

Hannah Blumhardt and Liam Prince

From Lines to Circles reshaping waste policy

Abstract

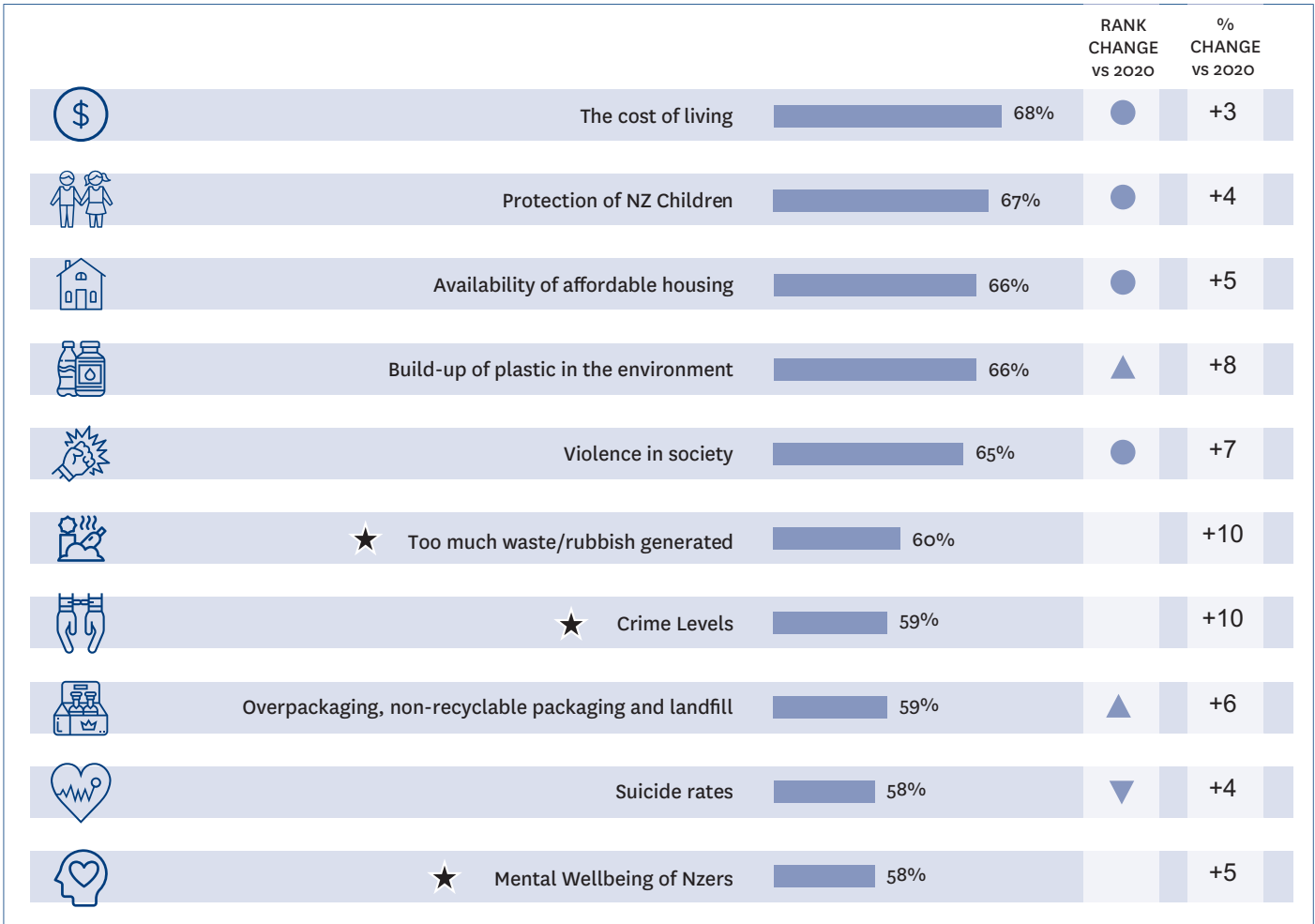
The impacts of waste transcend landfills and litter; emissions and pollution occur at every stage of the linear ‘take–make–waste’ economy. Zero waste and circular economy theories offer systemic perspectives and practical solutions. The New Zealand government has committed to a circular economy vision for Aotearoa. Given New Zealand’s ‘rubbish record on waste’, the social and economic transformation required will take extraordinary collaboration and a common direction of travel. This article diagnoses the extent of global waste problems, the circular pathways forward, and New Zealand’s early steps along them. With the government re-oriented to act, we urge an ambitious, joined-up approach that avoids locking in inadequate responses to existential threats.

Keywords zero waste, circular economy, bioeconomy, waste, climate

Hannah Blumhardt is a researcher for Āmiomio Aotearoa, a trans-disciplinary, multi-partner research project into the circular economy hosted by the University of Waikato, and a researcher at the Zero Waste Network. Liam Prince is a researcher for the Zero Waste Network, compost manager at Kaicycle and chair of the Aotearoa Plastic Pollution Alliance.

