The Sustainable Food Sector in Singapore

Opportunities in Waste Management for New Zealand Companies

Southeast Asia
Centre of Asia-Pacific Excellence

Challenge

Despite the recent attention on the growth potential of Southeast Asian markets, they are still classified as developing markets, which means they are behind countries such as New Zealand in infrastructure for waste management and sustainability initiatives. In addition, rapid economic growth has sometimes occurred at the expense of the environment.

With the looming climate crisis, food security, sustainable food supply, and value chains have become increasingly important. Because Singapore has limited land, these pressures are even greater. New Zealand, on the other hand, has potential solutions to these issues including high-value nutritional food, agri-technology, and sustainable packaging.

This project will highlight the sustainability opportunities in the Singapore food and nutrition sector. We discuss the opportunities we observed first-hand in Singapore that may not have been obvious without this experience.

Executive summary

This report explores the opportunities for New Zealand to contribute to Singapore's efforts to achieve a more sustainable waste management system. This is based on an analysis of the two countries' waste strategies, consumer behaviour, corporate social responsibility, and the potential of waste as a carbon sink.

While both New Zealand and Singapore have made significant progress in reducing waste and promoting sustainable practices, there are still many challenges. In Singapore, the government has launched several initiatives and funding schemes to support innovation and collaboration in the waste management space, and there is growing public awareness and demand for sustainable products and services. However, there are also systemic barriers, such as limited recycling infrastructure and a lack of awareness and engagement among certain segments of the population.

New Zealand has a strong focus on waste minimisation and resource efficiency, with ambitious targets and policies in place to reduce waste sent to landfill and to increase recycling and composting. Many innovative businesses and start-ups are working to develop sustainable solutions for waste and packaging. The things they have learned about consumer behaviour and corporate social responsibility, particularly regarding single-use plastics and domestic recycling, may be useful to Singapore.

Our findings suggest that New Zealand businesses should explore opportunities for collaboration with Singapore companies in the waste management space. In particular, sustainable packaging, waste reduction and diversion, and carbon sequestration are potential areas of opportunity. Changes in behaviour and infrastructure may both have a pivotal role in moving Singapore closer to its sustainability targets.

This report provides insights and recommendations for New Zealand businesses looking to contribute to Singapore's waste reduction and circular economy goals through collaboration and innovation. We highlight the significant opportunities for cross-border cooperation and knowledge-sharing, and emphasise the advantages of a collaborative approach to addressing the complex challenges of waste and sustainability.

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Introduction

Rapid economic growth in Southeast Asia, and more specifically Singapore, has created challenges for sustainability. For example, Singapore's rapid population growth has contributed to increased economic development (Furuoka & Munir, 2011), but the infrastructure for waste management has not kept pace. As a result, Singapore relies primarily on incineration rather than environmentally friendly methods such as recycling and reuse schemes. Singapore's '30 by 30' target and the United Nations Sustainable Development Goals require that Singapore invests in more sustainable approaches immediately.

Singapore's waste management system is far behind New Zealand's, which has kept up with our much slower population growth. For example, New Zealand has a National Waste Strategy (New Zealand Ministry for the Environment [MFE], 2023), which emphasises the waste hierarchy and favours circular economy options over disposal and value/energy recovery (see page 12).

This report explores why we should focus on waste in Singapore, how waste is addressed in manufacturing, and waste as a carbon sink. We then look at opportunities for New Zealand companies to improve waste management in Singapore, and how New Zealand's waste strategy could inform this approach. We specifically focus on the role of food packaging and how changing and improving packaging materials can improve the value chain.

Waste management in Singapore

Singapore has a similar population size to New Zealand but generates just 40% of the waste that New Zealand produces. Most of this waste is incinerated. Incineration generates 3% of Singapore's total energy consumption (Singapore Energy Market Authority [ENA], n.d.), which is significant considering approximately 95% of their energy (as of April 2022) is generated using imported natural gas (The Straits Times, 2022).

Incineration is also cheap, stable, and does not require large amounts of land or human resources. However, this does not account for the impacts of upstream creation or extraction of resources, both of which affect the life cycles of resource use. Raw materials will continually need to be farmed, mined, and extracted to replace the incinerated resources. In addition, the organic matter that could have been used to replenish nutrients and soil from productive land is lost.

