tackle poverty and societal inequalities at the same time (Schröder et al., 2020: 5). We posit that in the case of Thailand, some aspects of circularity are necessary to reform the political economy of plastic waste governance (Mah, 2021; O'Neill, 2019), but such an adapted model should not occur at the expense of human development or environmental justice. Specifically, we envisage a productive role for private companies in plastics reforms, but contend that growth-based agendas should not eclipse the public good of an overall reduction in plastic production. Inequities in the circular economy can be further mitigated by formalising Thailand's substantial informal recycling sector as public service providers (Singh, 2019).

In what follows, our methods are first described and we then develop these arguments by drawing from recent relevant literature to show how such inequities have become institutionally ingrained in the circular economy model in developing economies. The following section is a political-economy analysis of the main obstacles to implementing circular activities in Thailand's policy environment at local, sub-national and national scales of governance. The study then assesses how these barriers might be overcome by adapting aspects of circularity to reduce Thailand's contributions to marine plastic pollution, and, more broadly, to reform its political economy of sustainable development.

2. Methods

This research combines semi-structured interviews with qualitative documentary analysis. The purpose of combining these methods is both to triangulate our data and to bridge gaps in our primary and secondary data sets (Bowen, 2009). Between April and June 2021, the first author conducted 36 interviews using purposive (selective) sampling and snowball sampling (recruiting interviewees based on the recommendations of selected interviewees). We selected respondents to capture

sectoral diversity from (sub)national government agencies (8 representatives), private companies (14), civil society (7), academics (4), and international organisations (3) invested in Thailand's circular economy transition (see Appendix A). This was necessary to ensure that the full range of perspectives about inequality and its redress are represented in sustainability discourses. The third author, a Thai specialist of plastic waste management, identified and facilitated introductions to these interviewees. Due to the progression of the COVID-19 pandemic, the majority of interviews were conducted online via Zoom amidst intermittent lockdowns in Thailand's capital of Bangkok, where the field research was undertaken, although some in-person interviews were possible during the easing of travel restrictions. In the findings below, views and quotes from interviewees are denoted by their interview number as listed in Appendix A. We asked interviewees to articulate their beliefs and perspectives on a number of issues, including Thailand's progress in achieving a circular economy, barriers to improving the circular economy, the role of key agencies in promoting the circular economy, and their recommendations for reforms (see Appendix B for the list of interview questions).

We used qualitative documentary analysis to triangulate our interview findings. This entailed analysing government legislation, journal articles, NGO reports and media articles. Documents were selected for their focus on the governance dimensions of circularity. As for our literature review, we prioritised analysis of articles about the circular economy model that addressed social science questions of: (1) the (geo) political economy of plastics; (2) economic or social inequality; and (3) differences between waste-exporting countries and waste-importing countries. Qualitative document analysis is well suited to examining perceptions of (in)equity in the circular economy model that cannot be captured by quantitative methods. It is also conducive to analysing political choices and power asymmetries that do not lend toward statistical analysis (Bowen, 2009).

3. Global inequities and inequalities in the circular economy model

This section is concerned with how *inequities* (institutionalised injustices in governance) become embedded in the circular economy model to perpetuate and give rise to new social and spatial *inequalities* (unequal access to societal and ecological co-benefits). The circular economy mainly focuses on the materialities of plastic waste rather than on advancing societal well-being (Kirchherr et al., 2017; Schröder et al., 2020). Technocentric policy discourses about creating a closed loop for cycling linear waste processes back into production are designed to be reassuring, socially uncomplicated and environmentally attainable to attract financial investors (Corvellec et al., 2022). For these reasons, the ways in which circular visions of sustainable development perpetuate inequity and inequality remain critically understudied and largely undocumented (Valenzuela and Böhm, 2017). Yet, the "shadows of consumption" (Dauvergne, 2010) cast by the circular economy produce widespread and cascading impacts that raise difficult questions of environmental injustice within as well as between waste-importing and waste-exporting countries (Liboiron, 2021).

Our circular economy analysis aims to provide corrective redress for existing studies of between-country inequities that disproportionately blame developing countries for failed sustainability transitions. There is a tendency in existing literature to emphasise domestic barriers to implementing circular activities and to prescribe costly plastic reduction "solutions" that seek to replicate or emulate successful waste management regimes in developed countries. In such cases, the failure of developing countries to achieve Western European sustainability standards is generally understood to result from the former's inability or unwillingness to adopt more ecologically sustainable behaviours and practices (Ferronato et al., 2019). Discrepancies between developed and developing countries in capital, labour and environmental regulations therefore remain uncaptured in European Union (EU)-dominated

discourses that assume a one-size-fits-all circular economy model for Western market economies (Genovese and Pansera, 2021). Moreover, the EU has been able to set ambitious zero-waste targets as a core component of its climate plans precisely because its member states can afford to divert plastic waste flows to low and middle-income countries, many of which are in Southeast Asia (O'Neill, 2019).

While wealthy countries mobilise circular economies to enhance the quality of their domestic policy environments, their actual contributions to sustainable development are thus misleading and fuel societal inequalities in developing countries. Plastic waste generation is higher per capita in developed countries than in developing countries (Liu et al., 2018), which is hidden and left uncounted in offshoring policies and practices (Dauvergne, 2010; Giannakitsidou et al., 2020). For instance, China's circular economy has evolved alongside its transition into a waste-exporting country, placing additional pressure on Thailand and other countries in Southeast Asia to absorb waste that China once imported from the EU and USA (Marks et al., 2020).

Here, we posit that the circular economy, as a growth-based model, is structurally predisposed to perpetuating socially and spatially extended inequalities. The dumping and leakage of plastic waste into global oceans creates de-territorialised borderland spaces, representing the acute expression at the periphery of neoliberal capitalist agendas that absolve major polluters from legal and financial responsibility (Miller, 2020). Although up to 80% of marine plastic derives from land-based sources (Pawar et al., 2016), these terrestrial origins are not properly accounted for, either in circular economy models or in the United Nations Convention on the Law of the Sea (Marks et al., 2020). This lack of international legislation to enforce compliance with best waste management practices creates loopholes for petrochemical companies to push back against circular reforms aimed at limiting production. It also widens the space for circular marketing strategies to persuade consumers to take responsibility for their own actions (Clapp and Swanston, 2009) while allowing defenders of plastic production to blame societal actors for marine pollution (Mah, 2021). In emphasising plastic production's "demand" side (from consumers of plastic products), such arguments further assume a parity in consumers' capacity and willingness to pay for plastic bags without ever questioning the institutional imbalance of power in favour of the "supply" side by plastic producers (Valenzuela-Levi, 2020: 1100).