By global standards New Zealanders have big waste footprints; our hunger for resources outstrips our ability to return those resources to the economy. The result is overflowing landfills, plastic pollution, ecosystem degradation and greenhouse gas emissions. The government proposes to address these problems by moving to a low-waste, low-carbon, circular economy (Ministry for the Environment, 2021e, 2021f). The nature, scale and scope of the changes needed to achieve this vision are immense, given that production and consumption patterns drive waste and emissions and thus require transformation. All public sector agencies, industries and organisations must get with the programme and move beyond working at cross purposes in silos. Policies directed at waste, climate, business and innovation require harmonisation, underpinned by a shared understanding of the meaning and purpose of zero waste and circularity. While the government aims to replace extractive lines with regenerative circles, goodwill, coordination and clear-eyed ambition are needed to transcend inertia and the temptation to repackage business as usual in an eco-veneer.

Figure 1: New Zealanders' top 10 concerns according to the Kantar Better Futures Survey 2022



Source: Kantar and Sustainable Business Council, 2022, p.14

The waste problem is worse than you think
 People care about waste. While many unfolding ecological catastrophes, from climate change to biodiversity loss, can be hard to grasp or easy to deny, waste and plastic pollution are tangible, visible problems confronting people daily. Successive Kantar Better Futures surveys demonstrate that waste issues deeply trouble New Zealanders. In 2021 and 2022, topics related to waste and plastic pollution were the only environmental issues that ranked in New Zealanders' top ten concerns, taking up three spots in the list (Kantar and Sustainable Business Council, 2022). Other serious topics were absent, including climate change, water quality, biodiversity, Covid-19, healthcare, racism and social cohesion (see Figure 1).

The immediate impacts of waste are justifiably concerning. Between 2009 and 2021 New Zealand's waste sent to landfills increased 39% (Ministry for the Environment, n.d.).¹ Many landfills are filling up, necessitating new or expanded sites, which pleases nobody (Cardwell, 2021; Waste Management, 2022). Even engineered landfills pollute surrounding environments:

landfills emit methane from organic waste decomposing anaerobically, even with sophisticated gas capture technology;² liners designed to contain liquid leachate can fail and do not last forever (Pivato, 2011); and rubbish escapes, despite strategic fences. Old landfills are also vulnerable to rupture from extreme weather events and sea level rise, as the 2019 Fox River landfill disaster demonstrated (Ministry for the Environment, 2021f, p.19; RNZ, 2022).

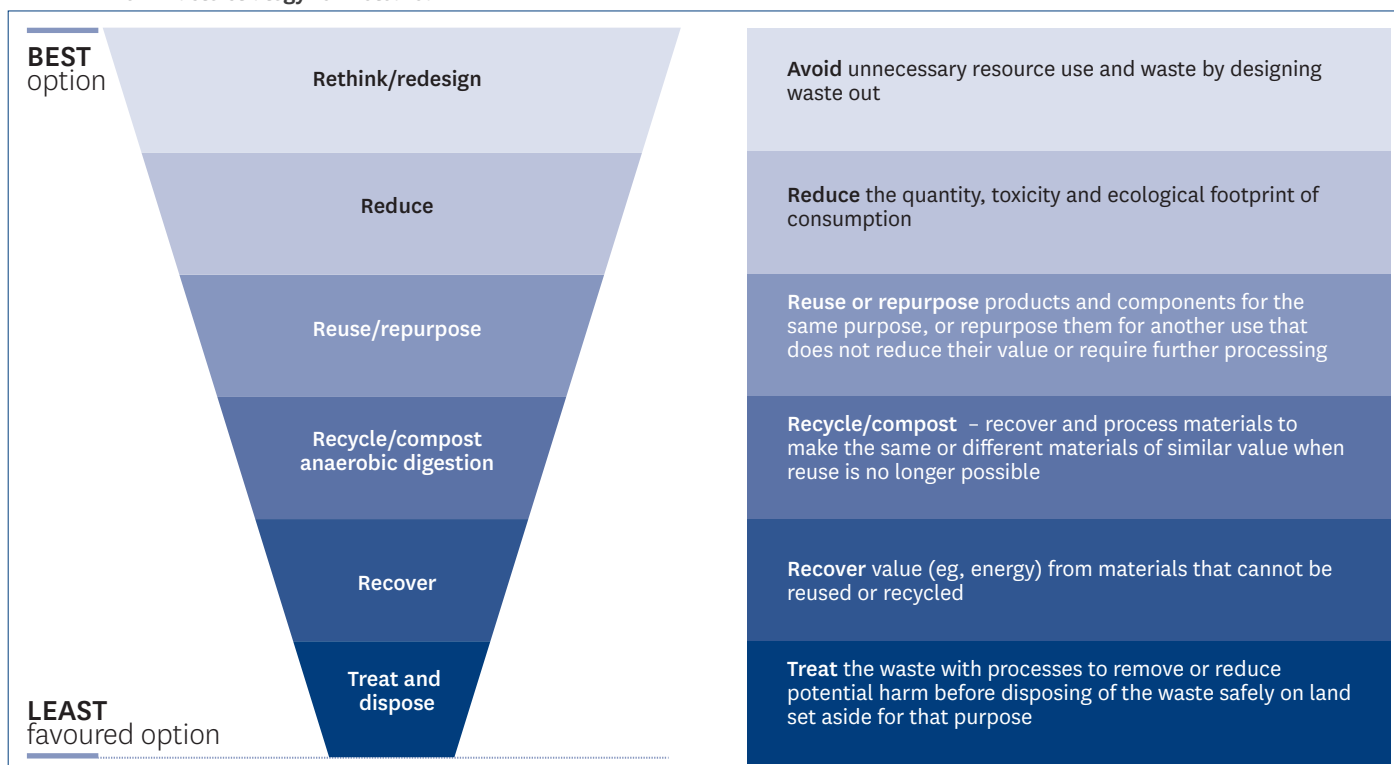
The inadequacy of recycling solutions elevates anxiety among the segment of the public who are concerned about waste. Most consumables are not made to be recycled, or appropriate and consistent collection and processing systems do not exist. New Zealand exports much of our recyclate, including shipping tonnes of plastic packaging waste to Southeast Asia (Wilson, Eve and Grant, 2018). Reports of this plastic being dumped or burned in receiving countries, detrimentally affecting local communities, is rightly challenged as 'waste colonialism' (#BreakFreeFromPlastic, 2020).

