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Fashion Clothing Consumption and Waste Flows in the Auckland Region

Towards understanding textile waste and consumption streams

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Executive summary

The research contained within this report aims to elucidate and quantify, where possible, consumption and waste streams of fashion textiles in the Auckland region. We are guided by the following objectives, to provide:

- a detailed description of the structure of the clothing sector and clothing flows, including the identification of Auckland's contribution to New Zealand's textile footprint
- a quantification of clothing imported into Auckland and New Zealand by weight, fibre type, and general application
- a quantification of the tonnages of clothing discarded before being sold or worn
- an understanding of the proportion of textiles in the New Zealand market attributable to clothing
- a quantification of local clothing manufacture
- an estimate of rates of clothing consumption per person, per annum
- an understanding of reasons for clothing disposal and an estimate of disposed tonnages
- an assessment of the durability of certain types of clothing available on the New Zealand market
- an understanding of practices relating to clothing reuse, recycling, or repair.

This report has been prepared by Sapere Research Group for Auckland City Council as part of its statutory obligations under the Waste Minimisation Act to produce a Waste Assessment and associated Waste Management and Minimisation Plan (WMMP). The research also aligns with the Council's commitments under Te Tāruke-ā-Tāwhiri: Auckland's Climate Action Plan to be carbon neutral by 2025.

As far as we are aware, this is the first such attempt to quantify flows of fashion clothing in the Auckland region. Therefore, this research represents more of a conversation starter around fashion clothing consumption and waste, rather than a final word on the matter, as such. This work could be used to identify waste reduction interventions across the main components of Auckland's fashion clothing system and serve as a basis for further analysis as more data and insights are produced.

Our approach

Our objectives are broad and require a composition of different research methods. As such, we adopt a pragmatic mixed-methods approach, involving quantitative and qualitative analysis of publicly available datasets, commercial data, stakeholder interviews, and extant literature.

Key findings

Identifying Auckland's contribution to New Zealand's textile footprint

2,815 tonnes of fashion clothing are exported from New Zealand per annum, of which 1,510 tonnes are attributable to the Auckland region. The majority of these exports are new clothing items, with roughly 1.35 tonnes being classified as worn clothing.

9,717 tonnes of fashion clothing are manufactured in Auckland per annum, slightly over half of the 18,105 tonnes manufactured across the whole of New Zealand each year.

Fashion clothing accounts for more than half of all textile imports to Auckland.

Fashion clothing accounts for almost 10 per cent of textile manufacture in Auckland.

Quantifying the tonnages of fashion clothing discarded before being sold or worn

3,106 tonnes of clothing are wasted before being sold or worn. These wasted items of fashion clothing come from imports.

Quantifying local fashion clothing manufacture

9,717 tonnes of fashion clothing are manufactured in Auckland per annum, slightly over half of the 18,105 tonnes manufactured across the whole of New Zealand each year.

Estimating rates of fashion consumptions per person, per annum

24,213 tonnes of fashion clothing are consumed in Auckland per annum. This equates to 14.28kg per person, per annum.

Quantifying fashion clothing imports into Auckland and New Zealand

22,260 tonnes of fashion clothing are imported intended for consumption in Auckland.

Understanding the reasons for clothing disposal and an estimate of disposed tonnages

The decision of consumers to dispose of fashion clothing include:

- type of garment
- garment's initial cost (with some retaining expensive garments even if no longer worn)
- physical condition (extent of damage to garment)
- whether the garment is odorous
- style of garment and whether it fits with consumer's taste/style/fashion
- fit and comfort of garment
- emotional attachment to garment
- how long the consumer has had the garment for.

10,846 tonnes of fashion clothing are donated to op-shops in Auckland per annum, 2,169 tonnes of these donations are sold, while 8,677 tonnes are redirected to landfill.

180 tonnes of fashion clothing are sent for textile reprocessing from consumers per annum.

210 tonnes of fashion clothing are sent for textile reprocessing from retailers – in the form of unsold, unworn items – per annum.

5,379 tonnes of fashion clothing sent to landfills comes from consumers in their household waste.

Assessing the durability of certain types of fashion clothing available on the New Zealand market

