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WASTEWARE

Rethinking the waste
hierarchy for the Global
South to tackle
greenwashing and
develop integrated
solutions for solid waste
management

OPINION PAPER

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WASTE AWARE

OUR MISSION IS TO DEVELOP AND
SHARE INNOVATIVE APPROACHES TO
WASTE AND RESOURCES MANAGEMENT

Disclaimer

This paper is the result of hundreds of hours of discussions amongst the Wasteaware team, drawing on our collective field experience of designing and implementing waste and resource management (WaRM) strategies across 70+ developing countries.

This paper should not be seen as a prescriptive manual, but rather as a *thinking piece* - an invitation to the WaRM community to question assumptions, explore new perspectives, and reflect on how we can sharpen our collective impact in addressing the triple planetary crises.



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Rethinking the waste hierarchy for the Global South to tackle greenwashing and develop integrated solutions for solid waste management

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Proposed waste hierarchy for integrated solid waste management interventions in the Global South

Key takeaways

This paper argues that integrated solid waste management (SWM) interventions are often ill-designed in the Global South because they rely on the waste hierarchy created for the Global North. Poorly designed and planned interventions have led global development agencies, practitioners, national/local authorities, and the civil society (amongst others) to spend resources on activities which yield minimum impact and do not improve neither public health nor environmental protection. A reframed hierarchy, or an investment/intervention hierarchy rather than a policy guiding hierarchy, is needed for integrated SWM interventions to be impactful and resilient in developing contexts.

This opinion paper proposes to rethink the waste hierarchy for SWM interventions in the Global South, to achieve three objectives:

1. Tackle greenwashing
2. Address the practical challenges of local authorities in the Global South
3. Create a donor focus on operational support and strengthening, rather than on investment

The key takeaways include:

- The 'hierarchy' term emerged first in 1986, to guide the priority order of options for managing specific hazardous waste, developed by the US Environment Protection Agency earlier in 1976. The term then evolved into 'Lansink's ladder' in the 1990s after the 1979 motion to Dutch Parliament by Ad Lansink for a concept of preferred sequence for waste management policy options. The waste hierarchy as we know it - a priority sequence when developing a waste management plan - was integrated in the 1993 Dutch Environmental Management Act, prior to becoming the foundation of the EU's Waste Framework directive through its 5-steps of prevention, re-use, recycling, recovery and disposal. That policy guidance has indirectly shaped investment patterns (taxes, targets, extended producer responsibility (EPR), bans), but investment steering was not the hierarchy's original purpose. This has worked well in the Global North, where collection and disposal were already well established or other frameworks ensured these conditions were in place.
- This waste hierarchy developed in (and for) the Global North is a broken lens for designing and planning integrated SWM interventions in the Global South. The proposed waste hierarchy is composed of 7 steps: reduce, reuse, controlled disposal, collect, recycle organics, recycle dry recyclables and recover energy from residuals. These 7 steps should be seen as a guide for preferred intervention to promote integrated SWM;
- Optimising investment for maximum impact means aligning good intentions with technical competence and stakeholder engagement, rather than letting ideology alone drive interventions;
- As the industrialised countries vilified disposal as the 'last resort', the global narrative has undermined investment in the very infrastructure that could prevent uncontrolled dumping, open burning, and the leakage of waste into the environment;
- While implicit in the EU hierarchy, waste collection cannot be taken for granted as 3 billion people still lack access, making it an intervention which deserves its full, explicit space in the waste hierarchy;
- Ensuring practical access to at least one well-defined, controlled disposal site is the necessary foundation of the circular economy. Only with a reliable and enforceable destination for residuals with a competitive price tag can upstream measures like recycling, composting, and reuse scale up without risk of backsliding into uncontrolled dumping;
- Putting a price on disposal aids greatly in creating the economic conditions for recycling to compete, ensuring that recovery and recycling systems are financially viable;
- Since organics often represent half the waste stream, their management is central to promote circularity. Organics recycling thrives when reliability and collaborations are secured;
- Successful interventions are not just a technical matter: they require an enabling environment through supportive policy, political courage, engaged stakeholders, suitable economic instruments, and other context-specific factors.
- Developing countries have wide demographic, social, economic and geographic differences, creating diverging development capabilities and patterns. There are no 'one-size-fits-all' solution, and whilst this paper advocates for certain priorities, any options analysis should include a socio-economic survey to really grasp the local context. In most cases, the right technical solution and often (if not always) the socially just solution.