Globally, over 5 billion tonnes of plastic waste were landfilled, informally dumped or

mismanaged between 1950 and 2017 (United Nations Environment Programme, 2021). Much of this plastic waste has entered the environment, affecting marine, coastal and terrestrial environments, and human populations. Microplastics are in the air, drinking water, food, and the bodies of living organisms, including human blood (Farrelly, Taffel and Shaw, 2021, p.2; Leslie et al., 2022). Plastic also pollutes inequitably. For example, Pacific Island countries are disproportionately affected by plastic pollution, despite contributing less than 1.3% of the plastic waste in the world's oceans (Farrelly, Borelle and Fuller, 2020, p.6).

Unfortunately, these immediate impacts of waste represent just a fraction of the overall harm. Waste is a symptom of systemic problems; a quotidian manifestation of humanity's careless exploitation of natural resources that follows the extractive 'take-make-dispose' formula. This global plundering has reduced the planet to an assembly line that ends in waste, but drives climate change, biodiversity loss and irreversible pollution along the way (Burke, Zhang and Wang, 2021). The Ellen MacArthur

Figure 2: The waste hierarchy featured in the Ministry for the Environment’s consultation document on a new waste strategy for Aotearoa



Source: Ministry for the Environment, 2021f

Foundation (2021) calculates that making, transporting and consuming goods creates nearly half of global greenhouse gas emissions; Circle Economy (2022) claims that 70% of global greenhouse gas emissions ‘are ultimately generated through material handling and use’ (p.27). Essentially, everything wasted represents embodied emissions lost to the economy and generates the need to repeat the harmful extraction, production and transportation process.

Plastic pollution transcends rubbish on beaches or roadsides. Extracting and refining oil for plastic production generates substantial greenhouse gas emissions (Centre for International Environmental Law, 2019). Plastic products can leach harmful additives and persistent organic pollutants before, during and after use, and plastics exposed to sunlight can release methane (Farrelly and Green, 2020; Royer et al., 2018). Furthermore, microplastics’ environmental prevalence is not only caused by mismanaged plastic waste degrading, but from products like tyres, clothes, carpets and upholstery shedding while performing the functions they were designed to perform (Pew Charitable Trusts and SYSTEMIQ, 2020, p.17).

Understanding zero waste and the circular economy

Zero waste and circular economy theory emerged to better understand and address

both upstream and downstream impacts of waste. From the late 1990s, early zero waste advocates began calling for systemic solutions to supplement end-of-pipe waste management, including eliminating waste at source through product redesign, reducing the volume and pace of materials and products moving through the economy through reuse and recycling, and harnessing the wasted potential of organic materials through composting (Dickinson and Snow, 2003). Guided by values of fairness, redistribution and community resilience, the zero waste movement supports regulatory mechanisms to elicit producer responsibility and cost internalisation, and champions public investment and procurement being directed to localised resource recovery and zero waste business models (ibid.; Varshneya, Abbe and Danovitch, 2020; Simon, McQuibban and Condamine, 2020; Bianchi and Yates, 2021, p.2).