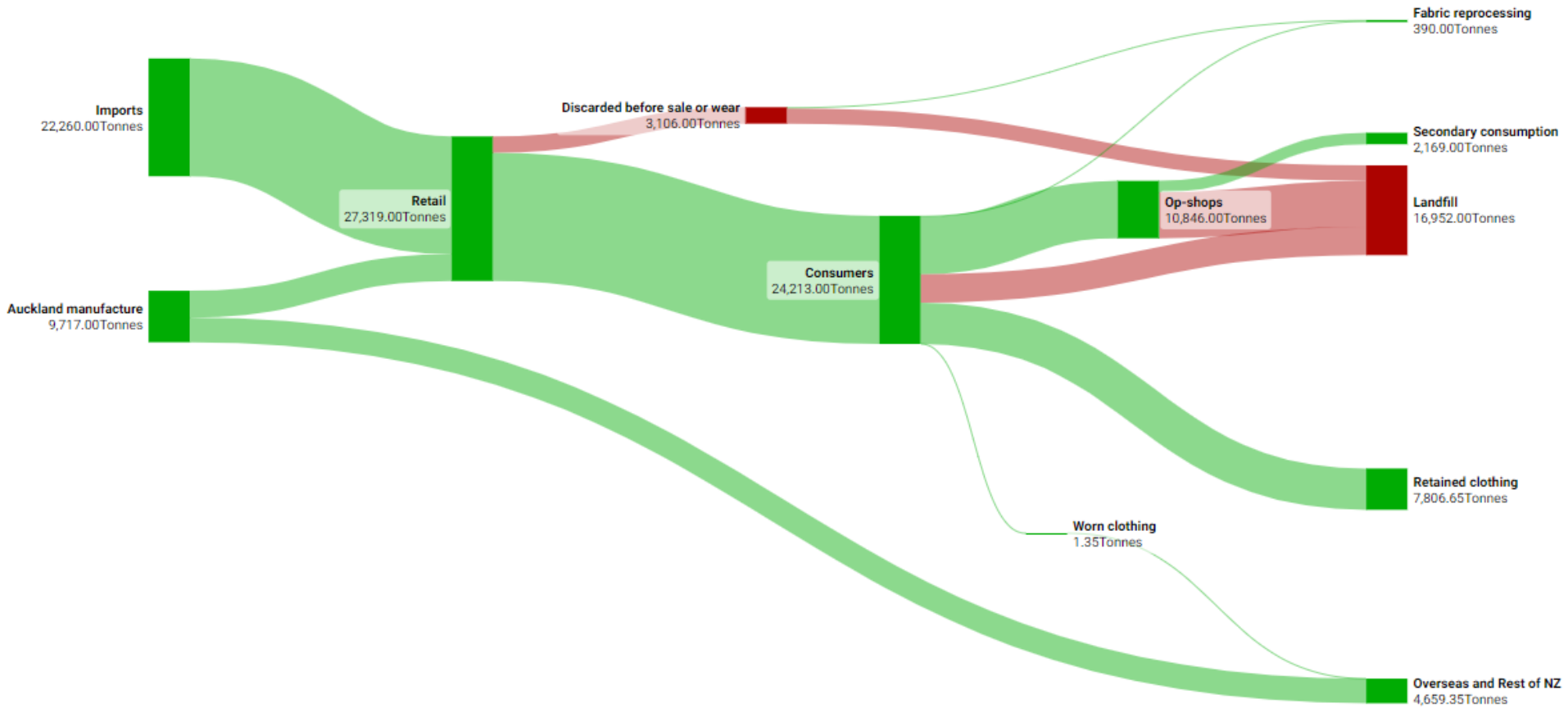
The average lifespan of garments varies considerably by type of garment:

- T-shirts – 4.6 (3.3–6.8) years
- Blouses/shirts – 4.8 (3.3–7.2) years
- Jumper/sweaters – 6.0 (3.7–10.8) years
- Suits – 8.7 years
- Jeans – 3.5 (2.5–4.3) years
- Trousers/pants – 4.7 (2.5–6.2) years
- Skirts – 6.9 (4.1–15.2) years
- Dresses – 7.1 (4.1–15.2) years
- Jackets/blazers – 6.8 (4.0–11.5) years
- Coats – 7.0 (4.0–11.6) years
- Underwear briefs/boxers – 3.1 (2.4–4.4) years
- Bras – 3.5 (3.0–4.4) years
- Socks (incl. stockings) – 2.6 (1.8–3.6) years

Understanding of practices relating to clothing reuse, recycling, or repair

The reusability of fashion clothing is dependent on the types of fibre used in the garments production and the quality of those fibres. Garments made with a single fabric type are more easily repurposed and reused.

Figure 1: Flows of fashion clothing through the Auckland clothing system



Source: Sapere analysis

1. Background and context

This research aims to elucidate and quantify, where possible, production, importation, consumption, and waste streams of fashion clothing in the Auckland region. We seek to provide a detailed description of the structure of the clothing sector and the flows of clothing within it. This includes:

- the identification of Auckland's contribution to New Zealand's textile footprint
- a quantification of fashion clothing imported into Auckland and New Zealand
- a quantification of the tonnages of fashion clothing discarded before being sold or worn
- a quantification of local fashion clothing manufacture
- an estimate of rates of fashion clothing consumption per person, per annum
- an understanding of the reasons for clothing disposal and an estimate of disposed tonnages
- an assessment of the durability of certain types of fashion clothing available on the New Zealand market
- an understanding of practices relating to clothing reuse, recycling, or repair.

This report has been prepared by Sapere Research Group for Auckland City Council as part of its statutory obligations under the Waste Minimisation Act to produce a Waste Assessment and associated Waste Management and Minimisation Plan (WMMP). The research also aligns with the Council's commitments under Te Tāruke-ā-Tāwhiri: Auckland's Climate Action Plan to be carbon neutral by 2025.

1.1 Scope of analysis

When discussing clothing consumption and waste in Auckland we refer to the chain of importation, production, consumption, and eventual waste that occurs within the geographical boundaries of Auckland Council's jurisdiction.

Figure 2: Auckland Council geographical boundaries

- We focus exclusively on fashion clothing in our analysis – at times referred to as *clothing* henceforth, which is inclusive of clothing intended for adult and child, males, and females. This means we do not consider other clothing textiles, such as workwear, medical clothing, nor items of personal protective equipment (PPE). Shoes and other footwear items are in scope, but footwear used primarily for work purposes, such as gumboots, are excluded.

- For the purposes of this research, workwear denotes clothing intended exclusively for work purposes. Salient examples would include clothing embroidered with company logos, boilersuits, and high visibility jackets. Workwear does not refer to the clothing people elect to wear to workplaces, such as shirts, ties, suits, blouses, dresses, and skirts – such items, for the purposes of this study, would be considered multipurpose.