1 Why adapt the waste hierarchy

For decades, the waste hierarchy - reduce, reuse, recycle, recover, dispose - has been seen as the universal prioritisation for municipal solid waste management (MSWM) interventions. It was developed in (and for) the wealthy, industrialised nations of the Global North, where SWM systems are underpinned by reliable funding, stable governance, and availability of infrastructure. Exported to the Global South, through various and numerous means, it often becomes less a tool for improvement than a framework for failed solutions, particularly in developing cities falling within the development bands 1-4.

With 'recycling' placed near the top of the hierarchy, it becomes tempting for governments, donors, and companies to highlight it as evidence of environmental responsibility. Yet, in many low- and middle-income countries, some of which are virgin plastic producers, recycling systems lack the markets and quality feedstock to promote recycled products. The result is a subtle form of greenwashing: waste is collected for 'recycling', but much is burned, dumped, or in some cases, shipped abroad, or investment is made in recycling infrastructure at the detriment of sustaining financing for pragmatic foundational collection and disposal infrastructure.

This has consequently pushed 'disposing' at the bottom of the hierarchy, stimulated by a) the Global North's realisation in the 1970s of the severe environmental impact of landfills which do not have any environmental standards, and b) that the environmental crises should push us to keep materials within the economy, rather than mining for new ones. Rising public opposition to new landfill sites, growing awareness of groundwater contamination, and the emergence of environmental legislation in the Global North all reinforced the idea that disposal was undesirable. Over time, this framing hardened into dogma: landfill became synonymous with environmental failure, while recycling and recovery were celebrated as markers of modernity and the circular economy.

When transplanted into the Global South, however, this hierarchy overlooks two fundamental realities: many cities lack even basic control of their disposal sites (which are inevitably still required, no matter the recovery rate), and those located far from capitals barely achieve 40% collection coverage. By vilifying disposal as the 'last resort', the global narrative has undermined investment in the very infrastructure that could prevent uncontrolled dumping, open burning, and the leakage of waste into the environment. The situation is made worse by the export of 'technical fixes' in the 90s from the Global North to developing countries, such as oversized (and overly expensive) centralised recycling/recovery facilities, designed for economic and governance contexts that simply do not exist in many developing cities of the Global South.

This opinion paper proposes to rethink the waste hierarchy for SWM interventions in the Global South, to achieve three objectives:

1. Tackle greenwashing
2. Address the practical challenges of local authorities
3. Create a donor focus on operational support and strengthening, rather than on investment

If our goal is to make impactful progress for integrated SWM, we should rethink the hierarchy for the realities of the Global South. That means resisting prestige ill-fitting projects, acknowledging the essential role of controlled disposal (separate but a stepping stone towards sanitary disposal), focusing on "no-regret" investments that work within local constraints, and letting go of the 'one-size-fits-all' mindset. Only by doing so can integrated SWM evolve from a set of well-intentioned slogans into a system that reliably protects health and the environment.