On the other hand, Singapore does not face the same economic and logistical barriers to recycling as New Zealand. In 2021, Singapore recycled just over 50% of its waste, compared with only 30% of waste recycled in New Zealand (MFE, 2023). Industry and commercial sectors in Singapore generate the largest portion of waste, with an increasing recovery rate of around 70% per year. In contrast, domestic recycling is only about 13% (Singapore National Environment Agency [NEA], 2022a), which is similar to recycling rates in relatively poorly funded regional New Zealand towns (New Zealand Rotorua Lakes Council, 2021).

With the costs of waste disposal increasing around the world and the international push for corporate responsibility, the industrial and commercial sectors in Singapore would benefit by increasing their resource recovery rates. Recycling is also more efficient and cost-effective for these sectors, because they have consistent, high volumes of waste streams that have low contamination (compared to post-consumer waste).

In contrast, domestic waste does not currently have an effective infrastructure for recyclable materials to be collected and sorted, then shipped to plants that can recycle the material into higher value products. In addition, consumers also buy items that cannot be reused, repaired, or recycled – which is often not by choice but rather because of what is available from manufacturers. By improving and optimising its infrastructure, Singapore could reach a much higher rate of domestic waste recycling. The Singapore government has implemented various measures to support domestic recycling through their "3Rs" approach, including mandatory waste segregation at the source, recycling incentives, and the implementation of Extended Producer Responsibility (EPR) schemes (NEA, 2021).

Singapore produced 7 million metric tons (MT) of waste in 2021, with 3.6 million MT recycled from non-domestic waste and 0.25 million MT recycled from domestic waste. Of the total waste generated, only 6% of plastics were recycled and less than 40% of paper and cardboard (which is decreasing due to reduced exports). On the other hand, 75-85% of wood and horticultural waste was recycled. Food waste had a low recovery rate of 19%, which suggests there is an opportunity to introduce food waste collections for composting or anaerobic digestion.

As working from home increases, domestic office waste is increasing and relying on office waste recycling infrastructure is no longer sufficient. Singapore is implementing consumer focused strategies such as surcharges on disposable carry bags.

Table 1 shows the waste generated and recycled in Singapore, with paper/cardboard, plastics, and food waste having the lowest recovery rates from the food and fibre-related waste streams. In New Zealand, these waste streams are also an increasing problem due to the production of methane in landfills, but methane is not a problem in Singapore because of its waste-to-energy plants (NEA, 2023).

Glass is also perpetually recyclable but has an incredibly low recycling rate in Singapore. Even though the tonnage of glass generated is low, it could be an easy way to increase recycling. Additionally, since glass absorbs large amounts of heat, diverting glass and other inert materials (such as stones and ceramics) from general waste streams will make waste-to-energy plants more efficient at creating heat and energy from the disposed waste.

Table 1: Singapore's waste and recycling rates, which shows a low recovery rate for plastics, paper/cardboard, food, and glass (NEA, 2022a).

Waste Type	Total Generated ('000 tonnes)	Total Recycled ('000 tonnes)	Recyling Rate	Total Disposed ('000 tonnes)
Ferrous metal	1,312	1,306	99%	6
Paper/Cardboard	1,136	437	39%	699
Construction and Demolition	1,013	1,011	99%	2
Plastics	982	58	6%	924
Food	817	154	19%	663
Horticulture	332	277	83%	55
Wood	310	234	76%	76
Ash and sludge	249	22	9%	227
Textile/Leather	189	7	4%	182
Used slag	182	181	99%	1
Non-ferrous metal	88	87	98%	1
Glass	74	9	13%	65
Scrap tyres	27	26	95%	1
Others (stone, ceramics, etc.)	233	18	8%	214
Overall	**6,944**	**3,826**	**55%**	**3,118**