These inequities generate socially and spatially specific inequalities in varying (sub-)national contexts. In low and middle-income countries, government agencies frequently lack sufficient funds to effectively manage waste and undertake circular reforms (Diaz, 2017). This aggravates domestic inequalities. Day-wage waste pickers, who lack labour protections and health insurance, have long bridged state allocative deficiencies by playing a leading role in garbage collection, sorting and recycling (Ferronato et al., 2019). The exclusion of this low-income community of environmental best practice from circular discourses encourages "neo-colonialism" by depriving marginal people of political and economic agency (Corvellec et al., 2022). Unlike EU member countries, where the state is primarily responsible for waste segregation and recycling, in developing countries like Thailand, informal waste collectors play a key role (Archer and Adelina, 2021). The Thai government's uncritical adoption of trending concepts like circularity and eco-efficiency risks further displacing the important service provider role played by the informal sector, which already implements circular activities of recycling, reuse and repair activities (Genovese and Pansera, 2021; Scheinberg, 2011).

Hegemonic discourses that frame circularity as a lucrative growth opportunity add to existing societal imbalances and over-simplify complex environmental problems (Kovacic et al., 2019). In Thailand, for instance, the circular economy has been discursively embedded within the late King Bhumibol's (1946–2016) Sufficiency Economy philosophy. This has legitimised the national government's articulation of ambitious plans to develop a sustainable bio-economy that accelerates production of biochemicals, biopharmaceuticals and bioenergy "to

contribute up to 10% of the national GDP by 2037" (Thailand Board of Investment, 2019: 4). This profit-oriented vision of circularity that fuses corporate and political interests is by no means unique to Thailand. Rather, it patterns onto experiences of other developing countries where circular transitions have only been weakly implemented as investments in cost-effective but unsustainable plastics products have taken precedence over meaningful efforts to green value chains. Vague definitions and implementing guidelines that typically accompany growth-oriented circular transitions also mask or conceal a continued adherence to unsustainable development practices (Ngan et al., 2019). This in turn widens societal inequalities that have been found to displace development pressures through economic migration, evictions and forced resettlement (Corvellec et al., 2022).

Notwithstanding evidence that the circular economy contributes to, rather than reduces, inequities and inequalities within and between countries (Genovese and Pansera, 2021; Valenzuela and Böhm, 2017), this study shares the view taken by O'Neill (2019) and developed by Mah (2021) that some aspects of circularity are necessary to reform the political economy of plastic waste management. Building on this idea, we further argue that in the case of Thailand, the value perspectives of both plastics producers and the informal sector need to be officially integrated into such reforms. This is necessary to overcome existing barriers to cross-sector cooperation and to encourage the private sector to financially and logistically support the important work already undertaken by waste pickers in implementing circular activities. Recognising that powerful petrochemical companies are in fact part of the circular economy thus opens up opportunities to think about enrolling their resources to enhance underfunded state and societal programs that could help to mitigate the environmental costs and societal burdens of plastic production. Without such a multi-stakeholder commitment at local, (sub-)national and higher scales of governance, the growth imperative of circularity is likely to continue to displace low-income communities of environmental practice while substantially worsening the marine plastic pollution problem in the medium to longer term.

4. Opportunities and obstacles in Thailand's circular transition

It is important to understand the ways in which decisions about the circular economy at one scale are interpreted and acted upon at other scales of governance, both to overcome barriers to cooperation and to address structural inequities and socio-spatial inequalities associated with this growth-based model. The political economy of Thailand's sustainable plastics transition has so far been characterised by a series of policy disconnects between ambitious circular reforms at the national scale and difficulties regarding implementation at lower scales of governance, thereby reflecting deep power asymmetries within the waste management industry. This section examines where these disconnects exist across scales and sectors, with the aim of identifying opportunities for adapting aspects of circularity to a Thai context in fairer and more inclusive ways.

At the national level, Thailand's government has taken a two-pronged approach of seeking to harness the circular economy's growth potential on the one hand, while reassuring investors of its environmental sustainability on the other hand. In policy terms, this dual-track approach has involved efforts to capitalise on the global shift toward circularity by scaling up Thailand's Bio-Circular-Green (BCG) Economy, including through the government's provision of "investment incentives for companies that use secondary raw materials, operate waste recycling businesses or improve production processes to be environmentally friendly" (Thailand Board of Investment, 2019: 4). At the same time, the government has sought to implement a "National Roadmap on Plastic Waste Management 2018–2030" (Fig. 1) that commits to an overall reduction in plastic waste. Amending an earlier "National Master Plan for Waste Management 2016–2021," the roadmap articulates ambitious medium-term targets of halving marine plastic debris by 2027 and increasing plastic waste recycling by 50% by 2022,



Fig. 1. Thailand's roadmap on plastic waste management 2018–2030 (source: Pollution Control Department, 2021).

with a view to achieving “zero plastic waste” by 2027. Despite these efforts, Thailand has consistently failed to achieve its annual targets and was ranked the lowest among several countries in a 2022 survey by the Organisation for Economic Cooperation and Development (OECD) for its non-compliance with key policy instruments aimed at strengthening EPR (extended producer responsibility) and improving recycling rates by imposing landfill taxes (Fig. 2) (OECD, 2022). At the same time, the results of Fig. 2 can be understood through our lens of inequality/inequity. Thailand, as a waste-importing country, processes plastic products from several developed countries, compromising its capacity to develop sustainability measures at a corresponding pace. Compounding this burden, within Thailand, the political power wielded by petrochemical companies aggravates domestic inequalities and impedes the ability of government agencies to act cohesively in implementing meaningful environmental reforms.

4.1. Legal gaps, institutional fragmentation and power asymmetries

The absence of EPR provisions to hold plastics producers financially and/or physically accountable for the circular treatment of post-consumer plastics represents a significant legal gap in Thailand's roadmap (World Bank Group, 2021; see also Fig. 1). This gap reproduces unequal power dynamics between individual line ministries and Thailand's petrochemical sector, the biggest in Southeast Asia and the 16th largest globally, which contributes around 7% of Thailand's GDP (approximately US\$37 billion) annually (World Bank Group, 2021). Like fossil fuel and petrochemical industries globally (Barrowclough and Birkbeck, 2020), Thailand's powerful local companies, particularly those in the plastics industry, have used their considerable political and economic power to seek to maintain business as usual. In part, the petrochemical sector's resistance to bearing any costs of EPR can be attributed to concerns by individual companies about state corruption (Marks and Breen, 2021), which permeates Thailand's government system “from the top to the bottom in terms of municipal solid waste” (24). As one petrochemical company representative asked, “If we are going to make an EPR law, what will they [the government] do with the

fees?” (15). Somewhat differently an international donor explained that:

Thailand has been advised to install EPR schemes over last 10–15 years but they've never pushed it through because a strong industry lobby resisted. CP [Charoen Phokphand; Thailand's largest private company] and Thaibev ([Thai Beverage Public Company Limited; Thailand's largest beverage company] have been very anti-EPR schemes. They have huge market shares compared to other companies (23).