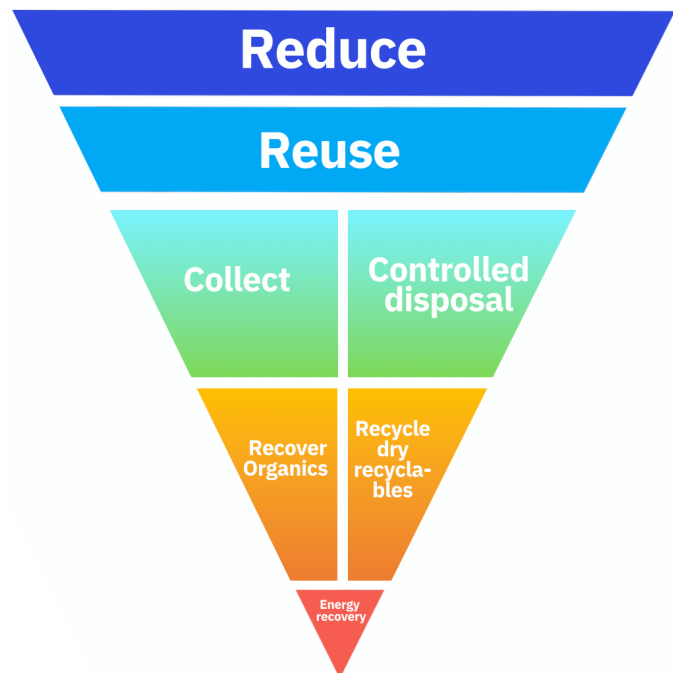
2 Proposed waste hierarchy for the Global South

2.1 Seven steps

The proposed waste hierarchy has 7 steps as shown in the figure below. This suggestion aims to support practitioners, local authorities and development agencies target integrated SWM interventions in developing countries. These 7 steps should not be seen as an investment tool, but rather a guide for preferred intervention to promote integrated SWM.

This seven-step waste hierarchy provides a priority order of preferred options for managing MSW. It preserves the original intent of minimising environmental impact through prevention and recovery, while also recognising the practical realities of developing country contexts. This structure also supports governments, local authorities, and development partners in sequencing interventions, targeting resources effectively, and building waste systems that deliver both public health protection and sustainable resource recovery.

The revised hierarchy is designed not as a rigid blueprint but as a compass for planning and design. It highlights the importance of establishing controlled disposal and universal collection as the foundation of an ISWM system, while progressively moving towards organics and dry recycling, and finally energy recovery for residuals.



2.2 Reduction is still the first upstream solution

Reducing waste at its source remains the most effective long-term strategy to reduce environmental degradation and protect public health. Yet, two challenges remain:

1. Until the day comes when we generate no waste at all, we must operate SWM systems that manage what is inevitably produced. All trends point towards rising consumerism, meaning waste will remain a constant feature of our economies for decades to come. Planning must therefore balance the ideal of prevention with the practical certainty that waste will persist in the short and medium term;
2. End-of-pipes solutions tend to be prioritised compared to upstream prevention, as policy efforts (particularly unified global policies) on waste reduction remains minimal. Waste prevention is still often limited to voluntary initiatives, pilot projects or bans (such as on plastic bags or single-use plastics (SUP)). Extended producer responsibility (EPR) schemes rarely go beyond packaging, Waste Electrical and Electronic Equipment (WEEE) and tyres, and global negotiations on plastics remain focused more on recycling than reduction, as the latest Plastics Treaty negotiations in Geneva have demonstrated.

It must, however, also be noted that the principle of reduction can be misused for greenwashing. For example, detergent and soap packaging is often shifted from heavier HDPE or similar plastic bottles to multi-layer plastic sachets or pouches. While this reduces packaging weight and material use, it replaces a higher-value, commonly recovered and recycled material with a low-value, rarely recyclable material - undermining the overall sustainability outcome.

2.3 The rise of reuse

Reuse has re-emerged as a cornerstone of sustainability, particularly sustainable product design. Governments can accelerate its uptake by embedding eco-design principles into regulations, such as specifying materials and testing protocols that ensure products can be easily repaired, refilled, or repurposed. Standards can also guide producers on demonstrating compliance, from proving recyclability to showing that a minimum proportion of recycled content (such as in PET bottles) has been achieved. Linking these requirements to recycling targets is essential, as such targets help guarantee a reliable supply of recycled feedstock.