1.2 There are three main ways to calculate flows of clothing in Auckland

Research concerned with material flows and waste generally adopts one, or a combination, of three methodological approaches:

- **Direct measurement**, which is often achieved via audits, typically produces the most accurate and reliable data. However, direct measurement is a time and labour-intensive exercise, unfavourable to the broader objectives and timeframes of this project.
- **Self-reporting** relies on clothing system entities collecting and reporting their production, consumption, and waste volumes. This approach is subject to a strong degree of reporting bias, where entities – consciously or otherwise – underreport volumes, especially waste volumes. It also requires extensive and prolonged engagement with various entities across the spectrum of the clothing system.

- **Inference and extrapolation** call upon multiple data types and source to construct a broad image of production, consumption, and waste in a given system. In terms of timeframes, this approach is favourable. However, estimates emerging from this approach should be treated as indicative only, as they tend to rely on a series of assumption more so than robust and accurate data.

1.3 Our approach

By necessity, our approach most closely resembles inference and extrapolation. Our approach is a top-down exercise driven by the availability of data and the particulars of each section of the Auckland clothing system. We take a bespoke approach to each part of the system, rather than employing a uniform method across all stages of analysis.

1.4 There is a paucity of data and insights

Comprehensive data pertaining to the importation and exportation of clothing and other textiles is available via Stats New Zealand. However, insights into local clothing manufacture, consumption, and waste are elusive. Therefore, we rely on data from previous studies and academic literature to extrapolate and infer for the clothing in the Auckland region. A concerted effort has been made to cover all facets of the clothing system in Auckland, however, data access limitations have frustrated that effort. Moreover, variances in data quality limit the granularity that we are able to exhibit at various stages of the clothing system.

2. Conceptualising and contextualising the Auckland clothing system

Here, we aim to describe the Auckland clothing system and its various domains. We present a brief qualitative description of the system. We also contextualise fashion clothing manufacture in Auckland against the backdrop of national production and present the proportion of textile imports attributable to fashion clothing.

2.1 The Auckland fashion clothing system is mostly linear

Compared to other systems of importation, manufacture, consumption, and waste – such as food, for example – fashion clothing is a relatively linear, uncomplicated system. Consumption of fashion textiles is serviced by two input domains:

- international imports
- domestic production.

Domestic production of clothing has experienced a sustained and rapid decline over the past several decades (KoiNo, 2020), which has meant domestic consumption has been serviced largely by imports. However, Auckland has retained a bastion of domestic production that services domestic and international markets.

Once consumed, fashion clothing in Auckland may progress along four main pathways:

- landfill
- donation to overseas markets
- donation to op-shops or
- retention of clothing

Donations to op-shops affords fashion clothing items the opportunity to be consumed in Auckland secondary markets[1], while donations to overseas markets removes clothing items from the Auckland system. It is important to note, however, clothing donations may ultimately end up in landfill if they are deemed unsuitable for sale.

2.2 Fashion clothing accounts for almost 10 per cent of textile manufacture in Auckland

To understand the proportion of textile manufacture in Auckland that is attributable to fashion clothing, we refer to prior research (Casey & Johnston, 2020) which has sought to quantify the totality of textile manufacture across New Zealand. They estimate, in 2020, 86,935 tonnes of carpet were manufactured in New Zealand, and 18,531 tonnes of 'other' textiles were also manufactured. We bring these figures into 2022 by accounting for the change in manufacturing GDP. On this basis, we assume

production of these textiles declined by 2.3 per cent. As such, we estimate national production of these textiles, during 2022, was 84,935.5 tonnes (carpets) and 18,1404.79 tonnes (other textiles). Determining Auckland's share of these manufacture volumes involves examining the Business Demography Statistics. According to these statistics, 98.63 per cent of carpet manufacture employees and 33.23 per cent of other textile manufacture employees are based in the Auckland region. Assuming employment proportions are a proxy for production volumes, and there are no differences in technologies deployed, we attribute 83,772 tonnes of carpet manufacture and 6,016.64 tonnes of other textile manufacture to Auckland. Contextualising these production volumes with our estimate of clothing manufacture in Auckland (9,717 tonnes),[2] we estimate fashion clothing manufacture to account for 9.77 per cent of all textile manufacture in the Auckland region.

2.3 Fashion clothing accounts for more than half of all textiles imports to Auckland

Analysing harmonised importation data, we find 56,248 tonnes of textiles (other than fashion clothing) are imported to New Zealand. Based on a population share of 33.08 per cent, we estimate 18,609 tonnes of these textiles will ultimately be consumed in the Auckland region. However, we acknowledge that some of these textiles may be further manufactured outside of the Auckland region, before being consumed. By comparison, 22,260 tonnes of fashion clothing are imported for consumption in Auckland per annum. In other words, 54.46 per cent of all textile imports to Auckland are fashion textiles.

[2] The calculation of this figure is found in section 3.4.

3. Quantifying importation, exportation, production, consumption, and waste streams

Here, we estimate volumes of fashion textile importation, domestic and local production, consumption, and waste streams. At each stage, we delineate the method of analysis employed, highlighting our assumptions and any relevant limitations. We begin our analysis by estimating fashion textile consumption volumes in the Auckland region, then work backwards to connect consumption volumes with the sources of fashion textiles, imports, and domestic manufacture. We adopt a similar approach to waste volumes, where we begin by estimating the headline volumes of fashion textiles sent to landfill, and from there inferring the sources of those textiles.

3.1 Over 24,000 tonnes of fashion textiles are consumed in the Auckland region per annum

As far as we are aware, there is no data readily available, nor collected, to accurately measure the volumes of clothing consumed per person, per annum, by Aucklanders or New Zealanders. However, insights can be drawn from comparative overseas contexts – in this case, Australia.[3] According to the Australian Fashion Council (2022), Australians consume 14.8kg of clothing per annum. This figure includes both fashion clothing and workwear[4].