Politically-connected Thai conglomerates have succeeded, through their lobbyists, in preventing the passing of bills that seek to legislate EPR, not only for plastic waste pollution, but also for air and water pollution (Marks and Breen, 2021; Marks and Miller, 2022). This power imbalance in favour of Thailand's petrochemical companies has stymied the development of the government's plastic roadmap, resulting in a strategic plan rather than binding legislation (28). Thailand's roadmap prescribes voluntary measures instead of legally enforceable incentives (rewards conditional upon environmental performance) or disincentives (fines or jail terms) to comply with circular activities (4, 11, 13, 20, 21). The use of only voluntary measures means that government officials need “to negotiate with industry” and seek “cooperation” from “many sectors” (31). For example, the roadmap sets a date for banning several types of single-use plastics, but this is “not exactly a ban” (28) because state agencies need to “corroborate with traders and retailers to adopt voluntary measures to reduce single-use plastics” (28). The considerable influence of profitable but polluting industries over critical aspects of government procedure has in turn eroded political will (13, 18) to make EPR mandatory through a “central coordinated effort” (5) or a “regulatory framework” (13) to impose waste collection taxes and financial penalties for non-compliance with circular activities (21). In the absence of broad-based consensus about the need to reduce plastic production, fragmented government departments have often been compelled to backtrack on official policy (“Enforce the plastic ban,” 2022). Although civil servants have individually expressed a desire to introduce law enforcement measures (20, 21), this important omission has given rise to complaints that the roadmap is simply “designed to respond to public

	EPR on packaging & durables	Landfill or incineration taxes	Deposit-refund	Pay-as-you-throw
Belgium	●	●	●	●
Denmark	●	●	●	●
Estonia	●	●	●	●
Finland	●	●	●	●
Germany	●	●	●	●
Korea	●	●	●	●
Lithuania	●	●	●	●
Netherlands	●	●	●	●
Norway	●	●	●	●
Sweden	●	●	●	●
Switzerland	●	●	●	●
Austria	●	●	●	●
Czech Republic	●	●	●	●
France	●	●	●	●
Greece	●	●	●	●
Hungary	●	●	●	●
Ireland	●	●	●	●
Japan	●	●	●	●
Latvia	●	●	●	●
New Zealand	●	●	●	●
Poland	●	●	●	●
Portugal	●	●	●	●
Slovakia	●	●	●	●
Slovenia	●	●	●	●
United Kingdom	●	●	●	●
Australia	●	●	●	●
Canada	●	●	●	●
Iceland	●	●	●	●
Israel	●	●	●	●
Italy	●	●	●	●
Luxembourg	●	●	●	●
Spain	●	●	●	●
USA	●	●	●	●
Costa Rica	●	●	●	●
Brazil	●	●	●	●
Chile	●	●	●	●
China	●	●	●	●
Colombia	●	●	●	●
India	●	●	●	●
Mexico	●	●	●	●
South Africa	●	●	●	●
Turkey	●	●	●	●
Egypt	●	●	●	●
Ghana	●	●	●	●
Indonesia	●	●	●	●
Morocco	●	●	●	●
Nigeria	●	●	●	●
Philippines	●	●	●	●
Russia	●	●	●	●
Thailand	●	●	●	●

●	Binding policy that applies over the whole country
●	No instrument with wide geographic reach operational
●	Regulation in place equivalent to landfill taxes
●	System in implementation or in need of restructuring
●	National voluntary initiative
●	Operational system in place at the local level

Fig. 2. Comparison of circular economy instruments in several countries (source: OECD, 2022).

pressure” (28) because without “binding regulations there is no plastic police going to enforce the bans” (13).

For some government and private sector actors, this lack of state transparency provides opportunities for self-enrichment (21). Within Thailand’s Ministry of the Interior, its powerful Department of Local

Administrations that coordinates waste management among local governments is especially well positioned to profit from maintaining the status quo. The warm relationship between this department and the private sector is evidenced in the “landfill politics” (21) of waste-to-energy schemes that rely upon an ever-increasing volume of waste in landfills to generate energy and incomes. By contrast, the less powerful Pollution Control Department that seeks to implement the roadmap’s targets has “a few good [waste management] programs that were discontinued because of a lack of manpower and resources” (24). This lack of inter-departmental coordination (21) and cross-sectoral cooperation makes EPR laws difficult to pass, both because “you have to fight with the Ministry of Interior” (21) and “you get some pushback from private sector” (19). The Ministry of the Interior’s powerful Department of Local Administration (DOLA) supervises local administrative organisations (LAOs) in charge of waste management and has recently promoted waste-to-energy schemes. As one Thai researcher explained, “They’re the ones who benefit from the current situation ... There is landfill politics” (21). These landfill politics involve irreconcilable tensions between proponents of waste production for economic profit (through waste-to-energy schemes) and environmental reforms designed to reduce the overall volume of waste.

Overall, there has been a lack of government initiative to develop a new EPR law. As an international NGO official explained, “the government has set the BCG plan but we haven’t seen much in terms of implementation or progress from the government on EPR” (13). Nor has any progress been made toward preparing a state entity to manage future EPR payments or impose taxes on single-use plastics. The Ministry of Finance, which is best equipped to implement such a tax scheme, reportedly “doesn’t want to set up a new organisation” to do so (7). Without state agencies to enforce EPR laws or taxes, NGO, academic and some government interviewees expressed concerns that market forces will continue to determine recycling collection rates, which are especially low for multi-layered plastics that are too chemically complex to recycle using traditional and easily affordable technologies. Whereas PET (Polyethylene terephthalate, 100% recyclable plastic) packaging’s collect for recycling (CFR) rate was 46% in 2018, the CFR rates of all other types of plastic were 17% or lower (Fig. 3) (World Bank Group, 2021). For this reason, according to one government official, “In the absence of EPR, the informal sector usually won’t collect it [multi-layered plastics]. Or even if they do collect it, we need to have different outlets” (19). An executive of Indorama, a major plastic recycler, lamented, the reason why Thailand doesn’t follow European models that “put deposits back” is because Thailand’s Food and Drug Administration (FDA) “won’t be involved in passing regulations about bottle collection” (25).