Yet the rise of reuse also raises a caution: in the absence of oversight, 'reusable' products can become a new form of greenwashing, marketed as sustainable while offering little real reduction in waste. Reuse can drift into greenwashing when products are labelled 'reusable' without the systems to make reuse practical or widespread. A heavy-duty plastic bag designed for 50 uses does little good if consumers treat it as single-use, even more so when the additional weight of plastic does not encourage recovery or recycling, or if infrastructure to recover

clean bags over dirty bags after disposal doesn't yield results. Similarly, refillable packaging schemes can mask overproduction if they serve as marketing tools rather than genuine replacements for disposable items. Without enforceable standards, monitoring, and a shift in consumption habits, the label 'reusable' risks becoming another badge of fake environmental virtue with little substance behind it.

2.4 Upgrading landfills as the pivotal step towards the circular economy

For many in the environmental community, the word 'landfill' still carries the weight of failure, with the usual image in the collective imagination of towering piles of waste, often on fire. This is the reality for uncontrolled disposal sites (or 'dumpsites'), not for controlled disposal. A controlled disposal site is an entirely different beast: the site is fenced with access control, waste is compacted, covered, and managed with systems to manage leachate, suppress fires, and limit emissions. Controlled disposal considerably limits environmental harm if managed and operated in an environmentally sound manner.

The distinction matters. As highlighted in Andrew Whiteman et al.'s 2021 revision of the waste hierarchy, 'disposal' should no longer be treated as a single category. Instead, it must be split into uncontrolled dumping, controlled disposal, and engineered landfilling, each representing a step towards better environmental protection. Analysing Wasteaware's data from 126 cities, disposal is the second largest source of plastic leakage within the SWM system, contributing on average to 33% of the total unmanaged plastic waste. Upgrading from uncontrolled to controlled disposal is therefore an important way for reducing waste (and plastic) leakage to the environment.

In much of the Global South, particularly in sub-Saharan Africa, uncontrolled open dumping persists as the default endpoint for municipal solid waste. It is financially cheap, simple, and immediate: the cost of depositing waste in an open space can be as low as 0 USD per tonne. By contrast, sophisticated recycling and recovery systems can cost more than 60 USD per tonne. Such financial realities make clear why exporting recycling technologies from the Global North often fails: municipalities cannot afford to operate them, and facilities remain idle. Cities in the Global South cannot leap into the highest development bands of waste and resource management (WaRM): waste solutions must be locally adapted, or they will simply collapse under the weight of financial impracticality. There is a history of well-intentioned donors imposing to borrowers very expensive 'western' landfills without caring of the operational costs (not locally affordable, not even with gate fees) and without ensuring proper local operational capability. The view from these donors needs to change from an investment focus to one of operational support and strengthening, if we are to give a chance to developing countries to afford integrated SWM.

Putting a price on disposal is the logical next step. Gate fees and other economic instruments create a competition between controlled disposal and recovery systems, nudging investment toward recycling. While a recycling facility like composting always has capital and operating costs, open dumping might have none. By establishing a cost for disposal, the alternative system costs can start to be cost competitive and even cheaper than disposal, making them more attractive, provided enforcement mechanisms are in place to prevent illegal dumping. In doing so, they transform waste from a cost burden into an opportunity for a circular economy. Without a controlled site, however, this strategy is futile. Collected waste with no defined, managed destination will inevitably be dumped. This is a reality that Brian McCarthy first highlighted in the post-conflict recovery context of Afghanistan 15 years ago. In short, upgrading dumpsites and attaching a price to disposal is not just a technical fix: it is the pivotal intervention on which all downstream recycling, recovery and circular economy efforts depend.