Assuming these consumption volumes are transferable to the Auckland region population (1,695,200 in 2022), we estimate 25,088.96 tonnes of clothing are consumed in the Auckland region per annum. To determine the composition of this headline figure, we draw on insights from Europe.

According to the European Environment Agency (2023), the proportional composition of clothing in EU member state households is as follows:

- Coats, jackets, trousers, skirts, suits, dresses: 9.3 per cent.
- Stockings, tights, socks: 5.81 per cent.
- Pullovers and cardigans: 11.63 per cent.
- Baby clothes, sportswear, scarves: 15.2 per cent.
- Blouses, t-shirts, underpants, pyjamas: 23.26 per cent.
- Shoes: 31.4 per cent.
- Workwear: 3.49 per cent.

[3] Although like-for-like comparisons between international settings are often frustrated by extensive variability, we deem Australia to be a suitable comparison for the Auckland clothing system given the broad similarities in culture and climate. Moreover, household expenditure on clothing and footwear between the two contexts is similar: $41 in Auckland, based on 2019 household economic survey adjusted for inflation, and $44 per household in Australia (Clark, 2022).

[4] Inclusive of work footwear

Assuming these proportions are representative of the typical Auckland household, we estimate the following composition of clothing consumption in the Auckland region.

Table 1: types of clothing consumed in Auckland region per annum

Clothing type	Proportion (%)	Tonnes
Coats, jackets, trousers, skirts, suits, dresses	9.30	2,333.86
Stockings, tights, socks	5.81	1,458.66
Pullovers and cardigans	11.63	2,917.32
Baby clothes, sportswear, scarves	15.12	3,792.52
Blouses, t-shirts, underpants, PJs	23.26	5,834.64
Shoes	31.40	7,876.77
Workwear	3.49	875.20

Source: Sapere analysis

Removing workwear, as an out-of-scope element of this research, total fashion clothing consumption in the Auckland region is estimated to be 24,213.76 tonnes per annum, or 14.28kg per person, per annum.

3.2 Imports

We arrive at our estimate of fashion textile imports by analysing harmonised import/export datasets (Stats NZ)[5]. These datasets contain insights into the volumes and types of clothing imported and exported from New Zealand, as well as volumes and types of other textile imports and exports. Data are presented on a national aggregation. Disaggregation by port is possible; however, this does not provide a strong indication of the final destination. For example, clothing landed in an Auckland port may go on to be transported for consumption in Northland, Waikato, and elsewhere in New Zealand. As such, to estimate the volume of imports attributable to Auckland, we cut the national-level data by Auckland's share of the national population in 2022 (33.08 per cent).

3.2.1 Over 22,000 tonnes of fashion textiles are imported for consumption in the Auckland region per annum

Across all ports in New Zealand, during 2022, 69,773.99 tonnes of clothing were imported into New Zealand. Based on a 33.08 per cent share, we estimate 23,083 tonnes of these clothes were attributable to Auckland.

Table 2: Clothing import volumes to Auckland by clothing type

Type of clothing	Volume (tonnes)
Worn (second-hand) clothing	18

[5] Our use of official import statistics means we do not account for private imports direct to consumers

Headgear & parts	436
Footwear	4,876
Apparel & clothing accessories; not knitted or crocheted	7,587
Apparel & clothing accessories; knitted or crocheted	10,166
Total	23,083

Source: Sapere analysis

However, we acknowledge that not all of these clothing imports would necessarily qualify as fashion textiles, and a proportion would be considered workwear.

To estimate the volume of clothing deemed to be workwear, we follow the European Environment Agency (2023), which suggests workwear accounts for 3.49 per cent of clothing. We apply this proportion to all clothing categories except for worn clothing, which appears unlikely to encompass any workwear items. In doing so, we estimate a total of 805 tonnes of workwear imports attributed to Auckland. By deducting workwear imports, we infer that 22,260.04 tonnes of fashion textile imports are landed in New Zealand, intended for consumption in Auckland, per annum.

Table 3: Fashion textile import volumes to Auckland by clothing type

Type of clothing	Volume (tonnes)
Worn (second-hand) clothing	18
Headgear & parts	421.26
Footwear	4,705.88
Apparel & clothing accessories; not knitted or crocheted	7,322.02
Apparel & clothing accessories; knitted or crocheted	9,810.88
Total	22,260.04

Source: Sapere analysis

3.3 Exports

Similar to our approach to imports, we first examine clothing exports from the whole of New Zealand. During 2022, a total of 2,815.23 tonnes of clothing were exported from New Zealand ports.

Table 4: Clothing export volumes from New Zealand by clothing type

Type of clothing	Volume (tonnes)
Worn (second-hand) clothing	4.07
Headgear & parts	58.56

Footwear	245.75
Apparel & clothing accessories; not knitted or crocheted	1,208.28
Apparel & clothing accessories; knitted or crocheted	1,298.55
Total	2,815.23

Source: Sapere analysis

To estimate the proportion of these headline clothing exports attributable to Auckland, we utilise Business Demography Statistics (Stats NZ). According to these statistics, 55.56 per cent of clothing and footwear manufacture employees are located in Auckland, and 51.79 per cent of geographic units (manufacturers) are also located in Auckland. By taking a mid-point of these two metrics, we approximate that around 53 per cent (53.68) of clothing manufacture is attributable to the Auckland region. We apply this proportion to all categories of clothing types, other than worn clothing (where a population share is applied). As a result, we estimate 1,510.38 tonnes of clothing exports originate in the Auckland region.