At the level of policy implementation, due to the country’s incomplete decentralisation (see Marks and Lebel, 2016), local governments represent an expression of these power imbalances - both between individual line ministries and between the national government and petrochemical companies - through their collective inability to put the roadmap into practice. Thailand’s 77 provincial and 7850 LAOs that were excluded from centralised decisions about the roadmap (24, 30) have been awarded insufficient funds to operationalise it. This is partly attributable to legislative gaps at the national level that prevent local governments from coordinating waste management funds. For instance, under the 2007 Thailand Public Health Act, local governments are only allowed to charge collection fees from waste generators, but they cannot impose taxes for the treatment and safe disposal of plastic waste. Consequently, local governments must use collection fees, which only cover around 10% of total waste management costs in small municipalities and up to 36% in large municipalities, for both collection and treatment expenses (Babel et al., 2020). In this regard, Thailand’s local governments face similar problems to their counterparts in many other middle-income countries that have inadequate dedicated funds to manage existing waste and undertake systemic reforms (Diaz, 2017). As one interviewee observed, with a total waste management budget of “30

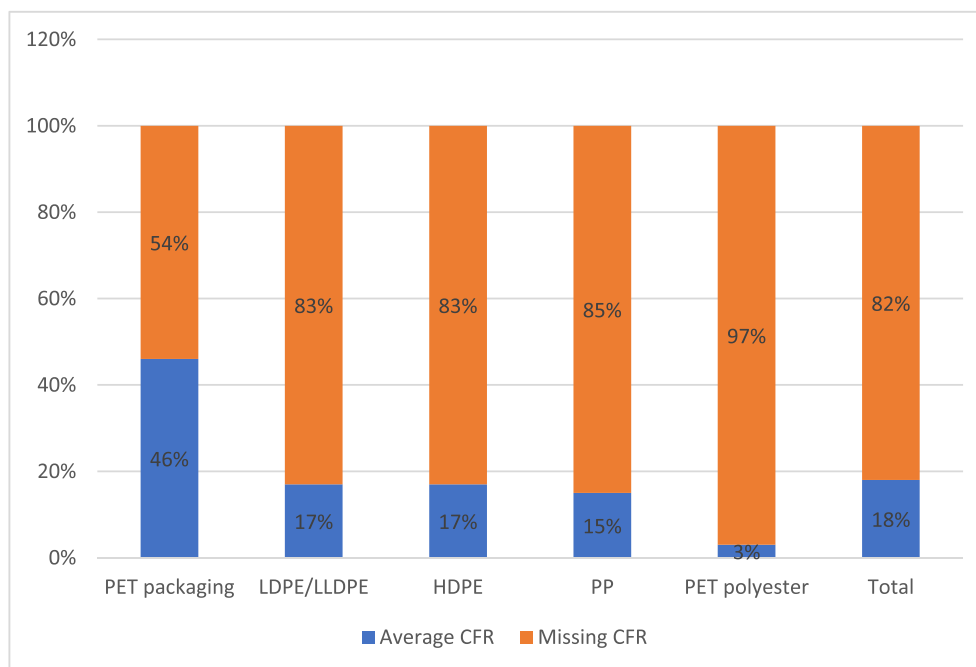


Fig. 3. Estimated CFR rates for each type of plastic resin (Source: World Bank Group, 2021).

million Baht [US\$ 867,000], it is impossible for local governments to have a good waste system” (20). An NGO representative added that “there is no budget that is assigned to the specific plan of implementation for relevant agencies”, which is “too small to implement ambitious plans in the roadmap” (28).

Little wonder, then, that under-funded local administrations have demonstrated low levels of commitment toward separating plastic waste (15, 21). Yet, separation is fundamental to circularity because “if you can separate waste at the source, you can reclaim it” (14). Although accurate national data on waste management is critically lacking, one interviewee estimated that only around 12% of Thailand’s local governments promote waste separation at source (21). That the great majority of local administrations, hospitals and households continue to merge waste (1, 3, 6, 12, 14, 22, 24; see also Johnson and Trang, 2019) owes mainly to inadequate infrastructure (for example, sorting centres and collection trucks for different types of waste) combined with low levels of public awareness and a lack of public education campaigns about why waste separation is necessary to tackle plastic pollution (2, 21). As a senior government official explained, “the first thing you should impose is waste separation. People should pay for waste they create. This would minimise waste. It is easier than imposing bans” (32). A key reason for the poor quality of Thailand’s post-consumer resin (PCR) is the lack of waste separation. An international organisation official argued “what is needed is recycled content standards, such as a 20% standard. We cannot simply demand this from voluntary campaigns” (19). However, the government has yet to pass any regulations to operationalise and enforce such standards.

This nationwide problem has been aggravated since 2020 by the diversion of central state funds to deal with the domestic exigencies of the COVID-19 pandemic and a severe Mekong Basin drought that led to a state of emergency being declared in 12 Thai provinces (Miller et al., 2022). These rapid onset emergencies, which, in 2021, led to a 47% reduction in central state spending on environmental issues (Wipatayotin, 2022), further reduced already low levels of political will to tackle the slower onset crisis of marine plastic pollution. In this shifting policy context, government officials have expressed concerns that mandating waste segregation risks alienating the majority of middle-class voters, whom “they need to please ... as best as they can” (13) for re-election purposes (21, 24).

4.2. Informal sector inequalities

State deficiencies in plastic waste management exacerbate informal sector inequalities in two key ways. First, the inability of local governments to fund circular activities displaces this burden onto waste pickers, who, in Thailand, like elsewhere in Southeast Asia, are officially overlooked in policy regimes (Dias, 2012). Thailand’s informal recycling sector is responsible for collecting and sorting the majority of post-consumer plastic products due to the lack of source segregation, meaning the preliminary separation of waste to make it suitable for partitioned collection through avoided contamination. This deficit complicates the labour-intensive task of processing plastic waste, creating major health risks for waste pickers (18, 19). Low-wage waste pickers must also prioritise the collection of high-value plastics and discard the large volume of mixed waste that cannot be reclaimed (Sharma et al., 2019), adding to problems of leakage into waterways. Because the incomes of waste pickers are tied to market prices for high-value plastic waste, collection rates suffer whenever prices drop (for example, see Table 1) (WWF Thailand, 2020). In Thailand, like other countries with unregulated environments, waste pickers become further disenfranchised when GDP increases due to linkages between elevated consumption levels and reduced recycling rates (3, 32; see also World Bank Group, 2021).

A second way in which state deficiencies increase the socioeconomic inequalities and livelihood stressors experienced by informal waster pickers is through privatisation processes (Dias, 2012). When states lack institutional capacities, they tend to restructure along market lines by

Table 1
Thailand virgin price comparison of plastics between 2019 and 2020 (Source: World Bank Group, 2021).

	April/May 2019 (US\$/Ton)	April/May 2020 (US\$/ton) %	Price reduction (year on year)
All Resins Average	1245	878	30%
PET	215	637	37%
HDPE	1166	768	34%
LDPE	1360	1094	20%
PP	1209	886	27%

outsourcing key areas of public responsibility to private companies, often through loosely regulated or unregulated arrangements that result in negligible contributions to societal and/or environmental wellbeing. In Thailand, too, waste pickers have been compelled to negotiate liminal, quasi-legal working spaces as government departments contract out the management of dumpsites and landfills to private companies. In Bangkok, which contributes an estimated 18% of plastic waste to Thailand's marine pollution quota (Johnson and Trang, 2019) and where only a limited percentage of the city's population segregates waste, the informal recycling sector subsidises municipal waste collection at around US\$16 million annually (Archer and Adelina, 2021). As Bangkok's waste pickers mainly comprise migrants from other provinces, they are also not allowed to register with the city government (Archer and Adelina, 2021) and are only granted access to privatised waste disposal sites on the condition that they sell their sorted or recycled products to particular companies (Scheinberg, 2011).