However, the step from dumpsite to landfill is not a minor technical upgrade – a matter of adding some liners, a cover system, and perhaps a weighbridge. In reality, it is the most fragile stage in the entire evolution of a waste management system. This stage is not so much a technological leap as a cultural one. The dismissive attitude of local politicians of 'waste management is not rocket science', sits at the root of failed initiatives. If waste management is trivialised, three predictable results follow: funding is insufficient (especially for ongoing operation), contractors and municipal authorities are undervalued and ill-equipped, and the profession itself becomes unattractive to skilled technicians, trapped under the stigma of being an "unfancy" job. Seen in this light, the leap from open dumping to controlled landfilling is not about engineering and operations alone. It is about whether a city or nation is ready to treat SWM as a legitimate, skilled, and dignified profession. If this cultural shift takes hold, the rest of the system will gradually align: separation at source, recycling, and energy

recovery all become possible because there is a stable foundation underneath. If it does not, no amount of investment will prevent backsliding into uncontrolled dumping. Michele Lambertini has defined a set of conditions for this leap to take root. He argues landfills must be:

- Affordable: requiring neither excessive capital outlays nor unsustainable operational costs;
- Simple: implementable with locally available skills and resources, without constant reliance on foreign expertise;
- Visible: socially recognised as a clear and positive improvement, so that the public and politicians alike see the value of doing things differently.

Another important point is that since the COP28 in 2023, the motive to upgrade disposal sites from a climate change perspective has grown more urgent as methane has become a central focus of emissions mitigation to tackle global warming. Recent studies reveal that roughly 15% of anthropogenic methane emissions originate from decomposing organic waste in open dumps: a hidden, yet potent, contributor to the climate crisis. This stark figure reframes what was once considered a local waste management problem as an issue of global significance. The implication is clear: upgrading these sites is not merely a circular economy booster, it is a climate intervention.

However, it is worth noting that moving from open dumping to controlled landfill can have negative climate impact consequences as organic waste disposed in deeper (controlled) landfills will produce more methane than openly and thinly dumped waste. It is important therefore that improved disposal is conducted with plans for organics recovery in mind.

2.5 Bringing collection into the waste hierarchy

The EU's waste hierarchy rests on an implicit assumption: that all waste is already collected. In much of the Global North, this premise holds true, and so collection fades into the background of policy debates. However, with 3 bn people globally still lacking access to a collection service, this makes collection not a peripheral concern, but a core intervention to safeguard both human well-being, dignity and public health.

Collection is often the SWM stage which requires the most expenditure and has the greatest impact on public health. This high expenditure, combined with the local authorities' inability to secure enough budget to provide an acceptable collection service, often leads a lot of waste remaining uncollected. According to Wasteaware's data of 120+ developing cities, uncollected waste contributes to 41% of the total unmanaged plastic waste. As highlighted by Manus Coffee and Adrian Coad, developing countries often suffer from 'unreliable, irregular and inefficient' collection service, reflecting the financial and institutional limits that leave municipalities trapped in a cycle of underperformance.

A growing sentiment in development circles holds that 'buying trucks' for municipalities is 'bad', or not 'sexy' enough to make for a good publicity photo. This is only partly true. The purchase of vehicles can indeed be wasteful when the municipality lacks a SWM strategy; one that maps waste flows, defines pickup points, and establishes where each load will ultimately go, or budget for operation and maintenance. Decisions about any single SWM stage cannot be made in isolation: each stage is linked, and a weakness in one will undermine the whole system. This system thinking and integrated mindset is currently a critical gap in development projects, which can lead to grim consequences.

It is also true that many vehicle donations have failed. Stories abound of European collection vehicles delivered to cities in developing countries, only to break down within months because they were unsuited to local road conditions, and/or had no available spare parts. Such failures are not anomalies: they are the predictable result of ignoring local social, cultural, economic, and environmental realities.

Yet, when grounded in reliable, up-to-date data and a baseline assessment of needs and current situation, the provision of collection vehicles can be transformative. The key is matching the equipment to the environment: vehicles that can withstand the climate, navigate narrow or unpaved roads, and be maintained locally. Designing and implementing the right collection service demands deliberate effort; this process calls for open-minded experts who are technically competent, unafraid to challenge 'one-size-fits-all' solutions and who can push for systems that work in the place where they are meant to work.

