Kōtuitui: New Zealand Journal of Social Sciences Online

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/tnzk20

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To cite this article: Gradon Diprose, Louise Lee, Hannah Blumhardt, Sara Walton & Alison Greenaway (2023) Reducing single use packaging and moving up the waste hierarchy, Kōtuitui: New Zealand Journal of Social Sciences Online, 18:3, 268-289, DOI: 10.1080/1177083X.2022.2154230

To link to this article: https://doi.org/10.1080/1177083X.2022.2154230

Published online: 16 Dec 2022.

KOTUITUI: NEW ZEALAND JOURNAL OF SOCIAL SCIENCES ONLINE
2023, VOL. 18, NO. 3, 268–289
https://doi.org/10.1080/1177083X.2022.2154230

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RESEARCH ARTICLE

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Reducing single use packaging and moving up the waste hierarchy

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ABSTRACT

Interest in circular economy practices is increasing. A key material that connects the circular economy and wider environmental concerns is plastic waste, which poses environmental, climate, and human health risks. Single-use plastic packaging is particularly problematic because it forms the largest share of the global plastics market, has a short life cycle, and has channelled investment towards the bottom of the waste hierarchy. Given single-use plastic packaging is embedded in global trade, transitioning away from use requires much more than 'behaviour change' from individual producers and consumers. In this article we use social practice theory to show how social change is occurring with regard to single-use plastics. We draw on two food retail case studies of (primarily) business-to-consumer packaging from Aotearoa New Zealand. We show how transitioning away from single-use plastic food packaging requires (1) understanding the function and meaning of packaging materials, and (2) coordinating other materials, skills and meanings to re-craft and substitute the functions that single-use packaging performs across businesses, supply chains and consumers. Our analysis illustrates the significant collaboration and emerging networks needed for change, and signals how investment towards the top of the waste hierarchy in reuse could contribute to a more circular economy.

ARTICLE HISTORY
Received 4 July 2022
Accepted 29 November 2022

KEYWORDS
Single-use plastic; packaging; re-use; social practice theory; circular economy; New Zealand

Introduction

The circular economy (CE) has become what Friant et al. (2021) term a 'go-to concept' in recent years. While the CE concept is often framed as a way to address the socio-ecological challenges of the anthropocene, its associated meanings and practices are contested (Corvellec et al. 2022; Friant et al. 2021). Some have suggested that depending on how a CE is operationalised, it could risk being mere greenwashing (Lazarevic and Valve

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2017). Furthermore, there has been little discussion about the 'complex and controversial relationships between CE, energy, resources, biodiversity, entropy and economic growth' (Friant et al. 2021, p. 2). As Corvellec et al. (2022) note, there are debates about whether a CE can deliver the radical transformation needed to regenerate the environment, redistribute wealth, improve human health and labour conditions, and create resilience. Or whether it has (and will) predominantly focus on the 'efficient' flow of materials and waste recycling without challenging the extractive growth-oriented status quo.

Single-use plastics[1] exemplify the challenges of shifting toward a CE. As Hawkins (2018) observes, single-use plastics have come to signify the 'throwaway culture' of the linear economy. The Ellen MacArthur Foundation (2016) note that from 1998, annual global plastics production more than doubled, and project it will double again in the next 20 years. Plastic packaging accounts for 36% of the total volume of global plastics produced, making it the single largest use (Geyer 2020). The majority of this plastic packaging is single-use, particularly in business-to-consumer (B2C) applications. The growth in single-use plastic packaging is often attributed to its functional properties that help to reduce transportation costs, enable export and trade, and protect food and other goods from damage and contamination (Hawkins 2018; Fuentes et al. 2019; Zeiss 2018; Hellström and Olsson 2017; Fuentes and Fuentes 2017). Notwithstanding these functional qualities, research is increasingly highlighting plastics' interconnected environmental (c.f. Ellen MacArthur Foundation 2016), climate (c.f. Ganguly and Ariya 2019) and human health risks (c.f. Amato-Lourenço et al. 2020; Prata 2018; Wright and Kelly 2017; Rodrigues et al. 2019). Plastics have become in-grained in everyday trade and exchange, so it is often difficult for businesses and communities to reduce use because they have limited ability to change wider infrastructures and are often locked into certain practices, including vested and sunk financial interests (Farrelly and Green 2020).

Concerns about plastics and waste have contributed to the (re)emergence of the 'unpackaged movement' (Hawkins 2020; Fuentes et al. 2019). Hawkins and Fuente et al. suggest that this 'unpackaged movement' includes a wide range of organisations and practices aimed at decoupling from single-use plastics and developing new market and consumer arrangements. Research on this 'unpackaged movement' has explored how consumption practices shift amidst wider infrastructures (c.f Hawkins 2018, 2020; Beitzen-Heineke et al. 2017; Sattlegger et al. 2020); how the removal of single use packaging is managed in food retail (c.f. Fuentes et al. 2019); and whether the removal of single use packaging does or does not contribute to reduced consumption as part of a CE (Kallis et al. 2018). More broadly, critical scholars have also questioned whether plastics have any place in a CE (Mah 2021).

In this article we use two case studies to illustrate different approaches to decoupling from single-use plastic packaging in food retail in Aotearoa New Zealand. The two case studies are (1) 'Food in the Nude' – a supermarket initiative introducing plastics-free produce-departments; (2) packaging-free zero waste 'niche' grocery stores. We use Shove et al.'s (2012) social practice theory (SPT) framework to first, document how practices that previously involved single-use plastics are shifting and intersect with wider material infrastructures.[2] Secondly, we highlight how the removal of certain materials (single use plastic packaging) requires the redistribution of their functions and associated shifts in meanings across business and consumer practices. Thirdly, we reflect on how

investment in both relational and material infrastructure towards the top of the waste hierarchy could reduce reliance on single-use plastic packaging and contribute to more circular practices. This article highlights the collaborative relationships and investment needed across food systems for producers, transporters, retailers and consumers to decouple from single use plastic packaging.