4.3. Waste and landfill politics

These structural inequities and the societal inequalities generated by them highlight the limits of the assumption that waste is a "de facto 'common property resource'" (Gidwani, 2015: 583), ripe for recycling, reuse or repair by "anyone". Although the livelihoods of waste pickers rely upon unfettered access to post-consumer products, in reality, their inequality and informality is reinforced by landfill proprietors and waste agents who legally control access to sites of waste internment. Here, the fusion of public and private business interests in shaping the unequal political economy of plastic waste should not be underestimated. Many local politicians have investments or even majority ownership in private waste management companies (13). As one start-up founder explained:

Waste is a mafia business – it's a black market ... Landfill operators get concessions from municipalities. They are paid by the kilogram. The more waste they get, more money they make. Why on earth would they want to change this? ... If you dig deep, there is a clear relationship of ownership of landfill sites and local officers and politicians. This is something that cannot be overlooked (17).

As a starting point to addressing this problem, an open-access database is urgently needed to provide publicly available information about waste types, volumes and values (24, 33). Without such a "common database", according to a Unilever representative, it is difficult to quantify the extent of mismanaged waste, identify where gaps exist, set targets or measure the extent to which these are met over time (5). To date, landfill operators have been reluctant to share waste processing data because, as an NGO official asserted, "they do not want you to know how much they're making" (24) in order to benefit from inflation opportunities in a deregulated environment (20). For this reason, landfills represent a "black box to outsiders ... They don't give us the data, don't disclose of how much they collect, and what types of waste being collected for fear that they might be taxed more" (24). With the beneficiaries of this opaque system treating circularity as a threat to the existing lucrative order, they do "not want to invest in the right facilities to do separation and to educate people about separation" (12). For this reason, an NGO representative explained: "If we kick-start the circular economy, most of the production and products are able to be put back into the loop. This means that less waste is gotten rid of. Local politicians would lose profits" (13). In other words, a continuous supply of incoming waste is necessary to maintain Thailand's existing political economy of plastic, within which, circularity is perceived to be more of a threat than a sustainability opportunity.

It is important to understand these tensions between the informal and formal, legal and illegal aspects of the overall political economy of plastic waste because they shape spatial patterns of uneven development and social inequalities at different scales of governance (Inverardi-Ferri, 2018). We see this at the level of individual households, where Thailand's wealth gap and institutional disparities represent a microcosm of

inequities between developed versus developing countries in circular economy discourses. Affluent households in urban neighbourhoods benefit from official (state or privately contracted) waste collection services, whereas households in urban and rural poor neighbourhoods rely partly or entirely on informal waste pickers. Wealthier urban residents are also more likely to live in well-funded jurisdictions with collection trucks that can transport waste out of sight to poorer areas. By contrast, according to interviewees, local governments in urban and rural poor areas that lack sufficient funds to properly dispose of plastic waste typically resort to using open fires and dumpsites (24, 34, 30; see also Manomaivibool et al., 2018). Moreover, upper and middle-class Thais—the most demographically vocal group in promoting recycling and willingness-to-pay for plastic bags—generate a far larger volume of waste than people from lower socioeconomic groups due to their enhanced purchasing power (Marks et al., 2020).

4.4. Some positive steps forward

Private businesses could potentially provide redress for some of these socially structured inequalities that underpin consumer imbalances by including more recycled content in affordably packaged products as well as making their products easier to recycle. At present in Thailand, only a handful of global brand owners such as Coca-Cola, Nestle and Pepsico intend to use recycled plastics known as rPET (recycled Polyethylene Terephthalate) for packaging their beverage products, while regional and national companies remain reluctant to follow suit. Increasing rPET content in packaging has been the primary means by which global brands have sought to demonstrate their circular economy commitments. In Thailand, however, the widespread lack of source segregation depletes the amount of high-quality recycled plastic available for conversion into rPET (27). There is also a "lack of demand for recycled resin" (27) as COVID-19-induced reductions in global oil prices led oil firms to invest in cheaper, oil-based plastics (Brock, 2020). This long-standing problem predated the pandemic (Table 1). The FDA has historically banned recycled content in food packaging due to its "concerns about food safety" (26) in "contaminated" recycled products (21), which, according to a Coca-Cola representative, stems from the department's "belief in the uniqueness of Thai consumers" (29). Although in 2022 the FDA announced plans to revoke this ban (SGS, 2022), its proposed legislation outlining stricter-than-usual guidelines for minimum residue values (21) threatens to elevate rather than reduce the costs of recycled plastic products in the near to medium term (10, 25, 29).

More positively, some multi-sector collaborations have begun to initiate affordable, ecologically safer and socially inclusive circular programs, even though these remain experimental and confined to pilot projects. In March 2021, for example, Thailand's Pollution Control Department launched three projects under the umbrella program, "Rethinking Plastics- Circular Economy Solutions to Marine Litter" using funding provided by the EU and German development agency GIZ (Thai-German Cooperation, 2021). Implemented in three provinces with local community partners, the year-long pilot projects applied aspects of circularity such as plastic waste segregation with Chulalongkorn University and coastal community-led plastic waste reduction programs using alternatives to single-use plastics to enhance the quality of marine environments (Thai-German Cooperation, 2021).

It is important to scale up these sorts of environmental collaborations by legislatively enforcing and regulating aspects of circularity that promote environmental justice and reduce social-ecological inequalities. Adapting a fairer and more inclusive approach to circularity should include making available discursive and physical space to reform capitalism by prioritising public social and environmental goods over privatised growth agendas. The alternative to fostering such environmental collaborations would be to wait until marine plastic pollution becomes so disruptive that formal cooperation around circular activities across scales and sectors becomes not only desirable, but essential, to

deal with the accumulating health and socioeconomic costs of development. Thailand has arguably reached a critical juncture where the societal burden and ecological costs of inaction outweigh the governance imperative to meaningfully address the plastic crisis at relevant scales and across sectors.

5. Conclusion

This political economy study has directed attention toward intersecting drivers land-based structural inequities and societal inequalities that together pose ongoing obstacles to Thailand's efforts to reduce marine-plastic pollution. We have presented these inequities and inequalities as problems that are inherent in the circular economy model itself. As such, they are not unique to the case of Thailand in generating negative transboundary effects that cross (sub)national and terrestrial-aquatic borders. Notwithstanding the specific cultural, economic and political variables that shape societal and ecological outcomes within particular national contexts, Thailand's experience with circularity patterns onto other developing countries in a number of key areas. Inequities between waste-exporting, developed countries and waste-importing, developing countries like Thailand are perpetuated by this model and impede the capacity of the latter to institutionalise sustainability measures at a comparable rate. Social and economic inequalities within developing countries also manifest domestically in burgeoning informal sectors that are already specialists in circular activities (for example, sorting and recycling plastics) but are actively marginalised in state discourses, budgets and labour rights regimes. In contrast, major plastic producers and retailers have benefitted the most from these inequities, such as not having to take responsibility for their products. Overall, scalar mismatches, perverse incentives for local government agencies, interagency fragmentation, and pushback from the private sector have compromised the model's objectives. Taken together, these (geo)political and economic power imbalances impede the formulation of cross-sector and multi-scalar forms of circular stewardship that are vitally needed to respond to the accumulating impacts of plastic pollution across land and sea boundaries.