In the proposed waste hierarchy, collection is shown at the same level of controlled disposal. That is because expanding collection and ensuring controlled disposal are two sides of the same coin. Both are essential for

protecting public health, and neither can succeed in isolation. If waste is collected but not safely disposed of, health and environmental hazards are merely shifted downstream. If disposal exists but collection lags, vast numbers of residents remain exposed to unmanaged waste. For this reason, collection and disposal should be pursued in tandem, with policy calibrated to maintain a balance between the percentage of waste collected and the percentage managed in a controlled way. Otherwise, dangerous gaps emerge:

1. Shifting health risks: Expanding collection without disposal concentrates waste in uncontrolled dumps, triggering fires, groundwater contamination, and outbreaks of disease. The problem is not solved, only displaced.
2. Environmental leakage: Collection alone does little to stop pollution if disposal sites remain uncontrolled, since these are among the largest sources of leakage into soil, air, and water.
3. Lost learning curve: Focusing only on collection delays the chance to build capacity in safe site operation. When disposal is finally addressed, authorities are suddenly overwhelmed with large volumes, higher technical demands, and steep costs - triggering unsustainability. In large cities, this imbalance has already produced notorious waste “monsters” such as Nairobi’s Dandora, where delayed investment in controlled disposal created sprawling, dangerous sites.

The lesson is simple: collection and controlled disposal must advance together. Only then can health, environment, and institutional capacity progress in step, rather than leaving systems vulnerable to collapse.

2.6 Recycling starts with organics

Any discussion of recycling in the Global South must begin with organics. Wasteaware’s analysis of 120+ cities shows that organic waste makes up, on average, half of the total waste stream. By contrast, plastics – which are so prominent in global debates - typically represent only around 15%. It seems a profound oversight to focus narrowly on plastics while neglecting the much larger organic fraction, especially when degraded soils are crying out for nutrients and when poorly managed organics are a major driver of pollution and greenhouse gas emissions.

Addressing organics is also the key to unlocking other forms of recycling. When wet organics are mixed into the mixed waste stream, they contaminate dry recyclables such as paper, cardboard, and plastics, making them far less valuable and often unrecyclable. The separation (ideally at source) of organics not only enables quality outputs from organics recycling, but also improves the quality - and therefore the economic viability - of material recovery for other fractions. In this sense, organics are not simply another category of waste: they are the foundation on which an integrated recycling system must be built.

The key challenge for recycling organics is achieving economies of scale. Small (<5 tonnes per day), decentralised facilities often struggle with high unit costs and inconsistent feedstock. By contrast, larger facilities can process greater quantities at lower operational costs per tonne, making organics recycling more financially viable. Facilities of medium size (2-8 tonnes per day), which seem to be popular amongst donors, fall into a range which can neither be manually (too much waste for manual) or mechanically (too little to justify investment in machinery) operated, increasing the design complexity, and consequently the implementation process.

This creates a compelling case for cooperation of larger facilities (>10 tonnes per day). Inter-municipal projects can spread fixed costs, ensure a steady input of material, and justify investment in better equipment and trained personnel. Beyond lowering costs, such cooperation also builds resilience: when one municipality falters, others can sustain the flow of feedstock, keeping the facility operational, and therefore viable.

Resilience also depends on the existence of markets for organic waste byproducts. Unlike dry recyclables (such as aluminium or PET), which usually have well-established national and/or international buyers, compost and other organics-derived products rarely enjoy a ready market. The harsh truth is that producing compost is often easier than selling it. Potential buyers may be sceptical of its quality, may lack transport to collect it, or may simply prefer chemical fertilisers that are subsidised (i.e. cheaper) or more predictable in effect. As a result, many organics recycling businesses/initiatives collapse; not for lack of technical skill in running a facility, but because they cannot sell their product and remain financially competitive.