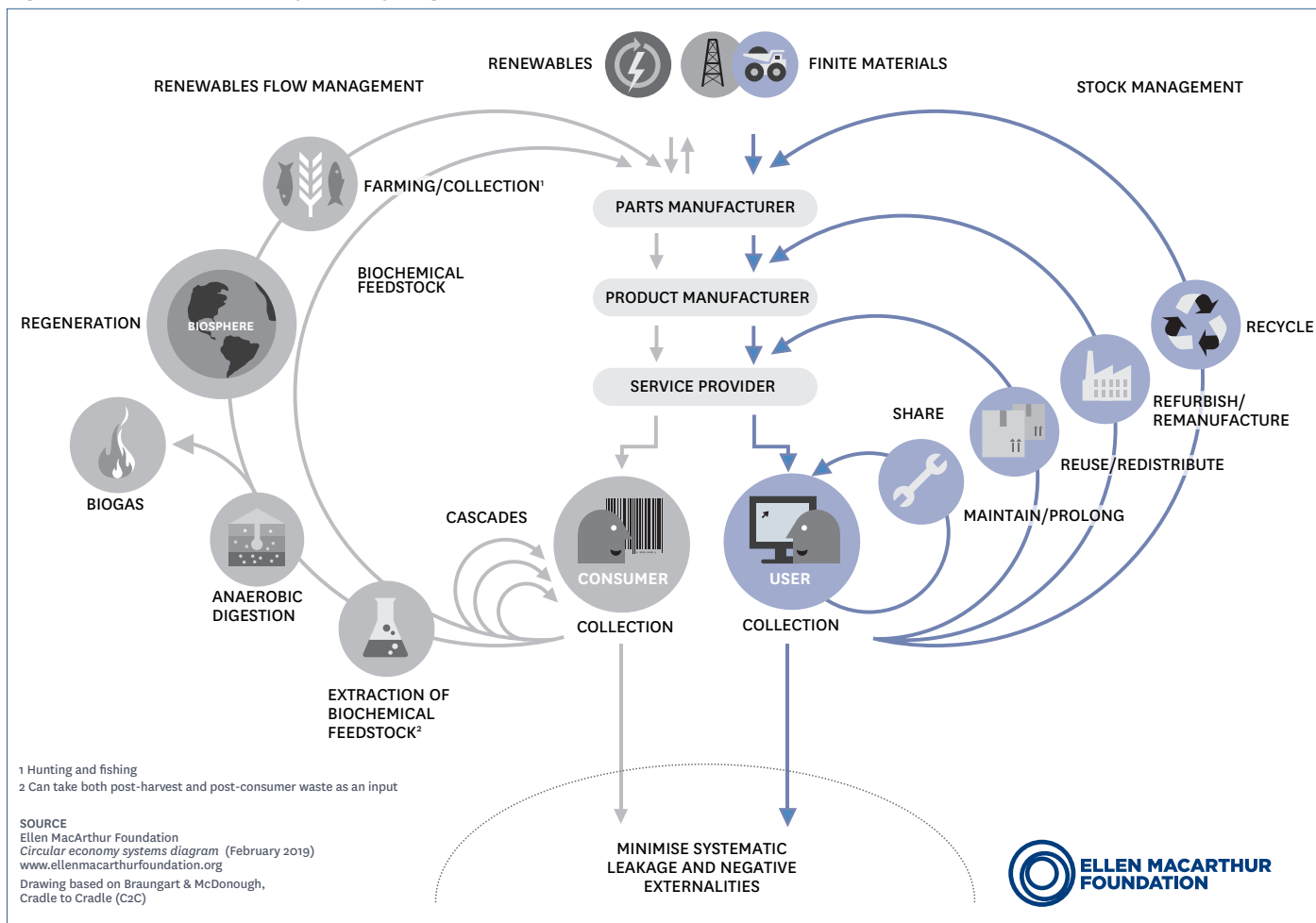
The zero waste approach is expressed in the waste hierarchy, now the mainstream cornerstone of effective waste policy (see Figure 2). The waste hierarchy prioritises preventing and reducing waste, and reusing products, over efforts to recycle, compost or dispose of materials because actions higher up the hierarchy are most effective at reducing both waste and emissions. The zero waste movement’s systemic focus is combined with the practical, ‘can-do’ orientation characterised by grassroots movements, making zero waste both ‘pragmatic and

visionary’ (Simon, McQuibban and Condamine, 2020, p.15). Today, zero waste is advanced by municipalities and NGOs globally, including local organisations like Para Kore and Zero Waste Network Aotearoa.

Overlapping with zero waste is the circular economy concept, emerging from William McDonough’s 2002 cradle-to-cradle design framework, and popularised by the Ellen MacArthur Foundation (Burke, Zhang and Wang, 2021). The circular economy has garnered respect from governments, international agencies, NGOs and multinational corporations (Circle Economy, 2022, p.14), and is defined as ‘a systems solution framework that tackles global challenges like climate change, biodiversity loss, waste, and pollution’, underpinned by three key principles: ‘eliminate waste and pollution; circulate products and materials (at their highest value); and regenerate nature’ (Ellen MacArthur Foundation, n.d.b). Advocacy of the circular economy and zero waste dovetail, although the former has a more corporate and technological flavour and following. The circular economy’s principle of regenerating nature also underscores new considerations, including the need to detoxify products and materials so they can circulate safely without causing pollution or toxicological harm (World Health Organization, 2018).

The circular economy butterfly diagram (see Figure 3) displays how resources should cycle in loops, prioritising the small closed

Figure 3: The circular economy butterfly diagram



Source: Ellen MacArthur Foundation (n.d.a)

loops closer to the centre of the butterfly as these reduce energy demand (mirroring the logic of the waste hierarchy, which also prioritises actions in accordance with resource efficiency and communicates this in a simple cascading visual). While relying on recycling can be circular, more energy-efficient closed-loop approaches include redesigning products and business models to reduce material footprints (e.g., sharing systems), or keeping products in use locally through reuse and repair. Practices like downcycling, incineration or landfill are discouraged as linear, ‘open loop’ practices. The butterfly diagram also shows that biological and technical materials should cycle in separate loops: these materials have different functions and mixing them makes their end-of-life recovery costly or impossible.

What do zero waste and the circular economy guide us to do in practice?