Table 5: Clothing export volumes from Auckland by clothing type

Type of clothing	Volume (tonnes)
Worn (second-hand) clothing	1.35
Headgear & parts	31.44
Footwear	131.92
Apparel & clothing accessories; not knitted or crocheted	648.61
Apparel & clothing accessories; knitted or crocheted	697.07
Total	1,510.38

Source: Sapere analysis

It is important to note that we are assuming that clothing exports from Auckland, and indeed the whole of New Zealand, qualify as fashion textiles. This is based on a series of stakeholder interviews which characterised New Zealand clothing manufacture as high-quality, niche, and specialised. Consequently, we do not attribute any workwear to New Zealand clothing exports.

3.4 Nearly 10,000 tonnes of fashion textiles are manufactured in Auckland per annum

With the advent of relatively low-cost and cheap international imports, local clothing manufacture in New Zealand has drastically declined (KoiNo, 2020). The remaining bastion of clothing manufacture in New Zealand is often characterised by speciality, niche, and high-quality garment making, particularly knitwear.

As far as we are aware, there is no available data that measures or estimates volumes of clothing manufacture in New Zealand, nor Auckland. As such, our estimates here are achieved by inferencing and extrapolating from earlier studies.

A previous study (Casey & Johnston, 2020) estimates clothing manufacture in New Zealand, during 2020, to be 18,531 tonnes per annum. Our first step in estimating Auckland clothing production is to bring this estimate into 2022. We do this by examining changes in the contribution made to GDP between 2020 and 2022.

Between 2020 and 2022, New Zealand manufacturing experienced a negative growth rate of 2.3 per cent.[6] From this, we assume national clothing manufacturing volumes declined by the same percentage. As such, we estimate total New Zealand clothing manufacture during 2022 to be 18,105 tonnes per annum.

To estimate the proportion of this headline production attributable to Auckland we follow the same methodology utilised to estimate Auckland's share of fashion textile exports (53.68 per cent). On that basis, we estimate total manufacture in Auckland to be 9,717.78 tonnes per annum.

We are unaware of any specific trends or specialities in terms of the types of clothing manufactured in Auckland. Consequently, we cannot apportion estimates to clothing types, such as coats, jumpers, or shoes. However, given the somewhat niche and high-cost nature of New Zealand clothing manufacture, we are of the view that no workwear[7] is included in our headline estimate.

3.5 Most domestic clothing manufacture is consumed locally

Here, we estimate the flows of domestically manufactured clothing. This estimate (1) provides a more granular understanding of domestic consumption habits, but (2) is also required to support our estimates of other domains of the fashion textiles system.

To understand the consumption flows of domestic clothing manufacture we begin with our headline manufacturing estimate of 18,105 tonnes (for the whole of New Zealand). We then deduct exports of new clothing[8] (2,811 tonnes). This suggests that 15,294 tonnes of domestically produced clothes are remaining for domestic consumption. If these items were to be sold proportionately across New Zealand, we estimate 5,059 tonnes would be consumed in Auckland, while the remaining 10,235 tonnes would be consumed throughout the rest of New Zealand.

Table 6: Domestic clothing manufacture consumption streams

Consumption flow	Volume (tonnes)
International exports	2,811
Auckland consumption	5,059

[6] https://ecoprofile.infometrics.co.nz/Auckland/Gdp/GrowthIndustries

[7] We acknowledge that some modification, such as embroidering of company logos, may occur in the Auckland region. However, we do not consider such modifications to constitute manufacture of a garment.

[8] To the exclusion of worn, second-hand, clothing exports.

Rest of New Zealand consumption	10,235
Total	18,105

Source: Sapere analysis

This also suggests that Auckland is a net producer of fashion textiles, producing nearly 10,000 tonnes in the Auckland region per annum, but consuming only 5,059 tonnes.

It is important to note that our estimate assumes that no domestically produced clothing is directed to landfill or other waste destinations before being worn or sold. This assumption is based on interviews with clothing manufacturers and textile suppliers who advised that clothing manufacture in New Zealand does not reflect the fast-fashion philosophy. Instead, clothes are made in small batches and frequently sold out before manufacture is complete. For items produced on a slightly larger scale, such as knit products in wool fibre (e.g., merino wool), there is the benefit of timelessness, which means retailers are not required to discard clothing before sale as it remains fashionable, and acceptable, for extended periods of time.

3.6 Consumption flows of clothing imports

Domestically produced clothing accounts for 5,059 tonnes of Auckland's 24,213 tonnes of annual fashion textile consumption (almost 21 per cent). The remaining 19,154 tonnes of consumption are therefore serviced by clothing imports.

Table 7: Sources of clothing consumption in Auckland

Source of clothing for consumption	Volume (tonnes)
Domestic production	5,059
International imports	19,154
Total	24,213

Source: Sapere analysis

3.7 Over 3,000 tonnes of clothing are wasted before being sold or worn

We estimate volumes of fashion textiles wasted before being worn or sold by subtracting volumes of consumption (24,213 tonnes) from estimates of supply (5,059 from domestic production and 22,260 from imports). This would suggest that 3,106 tonnes of fashion textiles are supplied, but not consumed. Given the small-scale, higher price, higher quality, and relative timelessness of domestically produced clothing, we attribute the totality of this unworn and unsold volume to clothing imports.

According to a key industry stakeholder interviewed for this research, the main reasons for this waste can include product defects and products reaching the end of their season. However, we are unable to attribute a proportion of our waste estimate to these reasons. Discussions were held with mainstream clothing retailers, but they were not forthcoming with their unsold and unworn waste volumes.