This underlines a wider truth for SWM: the viability of (organics) recycling is not secured by technology alone. It depends equally on the enabling environment that supports the initiative. That environment includes, for example, marketing/behaviour change ingenuities, regulations that encourage or mandate organic soil inputs,

and financial incentives that level the playing field between recycled and non-recycled products. Without such support, even the best-run organics recycling plants face the same fate: they pile up unsold products, run out of storage space, and eventually shut down.

2.7 Recycling dry recyclables

Recycling in the Global North has recently come under increasing criticism: too expensive, too slow, too marginal to make a real dent in the flood of virgin plastic. Yet, despite the scepticism, more investments are flooding into recycling, including in the Global South.

In the 1950s, plastic producers embraced the ‘throwaway living’ as a deliberate strategy to ensure continuous market growth. An internal report from the Vinyl Institute as early as 1986 was candid: ‘recycling cannot be considered a permanent solid waste solution [to plastics], as it merely prolongs the time until an item is disposed of.’ Decades later, recycling has failed to scale at the pace needed. From 2019 to 2021, growth in single-use plastics (SUP) made from virgin polymers surpassed that from recycled feedstocks by a factor of 15. By 2021, recycled polymers accounted for just 2% of all SUP consumed globally. It is not a surprise then to see that successful circular economy initiatives struggle to be upscaled.

Whilst the idea of recycling plastics for keeping materials in the economy remains appealing, the economic realities once again challenge the technical realm. Plastics degrade each time they are mechanically reprocessed, generally tolerating only one or two cycles before becoming unusable. Chemical recycling and re-cracking plastics from pyrolysis oils, has been a proven concept for 40 years, but not yet proven financially viable. Meanwhile, the waste stream itself is evolving and becoming increasingly complex, particularly with composite products deliberately designed for performance rather than recyclability (for example, films laminated with aluminium, sachets of several polymer layers, uniquely coloured PET bottles) all of which confound sorting, reduce the yield of recycling plants and forces operators to constantly adapt their operations. Furthermore, collecting, sorting, and transporting recyclables is costly and logistically complex, particularly where waste streams are contaminated with organics. Standardised material design and composition standards are either absent or unenforced, making it difficult to produce clean input (and thus output) streams. And even when recycling is technically feasible, recycled polymers rarely achieve the virgin plastics’ quality or cost. As long as virgin plastics remain artificially cheap - when measured only by market price and not by their full economic cost including environmental and social externalities - recycled materials will struggle to compete.

It is therefore unsurprising that petrochemical companies expand into recycling only where conditions are most favourable: in Europe, the United States, and parts of Asia, where progressive policies and consumer demand create at least a partial market pull. Elsewhere (including most of the Global South), the lack of regulatory oversight continues to slow the development of high-quality recycled streams. Recycling plastics, then, is not a simple technical fix, but a story of economics, policy, and design. Unless the system is reshaped through standards that enable recyclability, economic instruments that level the field between virgin and recycled polymers, and a deliberate effort to reduce material complexity (amongst other instruments), recycling will remain what it has long been: a marginal, insufficient response to a problem that was designed into plastics from the start.

2.8 The paradox of energy recovery

Energy recovery, and particularly Waste-to-Energy (WtE), rose to prominence in the Global North during the 1990s. Promoted as a modern solution to the waste crisis, it offered three simultaneous benefits: reducing landfill volumes, recovering energy from residuals, and generating new revenue streams. Countries such as Japan, Germany, France, and more recently China, scaled up WtE infrastructure dramatically, and their companies have since sought to aggressively export these technologies to the Global South. On paper, the proposition looks compelling.

WtE is often understood as large-scale incineration, but in practice it encompasses a broader set of energy recovery technologies, including anaerobic digestion of organic waste as well as thermal processes such as mass burn incineration, pyrolysis and gasification of higher calorific plastics and other residuals. It also includes co-processing in industrial facilities such as cement kilns, where waste-derived fuels substitute for fossil fuels. However, in many countries, such facilities remain constrained by legislation.