The article is structured as follows. Section 1 summarises relevant literature drawing on SPT and recent work theorising transitioning away from single-use plastics. Section 2 outlines the Aotearoa New Zealand context, methods, and introduces the two case studies. Section 3 summarises the results using a SPT framework to structure the discussion. Section 4 concludes with suggestions for where investment can be targeted to move up the waste hierarchy and encourage circular practices that reduce extraction, and limit plastic flows and leakages, using existing knowledge and materials.

Shifting toward circular economy practices at the top of the waste hierarchy

A CE is positioned as a response to the linear economy by transitioning from a take-make-waste system to eliminating waste in economic systems (Merli et al. 2018, Stahel 2016; Ellen MacArthur Foundation 2013). The burgeoning literature on CE refers to conceptualisations (Korhonen et al. 2018; Murray et al. 2017; Kirchherr et al. 2017), community led responses (e.g. Bradley, and Persson 2022), and business model innovation (Bocken et al. 2016; Lüdeke-Freund et al. 2019; Geissdoerfer et al. 2018). Recent commentary has also highlighted how CE theory under-addresses governance, social justice and cultural change (Friant et al. 2021; Frenken 2017; Kirchherr et al. 2017, 2018; Lazarevic and Valve 2017). For example, As Friant et al. (2021, p. 6) note, most of the CE focus to date has been on technological transitions, that fails to 'recognise the massive socio-cultural changes that a CE entails by transforming consumption and production structures based on materialism, convenience, and ownership to ones based on collaborative consumption, sharing economies and use value'. There has been important (but less) work that explores circularity through other lenses, such as degrowth and simple living (c.f. Alexander 2015), community economies, waste and care (c.f. Morrow and Davies 2021), and Indigenous or non-Western understandings of economy, wellbeing and waste (c.f. Amoamo et al. 2018; Fuller et al. 2022; Kothari et al. 2019; Shareef and Boasoa-Dean 2022). As Friant et al. (2021) note, this work on degrowth and Indigenous knowledge provides insights for responding to the plastics crisis by helping shift science investment systems and wider social norms towards practices like refusing, reducing, re-using and repairing.

CE theory overlaps with the research and application of zero waste principles, which emerged at the turn of the millennium. Blumhardt and Prince (2022) argue that the practices of zero waste provide insights that are critical to understanding the transition to more circular packaging systems. One of the foundations of zero waste is the waste hierarchy. This hierarchy prioritises interventions and systems centered on *preventing* and *reducing* waste in the first place, and *reusing* manufactured products for as long as possible, over efforts to recycle and dispose of materials (see Figure 1). Activities higher up the waste hierarchy, such as reuse, are more effective at reducing waste and reduce greenhouse gas emissions because they bypass raw material extraction by not continually

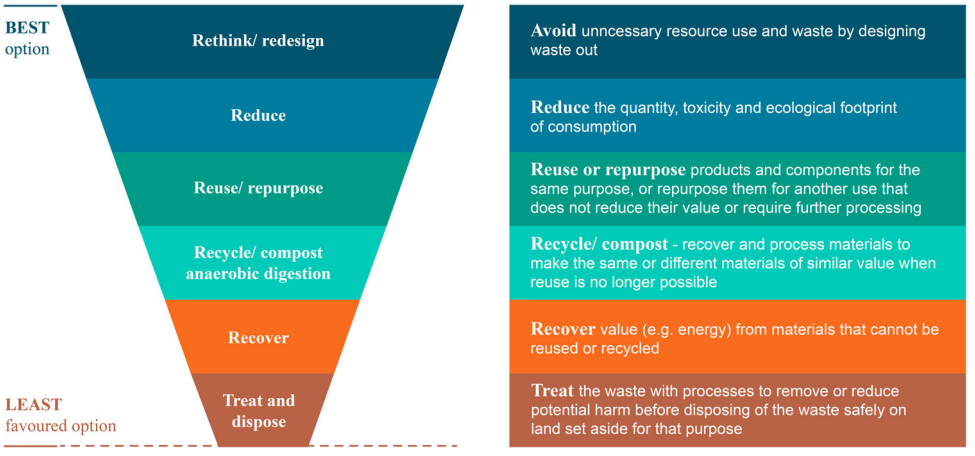

Figure 1. The Waste Hierarchy. Source: Ministry for the Environment (2021b).

manufacturing new products (the most energy intensive parts of consumption) (Wiefek et al. 2021).

Reuse packaging systems in particular, can help reduce single-use plastic packaging in a carbon sensitive way. Reusable packaging reduces downstream waste by displacing the manufacture of multiple single-use packages, and avoids the unnecessary loss of emissions embodied in packaging that is discarded after just one use. Reusable packaging systems come in many forms, usefully summarised by Coelho et al. (2020a) as:

- **Returnable packaging**; individual units of business to consumer packaging, e.g. a bottle or container, are loaned to the customer, who returns the packaging when empty for sanitisation and refill with the same type of product. Returnable packaging models typically rely on deposits for high return rates. Aotearoa New Zealand examples include reusable glass bottles for milk or beer ('Swappa Crate') and reusable takeaway container systems ('Again Again').
- **Refill by bulk dispenser**; goods are presented loose or 'on tap' and customers bring their own bags and containers to fill. Examples include: bulk bins for dried foods, unpackaged produce aisles, cleaning product refill stations, and off-licence tap rooms at breweries. Refill by bulk dispenser models can include business to business returnable packaging if the supplier takes the bulk dispenser back when empty to clean and refill (e.g. kegs).
- **Transit/transport packaging**; reusable secondary and tertiary packaging is used to transport products. Examples include: reusable crates instead of cardboard boxes, reusable pallets and wraps, and reusable courier satchels. In Aotearoa New Zealand, reusable transit packaging is most developed in business to business supply chains, where pools of reusable packaging (such as pallets and crates) are owned, managed and maintained by a third-party operator with reverse logistics, like CHEP.
- **Refill by parent packaging**; customers buy a product in a durable container (the parent packaging) that they refill from future purchases in packages that are made from less material than the parent package (such as pouches and bladders). Sometimes

the refill products are concentrates (such as tablets) where consumers add water inside the parent package.