To facilitate future research, this study has identified pathways to overcome these inequities and inequalities that compromise the circular economy model's overall objectives. These pathways can be summarised in terms of sector-specific recommendations that could be developed and applied to inform more equitable policy choices. For the private sector, a major opportunity currently exists for circular stewardship in Southeast Asia. Examples of best practice are emerging across the region that Thai companies could emulate or replicate in their collaborations with state and societal partners. Indonesia's successful waste banks, for instance, that encourage individual households to sell segregated recyclables in regulated markets by posting online prices for almost 70 types of recyclables (Johannes et al., 2021), could be inexpensively implemented in Thailand. Further, manufacturers can make products which can be better recycled as well as reduce the amount of plastic it uses in its products. For example, empty space in bottles and wrapping in semi-processed products could be eliminated which would also reduce production costs (23).

For the public sector, the political fragmentation, lack of coordination and incomplete data collation within and between government departments in Thailand signals the need to strengthen state waste management capacities at meaningful scales. In particular, given the wide level of fragmentation and LAOs' insufficient financing and capacity to govern waste, one way forward for countries like Thailand would be transferring this task to provincial-level bodies, such as provincial administrative organisations (PAOs), who would coordinate with the Ministry of Interior (Popattanacha, 2020). EPR mechanisms also need to be introduced and enforced by government institutions to incentivise inclusive pro-environmental behaviours and disincentivise negative behaviours through fines and even jail terms for major polluters. A promising model that Thailand could adapt is Vietnam's

revised 2022 Law on Environmental Protection, which includes an EPR provision to fine large companies that fail to create a recycling system for their post-consumer plastic products (Hoang, 2022). Further, municipal governments should give lower-income members of the public greater incentives to recycle. As an example, in Surabaya, Indonesia, the municipal government has initiated a scheme where people can drop off plastic items, such as cups and bottles, in exchange for free bus rides (Wardoyo, 2018). More research is needed to explore how state capacities might be enhanced in these areas through cross-sector mechanisms to enable private and societal actors and institutions to financially, technologically and logistically support underfunded government programs and circular activities.

Societal transformations should begin with the transformation of the informal recycling sector into a regulated waste management body. In Thailand and other countries where spatial inequalities exclude large sections of society from formal waste management regimes, informal service providers will likely remain essential for many communities. Registering and organising these key stakeholders as waste management providers would better align state and societal interests, thereby enhancing the efficacy of circular activities while alleviating the lived precarity and vulnerability of waste pickers (Archer and Adelina, 2021; Singh, 2019). While a successful project in one place is not always replicable to other contexts and conditions, an example of the incorporation of waste pickers into a formal waste management system can be found in Medellín, Colombia, where municipal revenues are structured to enrol waste pickers into the city's garbage collection services, thereby safeguarding their labour against unregulated traders of recycled materials (Valenzuela-Levi, 2020). Unless Thailand's informal recycling sector becomes similarly formalised, it is likely that source segregation will remain elusive and only high-value plastics will continue to be collected, perpetuating the seepage of large volumes of mixed waste into waterways that flow into the ocean.

Finally, future research should take full advantage of the current global moment that has afforded an unprecedented opportunity to reset the circular economy model along a more egalitarian trajectory. In March 2022, the United Nations Environmental Assembly adopted a resolution to create a legally binding global treaty to end plastic pollution. This resolution, which aims to finalise an international agreement by 2024, sets the territorial stage for land-based plastics producers to be held accountable for their transboundary pollution of the world's oceans. If Thailand's national government is able to use the resolution's emphasis on the supply side to exert pressure on plastics producers, then this would provide redress for existing power imbalances (Niskanen et al., 2020) that currently displace blame for marine plastic pollution onto the demand side. Should Thai government agencies miss this opportunity, then profit-oriented discourses will continue to subvert and undermine public environmental goods to the longer-term detriment of human development and sustainability.

CRedit authorship contribution statement

Danny Marks: Conceptualisation, Methodology, Investigation, Writing – original draft, Writing – review & editing, Funding acquisition.

Michelle Ann Miller: Conceptualisation, Methodology, Writing – original draft, Writing – review & editing, Funding acquisition. **Sujitra Vassanadumrongdee:** Validation, Resources, Writing – original draft, Writing – review & editing, Visualisation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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Appendix A. Interviewee Information

Interview Number	Identity	Sector	Date interviewed (in 2021)
#1	National Reform Committee on Marine Debris member	Government	12 April
#2	PTTGC representative	Private	27 April
#3	Bioplastic Industry Association representative	Private	27 April
#4	Official of domestic think-tank	Non-profit	29 April
#5	Unilever representative	Private	3 May
#6	Waste management company owner	Private	4 May
#7	Official of Department of Primary Mines	Government	4 May
#8	Official of Subcommittee on Circular Economy	Government	5 May
#9	Start-up founder #1	Private	6 May
#10	Nestle representative	Private	6 May
#11	Official of Plastic Institute	Non-profit	7 May
#12	Official of TPBI Group	Private	7 May
#13	International NGO official #1	Non-profit	11 May
#14	Thai university researcher #1	Academic	11 May
#15	SCG Chemicals representative	Private	18 May
#16	International organisation official #1	Multilateral	20 May
#17	Start-up founder #2	Private	20 May
#18	Thai Industrial Standards Institute official	Government	21 May
#19	International organisation official #2	Multilateral	24 May
#20	Thai university researcher #2	Academic	24 May
#21	Thai university researcher #3	Academic	25 May
#22	Start-up founder #3	Private	25 May
#23	International donor agency official	Multilateral	25 May
#24	International NGO official #2	Non-profit	26 May
#25	Indorama Ventures executive	Private	28 May
#26	Representative of CP All (owner of 7–11 stores)	Private	28 May
#27	Research institute official	Non-profit	31 May
#28	International NGO official	Non-profit	1 June
#29	Coca Cola representative	Private	3 June
#30	Local NGO official #1	Private	3 June
#31	Pollution Control Department official	Government	6 June
#32	Government policy think-tank official	Government	10 June
#33	Patong municipality official	Government	10 June
#34	Local NGO official #2	Non-profit	14 June
#35	Bangkok Metropolitan Administration official	Government	18 June
#36	Thai university researcher #4	Academic	23 June

Note: Due to the politically sensitive nature of this topic, we anonymised the names of NGOs, academics, and start-up companies.