Today, the circular economy and zero waste are often marshalled in tandem, given that they are complementary and mutually reinforcing. Both highlight that waste and plastic pollution result from how we live, consume and do business,

and interconnect with wider issues like climate change, social justice and public health. As waste and pollution are typically baked in at the product design phase, interventions must go up supply chains to decelerate resource extraction and simplify and reduce the products and materials cycling through the economy. The bigger picture that zero waste and the circular economy elucidate helps identify the necessary ambition and coordination to change the present trajectory and avoid false solutions that prolong root causes. Circle Economy’s *Circularity Gap* reports, and the zero waste masterplans created by Zero Waste Europe (Simon, McQuibban and Condamine, 2020) and the Global Alliance for Incinerator Alternatives (Varshneya, Abbe and Danovitch, 2020) provide comprehensive and practical blueprints for implementing these visions in reality.

Currently the global economy is only 8.6% circular; it is estimated that this figure must double by 2032 for the planet to stay within 1.5°C of global warming (Circle Economy, 2022, p.30). Doubling circularity requires transforming production and consumption systems. Currently business

models are built ‘to stimulate repeat consumption and production and thus profits’ (Burke, Zhang and Wang, 2021, p.1). Most products are inherently linear: short-lived and/or disposable, made from virgin materials, not designed for reuse, repair or recycling, and over-duplicated.³ Too much economic activity is not regenerative. We carelessly use materials and additives that expose biological organisms to persistent organic pollutants and microplastics, and compromise efforts to circularise because recycling and composting activities can increase exposure and propagate these contaminants (World Health Organization, 2018). Furthermore, roughly one-third of food produced is not eaten (Scialabba, 2015). Food waste, consistently the largest portion of household waste globally, typically ends up decomposing anaerobically in landfills, producing methane.

A zero waste, circular economy would produce only what is needed, and most products would be built to last. Business models would favour sharing over individual ownership, reuse over single-use, and upgradeability over replacement to reduce

quantities of product in the economy, conserve resources and extend product lifespans. Examples of these models in practice include public transport, library/loan systems (beyond books – e.g., tool and toy libraries), laundrettes, clothing rental, app-based peer-to-peer sharing services, reusable packaging systems, whole-house deconstruction to salvage and reuse building materials, and easy and affordable repair of consumables, appliances and equipment (Blumhardt, 2021b; Bianchi and Yates, 2021, p.11).

Furthermore, organic materials would be kept separate at design and end-of-life. Biomass would be utilised regeneratively, with only the highest value uses extracted in low quantities and the majority composted locally to replenish soils via decentralised models that reduce transport, increase compost quality, create more jobs and build local food resilience (Prince, 2021a, 2021b). Products would also be safe to use; regulations would control use of hazardous additives, chemicals and materials, and of polymers in functions with elevated risk of microplastic degradation – e.g., textiles, or horticulture, agriculture, viticulture and aquaculture applications (CHEM Trust, 2015; BEUC, 2017; World Health Organization, 2018).

The techniques and solutions deployed for a zero waste, circular economy future must fit within prescribed carbon budgets. This likely means technological simplification based on ‘what works’, rather than over-reliance on complex, unproven and/or experimental technologies (that can be carbon intensive without evidence that they will deliver necessary upstream reductions in waste). Governments could better identify and support organisations already using existing technology to implement circular practice up the waste hierarchy. Innovation should focus on reconfiguring business models, practices and relationships across supply chains, and incentivising product redesign to reduce waste and toxicity (Burke, Zhang and Wang, 2021). Well-designed product stewardship can support these transitions and put responsibility on producers to achieve prevention, reduction and reuse outcomes (Blumhardt, 2021a),⁴ alongside financial mechanisms to disincentivise linear business models and redistribute resources to those working to close the loop, including targeted levies, tax relief and subsidies (Burke, Zhang and Wang, 2021, p.14). Governments and industry must also invest in communications and standards

The government has signalled a desire for more reusable/refillable packaging in various policy documents, but has advanced few regulations to support this; its latest signatory report to the Ellen MacArthur Foundation’s New Plastics Economy Global Commitment did not cite a tangible, distinct policy action undertaken or in train to advance reuse ...

around circularity, the necessary infrastructure and reverse logistics for circular practices, and the specific skill sets, mindsets and training for work in the circular economy (te Bokkel et al., 2021).

Moving New Zealand’s economy from a line to a circle

Since 2017 the New Zealand government has done a lot to turn the page on previous decades of waste policy neglect (Blumhardt, 2018). The new policy direction has triggered a flurry of action: various measures to tackle plastics, including targeted bans; regulated product stewardship for six ‘priority products’; increasing and expanding the waste disposal levy; and proposals to

implement a beverage container return scheme, standardise kerbside recycling, mandate food scrap separation and collection, and update the New Zealand Waste Strategy, the Waste Minimisation Act and the Litter Act (Ministry for the Environment, 2021g).

The new-found momentum for waste policy is reflected by a rhetorical commitment to the circular economy both within and beyond the Ministry for the Environment (reflecting similar moves by the EU, the UK and several European countries).⁵ In 2019 the prime minister’s chief science advisor produced a seminal, 264-page report on rethinking plastics, with 51 recommendations addressing the full plastic life cycle, including the need for government-wide adoption of the circular economy. The circular economy was prominent in the emissions reduction plan discussion document (Ministry for the Environment, 2021e), and centre-stage in the proposed vision for the updated New Zealand Waste Strategy: ‘A circular economy for Aotearoa New Zealand in 2050’ (Ministry for the Environment, 2021f, p.25).