There is growing appreciation that single-use plastic packaging is a problem, alongside increasing awareness that reusable packaging systems are a key tool in reducing waste and associated emissions (Consumers Beyond Waste 2021). Despite this, changes in legislation, and investment at the top of the waste hierarchy in Aotearoa New Zealand and elsewhere is slow. There remains what could be called a 'value-action gap'; or in other words 'the problem that people who espouse green values do not always act in accordance with them' (Shove 2010, p. 1276). The value-action gap can be partly attributed to reusable packaging systems not being widely available, accessible and affordable compared to their single-use counterparts (Greenwood et al. 2021), with the global market share for reusable packaging remaining stubbornly low. Reusable packaging essentially competes against single-use packaging on an un-even playing field within present linear economic settings. Modern supply chains have developed around an expectation of single-use packaging, creating infrastructural, cultural and institutional barriers to reuse (Coelho et al. 2020a). These barriers are reinforced by both the upstream and downstream costs of single-use packaging being externalised because the price of single-use packaging does not reflect its environmental and social costs. Publicly-funded waste and recycling services then act as effective subsidies for single-use packaging (Beechener et al. 2020). The true cost of managing the end of life for plastic packaging is carried by municipalities, communities and tax payers, rather than the companies who manufacture and profit from their use.

To make sense of how social change in single-use plastic packaging emerges in complex contexts we draw on Shove et al.'s (2012) 'second generation' approach to SPT[3] (c.f. Hui et al. 2017). Shove et al. (2012) and others have critiqued 'behaviour change' frameworks – that assume people's beliefs and attitudes are predictors of their behavior – for being overly individualistic, reductive, and failing to account for the material infrastructures and social relations that shape people's actual practices. We draw on Alkemeyer and Buschmann (2017, p. 22) who understand a practice as 'typified and socially intelligible bundles of non-verbal and verbal activities'. As Hui et al. (2017, p. 1) suggest, 'practices consist in organised sets of actions … [linking] to form wider complexes and constellations – a nexus'. These nexus of practices are dynamic and change through the materials[4] people use and have access to (ie. 'with what'), the meanings that coalesce around certain actions (ie. 'why'), and the skills required to perform these actions (ie. 'how'). In this way, people doing things are understood as the 'carriers of practices'. Hui et al. (2017, p. 6) note that it is the 'bodily and mental-cum bodily formation of practitioners through their participation in practices and through the intertwined processes of becoming-a-subject and becoming-subject-to the normative organisations of practices'[5] that shape how people become carriers.

A SPT perspective suggests that intervening in multiple arenas (materials, skills and meanings) simultaneously is more likely to encourage social change. Furthermore, practices are shaped by multiple actors across different geographic scales, so it is important to identify what can and cannot be influenced. To first understand, and then intervene to create more sustainable practices, SPT scholars who draw on Shove et al. (2012) suggest focusing on: re-crafting practices, substituting practices, and changing how

practices interlock (c.f. Spurling et al. 2013). Re-crafting practices involves identifying those elements that might need to be removed so that more sustainable performances become easier. Substituting practices requires an understanding of how new/re-crafted practices compete for people's time, space and resources. Changing how practices interlock requires an understanding of sequences and synchronisation. People's lives are often shaped by institutions and organisations like schools and work, including opening and working hours, which in turn create synchronisation of practices and peak demands (e.g. 'rush-hour'). Understanding how sequencing and synchronisation work, and how materials and social norms have evolved around these processes can help identify whether the timing of practices could shift to reduce demands on people's time and the spaces in which competing practices occur. Finally, Spurling et al. (2013) argue that policymakers can only intervene in processes that are already underway because the social change associated with material and scientific innovations are notoriously difficult to predict. This necessitates the tracking of changes, and the recognition of history and context, before taking action.

The functions and meanings of packaging

Plastic packaging plays an important and increasingly contested role in food systems, particularly in transport, trade and exchange (Fuentes and Fuentes 2017; Hawkins 2018; Sattlegger et al. 2020). While historically packaging has helped build social trust and loyalty with consumers, convey product certification and ingredients, fulfill health and safety requirements, and help reduce food waste by extending product life (Frenken 2017; Fuentes et al. 2019; Hawkins 2018; Hellström and Olsson 2017), these functions and associated meanings are shifting. For example, recent research has highlighted the adverse health effects of plastic packaging (c.f. Flaws et al. 2020), and plastic packaging's role in actually perpetuating food and packaging waste (c.f. WRAP

Figure 2. Example of information packaging can provide.

2022). Notwithstanding these shifting functions and meanings, Figure 2 provides a visual representation of the information packaging can provide. Table 1 illustrates the wider functions and associated meanings attached to packaging for both consumers and retailers.

Packaging's multiple functions connect across consumer meanings, influence the time and resourcing needed to exchange products, can extend the life and value of products, and, in some instances, fulfill legal requirements. Removing packaging would require these functions to be met by new practices across the entire exchange system, including in consumers' homes (Zeiss 2018).

