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Image from Maleny Black Angus Beef, 2025.

The Fifth Quarter: are farmers paid for this?

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Contents

Executive Summary

The red meat industry is traditionally recognised for its production of muscle meat for human consumption, such as lamb chops and scotch fillet steak. Nevertheless, a considerable yet frequently overlooked segment of each animal is known as the "Fifth Quarter," comprising co-products including organs, bones, hides, fats, and blood. These co-products are integral to the sector's sustainability and profitability, as they can be processed into high-value commodities such as leather for apparel and automotive interiors, fertilisers, and pharmaceutical products. Despite their extensive applications, co-products tend to be undervalued at the farm level, with most economic gains accruing to processors who oversee extraction, refinement, and marketing once ownership transitions from farmers.

This report examines three key issues: the reasons co-products remain undervalued at the farm stage, potential strategies to improve transparency and recognition for farmers, and the implications of current management and value distribution policies across supply chain stakeholders. The analysis highlights that the existing supply chain structure, centralised processing dominance, and contemporary market dynamics collectively result in limited direct financial returns for farmers from co-products. This situation adversely affects farmers' incomes and business viability and has broader impacts on industry transparency and consumer confidence.

Industry perspectives have been reviewed, and opportunities for collaborative ventures and enhanced business practices are explored. The report recommends the Meat Industry Association establish a template to facilitate collaboration among processing members in the marketing and development of co-products. Additionally, the introduction of a distinct share value for investment by farmers and other stakeholders is proposed, aiming to unlock and fairly distribute the latent value within the Fifth Quarter. Implementing these measures would foster local value addition, with the objective of delivering increased financial returns to both processors and farmers, thereby enhancing industry profitability and competitiveness amidst land use changes. Sustained lack of profitability threatens the industry's overall stability.

By encouraging innovation and ensuring equitable benefit distribution, particularly to farmers, the industry must enable returns of at least $1kgCW(carcass weight profit for beef and $0.20kgCW for lamb directly to farmers to attract succession and support generational change as ownership transitions occur. The future generation demands profit not solely derived from capital gains on land but from value creation across the entire animal. Accordingly, profit generated through comprehensive utilisation of all animal components is vital for processors and essential for the long-term viability of farming.

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Introduction

Co-products or 5th Quarter of the Red Meat Industry:

This report examines the co-products of the red meat industry, covering their types, uses, economic impact and why farmers may not see much of their value and perception that farmers don't get paid for the 5th quarter while the industry's focus is muscle meat for consumption, a substantial part involves producing co-product which include organs, bones, fats, hides, blood and more. These are vital for sustainability and profitability across sectors like pharmaceuticals, agriculture, cosmetics, and pet food.

Co-products help maximise animal value and limit waste, supporting a circular economy approach. However, farmers often receive little financial benefit from them due to supply chain structures, centralised processing, and market forces. Ownership typically shifts to processors at the sale point, who then extract and market these materials, realising most economic gains downstream. Co-products boost resource efficiency and processor profits which strengthen industry sustainability, and reduce environmental impact by turning potential waste products into valuable goods.

Research Questions and Report Objectives

- What is the current role and economic significance of co-products in the New Zealand red meat industry?
- How are co-products and by-products differentiated in terms of intentional production, value, and utilisation?
- What are the main challenges and opportunities for farmers in benefiting financially from co-product streams?
- How do supply chain structures and processing practices influence the distribution of economic gains from co-products?
- What impact do co-product utilisation and commercialisation have on industry sustainability and environmental outcomes?

Report Objectives:

To analyse and quantify the flows and values of co-products within the red meat sector, using export data and industry sources.

To clarify the definitions and distinctions between co-products and by-products in the context of red meat processing.

To examine the financial benefits and limitations experienced by farmers with respect to co-product ownership and revenue streams.

To evaluate the role of processors in extracting, marketing, and profiting from co-products, and the implications for overall supply chain efficiency.

To assess the contribution of co-products to resource efficiency, circular economy practices,

and the environmental sustainability of the industry.

Research methodology

To gather data and insights on co-products in the red meat industry, I used numerous options to my research was undertaken. I understand the topic as I have been a farmer for 40 years.

The initial step involved was contacting the Ministry for Primary Industries (MPI) to obtain export data, which formed the foundation for quantitative analysis of co-product flows and values. Reference numbers and graphs derived from this data are attached to support the findings. Julian Ashby from Beef and Lamb New Zealand supplied a lot of the historical data.

Fieldwork comprised attending the Red Meat Sector Conference at Te Pae Christchurch on 21–22 July 2025. This event provided an opportunity to interview and network with numerous sector leaders, thereby enriching the research with expert perspectives and industry context. In addition, site visits were conducted to two processing companies, where interviews with the owners offered first-hand insights into co-product extraction, utilisation, and commercialisation practices.

Finally, further background was provided through online research: targeted Google Scholar searches identified relevant studies; the Beef and Lamb website and AI research engine (bella) were invaluable. My wife Jo has done numerous research topics in the medical field and has been invaluable with referencing, layout and support.