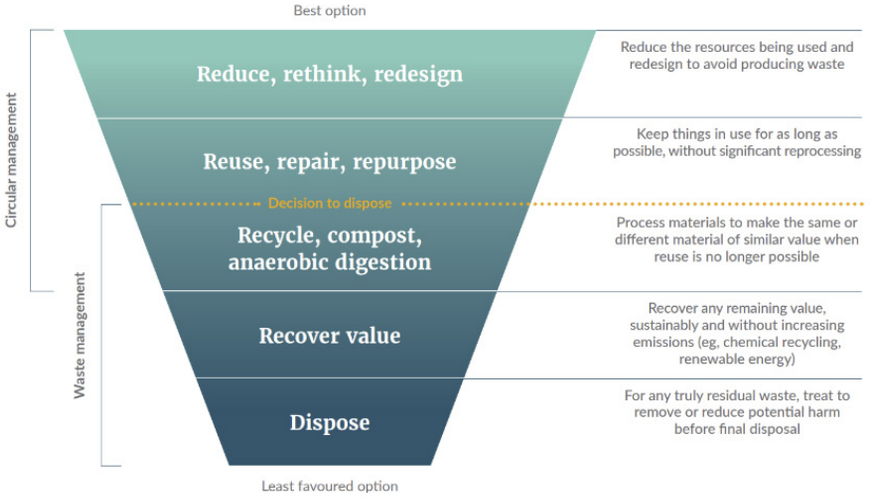
Some waste items are not considered recyclable in Singapore, even though they have been shown to have potential for recycling in New Zealand or other countries. For example, foil-lined plastic (e.g., chip packets) and Liquid Paperboard (e.g., TetraPak) can be processed through pyrolysis to recover aluminium. Organic waste can be recovered through composting or anaerobic digestion, and soft plastics can be recycled into fence posts (Future Post, 2023) and construction materials (SaveBOARD, 2023). Australia has developed technology to recycle diapers (Diaper Recycle, 2023), and New Zealand is currently commercialising technologies to recycle clothing and textiles into new materials and to create durable roading (UsedFULLY, 2023).

New Zealand's National Waste Strategy

New Zealand has just implemented a National Waste Strategy that emphasises the waste hierarchy and favours circular economy options over disposal and value/energy recovery (MFE, 2023). This is not a new concept, but it is being continually developed. New Zealand is a good place to develop these strategies as we have less spatial pressures than Singapore. Conversely, Singapore does not have the economic or logistical barriers that New Zealand has, so it is an optimal testing ground for the waste strategies developed here.

New Zealand businesses, councils, and the public are also adopting waste minimisation strategies and reducing the environmental impacts of waste disposal. Although there are cultural differences between the two countries, there may be some lessons that Singapore can take from New Zealand's waste minimisation experiences. For example, repair culture and Repair Cafes (RCANZ, 2023) are increasingly significant in New Zealand as a way to extend the life of household items.

Figure 1: The waste hierarchy in New Zealand's National Waste Strategy (MFE, 2023).



New Zealand's new waste strategy will be implemented in three phases, each a decade long. The third phase will use the knowledge and systems developed to help other countries reach similar milestones by 2050. This provides a key opportunity to start developing international collaborations to tackle global waste issues.

Figure 2: Phase 3 of New Zealand's National Waste Strategy is helping other countries develop more sustainable waste practices (MFE, 2023).

Phase 3

Helping others do the same

By 2050, New Zealand is a low-emissions, low-waste circular economy, helping others make the change

Domestic systems are as circular as possible	▸ Aotearoa New Zealand's consumption of virgin resources is largely from renewable sources and has stabilised at sustainable levels ▸ Regeneration is the norm and part of our circular business models
Aotearoa is contributing to regional and global networks	▸ Aotearoa is part of a regional Pacific network for circular management of materials ▸ Aotearoa actively participates in international efforts to support low-emissions, low-waste circular economies
Our management of materials does not harm the environment	▸ Resource recovery systems operate effectively, based on a strong understanding of carbon footprints ▸ Final disposal of residual waste is minimal, as are its environmental impacts

New Zealand is exploring the option of a Waste-to-Energy (WTE) plant as a backstop to recover energy from non-recyclable waste. The WTE process can stabilise waste and capture potential methane before it is generated in landfills. However, the disadvantage of having a backstop at the bottom of the waste hierarchy is that it can reduce the necessity and urgency of managing waste sustainably. It also does not incentivise the recovery of high value materials or even the use of high value materials that can be recovered in manufacturing.

New Zealand's Ministry for the Environment supports WTE as a concept, but only if operated in a way that does not increase emissions. However, there is strong public opposition to WTE plants in New Zealand (Galuszka, 2022). There may be an opportunity to use Singapore, as a user of WTE plants (Huang & Kim, 2018), to study how behaviours and attitudes to waste may be changed.

New Zealand consumers increasingly demand reusable, repairable, or recyclable products. However, domestic waste (also known as mixed municipal waste) is notoriously difficult to recycle due to the large variety of materials and the difficulty separating them. Some of the economic, logistical, and geopolitical barriers to recycling are lower in Singapore, which may make it an ideal place to pilot innovative resource recovery strategies. Co-developing technologies and strategies, the two countries together could develop innovative resource recovery systems that could eventually be applied in both countries.