Context and methods

Aotearoa New Zealand

Aotearoa New Zealand generates more plastic waste per capita compared to most other OECD countries (Royal Society 2019). In recent years, growing public awareness and concern about plastic's adverse impacts on New Zealand's marine, land environments, and wildlife has led to increased demands for action (Royal Society 2019; Kantar 2022). In response, the New Zealand Labour-led Government has made various policy

Table 1. Common material properties and associated functions of packaging.

Material properties	Everyday use/meanings by consumers/retailers
Displays information:	• Indictor of freshness/product quality and may be legal requirement in some contexts
• Best before date/expiry date	• Consumer information to prolong life of product
• Storage suggestions	• Consumer information – ease of use
• Cooking instructions	• Consumer information and may be a legal requirement in some contexts
• Weight/price	• Consumer information and may be a legal requirement in some contexts
• List of ingredients	• Consumer information and may be a legal requirement in some contexts
• Country of origin	• Consumer information
• Recipe(s)	• May be a legal requirement in some contexts
• Nutritional information	• Proxy for quality – helps to build trust
• Health star rating	• End of life/disposal consumer information
• Recycling number (for some materials)	
Brand name/logo loyalty	• Marketing/business promotion – social trust, loyalty, and may be an indicator of 'quality'
Packaging material/design	• Protects products – reduces damage while in transit; protects from physical deterioration e.g. shock protection; natural deterioration (protects from contaminants, water, insects, rodents)
	• Preservation – preserves products for longer, prolongs shelf life (reduces food waste)
	• Easier for consumers (e.g. convenience food products)
	• Logistics – safe and efficient transport
	• Business promotion – marketing
	• Transparent panel – customers (and supermarket staff) can check for freshness/quality
Barcode	• Enables quick purchase and reduces demands on consumer's and retail staff time

and legislative reforms. In 2019 the Government banned the import, sale and distribution of single-use plastic bags (up to 70 microns in thickness) (Ministry for the Environment 2019a). Instead, consumers can bring their own re-useable bags and containers, or retailers can switch to single-use bags made of other materials or thicker plastics.[6] In June 2021, the Government announced the decision to ban various hard-to-recycle plastics or single-use plastic items, including single-use plates, produce bags, cotton buds, drinking straws, non-compostable plastic fruit labels and some PVC and polystyrene products; the bans will come into force between 2022 and 2025 depending on the product (McDonald 2021).

Other reforms take an arguably more systemic focus. In July 2020, all single-use plastic packaging was also declared a 'priority product' under the Waste Minimisation Act (New Zealand Government 2020a). Consequently, a regulated product stewardship scheme that creates responsibilities for reducing or managing the waste caused by these products must be designed for implementation by July 2023 (New Zealand Government 2020b). At the end of 2021 the Government opened the contestable $50 million Plastics Innovation Fund (PIF), to sit alongside the existing contestable Waste Minimisation Fund, derived from the landfill levy. The goal of the PIF is to support projects that will minimise plastic waste, by finding ways 'to use less plastic and make what we do use reusable or recyclable' (Ministry for the Environment [date unknown]). At the time of writing, New Zealand's Ministry for the Environment is in the process of developing new waste legislation and a new Waste Strategy with a CE vision, and was consulting on waste related issues, including standardising household kerbside recycling across the country and introducing a beverage container return scheme (Ministry for the Environment 2022a). While the enacted measures signal shifts towards greater circularity, they do not go far or fast enough for some. For example; the lack of a national packaging strategy or product stewardship scheme (Farrelly and Green 2020), low landfill levy (Ministry for the Environment 2019b) and emphasis on consumer 'behaviour change' without considering the structural factors shaping behaviour (Sharmer et al. 2021). Farrelly and Green (2020) argue that these combined factors provide little incentive to reduce single-use packaging or change the externalities of the linear economy.

A diversity of business and community responses have emerged in Aotearoa New Zealand to address single-use plastic packaging. For example: new food retailers that enable packaging-free and zero waste shopping (Slade 2019; Lucio 2020); major supermarkets introducing plastic-free produce departments (Anthony 2018; Reymer 2020); initiatives and campaigns advocating for single-use plastics to be replaced with reuse systems (Takeaway Throwaways [date unknown]; RefillNZ [date unknown]); the development of reusable packaging schemes (c.f. Reusabowl [date unknown]), and Māori business and zero-waste community initiatives (Matata-Sipu 2018). These diverse initiatives, campaigns and infrastructures connect across an emerging ecosystem of businesses, activists, and consumers who are working towards zero waste or 'plastic-free' ways of being and doing. Taken together, our sense is that these contextual shifts reflect a growing recognition of the need to transform the linear economy and move beyond individual 'behavior change' framings to achieve this.

Methods

This research used a qualitative approach to explore two case studies in reducing single-use plastic packaging in Aotearoa New Zealand: a supermarket initiative introducing plastic-free produce departments, and packaging-free zero waste grocery stores. We focused on business to consumer food retail for two reasons. First, plastics are ubiquitous in food retail, and single-use plastic packaging is particularly problematic. Secondly, food retailers occupy a unique position between consumers and producers/suppliers to lead and/or support the transition away from single-use plastics (Oosterveer 2013). While our two case studies relate to food retailing, they were selected as 'compare and contrast' examples (c.f. Yin 2003) to illustrate how aspects such as business scale and size, customer demographic, store facilities/infrastructure, and wider material infrastructures (such as transport) interact to enable or constrain practices relating to single-use plastics.

The research methods included: nine semi-structured interviews – seven interviews with sustainability senior management, store managers and sustainability/packaging staff from Aotearoa New Zealand's largest supermarket chain; two interviews with business owner/managers of zero waste grocers; in-store observations; and a review of publicly available information (for example, businesses' websites, media reports, social media and presentations). The interviews lasted between 30 and 60 minutes and were conducted in-person or using a mixture of online tools, depending on COVID-19 response alert levels and participant preference.