Background to co-products and by-products of the red meat sector.

The terms "co-products" and "by-products" are often used interchangeably in the red meat sector, but they have distinct meanings. Co-products refer to materials intentionally produced alongside the main product meat from the animal carcass. These include items such as hides, blood, bones, and organs, which are processed for use in food, pharmaceuticals, cosmetics, and industrial applications. For example, hides are used to make leather goods like shoes and belts, blood can be processed for fertilisers or pharmaceutical products, bones are rendered for pet food or gelatine, and organs may be utilised in specialty foods or medicines. Co-products are valued for their utility and economic contribution, reflecting a deliberate effort to maximise the value extracted from each animal.

By-products, on the other hand, generally denote secondary materials generated during meat processing that are not the primary focus of production. While some by-products may be repurposed or further processed, such as trimmings used for low-grade pet food, or fat and bone fragments rendered for tallow or meat meal, they are typically viewed as residual outputs rather than integral components of the main processing strategy. The key difference lies in the intention and value: co-products are purposefully harvested and commercialised, whereas by-products are incidental and often treated as waste unless a secondary use is identified (Beef and Lamb New Zealand, 2021).

Historical Context of Animal Slaughter and Meat Exports

Animal slaughter for food has a long history, with origins tracing back to Roman times and France during the 15th and 16th centuries (Beef and Lamb New Zealand, 2020; Meat Industry Association, 2020). In New Zealand, the meat industry began in 1870, focusing initially on canned meat exports. A significant milestone was reached in 1882 with the first shipment of frozen carcasses sent to England, marking the start of New Zealand's international meat trade (Beef and Lamb New Zealand, 2020; New Zealand Meat Industry Association, 2020).

Early export practices involved shipping whole lamb carcasses until 1970, while boneless beef exports commenced in the 1960s. By the early 2000s, most of the exported meat was sent as smaller cuts, a shift that helped reduce transport costs and value add. At that time, approximately 45% of exports consisted of high-value muscle groups and prime cuts, with the remaining 55% made up of lower-value products such as mince and cuts suitable for

casseroles (Beef and Lamb New Zealand, 2020; New Zealand Meat Industry Association, 2020).

The rest of the animal that goes to slaughter is called the 5th Quarter or co-products. This is removed at slaughter such as the head, blood, shanks, hide and innards. Trimming is done to remove any bruising; the internal skirt is removed and even the spinal cord is removed. Once the co-products are removed, the carcass is weighed to determine the farmer's payment. When you think about meat processing, it would be no surprise that the first output you thought about, was food. But what happens to the rest of the carcass? The parts that are not suitable or desired for direct consumption.

In the industry, 'fifth quarter' co-products (materials intended for human consumption which may be edible or non-edible) are highly valued, constituting more than half the value of a carcass. These co-products facilitate optimal resource utilisation and significantly reduce the production of waste, otherwise would go to landfill or be rendered for fertiliser. Technological advancements and ongoing innovation have continually expanded the uses and applications of co-products across multiple sectors. For instance, while tallow was traditionally utilised in soap and candle production, it is now being refined into biofuel, contributing to cleaner combustion and lower emissions (Beef and Lamb New Zealand, 2020; Staff Reporters, 2021).

Examples of co-products commonly found in everyday consumer products include:

- Sausage meat casings, particularly for specialty sausages (often from lamb) (Beef and Lamb New Zealand, 2020; Staff Reporters, 2021).
- Meals used in the manufacturing of pet food kibble. (Beef and Lamb New Zealand, 2020; Staff Reporters, 2021).
- Tallow for biodiesel production (Beef and Lamb New Zealand, 2020; Staff Reporters, 2021).
- Hides employed in upholstery, footwear, luggage, bags, belts, and wallets. (Beef and Lamb New Zealand, 2020; Staff Reporters, 2021).
- Deerskins for luxury handbags, wallets and garments; notably, New Zealand lamb skins are featured in Prada and Gucci products (Beef and Lamb New Zealand, 2020; Staff Reporters, 2021).
- Wool trimmings incorporated into slippers and fleece-lined apparel. (Beef and Lamb New Zealand, 2020; Staff Reporters, 2021).
- Skins used for wool-on rugs
- Sheep pelts utilised in car chamois, leather inlays for furniture, books, and shoe linings. (Beef and Lamb New Zealand, 2020; Staff Reporters, 2021).

- Pharmaceutical products leveraging tallow for soaps, and lanolin from the wool as a key ingredient in lipsticks and as an alternative to mineral oils and synthetic substances in cosmetic products.
- Biological materials used in the development of serums for vaccines, cancer therapies, and treatments for various neurodegenerative, haematological and endocrine disorders (Beef and Lamb New Zealand, 2020; Staff Reporters, 2021).

Types of co-products in the red meat industry

Offal: This includes organ meats such as liver, heart, kidneys, tongue, tripe (stomach lining), and brain. Offal is a delicacy in many cuisines and is highly nutritious. Numerous studies and industry reports highlight the importance of offal in global diets, particularly in non-Western cultures where it is considered a staple or delicacy (Beef and Lamb New Zealand, 2020).