Climate policy has also driven significant waste policy developments. The Climate Change Commission, in response to the waste sector’s 4% contribution to New Zealand’s total greenhouse gas emissions inventory (81.2% of which arise from organic waste decomposing in landfills), recommended that the government set a target to ‘reduce biogenic methane waste emissions to at least 40% below 2017 levels by 2035’ (Climate Change Commission, 2021, p.302). This recommendation will influence efforts to remove organic waste from landfill, and the government has already proposed to require councils to collect household food scraps at kerbside and all businesses to separate their food scraps (Ministry for the Environment, 2022b). The Climate Change Commission advice also recommended that the government create strategies to move Aotearoa towards a circular economy and a bioeconomy, and appoint a minister and lead agency for these tasks. The commission understands the bioeconomy as essentially the biological cycle of the circular economy, viewing the latter as being ‘about directly displacing fossil fuels with renewable biological resources’ (Climate Change Commission, 2021, p.251).

Falling short, false solutions and fractured silos?

The government’s intention to reduce our shameful waste footprint, using the

circular economy as a yardstick for progress, is undeniably positive. Furthermore, recognising waste and circularity as relevant to climate conversations, and the broadening interest in these topics across the public sector, is important. The task government agencies now face is to elevate and sustain ambition, while ensuring cross-sector coordination to avoid diluted goals or divergent policy approaches.

Falling short of ambition

Given the magnitude of the necessary transformation, even the most ambitious states fall short in activating circularity promises. The European Union has struggled to fulfil its ambitious Circular Economy Action Plan, and to consider policies that acknowledge biophysical limits to economic growth and intersecting social and ecological issues (Friant, Vermeulen and Salomone, 2021). Everywhere, the rhetoric–action gap is demonstrated by the lip service governments pay to the waste hierarchy, only for ‘this golden principle [to be] pretty much thrown out the window’ when policy, practice and investment concentrates towards the bottom of the hierarchy (Kunamaneni, Jassi and Hoang, 2019, p.257). Treating the hierarchy like a ladder to climb, rather than a funnel, should be avoided because of the real-world implications of path dependence and lock-in associated with investing at the bottom of the hierarchy.

The waste strategy consultation document released in 2021 acknowledged that New Zealand is ‘behind the curve’ on waste and must lift its ambition (Ministry for the Environment, 2021f, p.17). However, it proceeded to propose that the remainder of the 2020s be spent ‘catching up’ (p.31) by accelerating activities overwhelmingly focused on waste management and anti-littering (Blumhardt, 2021b). In response, Para Kore (2021) called the proposal ‘catastrophically inadequate’ given the scale and urgency of the ecological crises presented by waste and climate change. Similarly, the National Plastics Action Plan (Ministry for the Environment, 2021c) released earlier in 2021 was criticised by the Aotearoa Plastic Pollution Alliance and others because it ‘lacks concrete and measurable targets, actions and investments at the top of the waste hierarchy, acknowledgement of Te Tiriti o Waitangi and mātauranga Māori, and does not address the human and ecological health impacts of chemical additives and microplastics’ (Aotearoa Plastic Pollution Alliance, Para

The government could do more to clarify the meaning and purpose of the circular economy and zero waste, and share information about closed-loop processes and their importance.

Kore and New Zealand Product Stewardship Council, 2021).

A more ambitious aim would be to leapfrog rather than catch up – whereby New Zealand strides ahead with transforming business models, strengthening producer responsibility to achieve and finance upstream actions, and looking to mātauranga Māori to guide a place-appropriate, equitable pathway forward. More must also be done to ensure that products circulate in small, closed loops at the top of the waste hierarchy. Neither the emissions reduction plan discussion document, nor the waste strategy consultation document properly identified the role of new business models to increase circularity. While product stewardship has the potential to promote reduction and reuse, these activities are currently under-prioritised in scheme designs (Blumhardt, 2021a). The government has signalled a desire for more reusable/refillable packaging in various policy documents, but has advanced few regulations to support this; its latest signatory report to the Ellen MacArthur Foundation’s New Plastics Economy Global Commitment did not cite a tangible, distinct policy action undertaken or in train to advance reuse (Ministry for the Environment, 2021a). Furthermore, the proposed updates to the Waste Minimisation Act 2008 included

virtually no regulatory tools for outcomes up the waste hierarchy, except potential right to repair provisions, which are welcome, but not sufficient to transform the economy (Ministry for the Environment, 2021f).

Government investment and procurement should be allocated according to the waste hierarchy, and with greater transparency. Most local government waste minimisation expenditure is on recycling activities, such as kerbside recycling. Furthermore, without social procurement policies, most resource recovery service contracts are won by large corporations. The majority of the Covid-19 Response and Recovery Fund earmarked for waste went to infrastructure focused on downstream waste management, despite major infrastructure gaps for upstream prevention, reduction and reuse activity (Ministry for the Environment, 2021b). The contestable central government Waste Minimisation Fund has no mechanism to distribute funds according to the waste hierarchy. Furthermore, a lack of transparency hampers the ability to track funding allocations and the surrounding decision-making process. This includes the non-disclosure of the membership of the funding panel and the criteria against which applications are assessed, granted and rejected, and the fact that the ministry does not release complete information about all applicants and projects funded. Despite these limitations, PhD candidate Warren Fitzgerald analysed the publicly listed grants that have been awarded since the fund’s inception and found that the overwhelming majority went to activity lower down the waste hierarchy (Zero Waste Network et al., 2021) (see Figure 4).⁶