The paper's first two authors undertook a thematic analysis to code and analyse themes across the data (Braun and Clarke 2006). Although the thematic analysis employed used elements of inductive and deductive approaches, the overall orientation was deductive. It was inductive in the sense that we began by coding from the data to understand the experiences and meanings of participants in relation to changes regarding single-use plastics in food retail. To make sense of the data through a theory of social change we drew on Shove et al.'s (2012) SPT framework. The results were analysed using a template analysis approach based on SPT to show how materials, skills and meanings shape people's practices, and the labour and other changes required when people attempt to shift practices.

The first case study, 'Food in the Nude' started in 2016 in a Christchurch New World supermarket. The initiative involves removing almost all single-use plastics from fruit and vegetables in participating supermarkets. At the time of writing, Food in the Nude has been implemented across 36 of 42 Foodstuffs supermarkets in the South Island.[7]

The second case study is zero waste grocers. In recent years, the number of zero-waste grocers in Aotearoa New Zealand have increased dramatically. For example, 13 new stores opened in 2020, on top of the 19 stores already operating at the end of 2019 (The Rubbish Trip 2020). Currently, ~26 of these stores are operating nationwide. While there are differences across these stores (such as ownership models, customer demographic, type of food stocked), many aspire to zero waste, or significantly less waste compared to conventional food retail stores. Compared to standard supermarkets most zero waste stores require quite different store infrastructure to either stock unpackaged products in bulk dispensers or have products 'on tap' and customers generally fill their own reusable bags, bottles, and containers. In June 2020, 12 independently owned zero waste stores formed an incorporated society 'Sustain Aotearoa: Independent

Zero Waste Grocers' to support new/emerging stores and grow their impact through collaboration, including collective buying power (McIlvaine 2020; Stewart 2022).

Results and discussion

Food in the nude

> 'Food in the Nude' was originally trialled by a Foodstuffs supermarket store owner who was inspired by changes in the United States and in-store customer requests to reduce single-use packaging. Prior to 'Food in the Nude', fresh produce in Foodstuff's stores generally either: arrived in single-use plastic packaging from suppliers; was pre-packed into single-use plastic by staff (such as trays and plastic bags); or customers selected and placed their goods in single-use plastics, paper, or reusable bags. 'Food in the Nude' has required changes for customers, suppliers, store infrastructure and staff. In the following sections we describe the key changes using SPT.

Materials (tools, objects, infrastructure)

The shift away from single-use plastics required significant investment in new in-store infrastructure, changes along supply chains, and the substitution of packaging materials in-store. The new in-store infrastructure included refrigeration and misting systems to keep the food fresh, and 'pod shelving' in vertical walls to store the food differently and ensure mist covered the produce to minimise spoilage. Participants noted how previous refrigeration systems and in-store practices were dependent on plastic packaging to keep food fresh and stop it drying out. The new infrastructure is expensive – upwards of hundreds of thousands of dollars, and purchased from an international refrigeration supplier. Participants noted that for some stores, the initial cost of this infrastructure was unaffordable, while for other stores it required planning and significant lead-time.

Changes were also required along produce supply chains. Participants described how Foodstuffs had to work with suppliers to stop packaging produce in single-use materials (including cardboard). Through collaboration with suppliers and transport operators, Foodstuffs invested in new re-usable polypropylene crates (made of 50% recycled material) to transport and store products. This shift to re-usable crates then required changes in both the packaging and transport of goods, and 'buy-in' from producers, suppliers and transport operators. Participants noted that achieving this level of successful collaboration was partly possible because Foodstuffs is a large retailer that can more easily influence local producer practices than smaller retailers, although it has little ability to influence producer and supplier practices beyond Aotearoa New Zealand.

Participants felt that most producers, suppliers and transport operators were happy to shift practices if it did not add too much additional cost or labour time. Participants described how the new re-useable crates were considered a better investment and solution than other single-use packaging options (like cardboard) because they were more durable, protected food and reduced spoilage, and could be easily re-used many times by suppliers and staff. In addition to working closely with suppliers, Food in the Nude required considerable internal collaboration including alignment across merchandise, retail, and operations teams. Finally, material packaging substitution was also required in-store, i.e. replacing single-use plastic produce bags with other options, including recycled paper bags. Foodstuffs actively supported the development of new

reusable options such as multi-use bags, working with a local start-up business throughout the development process to scale up production.

Skills (knowledge & competencies)

The material shifts outlined above required new skills and knowledge for store staff and customers. The new refrigeration units required training staff in new misting schedules, and increased cleaning to keep the cabinets looking 'fresh'. With removal of packaging and associated 'best before dates', staff also had to become more competent at visually identifying when produce was no longer saleable. Finally, some participants noted how 'food in the nude' meant that for some produce (primarily imported products), staff were now removing single-use plastic packaging in the 'back' of the store. This created an 'additional' job for staff to complete and posed reputational risks and accusations of 'green-washing'.

To build these new skills and competencies, participants described how some stores had made certain staff 'responsible' for managing the new refrigeration units. Store managers and others would identify staff who were particularly interested or passionate about waste-reduction and give them responsibility for promoting the new practices with other staff as 'in-store champions'.

Finally, customers needed to be trained to bring their own reusable bags. At the time of the interviews (2020), participants noted how the effects of the ban on single-use plastic shopping bags had helped to create shifts in customer practices, with most now bringing their own reusable bags for produce. However, participants described how they used signage and other reminders to reinforce these shifts. To ensure 'customer choice', participants noted that their stores still provide single-use paper bags and other options (including 'compostable' plastic[8]).