The nutritional value of offal, being rich in essential vitamins and minerals, has been well documented in food science literature (Beef and Lamb New Zealand, 2020)

Blood: Used in products like blood sausage, black pudding, and as a protein additive in some processed foods. Blood is recognised as a significant co-product, with applications in both traditional foods and as a functional ingredient in processed food products. (Beef and Lamb New Zealand, 2020).

Fat: Fat rendered from animals is used in cooking (e.g., tallow, lard), baking, and even for frying purposes. Rendered animal fats like tallow are also utilised in the production of soaps and as alternatives to synthetic substances in cosmetics, as highlighted in the New Zealand Meat Industry Association's 2020 report.

Bones: Bones are utilised for making stocks, broths, and gelatine, which is used in food production and confectionery. The versatility of bones in both culinary and industrial applications are well established in the literature (Beef and Lamb New Zealand, 2020; Meat Industry Association, 2020).

Co-products from the red meat industry find their way into numerous sectors, often in ways that consumers may not realise (figures 1 and 2)

- Food Industry: Edible co-products are used in processed foods, traditional dishes,
- flavourings and supplements (Beef and Lamb New Zealand, 2020).
- Pharmaceuticals: Insulin, heparin and other critical medicines are derived from animal organs and tissues (Beef and Lamb New Zealand, 2020; Meat Industry Association, 2020).
- Cosmetics and Personal Care: Ingredients like collagen and lanolin are sourced from animal co-products and are found in lotions, shampoos, and makeup (Beef and Lamb New Zealand, 2020; Meat Industry Association, 2020)
- Agriculture: Blood meal, bone meal and rendered fats used as fertilisers and animal feed supplements, supporting crop and livestock production (Beef and Lamb New Zealand, 2020; Meat Industry Association, 2020).
- Industrial Applications: Leather production, glue, biodiesel and other manufactured goods depend on co-products (Beef and Lamb New Zealand, 2020; Meat Industry Association, 2020).
- Pet Food: Commercial pet foods contain organ meats and animal meals derived from co-products (Beef and Lamb New Zealand, 2020).