3.8 Almost 11,000 tonnes of clothing are sent to op-shops by consumers in Auckland per annum

According to Casey and Johnston (2020), 6,795 tonnes of clothing are reused via op-shops per annum. However, this pertains only to the items of clothing sold by op-shops and channelled back to consumers as secondary consumption. It does not account for donations to op-shops that are unsold.

Charities and op-shops, such as the Salvation Army or Red Cross, are recipients of high volumes of old and unwanted clothing, both in New Zealand and overseas contexts (Rotimi et al., 2021). In the city of Edmonton, Canada, donations to charitable organisations is the preferred method of clothing disposal, around 55 per cent of clothing donations in Canada are made directly to organisations, while around 44 per cent are dropped off at clothing donation bins (Degenstein et al., 2021).

Generally, people making donations of clothing to charities are of the view that donating is a mutually beneficial action that allows them to get rid of old and unwanted items, while supporting a philanthropic cause. However, our discussions with op-shop executives indicated that the volumes, and quality, of donated clothing is particularly burdensome.

All donations must be manually sorted into items that can and cannot be sold. There is a high time and financial cost associated with sorting. Executives estimated that only 20 per cent of donations are deemed suitable for sale, while the remaining 80 per cent are redirected to landfill. This indicates that, for a large part, op-shops are a costly stop en route to landfill for clothing.

By applying these donation-sale proportions (80:20), we estimate op-shops across the whole of New Zealand receive around 33,975 tonnes of clothing per annum. Op-shops are known to accept donations of workwear which, in accordance with European Environment Agency (2023), we estimate to be 3.49 per cent of total donation volumes. As such, we estimate 32,789 tonnes of these donations could be considered fashion textiles. Assuming Auckland accounts for 33.08 per cent of these donations, we attribute 10,846 tonnes to the Auckland region. However, 80 per cent of these donations will not be sold, and instead redirected to landfill. As such, we estimate 2,169 tonnes of fashion textiles donated to op-shops in Auckland are sold on for secondary consumption, while 8,677 tonnes are redirected to landfill.

In understanding the sources of op-shop donations, op-shop executives advised upwards of 99 per cent of their donations come directly from members of the public. As such, we consider any volumes of clothing donated to op-shops from clothing retailers to be negligible for the purposes of this research.

3.9 Around 390 tonnes of fashion clothing are directed to fabric reprocessing per annum

There are at least two businesses operating in Auckland making products from waste clothing items. These products include, but are not necessarily limited to, carpet underlay, housing insulation, stuffing for furniture, and biodegradable signage. At a high level, these businesses breakdown clothing items into fibres, which can then be repurposed into different products. However, the processes deployed by these businesses cannot be applied to all clothing and fibre types. Cotton, for example, burns easily

when exposed to heat, and so is not, at present, reprocessed by these businesses. Additionally, these businesses, at present, cannot easily manage clothing products composed of multiple different fibres. Considerable work is required to de-construct clothing items, removing buttons, zips, and other materials. The owners of these businesses indicated a great deal of passion and ambition surrounding the reuse of old and unwanted clothing. They noted that the most significant barrier to repurposing old clothing items was their production capacity and the management of multi-fibre clothing products.

We were able to obtain processing volumes from one of these businesses, which we have used to estimate the volumes of fashion clothing that are reprocessed into other products in the Auckland region. One of these businesses receives 300 tonnes of clothing for reprocessing per annum. 35 per cent, or 105 tonnes, of these volumes are considered workwear items and are therefore not included in our estimates. The remaining 195 tonnes are attributable to consumers (90 tonnes) and fashion retailers (105 tonnes). We assume these volumes and proportions are similarly reflected in the other reprocessing business in Auckland (which we were unable to speak with directly) and, therefore, multiply these estimates by two.

We estimate a total of **390** tonnes of fashion clothing are reprocessed in Auckland per annum, with a total of **210** tonnes coming from the supply of clothing that is never sold nor worn, and **180** tonnes coming from consumers.

3.10 Almost 17,000 tonnes of fashion clothing are sent to landfill in Auckland per annum

Accurately measuring, or estimating, the volumes of clothing directed to landfill is challenging because data collection practices vary across recycling centres – some have comprehensive data of types and volumes of waste received, while others collect no data. Moreover, disaggregating clothing in landfill from domestic and commercial sources is difficult because commercial waste streams are commercially sensitive, and generally unavailable.

Looking across to Australia once again, the Australian Fashion Council (2022) estimates that approximately 10kg of clothing per person, per annum, are sent to landfill. Applying this estimate to the 2022 Auckland population suggests clothing directed to landfill in the Auckland region is **16,952 tonnes**[9] per annum.

3.11 Consumers, via op-shops, are the largest source of fashion clothing sent to landfill

To understand the source, and associated volumes, of fashion clothing sent to landfill we first re-examine the volume of clothing wasted before being sold or worn. Of the 3,106 tonnes wasted before

[9] This estimate is somewhat higher than findings in 2020 that estimated total apparel to landfill in New Zealand to be 34,922 tonnes (Casey & Johnston, 2020), of which 11,762 tonnes would be attributable to Auckland, assuming a proportion of 33.68 per cent based on Auckland's share of the national population.

being worn or sold, we estimated 210 tonnes were diverted to fabric reprocessing. We, therefore, estimate the remaining **2,896 tonnes** are sent to landfill.

By re-examining donations and sales volumes from op-shops, we estimated 10,846 tonnes of clothing were donated to op-shops per annum, but only 2,169 tonnes were sold. As such, we estimate **8,677 tonnes** are sent to landfill from op-shops.