Shared meanings (expectations and conventions)

The shifting practices described above both reflect, and reinforce changes in meaning happening across wider society and within Foodstuffs. For example, Foodstuffs Head Office used 'Food in the Nude' to demonstrate and model their commitment to wider sustainability and corporate social responsibility initiatives through reporting, branding and marketing. 'Food in the Nude' was narrated as a key part of Foodstuff's waste minimisation strategy and was branded as an example of action reflecting their commitments to 10 sustainable packaging principles (Foodstuffs [date unknown]a), circular design (Foodstuffs [date unknown]b), and the NZ Plastic Packaging Declaration (Ministry for the Environment 2021a). Individual store's investment in the new refrigeration and misting systems and promotion of 'healthy, fresh and loose' produce also reflected, and sought to respond to concerns about the human health risks of plastics. Some participants described how the new misting systems created a kind of 'theatre' that customers engaged with by putting their hands through. 'Food in the Nude' could be seen as an attempt by Foodstuffs to intervene and potentially try and shift the meaning of plastic packaging as an indicator of 'freshness', to 'loose, misted produce' as an indicator that the business cares about consumers by reducing their exposure to plastics. The investment in the new infrastructure provides the evidence of this care, and the theatre of it provides a way to engage customers in new practices and retain their trust in both the freshness of the products, and their business.

However, 'Food in the Nude' is not necessarily about zero-waste. Rather, it is framed as a 'waste reduction' effort that still offers 'customer choice'. Most participants emphasised the need to maintain 'consumer choice' and accommodate shoppers' expectations of providing packaging for convenience. For Foodstuffs participants this meant that they did not feel they could 'dictate' to consumers what packaging they should use unless this was legislated. Rather, they noted that they would need to provide the 'consumer choice' (e.g. providing single-use bags) until legislation shifted.

Finally, participants talked about how the actual adoption of 'Food in the Nude' in different owner-operated stores reflected the priorities of the store owners. For example, participants recounted how most store owner-operators needed to see the new system working successfully elsewhere, highlighting the important role of early-adopters. Promotion of 'Food in the Nude' within the cooperative also emphasised different meanings to encourage uptake. Sometimes these meanings related to the cost-savings of reduced food waste, at other times brand benefits and consumer satisfaction[9], or the future-proofing of infrastructure to be 'ahead of legislation' changes.

> 'Food in the Nude' required coordinated investment in new materials and people's skills, and the promotion of new meanings to re-distribute the functions single-use plastic packaging fulfils along the food system. This resulted in both re-crafting and substituting practices through different materials, skills and human labour, and promoting different meanings. The example highlights the important role wider infrastructure plays, including the energy (electricity) and water required to keep now unpackaged 'loose' produce 'fresh'.

Zero waste grocers

The removal of single-use plastic packaging and emphasis on re-using containers in zero waste grocery stores fundamentally reorganises the practice of shopping for suppliers, retailers, and particularly customers (Zeiss 2018). For customers, there are often significant shifts in terms of pre-shopping planning. In what follows we describe these key practice changes using SPT.

Materials (tools, objects, infrastructure)

Zero-waste grocers require quite different in-store infrastructure to most standard food retailers. Rather than flat shelves for instance, large water-tight containers are needed to store product so customers can then transfer this into their own smaller containers. These in-store containers generally have transparent tops or clear windows so customers can view the product.[10] Signage (often hand-written and reminiscent of historical rural 'grocers') recalls nostalgic re-use practices while fulfilling the functions of single-use packaging by identifying the type of product, country of origin and other branding and certification (such as whether it is 'organic'). Signage is also used to educate customers in the correct shopping practice. For example, in some stores, weigh scales and pens are provided so customers can weigh and label their containers before filling with product. Some stores also provide customers with non-plastic packaging options or serve as re-use exchange sites for containers. For example, paper bags, reusable cloth bags or glass jars are collected and donated by customers creating a kind of 'container commons'. Providing these re-use containers requires space which at times can displace the primacy of the products being sold. Additionally, some stores stock products in

returnable packaging and act as a drop-off point for customers' empty packaging to transfer back to suppliers. Through the layout and signage, zero-waste stores seek to enrol the consumer as a capable plastic-free agent who is given the substitute materials and education needed to perform these new practices in-store.

Zero-waste store-owner/manager participants described challenges from operating outside of the 'dominant' single-use packaging retail environment. For example, there are fewer zero-waste grocers than conventional food retailers, and stores are often located away from major shopping routes or prime large-scale retail locations. Zero waste stores also have shorter, or more limited opening hours compared to supermarkets. These factors (along with others discussed below) create challenges to increasing customer uptake and scaling out impact. For instance, the siting of stores away from major transport routes (especially public transport) and lack of parking for some stores can simultaneously reinforce the need for customers to use individual vehicles, while creating parking difficulties. The small-scale nature of the stores and associated limited buying-power can also pose challenges when sourcing packaging-free product from suppliers. Reflecting work by Stewart (2022), our participants also described their limited ability to influence the packaging practices of larger-scale producers, especially those outside Aotearoa New Zealand. Generally, they have more ability to influence and support the packaging practices of (hyper) local producers and suppliers. For our zero-waste participants, this focus on local products resonated with other values of supporting local food production.