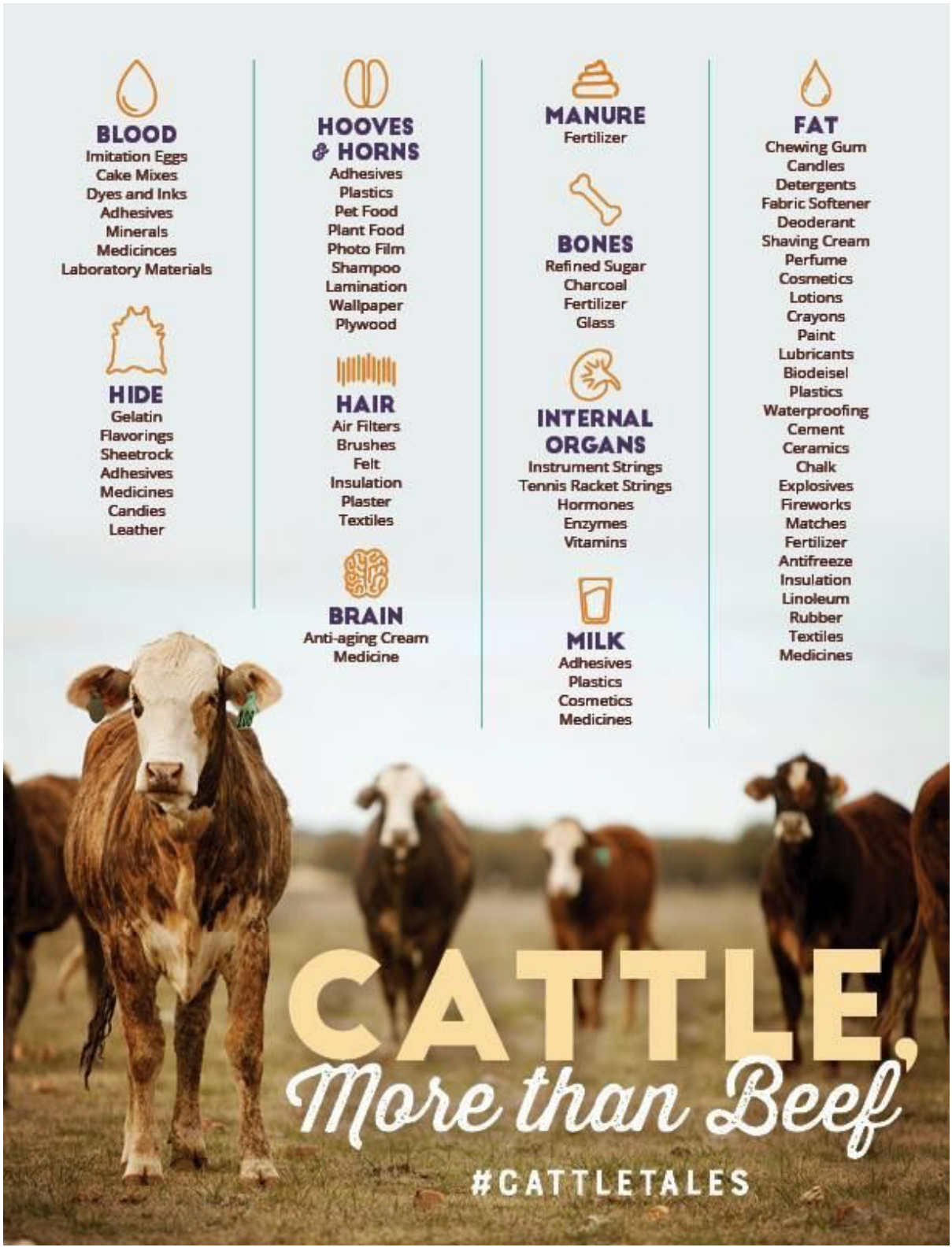


Figure 1., Note. From Parsons Creek Steak. (2022). Images of the 5th Quarter in the beef and sheep industries that have applications supporting other industries.

Figure 2., Images of the 5th Quarter in the sheep industries that have applications supporting other industries. Note. From Farm Credit Knowledge Centre, 2023.

Export trends for red meat co-products

Value and Volume Over 34 Years

- In 1990, total co-products exported amounted to 227,887,496 kg, with a Free on Board (FOB) value of $2,158,802,377. Which is driven by the high wool price.
- By 2024, exports reached 380,613,031 kg, with an FOB value of $2,358,224,733. In this 34 year period the wool lost 1 billion dollars in value.
- Over the 34-year period, export volume increased by 152,725,535 kg, representing a 4% rise.
- Export value increased by $199,422,356, a growth of 0.8% (Figure 3)

(J Ashby, personal correspondence, July 7, 2025).