Avoiding false solutions

Globally, endless false solutions have arisen that distort the meaning of zero waste and circularity: for example, technical efforts to ‘get rid of waste’, like waste-to-energy, downcycling or inventing compostable products. None of these challenge overconsumption or tackle upstream emissions; nor do they close the loop and slow down extraction by putting materials back to their original use. In fact, they risk creating market demand for waste generation, are usually expensive, and can generate a path dependence or lock-in effect. Furthermore, both bioplastics and compostable products put organic materials into technical contexts, while many downcycled products combine organic and technical materials. These approaches violate the circular economy’s

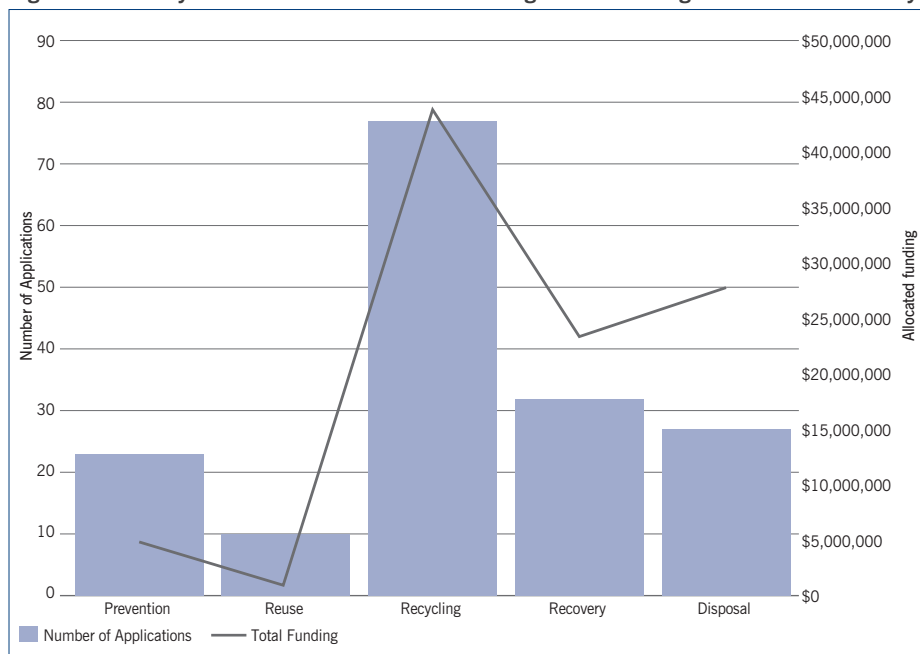
butterfly principle by mixing technical and biological loops, create ‘monstrous hybrid’ final products that are not themselves circular, or use soil as a waste disposal system for manufactured products. Many false solutions ignore or gloss over their toxicological impacts and cannot be described as regenerative.

In New Zealand, private and public entities are advancing many such projects, including research into bioplastics and waste-derived sustainable aviation fuel, using waste materials for construction supplies, agricultural products and roading, and numerous waste-to-energy proposals. The government could do more to clarify the meaning and purpose of the circular economy and zero waste, and share information about closed-loop processes and their importance. The Ministry for the Environment has released a position statement on compostable products, highlighting their potential toxicological impact for soil, waterways and human health and underscoring the preferability of reusable alternatives (Ministry for the Environment, 2022a). The ministry has also raised the possibility of expanding the waste disposal levy to capture downcycling and waste-to-energy (Ministry for the Environment, 2021f). The government could consider developing express funding restrictions or exclusions for activities that could constitute false solutions, and a clear position on waste-to-energy in a circular economy. There is also need for a lead agency to generate reputable, consistent and evidence-based information on the circular economy that can be referred to by all government agencies and the private sector to help avoid the concept’s dilution via greenwashing. Improved economic and regulatory incentives for initiatives up the waste hierarchy would also shift attention away from false solutions.

Fractured silos

The ambition deficiency and dilution of zero waste and circularity risks exacerbation as the circular economy agenda is diffused across government agencies, and climate and waste portfolios. The increased focus on waste in climate policy could distort the long-term direction of waste policy and practice, unless the way emissions are understood better reflects the analyses produced by zero waste and circular economy theory. The strict adherence to production-based emissions accounting in New Zealand’s greenhouse gas inventory (which counts emissions where they occur) effectively suggests that

Figure 4: Publicly Listed Waste Minimisation Fund grants according to the waste hierarchy



Source: Warren Fitzgerald (cited in Zero Waste Network et al., 2021)

waste’s climate impact is limited to methane produced by organic waste in landfills. This overlooks the upstream embodied emissions of all waste products, from plastics, e-waste, textiles, furniture and packaging, to the upstream emissions associated with organic waste, such as avoidable food loss and waste. This oversight undervalues the climate impact of zero waste initiatives and has the unfortunate side-effect of continuing to marginalise resource use considerations in climate action debates, vis-à-vis transport, agriculture, renewable energy and tree planting. While these actions are critical, they only address part of the picture (Circle Economy, 2022, p.14).