Skills (knowledge and competencies)

Zero-waste grocers require significant shifts in customer practices before, during and after shopping. For example, customers generally need to plan ahead and remember to bring containers and bags. During shopping, customers are also required to do more – from weighing and labelling their empty containers through to opening jars, bulk containers, measuring out product, and explaining to shop staff what each product is when purchasing. This takes more time, cognitive energy, and potential social interaction, than selecting products in single-use packaging. New uncertainties can also be introduced into the process when compared with fixed-price packaged products. For instance, while the price per weight may be provided for bulk products, the total cost may not be known until the product is weighed. For those shopping on a tight budget, this can add further labour and potential anxiety. However, the opportunity for portion control purchasing 'by the gram' has also been identified as a potential benefit for budget shoppers (Beitzen-Heineke et al. 2017, p. 1537). Participants generally talked about this increase in labour time as a positive thing – with shopping reverting to a more relaxing activity, rather than the efficient experience associated with late-stage capitalism. However, as some participants noted, not everyone has the time to labour like this, particularly those on low-incomes or the 'time-poor'.

To help substitute some of the functions single-use plastic packaging provides, zero-waste grocers often form communities of practice through the use of in-store-signage communicating sustainability messages and promoting a zero waste ethos, online and in-person events, seminars, and social media groups. These communities of practice include information about how to identify and name products, share recipes, packaging-free 'life-hacks', and other practices to inspire and educate people. Importantly,

the communities of practice help educate customers to participate at a zero-waste grocer before they arrive (such as needing to bring re-usable containers).

Shared meanings (expectations and conventions)

Zero-waste grocers both reflect and foster waste-free/plastic-free meanings through everyday practices. They provide a retail experience for those consumers for whom this resonates, and who have the skills and resources to participate. Our zero-waste participants emphasised aspects such as providing '*plastic free affordable essentials*' to '*make shopping for plastic free essentials easy*'. Others emphasised the '*locally-sourced*' nature of their products and how the store provides '*a sanctuary where you can slow down and stock up on everyday essentials*'. In this way, the stores reflect meanings associated with the slow-consumption movement, through attempting to foster more mindful and ethical shopping while still being 'affordable'. Participants noted how this often requires balancing different values. For example, all zero-waste participants described how they did not necessarily only stock 'organic' or expensive products and sought to provide affordable products like grains, cereals and carbohydrates. They described considering whether it was better to stock an imported organic product, or a locally produced non-organic product; stock a product that came in bulk single-use packaging to ensure it was affordable, or a more expensive (and potentially unaffordable) product that arrived via zero waste systems. These negotiations require balancing different values and responding to critiques that zero-waste retail is an exclusive middle-class luxury. These negotiations also reflect another important meaning that emerged through participants' accounts: 'zero-waste' is a journey and there will be times when zero-waste is not possible due to wider societal constraints, or, that other values (such as affordability and inclusion) are more important than absolute zero-waste.

Participants noted how zero-waste retail means reducing 'consumer choice' (meaning the stocking of large numbers of similar products). This is due to the high cost of the infrastructure required (bulk dispensers), the limited purchasing power of stores, and the limited number of producers and suppliers willing and able to operate zero-waste supply chains. For example, participants noted that they sometimes struggled to find even one local supplier of oats who was willing to distribute without single-use packaging. However, zero-waste participants talked about this limited consumer choice in relatively positive ways. They referred to being 'choice editors' for consumers by stocking more sustainable, locally sourced products. Reflecting work by others (c.f. Gunn and Mont 2014), this 'editing' of choices provides a way to reduce the cognitive burden on consumers to always 'choose' the right option. Editing can also redistribute trust. So, rather than trust being fostered between a producer and consumer through branding and hygiene provided by single-use packaging, trust is fostered between the consumer and zero-waste grocer who selects the best options while balancing multiple priorities. Building this trust requires new forms of labour by zero-waste store staff, including regular cleaning of bulk bins and dispensing infrastructure, transparency around the ethical values informing product purchasing (e.g. local, organic, vegan, fairtrade), and clear communication about how hygiene and consumer safety is ensured without single-use packaging.

Understanding practice shifts

Our SPT analysis highlights how reducing single-use plastic packaging is complex, requiring careful attention for transitioning practices to be successful. Throughout our research, participants and others regularly referred to the New Zealand law change around single-use plastic bags. Some participants observed how easy this appeared, suggesting that further transitions away from single-use plastics will be as easy, and that this success provides momentum for further change. While we partly agree, we note that the functions of single-use plastic shopping bags were relatively limited – primarily carrying (often already packaged) things, and advertising. Redistributing these functions was therefore relatively simple compared to the large number of functions single-use plastic food packaging fulfils. Our SPT analysis shows how the functions of single-use packaging are re-distributed – in both cases requiring new combinations of materials, skills and shifts of meaning. Both case studies highlight the significant and collaborative investment in re-use infrastructure needed across the Aotearoa New Zealand food system to operate in a more circular manner amidst more dominant socio-economic linear practices. The practice changes illustrated could not have been achieved by the 'behaviour change' of a single food supplier, business/retailer, or consumer in isolation. Our case studies also illustrate how meanings are shifting in relation to linear waste practices. The different meanings attached to, and valued through, the contrasting shopping experiences both enable and create barriers to detaching from single-use plastics. Within the mainstream supermarket of 'Food in the Nude', meanings around 'consumer choice' and 'convenience' have meant that single-use packaging (albeit less than before) is still provided and retailers are reluctant to 'enforce' the removal of single-use packaging unless mandated through legislation. In this way, linear economy practices remain, narrated through words like 'consumer choice' and 'convenience' as retailers seek to slowly shift consumer practices while not alienating consumers.

In contrast, zero-waste grocers use concerns about plastics to foster new practices that re-frame consumer expectations and meanings by explicitly reducing choice ('editing') and only stocking products that reflect ethical values expressed through the practice (zero-waste or minimal waste supply chains, and affordable local products). While zero-waste grocers do not explicitly use terms like 'de-growth', the underlying meanings reflect many of the shifts towards reduced and mindful consumption. We wonder how different meanings associated with single-use plastics will shift as new legislation and product stewardship schemes are introduced. Aside from shifting economic and regulatory incentives, will these also contribute to the loss of social licence for single-use plastics to such an extent that further dramatic shifts emerge?