Addressing waste at a manufacturing level

Singapore is exploring waste at the manufacturing level, with opportunities for recycling and reduction at different levels of the value chain. For example, the Singapore Food Manufacturers' Association has noted opportunities for upcycling soybean by-products, including soybean liquid and powder, since soy is a primary source of protein used in the creation of plant-based meat alternatives (SFMA, 2023). These waste streams have the potential to play a role in Singapore's food security strategy.

An example of reducing manufacturing waste in New Zealand is the 'Sustainable is Attainable' project, started in 2019 by the South Canterbury Food Processors and Manufacturers Business Connection Group in collaboration with the University of Canterbury. The project aims to add value to industrial food waste and by-products, and it is currently running in Timaru, Hawkes Bay, and other regions.

Through the project, companies work together to co-invest in R&D and infrastructure to add value to waste, reducing the need for every business to buy specialised equipment. For example, multiple food businesses might buy shares in one anaerobic digester, allowing greater access to technology, shared learning, and collaboration. The benefits are improved economies of scale, reduced capital and operational costs, and reduced liability (Venture Timaru, n.d.).

Waste as a carbon sink

With Singapore's drive for self-sufficiency, carbon emissions should be a focus. There is an international push for countries to lower carbon emissions, and as such, lowering emissions is essential to the economy and international trade. Although low-carbon technologies are continuously improving, it is unlikely that a country will ever be truly carbon positive without offsetting. Waste is rich in carbon, and in Singapore, carbon is largely released into the atmosphere through incineration. There is an opportunity to convert specific waste streams that are low in ecotoxic contaminants (such as biological waste) into a char that can effectively sequester carbon indefinitely. This stored carbon could be mixed into concrete, soil, and other mediums and then incorporated into land.

Other Carbon Capture and Storage (CCS) technologies could be explored to convert waste into a carbon sink. New Zealand has an ecosystem of cleantech companies developing such technologies (Ministry for Business Innovation & Employment, 2022), including the conversion of earth minerals into CCS (Harvie, 2021), air capture technology (Cardwell, 2022), and more. This R&D is funded by the New Zealand government, and so the technologies are often designed to overcome the specific barriers in New Zealand. Singapore has a significant need for such technology and the capital to accelerate its development – which provides an optimal testing ground.

Corporate Social Responsibility in Singapore

Globally, companies are increasingly being expected to contribute to society beyond their business practices. In Singapore, the government is incentivising Corporate Social Responsibility (CSR), which has been embraced by many companies to positively contribute to the environment and society. Businesses are in particular implementing environmentally friendly practices and policies, with a focus on renewable energy, carbon emissions, and reducing or optimising waste streams (SGX Group, 2022). This is rewarded by consumers, who are gaining awareness and shifting their behaviour to support companies that practise CSR.

The environmental, social, and governance (ESG) performance of Singapore corporates is disclosed through sustainability reports. However, sustainability reporting has traditionally not had a set format, which makes it difficult to compare businesses and easier for businesses to 'greenwash' (Delubac, 2023). However, the Singapore Exchange (SGX) requires that all listed companies in Singapore disclose their sustainability practices in their annual reports, using either the Global Reporting Initiative (GRI) or the Sustainable Reporting Guidelines for Companies in Singapore (SGX Group, 2022).

United Nations Sustainable Development Goals

The United Nations (UN) Sustainable Development Goals (SDGs) are a set of 17 global goals adopted by all UN member states in 2015. The SDGs address the most pressing economic, social, and environmental challenges the world is currently facing. They are designed to be universal and interconnected, helping to provide a framework for countries to work together to help eliminate challenges such as climate change and environmental degradation. Achieving the SDGs requires a coordinated effort from civil society, governments, the private sector, and individuals. Having nationwide goals that are interconnected with the SDGs can also help to make them more attainable.

As members of the UN, both Singapore and New Zealand have a responsibility to produce and share annual SDG progress reports with the UN Secretary-General. New Zealand has embraced the SDGs to help inform and check how businesses are performing against global sustainability standards. Although Singapore has also made a commitment to meet the SDGs, it can learn from New Zealand's expertise and knowledge of how to add value to products, specifically relating to waste minimisation and sustainability initiatives. This would improve the value of Singapore's sustainable products and services. The SDGs that could bring the most value to Singapore products are goals 9 (Industry, Innovation and Infrastructure), 11 (Sustainable Cities and Communities), and 12 (Responsible Consumption and Products).