Such neglect is not unique to New Zealand, but we do lack systematic methods to measure and manage consumption-based emissions and material footprints. While consumption-based emissions accounting may not be suited as the primary method for setting emissions targets and obligations, it is critical for waste and circular economy policy development (Afionis et al., 2017). The Climate Change Commission (2021) recognised that consumption-based emissions ‘are a useful complement to the national inventory... [that] provide insights into the wider impact Aotearoa has on global emissions, carbon intensive supply chains and trade flows’ (p.199). However, this was not mentioned in the government’s emissions reduction plan discussion document, which largely overlooks embodied emissions (excepting some promising comments and initiatives in relation to buildings – e.g., the

Building for Climate Change programme – but this approach is not translated to any other product, material or industrial sector).

Finally, the Climate Change Commission’s circular economy and bioeconomy recommendations have catapulted circularity to the attention of agencies beyond the Ministry for the Environment.⁷ This increases potential for cross-sector coordination, and more powerful upstream interventions to influence business models and supply chains. However, it also exposes the interpretation of circularity to ministries with different priorities, at a time when we still lack shared understandings of definitions, measurements and targets for circularity.

One area already exposing some shaky faultlines is the bioeconomy, which the Climate Change Commission has advanced as a stand-in for the biological cycle of the circular economy (an interpretation the emissions reduction plan discussion document adopts). However, the circular economy and bioeconomy come from different conceptual traditions, and emerging notions of a ‘circular bioeconomy’ are highly contradictory and immature in the literature (Giampetro, 2019; Prince, 2021b). In circular economy theory, the biological cycle limits overly exploitative and wasteful extraction of natural resources and biomass, and ensures that those resources and their nutrients return to nature to regenerate its life-sustaining and resource-providing capacity (Burke, Zhang and Wang, 2021, p.3). Reducing biomass wherever possible first, and harnessing the remainder to build soil

health or increase regenerative agriculture practices is prioritised (Prince, 2021a, 2021b; Zero Waste Network et al., 2021).

In contrast, the government's proposed bioeconomy is primarily concerned with feedstock replacement: i.e., displacing fossil carbon with renewable biomass for fuel, products, chemicals and food. Accounting for the impacts of natural resource extraction, or designing ecosystem regeneration into the system are not centre-stage. The government has tailored the bioeconomy to its goal of developing a bioenergy/biofuels sector to offset hard-to-abate emissions sources, rather than achieving circular economy outcomes. As such, it does not truly reflect the circular economy's biological cycle because it follows an extractive, not regenerative, model.

Establishing a new independent Crown agency for the circular economy could help avoid too many more divergent misinterpretations and siloes (Bianchi and Yates, 2021, p.6). Many jurisdictions currently leading in zero waste and circular economy policy have dedicated independent agencies or delivery bodies, such as Zero Waste Scotland, the Waste Reduction Action Programme in the UK and Sustainability Victoria in Australia. These agencies bring consistency, specific expertise and thought leadership to their respective jurisdictions, enabling effective delivery of government

programmes, funding allocation and research, in alignment with best-practice understandings of circularity (Zero Waste Network et al., 2021). In New Zealand, an independent, Te Tiriti-based agency, tasked with both delivery and research, and better able to connect into the existing expertise of local communities, might also soften the government's current top-down, sector-focused approach to wicked ecological problems, which undervalues mātauranga Māori and community knowledge and capability (Zero Waste Network et al., 2021; Para Kore, 2021; Stephenson, Kawharu and Burch, 2021; Bargh and Tapsell, 2021).

Coming full circle

The government is launching a multi-sector programme to move Aotearoa towards a low-waste, low-carbon circular economy by 2050. Policies on waste, climate and industry transformation are in development across public sector agencies. Locally and globally there is increased awareness that waste, climate, biodiversity and plastic pollution are interconnected. In Aotearoa, it is positive that environmental protection issues are no longer siloed to one ministry. More work is needed to ensure that all parties understand the purpose and depth of zero waste and circular economy theories, to sing from the same song sheet. Furthermore, despite

all the talking, research and consultation documents, the jury is still out on whether the government can muster meaningful action to deliver the upstream transformation needed to move to an equitable zero waste, circular economy compatible with a world that stays within 1.5°C of global warming.

- 1 Between 2009 and 2019 waste to levied landfills increased by 47%. A decline in waste between 2019 and 2021 accounts for the smaller overall increase of 39% cited here. The Ministry for the Environment notes that this decline is likely due to Covid-19 and that longer-term trends suggest waste disposal is increasing.
- 2 The average lifetime efficiency of landfill gas capture in New Zealand is 68% (Ministry for the Environment, 2021d, p.377).
- 3 Over-duplication occurs when production of a particular item exceeds what is necessary to meet everybody's needs. It is typically connected with inefficient allocation of resources.
- 4 Product stewardship is about creating responsibility for products throughout their full life cycle, and implementing fair financing mechanisms to enable those responsibilities to be effectively discharged.
- 5 See European Commission, 2020; Department for Environment, Food and Rural Affairs et al., 2020.
- 6 Due to the limited information available, only 67% of total applications (representing 78% of total approved funding of roughly \$277 million) could be classified.
- 7 The Ministry for Business, Innovation and Employment will likely be tasked with leading the circular economy and bioeconomy strategies.

Acknowledgements

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