Appendix B. Initial interview questions

1. What would you say is the current situation of marine plastic pollution in Thailand?
2. What is the role of your organisation in terms of addressing this problem?
3. The government created a "Roadmap on Plastic Waste Management, 2018–2030" in 2018 as well as "National Master Plan for Waste Management 2016–2021" in 2016. Have these led to any major changes?
4. How far along do you think Thailand is to achieve a circular economy of plastics?
5. How do you think Thailand ranks globally in its progress?
6. What, if anything, has Thailand been able to learn and apply from other countries experiences of developing a circular economy?
7. What are the major gaps in the plastics sector?
8. Why do you think Thailand's recycling rate is so low?
9. Have there been any recent policy interventions to increase this rate?
10. What do you think is the current status of extended producer responsibility (EPR) schemes in Thailand?
11. Has there been any progress recently in regard to this?
12. What do you think are the major economic and political barriers to improving the circular economy in the plastic sector?
13. What about any legal gaps?
14. Which agencies play the leading role in terms of the circular economy of plastics?
15. What mechanisms are in place to facilitate inter-agency cooperation?
16. How do you think inter-agency and cross-jurisdictional cooperation needs to be developed further?

17. What's your opinion of the current management of the system?
18. Can the public do more to further the circular economy of plastic?
19. To what extent do you think pollution of marine and coastal environments factors into decision-making about plastic pollution?
20. If you were the Prime Minister, what would you do to address this problem?