Consumer attitudes towards waste in Singapore

Internationally, consumers are becoming increasingly aware of the urgency to adopt more sustainable ways of living to reduce our impact on the planet. Singaporeans generally view waste as a serious issue, and a recent study showed that 85% of shoppers in Singapore are willing to spend more for sustainable products (Singapore Business Review, 2022).

However, cultural factors are also limiting sustainable waste management. A study of over 1,000 demographically diverse consumers in Singapore found that 95 percent were inclined to opt for sustainably packaged products, but more than half will not do so if such packaging costs more (Ang, 2022). We observed that having conveniently packaged items was a high priority for consumers in Singapore. While New Zealand and many other countries banned single-use plastic bags years ago (Klein, 2018), they are still a prevalent everyday item in Singapore. Consumers use plastic bags to carry a multitude of items, including takeaway coffees and pizza boxes.

Singapore may need to allocate resources to educate consumers and influence their behaviour, while also focusing on innovation in the manufacturing sector. There is demand for cheaper alternatives to the current sustainable packaging options on the market (Ang, 2022). In 2021, packaging waste accounted for one third of the total 1.82 million tonnes of domestic waste, with plastic packaging alone constituting 289,000 tonnes. With the same population as New Zealand but a fraction of the land mass, Singapore does not have the luxury of having ten landfills like New Zealand does.

Semaku Landfill is Singapore's only active landfill, receiving incinerated ash and non-incinerable waste. It is anticipated to run out of space by 2035 (Begum, 2022).

Director of Sustainability Services at KPMG Singapore Ms Cherine Fok believes educating consumers about recyclable items is keenly needed. A recent study showed that 7 out of 10 consumers in Singapore lacked an understanding of recyclable materials, with 50 percent not understanding the benefits of sustainable packaging at all. Consumers said that current labelling does not clearly communicate the most appropriate disposal option, and 70 percent said packaging materials could be reduced for the majority of the products they purchased regularly (Ang, 2022).

Reducing packaging waste

In 2022, Singapore's National Environment Agency implemented the Mandatory Packaging Reporting (MPR) scheme, which requires producers of packaged products (including importers, manufacturers, brand owners, and supermarkets) to submit reports on packaging. Each report must detail the type and quantities of packaging used annually for their products and outline plans to reduce, reuse, or recycle them. In turn, the National Environment Agency monitors packaging waste and identifies areas for improvement.

In addition, the Extended Producer Responsibility (EPR) scheme will be implemented by 2025 (Begum, 2022). The EPR scheme uses the data from the MPR scheme to make companies that import products into Singapore responsible for the end-of-life management of their packaging. The EPR scheme aims to promote the use of environmentally friendly packaging and encourages producers to design products and packaging with a focus on sustainability.

The Packaging Partnership Programme supports companies through the reporting process, training staff in effective and accurate ways to report waste. Workshops allow businesses to come together to collaborate and share ideas on waste reduction. Retailer KrisShop has led the way, replacing bubble wrap with a biodegradable paper wrapper that features an outer honeycomb structure, allowing for twistability and eliminating the need for tape (Begum, 2022).