When technically feasible, large WtE plants (>1 megawatt) rely on the same logic that has made them attractive in the Global North: economies of scale. The larger the facility, the lower the cost per tonne of waste recovered. But this efficiency is fragile. Such facilities require a steady feedstock of high-calorific waste, which is difficult to secure in the Global South. Waste streams are dominated by organics with high moisture content and low calorific value (<7 megajoules/kg), and subpar collection coverage mean feedstock arrives inconsistently. Addis Ababa in Ethiopia has a famous case of a large WtE facility that failed to achieve its hyped targets: the Reppie WtE plant, opened in 2018, struggled almost immediately when the incoming waste proved too wet, inconsistent, and contaminated for efficient burning. The paradox emerges: the larger the facility, the cheaper the operating cost per tonne, yet the more dependent it becomes on service chains that are, often at best, unreliable.

A particular nuance exists for some of the larger Small Island Developing States (SIDS). Here, some of the same barriers can make WtE appear more viable. Small waste volumes limit economies of scale for dry recyclables recycling, transport costs to off-island markets are high, and land for new disposal sites is scarce. In this context, a medium-sized WtE plant could potentially serve a dual role: managing residual waste while producing energy that substitutes for imported fossil fuels, often purchased in expensive foreign currency. For island states already struggling with energy security, this alignment is attractive.

Yet the risks are equally plain. SIDS are among the most vulnerable regions to extreme climate events. A single hurricane can disable a multimillion-dollar plant for months, if not permanently, thus creating a backlog for waste recovery/disposal and threatening waste to end up in nature. Resilience here may come not from large-scale solutions but from modular, decentralised technologies that can be restarted quickly after disruption.

Across the Global South more broadly, WtE faces the same constraints seen in recycling: limited volumes of suitable material, absent or unstable markets for (by-)products, high transport costs, and the financial weight of imported technologies. The paradox deepens: WtE requires a long-term guarantee of steady, high-calorific feedstock; yet this locks countries into dependence on feeding facilities continuous residual waste, contradicting directly the waste hierarchy's emphasis on reduction and prevention. The question is therefore not whether WtE works, but under what circumstances it can form part of a resilient, locally grounded waste management strategy, highlighting once again the need to understanding the enabling environment to ensure the 'technical fix' can work locally.

3 Practical way forward for donors and practitioners

Whilst innovations in SWM exist, the Global South needs practical, pragmatic and affordable solutions which are tailored for the local context. All the technologies to tackle the waste problem exist – it is about designing and planning a compatible, integrated system of existing technologies with, and for, the local people.

A practical pathway begins with considering **three 'no-regret' investments**, valid in almost every context:

1. **Upgrading disposal sites:** to ensure residual (non-recoverable) materials do not end up in nature (this must include capital and operational upgrades including budget allocations and capacity enhancement);
2. **Expanding collection coverage:** as the basis for public health protection and because no downstream system can function if waste never enters it;
3. **Strengthening recovery systems:** to turn waste into a resource, particularly prioritising organics to minimise their methane emissions when landfilled and to increase the value of dry recyclables.

Using the revised waste hierarchy can help prioritise locally integrated SWM interventions and 'no-regret' investments:

- After reduction and reuse, the next lever is to put a **price on disposal**. Without economic instruments, the system will always default to the cheapest option. Upgrading disposal sites both reduces environmental and public health risks and sets a benchmark against which recycling/recovery alternatives can be assessed;
- Simultaneously to upgrading disposal facilities, **organising the collection system**, including a plan for dual separation at source (dry/wet) should be considered. Households, businesses, and institutions can only sort if the system gives them both means and incentive to do so;
- Once clean waste streams exist, **recycling follows**. A clean (uncontaminated) stream of dry recyclables can then be channelled into recycling markets in a financially affordable manner. Without contamination, plastics, paper, and metals increase in value, making recovery more financially viable;

- Finally, and only if the enabling environment allows, one may **consider energy recovery systems**. This step comes last not because it is unimportant, but because it is the most demanding: requiring steady waste supply, high technical capacity, supportive legislation, and resilient infrastructure.

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