We infer, from fashion clothing volumes sent to landfill from retailers (in the form of unsold and unworn clothing) and op-shops that the remaining **5,379 tonnes** of fashion clothing sent to landfills comes from consumers in their household waste.

Table 8: Source and volumes of fashion clothing sent to landfill

Source	Volumes (tonnes) sent to landfill
Op-shops	8,677
Consumers	5,379
Retailers	2,896

Source: Sapere analysis

It is important to note, however, op-shops should not be considered a source of clothing being sent to landfill per se. Instead, op-shops, as a preferred pathway for consumers' unwanted clothing, are more of a stop gap for clothing on the way to landfill.

4. Reasons for disposal, assessment of durability, and recycling

In this section, we highlight how and why clothing is typically disposed of, assess the durability of different types of clothing, and discuss opportunities for reuse, recycling, and repair. This section has been informed largely by an extensive literature review, supported by insights from stakeholders operating at the coalface of New Zealand's clothing industry.

4.1.1 There are numerous reasons for clothing disposal, but few means of disposal

There is a paucity of literature that assesses the reasons for and methods of clothing disposal, less still for literature contextualised within New Zealand. Consequently, insights are drawn from literature within comparable settings, such as Australia, Canada, and Norway. Most research concerning clothing consumption, use, and disposal focuses on adult females (often of younger demographics), as this group tends to be the most heavily involved in apparel purchase, care, and eventual disposal (Cleveland, 2018; Cumming, 2016; Durrani, 2018; Wakes et al., 2020).

Choice to dispose depends on a range of personal, social, and garment-specific factors

There are many factors that may determine why someone chooses to dispose of a garment (Bianchi & Birtwistle, 2010, 2012; Degenstein et al., 2020, 2021; McQueen et al., 2021; Norum, 2017). These factors include, but are not limited to:

- type of garment (e.g., dress versus underwear)
- garment's initial cost (with some retaining expensive garments even if no longer worn)
- physical condition (extent of damage to garment)
- whether the garment is odorous
- style of garment and whether it fits with consumer's taste/style/fashion
- fit and comfort of garment
- emotional attachment to garment
- how long the consumer has had the garment.

There is some evidence from Canada that consumers are willing to do minor alterations to their clothing and the very need to do alterations itself is not a motivation to dispose of clothing (Degenstein et al., 2021).

Evidence from Australia and the United States suggests a person's age is another factor that determines how and why garments are disposed of. Older consumers dispose of garments less frequently than younger ones, but when garments are disposed of, younger consumers are less likely to send the garments to waste than older consumers, and are more likely to donate to second-hand organisations (Bianchi & Birtwistle, 2012; Laitala et al., 2018; Norum, 2017).

Overseas, the most common pathway for disposal is to donate to charities

Australian and Canadian evidence suggests the most common pathway for disposal of clothing is to donate it to charities and the second most common was to give the clothing to families and friends (Bianchi & Birtwistle, 2010, 2012; Degenstein et al., 2021). The Canadian study (Edmonton, Alberta) found consumers' disposal preference was to donate direct to charities or to use donation bins. Less commonly reported pathways included repurposing of the garment or selling it. Most said they would never donate if the clothing was too worn / damaged beyond repair, and instead would put it in wastebins, which are generally directed to landfill (Degenstein et al., 2021). The general recycling behaviour and environmental attitudes of consumers in the surveyed countries was seen to be the greatest predictor of whether consumers would donate to charities.

In New Zealand, the most common disposal pathway for knitted jumpers was to donate to charities, followed by giving to family or friends (Nautiyal et al., 2023).

Some charities take the donated garments offshore – in New Zealand there are charities that send donations to places like Papua New Guinea in the Pacific, where some of the garments are then retailed to local businesses (Hernandez-Curry, 2019). This practice has been criticised for dumping excessive volumes of poor-quality clothing into overseas markets, deferring the issue of waste management to developing economies and diminishing opportunities for local clothing manufacturers (Shao, 2023).

4.1.2 Durability depends on the type of clothing and what it is made from

The durability and wear patterns of clothing both have an influence on consumer's disposal behaviour and are linked to the type of clothing itself and its construction and materials.

Evidence from New Zealand shows wool jumpers have a higher expected number of times used (including reuse) compared to synthetic-blend jumpers (237 versus 171), while also being washed less often than synthetic-blend (Nautiyal et al., 2023). Specific information on use patterns of other clothing types in New Zealand was not identified.

New Zealand consumers generally expect greater-durability clothing, that retains shape and wearability after several washes and wears, and higher quality when the price of a garments increases. However, it has been found the price is not necessarily a good indicator of the physical performance of a garment (Wakes et al., 2020). In other words, some highly priced garments may be less durable than lower priced garments.

The average lifespan of garments varies considerably by type of garment

Table 9 shows the average garment lifespan (and range) for different types of garments compiled across a range of studies (Laitala et al., 2018). The data comes from surveys and wardrobe audits across mainly European countries.