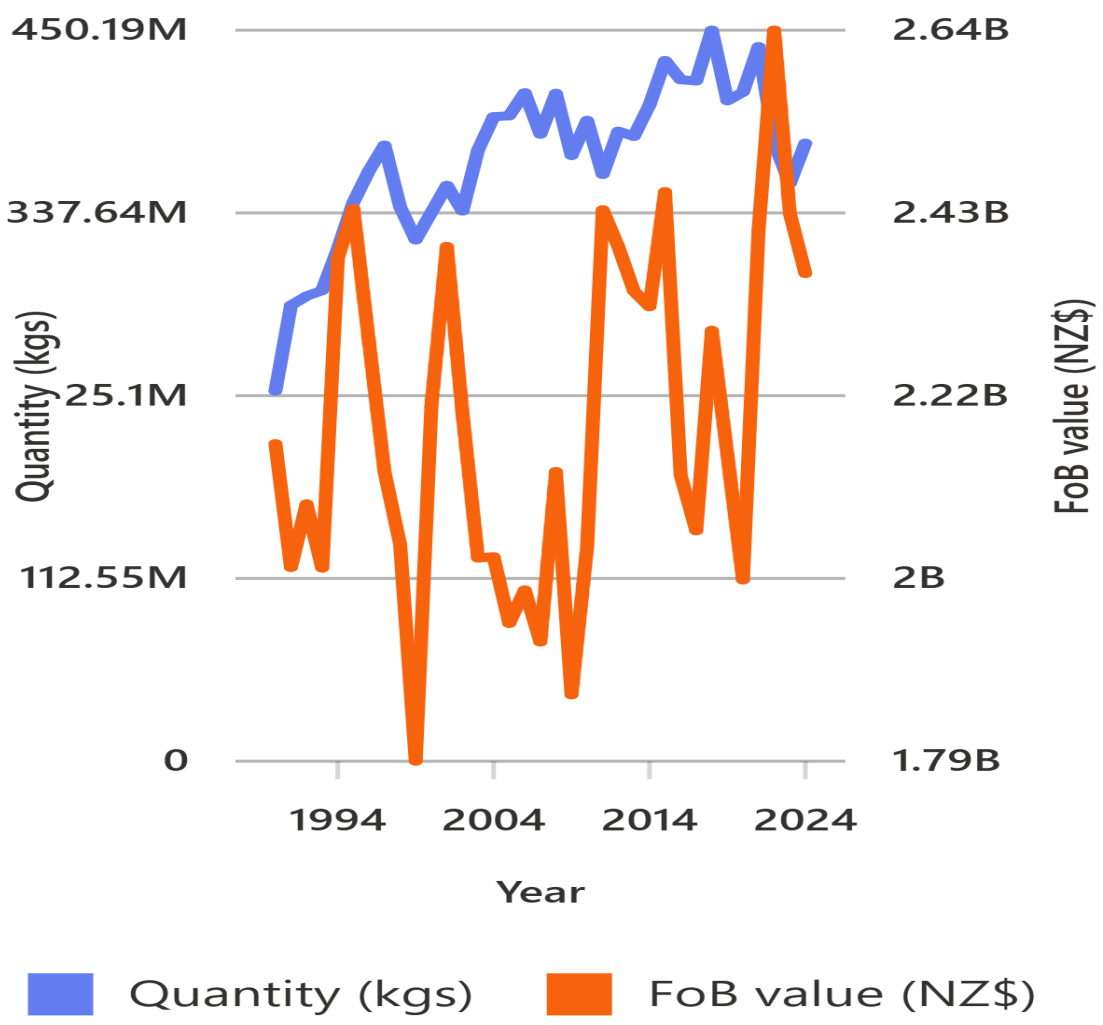


Figure 3., Graph showing quantity and value of co-products from New Zealand from 1990 to 2024. (J Ashby, personal correspondence, July 7, 2025).

Export trends for red meat co-products.

In 1990, total co-products exported amounted to 227,887,496 kg, with a Free on Board (FOB) value of $2,158,802,377.

By 2024, exports reached 380,613,031 kg, with an FOB value of $2,358,224,733.

Compared to the 1990 baseline, the export volume increased by 152,725,535 kg, which represents an approximate 67% increase (calculated as (380,613,031 – 227,887,496) ÷ 227,887,496 × 100).

The export value rose by $199,422,356, an increase of about 9.2% (calculated as ($2,358,224,733 – $2,158,802,377) ÷ $2,158,802,377 × 100). Over 34 years which is 0.26 % per year Inflation for the same 34-year period was 4.6% per year

There are no quantity measures for specific products such as casings, bovine hides and sheep skins, blood products, and wool. A steady upward trend is shown in export volumes over the 34-year period (Figure 4).

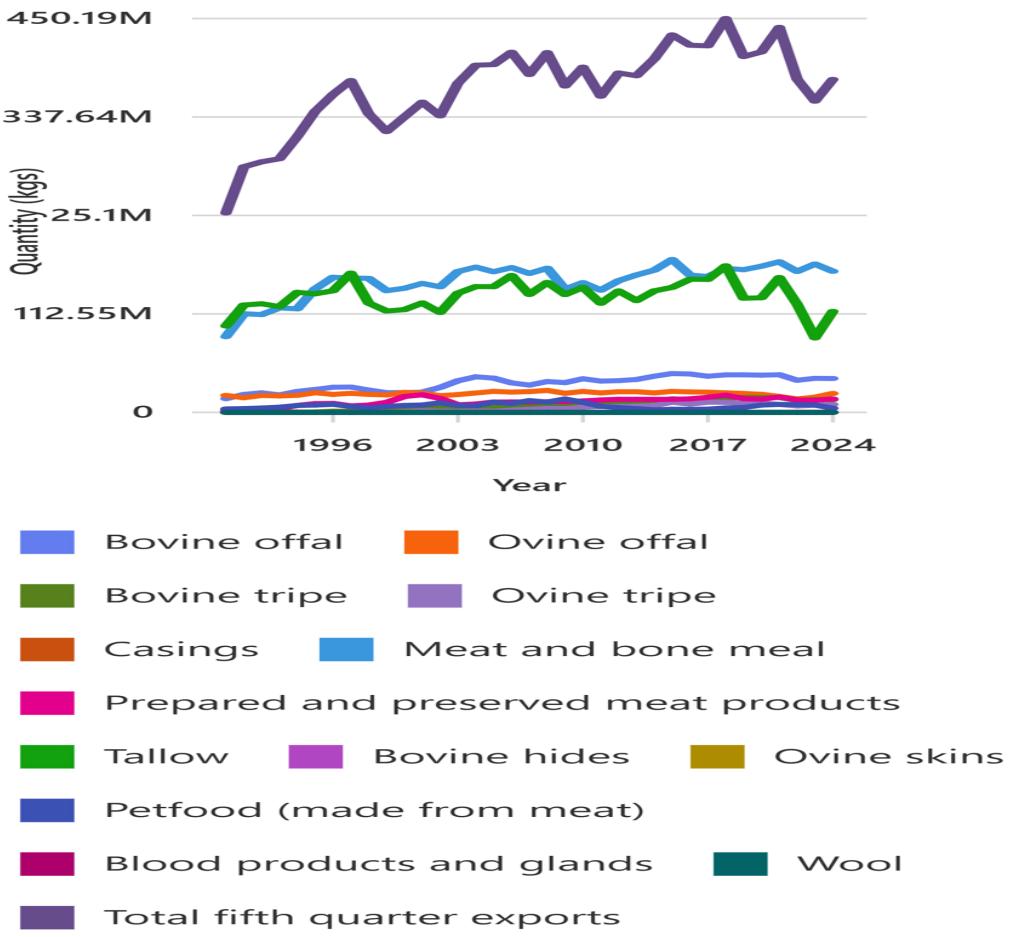


Figure 4., (J Ashby, personal correspondence, July 7, 2025).