References

- Archer, D., Adelina, C., 2021. Labour, Waste and the Circular Economy in Bangkok. Stockholm Environment Institute.
- Arsova, S., Genovese, A., Ketikidis, P.H., 2022. Implementing circular economy in a regional context: a systematic literature review and a research agenda. *J. Clean. Prod.* 368, 133117 <https://doi.org/10.1016/j.jclepro.2022.133117>.
- Babel, S., Ta, A.T., Liyanage, T.U.H., 2020. Current situation and challenges of waste management in Thailand. In: Pariatamby, A., Hamid, F.S., Bhatti, M.S. (Eds.), *Sustainable Waste Management Challenges in Developing Countries*. IGI Global, Hershey, USA, pp. 409–440.
- Barrowclough, D., Birkbeck, C.D., 2020. Transforming the Global Plastics Economy: the Political Economy and Governance of Plastics Production and Pollution (No. 142), GEG Working Paper. Global Governance Centre.
- Board of Investment, Thailand, 2019. Circular Economy: Shaping a Sustainable Future, 29.
- Bowen, G.A., 2009. Document analysis as a qualitative research method. *Qual. Res. J.* <https://doi.org/10.3316/QRJ0902027>.
- Brock, J., 2020. Special Report: Plastic Pandemic - COVID-19 Trashed the Recycling Dream. Reuters.
- Clapp, J., Swanson, L., 2009. Doing away with plastic shopping bags: international patterns of norm emergence and policy implementation. *Environ. Polit.* 18, 315–332. <https://doi.org/10.1080/09644010902823717>.
- Corvellec, H., Stowell, A.F., Johansson, N., 2022. Critiques of the circular economy. *J. Ind. Ecol.* 26, 421–432. <https://doi.org/10.1111/jiec.13187>.
- Dauvergne, P., 2010. *The Shadows of Consumption: Consequences for the Global Environment*. MIT Press, Cambridge, MA.
- Dauvergne, P., 2018. Why is the global governance of plastic failing the oceans? *Global Environ. Change* 51, 22–31. <https://doi.org/10.1016/j.gloenvcha.2018.05.002>.
- Dhokhikah, Y., Trihadiningrum, Y., 2012. Solid waste management in Asian developing countries: challenges and opportunities. *J. Appl. Environ. Biol. Sci.* 2, 329–335.
- Dias, S., 2012. Waste and development—perspectives from the ground. *Field actions science reports*. *J. Field Act.* special issue 6, 1–5.
- Diaz, L.F., 2017. Waste management in developing countries and the circular economy. *Waste Manag. Res.* 35, 1–2.
- Ellen Macarthur Foundation, 2021. *Universal Circular Economy Policy Goals*. Enforce the plastic ban, 2022. Bangkok Post.
- Ferronato, N., Rada, E.C., Portillo, M.A.G., Cioca, L.I., Ragazzi, M., Torretta, V., 2019. Introduction of the circular economy within developing regions: a comparative analysis of advantages and opportunities for waste valorization. *J. Environ. Manag.* 230, 366–378. <https://doi.org/10.1016/j.jenvman.2018.09.095>.
- Genovese, A., Pansera, M., 2021. The circular economy at a crossroads: technocratic modernism or convivial technology for social revolution? *Appl. Econ. Lett.* 32, 95–113. <https://doi.org/10.1080/10455752.2020.1763414>.
- Giannakitsidou, O., Giannikos, I., Chondrou, A., 2020. Ranking European countries on the basis of their environmental and circular economy performance: a DEA application in MSW. *Waste Manag.* 109, 181–191. <https://doi.org/10.1016/j.wasman.2020.04.055>.
- Gidwani, V., 2015. The work of waste: inside India's infra-economy. *Trans. Inst. Br. Geogr.* 40, 575–595. <https://doi.org/10.1111/tran.12094>.
- Hoang, L., 2022. Vietnam Aims for "Circular Economy" with Recycling Law. *Nikkei Asia*.
- Inverardi-Ferri, C., 2018. The enclosure of "waste land": rethinking informality and dispossession. *Trans. Inst. Br. Geogr.* 43, 230–244. <https://doi.org/10.1111/tran.12217>.
- Jambeck, J.R., Geyer, R., Wilcox, C., Siegler, T.R., Perryman, M., Andrady, A., Narayan, R., Law, K.L., 2015. Plastic waste inputs from land into the ocean. *Science* 347, 768–771. <https://doi.org/10.1126/science.1260352>.
- Johannes, H.P., Kojima, M., Iwasaki, F., Edita, E.P., 2021. Applying the extended producer responsibility towards plastic waste in Asian developing countries for reducing marine plastic debris. *Waste Manag. Res.* 39, 690–702. <https://doi.org/10.1177/0734242X21101341>.
- Johnson, O., Trang, N., 2019. Closing the Loop: Sai Mai District, Bangkok Case Study. UNESCAP, Bangkok.
- Kirchherr, J., Reike, D., Hekkert, M., 2017. Conceptualizing the circular economy: an analysis of 114 definitions. *Resour. Conserv. Recycl.* 127, 221–232. <https://doi.org/10.1016/j.resconrec.2017.09.005>.
- Kovacic, Z., Strand, R., Völker, T., 2019. *The Circular Economy in Europe: Critical Perspectives on Policies and Imaginaries*. Routledge, Abingdon, Oxon; New York, NY.
- Liboiron, M., 2021. *Pollution Is Colonialism*. Duke University Press, Durham.
- Liu, Z., Adams, M., Walker, T.R., 2018. Are exports of recyclables from developed to developing countries waste pollution transfer or part of the global circular economy? *Resour. Conserv. Recycl.* 136, 22–23. <https://doi.org/10.1016/j.resconrec.2018.04.005>.
- Mah, A., 2021. Future-proofing capitalism: the paradox of the circular economy for plastics. *Global Environ. Polit.* 21, 121–142. https://doi.org/10.1162/glep_a_00594.
- Manomaivibool, P., Srivichai, M., Unroj, P., Dokmaingam, P., 2018. Chiang Rai Zero Waste: participatory action research to promote source separation in rural areas. *Resour. Conserv. Recycl.* 136, 142–152. <https://doi.org/10.1016/j.resconrec.2018.04.002>.
- Marks, D., Breen, M., 2021. The political economy of corruption and unequal gains and losses in water and sanitation services: experiences from Bangkok. *Water Altern. (WaA)* 14, 795–819.
- Marks, D., Lebel, L., 2016. Disaster governance and the scalar politics of incomplete decentralization: fragmented and contested responses to the 2011 floods in Central Thailand. *Habitat Int.* 52, 57–66. <https://doi.org/10.1016/j.habitatint.2015.08.024>.
- Marks, D., Miller, M.A., 2022. A transboundary political ecology of air pollution: slow violence on Thailand's margins. *Environ. Pol. Governance* 32, 305–319. <https://doi.org/10.1002/eet.1976>.
- Marks, D., Miller, M.A., Vassanadumrongdee, S., 2020. The (Geo)political economy of Thailand's marine plastic pollution crisis. *Asia Pac. Viewp.* 61, 266–282. <https://doi.org/10.1111/apv.12255>.
- Miller, M.A., 2020. B/ordering the environmental commons. *Prog. Hum. Geogr.* 44, 473–491. <https://doi.org/10.1177/0309132519837814>.
- Miller, M.A., Astuti, R., Hirsch, P., Marschke, M., Rigg, J., Saksena-Taylor, P., Suhardiman, D., Taylor, D.M., Varkkey, H., 2022. Selective border permeability: governing complex environmental issues through and beyond COVID-19. *Polit. Geogr.* 97, 102646. <https://doi.org/10.1016/j.polgeo.2022.102646>.
- Ncube, A., Sadondo, P., Makhanda, R., Mabika, C., Beinisch, N., Cocker, J., Gwenzi, W., Ugiati, S., 2022. Circular bioeconomy potential and challenges within an African context: from theory to practice. *J. Clean. Prod.* 367, 133068. <https://doi.org/10.1016/j.jclepro.2022.133068>.
- Ngan, S.L., How, B.S., Teng, S.Y., Promentilla, M.A.B., Yatim, P., Er, A.C., Lam, H.L., 2019. Prioritization of sustainability indicators for promoting the circular economy: the case of developing countries. *Renew. Sustain. Energy Rev.* 111, 314–331. <https://doi.org/10.1016/j.rser.2019.05.001>.
- Niskanen, J., Anshelm, J., McLaren, D., 2020. Local conflicts and national consensus: the strange case of circular economy in Sweden. *J. Clean. Prod.* 261, 121117. <https://doi.org/10.1016/j.jclepro.2020.121117>.
- OECD, 2022. *Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options*. Organisation for Economic Co-operation and Development, Paris.
- O'Neill, K., 2019. *Waste*. USA: Polity Press, Cambridge, UK; Medford, MA.
- Pawar, P.R., Shirgaonkar, S.S., Patil, R.B., 2016. *Plastic Marine Debris: Sources, Distribution and Impacts on Coastal and Ocean Biodiversity*, 3. PENCIL Publication of Biological Sciences, pp. 40–54.
- Pollution Control Department, 2021. *Thailand's Roadmap on Plastic Waste Management 2018 - 2030*. Bangkok.
- Popattanacha, N., 2020. The legal, policy and institutional frameworks governing marine plastics in Thailand. *IUCN Papers on Marine Plastic Pollution*. IUCN.
- Pucino, M., Paruta, P., Bouchet, A., Zgola, M., 2020. *Plastic Pollution Hotspotting and Shaping Action: Regional Results from Eastern and Southern Africa, the Mediterranean, and Southeast Asia*. IUCN, Gland, Switzerland.
- Róto, G.C., Vassillo, C., Rodriguez, A.A., Magnano, L., Milo Vaccaro, M., Civit, B.M., Covacevich, M.S., Arena, A.P., Ugiati, S., 2022. Perception and awareness of circular economy options within sectors related to agriculture in Argentina. *J. Clean. Prod.* 133805. <https://doi.org/10.1016/j.jclepro.2022.133805>.
- Scheinberg, A., 2011. *Value Added: Modes of Sustainable Recycling in the Modernisation of Waste Management Systems* (PhD Thesis). Wageningen University and Research.
- Schröder, P., Lemille, A., Desmond, P., 2020. Making the circular economy work for human development. *Resour. Conserv. Recycl.* 156, 104686. <https://doi.org/10.1016/j.resconrec.2020.104686>.
- SGS, 2022. Thailand Proposes New Legislation for Food Contact Plastics [WWW Document]. URL: <https://www.sgs.com/en/news/2022/02/safeguards-02622-thailand-proposes-new-legislation-for-food-contact-plastics>. accessed 5.26.22.
- Sharma, A., Aloysius, V., Visvanathan, C., 2019. Recovery of plastics from dumpsites and landfills to prevent marine plastic pollution in Thailand. *Waste Disposal Sustain. Energy* 1, 237–249.
- Singh, K., 2019. Thailand's plastic waste problem and its road to zero waste. *Urban Solutions* 78–83.
- Thai-German Cooperation, 2021. New local approaches to tackle the plastic waste challenge launched [WWW Document]. URL: https://www.thai-german-cooperation.info/en_US/new-local-approaches-to-tackle-the-plastic-waste-challenge-launched/.
- Thailand, W.W.F., 2020. *Scaling up Circular Strategies to Achieve Zero Plastic Waste in Thailand* (Bangkok).
- Valenzuela, F., Böhm, S., 2017. Against wasted politics: a critique of the circular economy. *Ephemera theory Polit. Organ.* 17, 23–60.
- Valenzuela-Levi, N., 2020. Waste political settlements in Colombia and Chile: power, inequality and informality in recycling. *Dev. Change* 51, 1098–1122. <https://doi.org/10.1111/dech.12591>.

Wardoyo, P., 2018. Plastic to ride: Indonesians swap bottles for bus tickets. Reuters.
Wipatayotin, A., 2022. Ministry Budget Cuts "Need Review (bangkok post).

World Bank Group, 2021. Market Study for Thailand: Plastics Circularity Opportunities and Barriers. World Bank, Washington, DC.