Table 9: Garment lifespan in years (first owner), compiled over various studies

Garment type	Average garment lifespan (range)
T-shirts	4.6 (3.3–6.8)
Blouses/shirts	4.8 (3.3–7.2)
Jumper/sweaters	6.0 (3.7–10.8)
Suits	8.7
Jeans	3.5 (2.5–4.3)
Trousers/pants	4.7 (2.5–6.2)
Skirts	6.9 (4.1–15.2)
Dresses	7.1 (4.1–15.2)
Jackets/blazers	6.8 (4.0–11.5)
Coats	7.0 (4.0–11.6)
Underwear briefs/boxers	3.1 (2.4–4.4)
Bras	3.5 (3.0–4.4)
Socks (incl. stockings)	2.6 (1.8–3.6)

Source: Sapere analysis based on (Laitala et al., 2018)

Perhaps unsurprisingly, garments with the shortest lifespans are those which would qualify for everyday use, particularly products worn next to the skin, such as socks, bras, and underwear. Conversely, clothing with the longest lifespan tends to be outerwear worn less frequently, such as suits and coats. Jeans have a particularly short lifespan, which may seem surprising given their initial creation was as a form of heavy duty, durable workwear. However, jeans have become an everyday clothing item, manufactured from a wide range of fabric types and in many styles.

4.1.3 What determines a second life for clothing?

There are a range of factors that could determine how reusable a piece of clothing is (and is perceived to be by consumers).

Product types and fibre content largely determine the reusability of a garment

Suitability for a product second life or re-use is determined largely by the product type or fibre content (i.e., sweaters; wool or wool blend, e.g., Laitala et al., 2018; Nautiyal et al., 2023); the extent of garment structural and/or corporate features (Cumming, 2016); or evidence of the need for fewer cleaning cycles (e.g., Laitala et al., 2018). In general, given all other variables 'the same' (fibre type, yarn structure, finishing treatments, mass) woven fabrics are more stable to repeated use than knit structures.

Garments with the most potential for re-use, recycling and/or repair include those manufactured with good quality fabric (i.e. economically viable), items of one colour (various shades) (Cleveland, 2018; Rosson et al., 2023), groups of items of the same fibre content/fabric structure (i.e. those which can be

treated in the same or similar way physically and/or chemically (Riba et al., 2020), items which are known to have required fewer cleaning cycles (i.e. those not already abraded, pilled, faded, dimensionally changed), more structured garments of higher quality if part of the structure can be incorporated in the design or less structured if garment disassembly is needed (Cumming, 2016), and garments manufactured in wool fibre given typically longer use period and fewer issues related to odour retention (Laitala et al., 2018; McQueen et al., 2021).

A garment's reusability may also depend on its odour and ability to manage odour

A garment's reusability may depend on its odour and ability to manage odour (McQueen et al., 2020; Waskul & Vannini, 2008). Odour may not be a major reason for people to discard clothing (i.e. people may find other uses for it, unless the odour is persistent (McQueen et al., 2020)), but if the clothing is to be disposed of, people are more likely to send odorous clothing to waste streams rather than donate, sell, or give away the clothing (McQueen et al., 2021, 2023).

Activewear and athletic clothing is generally perceived as smelling more intense than other types of clothing. Consequently, it tends to be laundered more frequently, and at a greater intensity, than other clothing types (McQueen et al., 2021). This, in part, could be because of its typical synthetic fibre make up, since consumers generally associate clothes constructed from synthetic fibres, heavier knitted fabrics, and clothing designed to hug the underarm areas as those that retain odours more, or have intensified odours (McQueen et al., 2020).

4.1.4 An understanding of practices relating to clothing reuse, recycling, or repair

During our investigation, we found evidence of various practices intended to extend the life of fashion textiles through methods of reuse, recycling, and repair. In Chapter three, we quantified volumes of clothing diverted for textile reprocessing and to op-shops- these are common examples of clothing re-use and recycling. Here, we discuss a domain of repair that we have been unable to quantify for this research.

A repair service from clothing retailers can prolong the lifespan of a product

We spoke to some clothing retailers who advised that they operate 'repair service shops, where customers can return damaged items of clothing for repair. Damage does not have to be the result of a manufacturing defect, meaning customers are able to send items for repair that have become damaged through use and wear. According to these retailers, this practice greatly extends the life of a garment. One retailer noted that customers can expect some clothing items to last upwards of 25 years, using their repair service. From an economic perspective, however, customers will tend to use repair services for relatively expensive clothing items, where the cost of repair is considerably less than the cost of purchasing a new item. It is also worth noting that retailers we spoke with offering a repair service would not necessarily be considered fashion in the strictest sense, instead offering outdoor clothing products that generally withstand the churn of fast fashion. However, we did find some evidence of New Zealand fashion retailers offering a repair service, and some knitwear manufacturers also provide this service.

5. Concluding remarks

Tackling waste volumes in Auckland's fashion clothing system appears to be a question in two parts. The first contends with the issue of reducing consumption volumes. Aucklanders are consuming more than 24,000 tonnes of fashion clothing per annum but retaining only 7,800 tonnes for continued use and wear. The consumption to retention ratio is likely the result of a combination of two main factors (1) excess consumption and (2) the purchase of clothing that is not particularly durable. Reducing waste, therefore, could be achieved by discouraging excess consumption and encouraging the purchase of higher quality, and more durable, clothing. Waste, however, remains an inevitability even if consumption patterns could be shifted. Hence, the second issue contends with how fashion clothing waste is managed.

It is clear from our research that op-shops are more of a stopgap on the way to landfill than they are a means to divert clothing into secondary markets. While op-shops are the consumers preferred destination for old and unwanted clothing, it seems that present donation volumes are unsustainable and broadly inconducive to the objectives of the charities behind op-shops. Establishing and promoting alternative pathways for old and unwanted clothing may reduce the burden on op-shops and limit clothing volumes that ultimately arrive in landfill.

Fabric reprocessing is one existing opportunity to give clothing a second life and divert it from landfill. At present, however, reprocessing facilities in Auckland only can process around 300 tonnes of clothing per annum (per unit). A significant uplift in processing capacity would be required for fabric reprocessing to offset the volumes of clothing currently being sent to landfill.

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