New Zealand local market

Direct Comparison: co-products vs. red meat

Some co-products command higher per-kilogram prices than prime red meat, offering compelling opportunities for to extract more value for processors and farmers. Table 1 below provides direct price comparisons, using July 2025 Wilson Hellaby price data for the local New Zealand market:

Table 1., Processors pricing to butchers.

Product	Price per kg (NZD)	Comment
Beef Tongue	$18.20	More than double the carcass price, driven by export and specialty demand.
Beef Tails	$14.20	Popular in specialty cuisines, exceeds red meat value.
Beef Cheeks	$13.75	Favoured by chefs; highly valued cut.
Beef Tripe (avg.)	$11.40	Ethnic and export markets support higher prices.
Whole Beef Carcass (to butchers)	$10.55	Reference price for comparison.
Farmgate Carcass Price (to farmers)	$8.20	Margin covers processing, distribution, and overhead.
Beef Tendons	$7.10	Specialty export markets.
Beef Heart	$4.75	Lower than carcass price, but significant volume.

(Omak Butchery, personal communication July 10, 2025).

Key takeaway: Processors can capture greater value by maximising the sale of high value Co-products. For farmers, this can ultimately translate into higher livestock returns as processors seek to remain competitive.

Beef Co-products: Local market prices and estimated weights

The Auckland local market for beef co-products offers a range of saleable items, each playing a significant role in maximising the overall value extracted from an individual beef animal. The figures below provide a comprehensive overview of the key beef coproducts, including their typical weights, prevailing market prices for the purchasing consumer and corresponding values based on current $ rates.

- **Beef Cheeks**
  Typically weighing 600-800 grams, beef cheeks usually command an average price of $13.75 per kg. For instance, cheek at 0.7kg x $13.75 = $9.63
- **Beef Tails:**

Typically weighing between 2 and 3 kilograms, beef tails command an average price of $14.20 per kilogram. For instance, a 2.5 kg tail would be valued at $35.50.

- **Beef Tongue:**

Beef tongues, commonly divided into three muscles, usually weigh between 2 and 2.5 kilograms. At an average price of $18.20 per kg, a 2 kg tongue yields a value of $36.40.

- **Beef Hearts:**

The standard weight range for beef hearts is 1.5 to 2.5 kilograms. With a current market price of $4.75 per kilogram, a typical 2 kg heart is valued at $9.50.

- **Beef Kidneys:**

Beef kidneys generally weigh between 0.8 and 1.2 kilograms. At an average price of $4.75 per kilogram, a 1 kg kidney is valued at $4.75.

- **Beef Tripe (Green Tripe and Honeycomb):**

An adult cow typically produces about 7 kilograms of tripe. Priced at $11.40 per kilogram, this equates to a total value of $79.80, which is generally rounded to $80.00.

- **Beef Tendons:**

These typically weigh between 3 and 4 kilograms. At an average price of $7.10 per kg, a 3.5-kilogram portion has a value of $24.85.

The aggregate local market value of these selected saleable co-products from a single beef animal amount to $200.50. By acknowledging the economic significance of these items, processors and retailers can uncover new opportunities for value maximisation and supply chain optimisation, while also promoting greater transparency within the beef industry.

Missing are numerous other products like blood and tallow that would be exported for example. (Omak Butchery, personal communication July 10, 2025).

Sheep co-products: Local Auckland market prices and estimated weights

Saleable co-products from a single lamb in the Auckland market are valued at approximately $5.60.

Lamb Co-Products: Pricing and Weights

- *Lamb Heart*: The average weight ranges from 200 to 300 grams, depending on the animal's size and breed. A standard 250-gram heart, priced at $5.75 per kilogram, yields a value of $1.40 (0.25 kg × $5.75/kg).
- *Lamb Liver*: Typically weighing between 500 and 800 grams, a 650-gram liver at $4.75 per kilogram totals $3.00 (0.65 kg × $4.75/kg).
- *Sheep Kidney*: The average weight falls between 80 and 120 grams. A 100-gram kidney valued at $12.10 per kilogram is worth $1.20 (0.1 kg × $12.10/kg).

Valuation and Sale of Co-Products

The aggregate value of saleable co-products from one lamb in the local Auckland market is approximately $5.60. This assessment is based on average weights for each co-product and current market prices as of June 2024 (Omak Butchery, personal communication July 10, 2025).

Wilson Hellaby Price List – July 2025

Local North Island Butchers & Supermarkets: On July 14, 2025, New Zealand butchers and supermarkets paid $10.55 per kilogram for a whole beef carcass, while farmers received $8.20 per kilogram. This margin of $2.35 per kilogram covers processing and distribution costs, including fees, transport, overhead, investment, and delivery.

Wilson Hellaby Beef Animal Co-products – Prices and Weights

Twelve co-products from beef animals are sold to butchers, but farmers do not receive payment for these. Other items like hides and blood are excluded. These co-products generate significant revenue for butchers, highlighting a need for better supply chain transparency and recognition of their economic value in local markets (Omak Butchery, personal communication July 10, 2025).