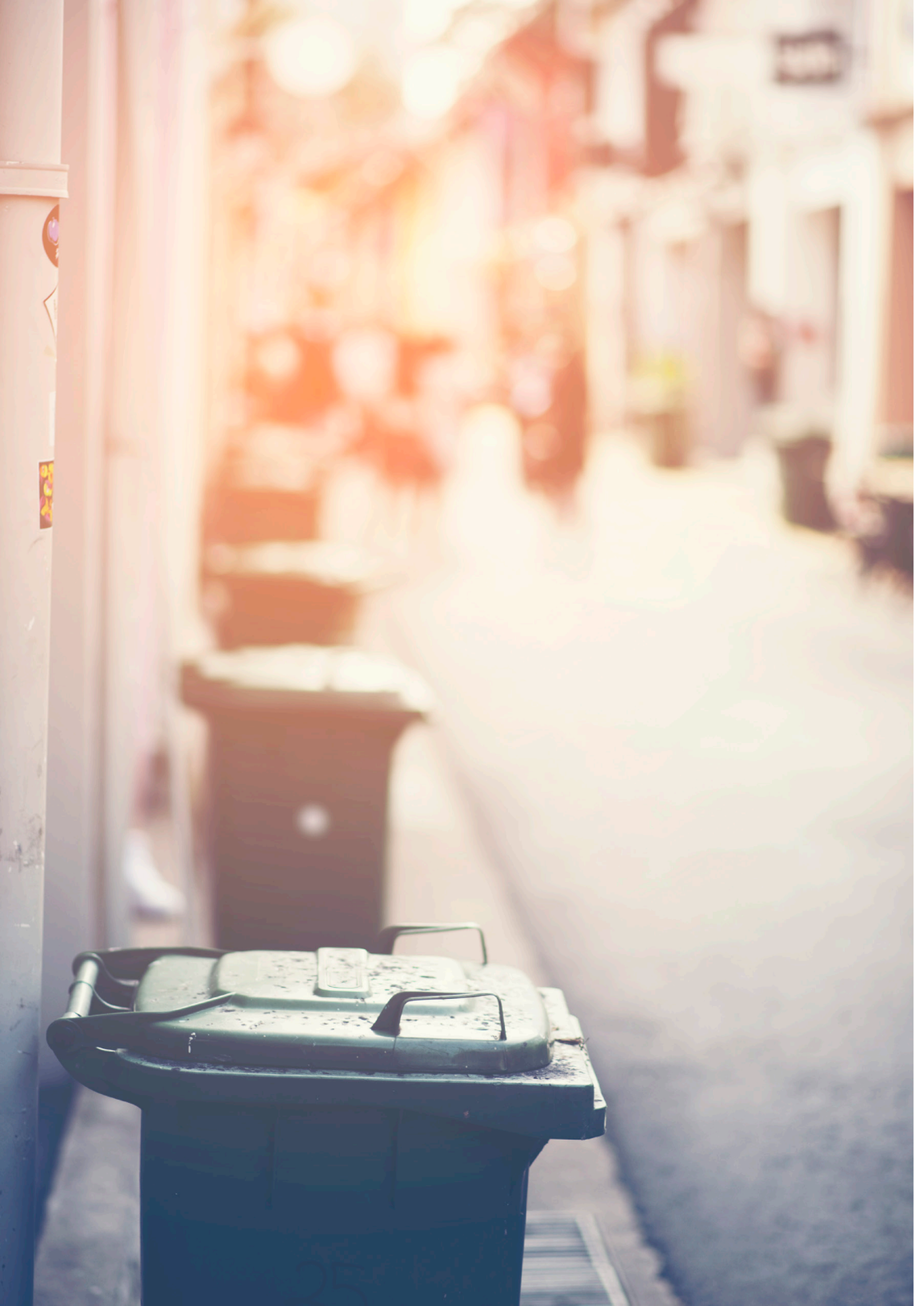
A beverage packaging return scheme will be implemented in 2023, which will gauge consumer acceptance of the programme and if viable, be extended in the future.

Opportunities for sustainable packaging

Sustainable packaging has become an increasingly important issue in Singapore, as companies seek to reduce the environmental impact of packaging. As a small and densely populated city-state that imports more than 90% of its food, sustainable packaging on imported items will be critical. The EPR scheme gives Singapore a mechanism for encouraging importers to use sustainable packaging.

If New Zealand companies offer sustainable packaging options for the products they export to Singapore, they will have an advantage over competitors. However, New Zealand exporters need to be aware of the minimal recycling infrastructure in Singapore. The government is currently taking steps to address this issue to align with the EPR scheme. Similarly, the National Environment Agency has launched a food waste valorisation roadmap to explore ways to convert food waste into value-added products (NEA, 2021). The implementation of the beverage packaging return scheme in 2023 will also help New Zealand exporters understand whether recycling is becoming more accepted by consumers in Singapore.

The lack of infrastructure is also a good reason for exporters to use packaging materials with non-fossil fuel precursors to avoid adding carbon to the environment. These packaging materials could be specifically designed for the Singapore market with higher stored energy than traditional packaging to increase electricity generated via incineration at the end of life. Likewise, when designing packaging for exported products (such as repacking operations), the materials should consider the destination's waste management infrastructure.



Conclusion

There are great opportunities for New Zealand companies to help educate and influence Singapore's government and consumers to improve their waste management strategies. The opportunities laid out in this report reflect two main themes: changes in behaviour and infrastructure. Each will play a pivotal role in ensuring a sustainable future for Singapore. Implementation of initiatives at both the consumer and manufacturing levels will require the cooperation and education of consumers and businesses to ensure the investment proves successful.

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