Zero-waste scholars and others have long argued that public investment needs to be targeted towards the top of the waste hierarchy, rather than focused on recycling and waste disposal (Farrelly and Green 2020; Varshneya et al. 2020; Simon et al. 2020). Yet, in Aotearoa New Zealand, most of the funding for public waste infrastructure (through mechanisms such as Territorial Authorities rates) is for 'open-loop' recycling and landfill disposal. These practices subsidise the linear economy by marshalling communities to cover the costs of recycling and disposing of single-use products, rather than the producers. This creates a significant barrier to reuse systems because although well-designed reusable packaging systems are likely cheaper to society overall, they have to

internalise their costs for reuse and circulation when single-use systems do not (Coelho et al. 2020b). As Sharmer et al. (2021) notes, public investment at the bottom of the waste hierarchy has created a 'lock-in' effect, entrenching the social expectation that these linear waste management services, and the material landscapes that support them will continue. While the re-use practices in our case studies point to some (albeit limited) displacement of linear waste, they compete for practitioners' labour, time, physical and cognitive space, and ultimately capacity on an 'un-even playing field'. Our research supports the view that transformative change lies outside these current waste investment approaches.

Central and local government can play an important role in helping to shift this 'un-even playing field' to support more circular, reuse practices. Reflecting recent work by Reuse Aotearoa (2022), our two case studies highlight the need for government policies and regulation that incentivise reuse, and disincentivise single use packaging. Incentivising reuse could be achieved through; investing public funding in reuse trials and research at the top of waste hierarchy[11], using public procurement processes to support reuse systems, creating standards and 'best practice' guidelines for reuse systems, mandating reuse in certain industries/products, and acting as or funding brokers to support the collaboration needed to coordinate reuse practices. Disincentivising single-use packaging could be achieved through: compulsory product stewardship schemes that fully internalise a product's life cycle costs[12], supporting local and international legislation that bans certain single use plastics, and increasing waste disposal costs.

Conclusion

Our two case studies provide evidence of where investment was needed to shift practices towards the top of the waste hierarchy. The practice shifts we have described involved the removal of material artefacts, using existing technology and materials currently available. However, significant investment was needed to support collaboration across different businesses and consumers to achieve these changes. Some research into new materials may help with shifting towards a CE. However, our case studies highlight that what is really needed is further investment in, and research on, collaboration across the complex networks of actors to bring about, relatively simple practice changes. Our sense is that future research needs to explore re-use schemes in their context – including how transportation networks, labour time, price, legislation and planning rules, and shifting meaning/s all intersect to enable or constrain practices at the top of the waste hierarchy. SPT provides a helpful framework for material and product designers, businesses, and social change theorists to map out how these transitions are already underway, and how they can be further supported.

Notes

1. Throughout this article we move between 'plastic' and 'plastics' (depending on grammatical context). Pluralising 'plastics' acknowledges the heterogeneity of polymers and products.
2. By 'material infrastructures' we mean the (often) immobile non-circulating capital goods which enable social needs to be met via mass production and distribution. These are typically made from asphalt, concrete, steel, masonry, wood, polymers and composites.

3. There is a wide range of approaches to 'practice theory'. Here we draw on the work of, and that influenced by, Shove et al. (2012) to explore practice changes in sustainable consumption.
4. We draw on Hui et al. (2017, p. 4) who suggest that 'materials' can be objects or things that move or advance through the nexus of practices, thereby linking the practices though which they pass or to which they're connected'.
5. We do not have space to theorise subjectivity and agency here, except to note that we draw on Alkemeyer and Buschmann's (2017) understanding that practices do not entirely determine what people do, but nor are people fully formed ready for action. Rather, competent participation in any practice is a process where specific knowledge, identity, and social membership are formed, embedded within power relations. This suggests that performing practices can both help stabilise them through repetition, while also introducing the possibility for diversity, conflict, and change.
6. Substitution using new/different materials can create other problems if end of life is not considered. For example, re-usable but flimsy 'thicker' plastic bags that still have limited life spans.
7. Foodstuffs is Aotearoa New Zealand's largest grocery retailer operating two Co-operatives: the North Island (330 stores) and South Island (220 stores).
8. Similar to other regrettable substitutes, 'compostable' plastic packaging creates challenges including; contamination of other recycling streams, lack of end-of-life processing capacity, and consumer confusion (Ministry for the Environment 2022b).
9. As one participant stated, 'Food in the Nude' is the 'one thing I've done in store that has had overwhelming positive feedback from customers'.
10. One participant noted that in Aotearoa New Zealand the options are generally limited to plastic (acrylic) bins, which can appear contradictory to the ethos of a zero-waste store.
11. For example, in Aotearoa New Zealand the allocation of grants from the Waste Minimisation Fund and the Plastic Innovation Fund could be prioritised according to the zero waste hierarchy, and begin to fill some of the gaps around reuse infrastructure that otherwise impede more circular, reuse practices (c.f. Blumhardt and Prince 2022).
12. For example, ensuring that the upcoming regulated product stewardship scheme for single-use plastic packaging, and the proposed beverage container return scheme, are designed to fully internalise the costs of single-use packaging, and include specific measures to support and incentivise the uptake of reusable packaging (Blumhardt 2020; Zero Waste Network Aotearoa and New Zealand Product Stewardship Council 2021).

Acknowledgements

We would like to thank our research participants for their time and the care they take to think through how to transition away from single-use plastic packaging. We would also like to thank Emily Levenson for help with the reference list.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the Ministry of Business, Innovation and Employment Āmiomio Aotearoa research programme [Grant Number UOWX2004].

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