Halal certification and its role in New Zealand's red meat co-products

New Zealand produces predominantly halal-certified meat that meets strict animal welfare standards, giving it a competitive advantage in global markets.

The Middle East is a major destination for New Zealand's halal meat exports, with Saudi Arabia and Jordan being the largest markets (New Zealand Meat Association, 2025).

New Zealand's halal certification combined with high animal welfare standards differentiates it from competitors like Australia and the UK (Kissun, 2024).

Free trade agreements with Gulf Cooperation Council countries are opening new opportunities for halal meat exports (Kissun, 2024).

There are ongoing animal welfare concerns in other countries' halal processing that New Zealand avoids. New Zealand has a significant competitive advantage in global meat markets because most meat processed and exported from New Zealand is halal certified while meeting New Zealand's strict animal welfare standards. This combination of halal certification with high welfare standards makes New Zealand's products unique in the international marketplace (Kissun, 2024).

Middle East Region

The Middle East represents a crucial market for New Zealand's halal meat exports: Saudi Arabia and Jordan account for the biggest proportions of exports to the Middle East region. (Kissun, 2024).

New Zealand's trade relationships are expanding halal meat market access: The Gulf Cooperation Council (GCC) free trade agreement is expected to enter force before the end of 2025, providing better market access. (Kissun, 2024).

The New Zealand-UAE Comprehensive Economic Partnership Agreement entered force on 28 August 2025, eliminating tariffs and is expected to increase Lamb exports value. (Beef and

Lamb New Zealand, 2025).

New Zealand, along with Australia and Uruguay, are global leaders in halal grass-fed meat production. In the United States market specifically, there's very little domestically produced halal grass-fed meat, creating significant opportunities for New Zealand exporters into the USA. (Kissun, 2024).

Animal Welfare Standards

New Zealand's approach contrasts favourably with other countries. For example, in the UK, only 75% of lambs receive halal processing, with 25% of plants not providing halal slaughter. This creates animal welfare concerns as some facilities don't stun animals prior to slaughter, whereas New Zealand maintains consistent welfare standards across its halal processing. (Nature Tech Collective, 2024).

Market Performance

The halal certification has proven commercially valuable, with one US restaurant chain noting that they capture a significant percentage of sales from Muslim customers following halal eating practices through New Zealand's halal-certified products. This demonstrates the market demand for properly certified halal meat that meets both religious requirements and animal welfare expectations. The combination of halal certification with New Zealand's reputation for high animal welfare standards positions the country well for continued growth in Muslim-majority markets globally. (Kissun, 2024).

Export trends of some co-product value in New Zealand's Meat Sector

Source of Data

(J Ashby, personal correspondence, July 7, 2025).

Export Volume and Value Trends (2002/03 to 2023/24)

- Export volumes and values reflect prices in New Zealand dollars.

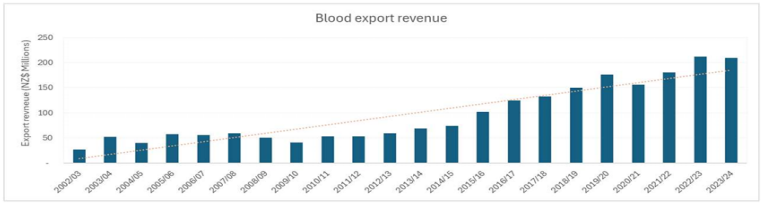
Blood Product Exports

Price per kilogram has remained stable over the past two decades.

- Export volume increased by 784%.
- Total revenue from blood products grew by 129%.

Stable pricing combined with surging volumes has made blood products a growth area showcasing the impact of global demand and improved collection/processing (Figure 5).

Blood



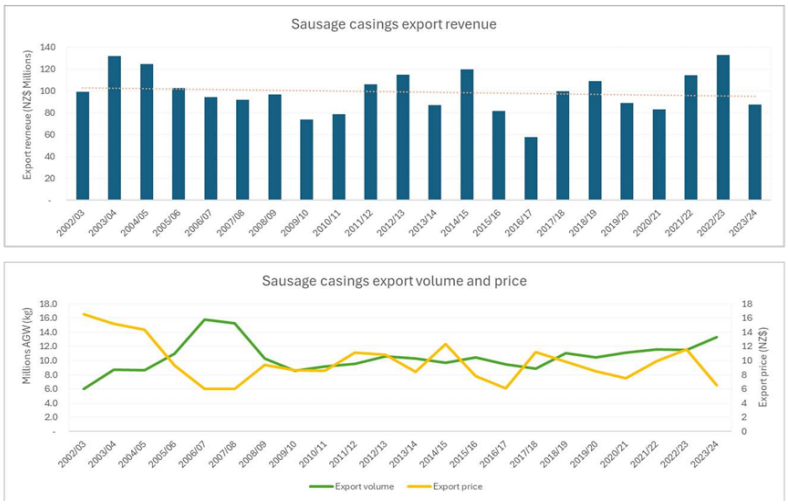
Financial year	Export revenue (NZ$)	Export Volume AGW (KG)	Price (NZ$/kg)
2002/03	27,080,049	398,367.79	67.98
2003/04	52,569,394	600,643.67	87.52
2004/05	40,279,504	576,709.73	69.84
2005/06	57,467,737	538,510.62	106.72
2006/07	56,067,228	787,729.62	71.18
2007/08	59,112,031	742,956.49	79.56
2008/09	50,707,198	663,439.15	76.43
2009/10	41,095,310	647,990.07	63.42
2010/11	52,695,856	909,857.22	57.92
2011/12	52,780,356	1,035,157.09	50.99
2012/13	58,806,710	1,266,117.43	46.45
2013/14	68,586,570	1,251,786.91	54.79
2014/15	74,077,652	1,065,942.14	69.50
2015/16	101,511,892	1,473,579.59	68.89
2016/17	124,768,418	1,867,904.94	66.80
2017/18	132,543,958	2,021,559.78	65.57
2018/19	149,436,199	2,428,262.97	61.54
2019/20	176,299,291	2,729,358.57	64.59
2020/21	155,605,878	2,925,043.03	53.20
2021/22	180,019,017	3,397,279.55	52.99
2022/23	211,772,433	2,441,444.65	86.74
2023/24	209,492,261	3,122,586.81	67.09

Figure 5., Volume and value of exported blood products from New Zealand from 2002 to 2024. Data sourced from J Ashby, personal correspondence, July 7, 2025.

Sausage Casing Exports

- Unit price fell from $16.52 in 2002 to $6.55 in 2024.
- Overall export revenue declined by 8% Sausage casings saw a significant decrease in price per kilogram, falling from $16.52 in 2003 to $6.55 in 2024. Despite this, export volume grew by 44%, though overall export revenue declined by 8% over the same period
- Despite higher volumes, falling prices resulted in lower revenues (Figure 6).

Sausage casings



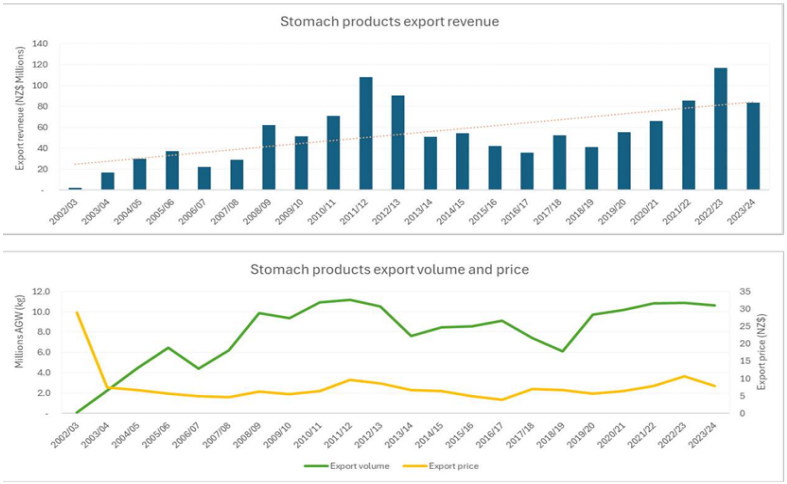
Financial year	Export revenue (NZ$)	Export Volume AGW (KG)	Price (NZ$/kg)
2002/03	98,927,998	5,989,658.37	16.52
2003/04	131,676,518	8,686,178.43	15.16
2004/05	124,670,945	8,668,811.01	14.38
2005/06	102,390,465	10,990,921.84	9.32
2006/07	94,403,151	15,788,110.03	5.98
2007/08	91,599,764	15,274,684.19	6.00
2008/09	96,597,131	10,297,299.58	9.38
2009/10	73,977,794	8,549,238.32	8.65
2010/11	78,844,455	9,174,163.06	8.59
2011/12	106,057,011	9,545,400.26	11.11
2012/13	114,852,657	10,587,900.42	10.85
2013/14	86,939,095	10,310,336.54	8.43
2014/15	119,565,425	9,713,071.42	12.31
2015/16	81,646,366	10,460,338.73	7.81
2016/17	57,621,843	9,460,802.15	6.09
2017/18	99,690,624	8,885,819.51	11.22
2018/19	108,943,752	11,083,828.10	9.83
2019/20	88,800,540	10,431,665.68	8.51
2020/21	83,225,056	11,118,173.77	7.49
2021/22	114,476,276	11,557,765.55	9.90
2022/23	133,024,200	11,479,218.12	11.59
2023/24	87,355,094	13,340,344.82	6.55

Figure 6., Volume and value of exported sausage casings from New Zealand from 2002 to 2024. Data sourced from J Ashby, personal correspondence, July 7, 2025.

Stomach Product Exports

Export volume increased by 6.2%. From 2002 to 2024, the value per kilogram for stomach products dropped from $28.93 to $7.83. Export volume increased moderately by 6.2% over these 21 years. Price declines have outpaced volume growth, so innovation and new uses are needed to sustain value (Figure 7)

Stomach products



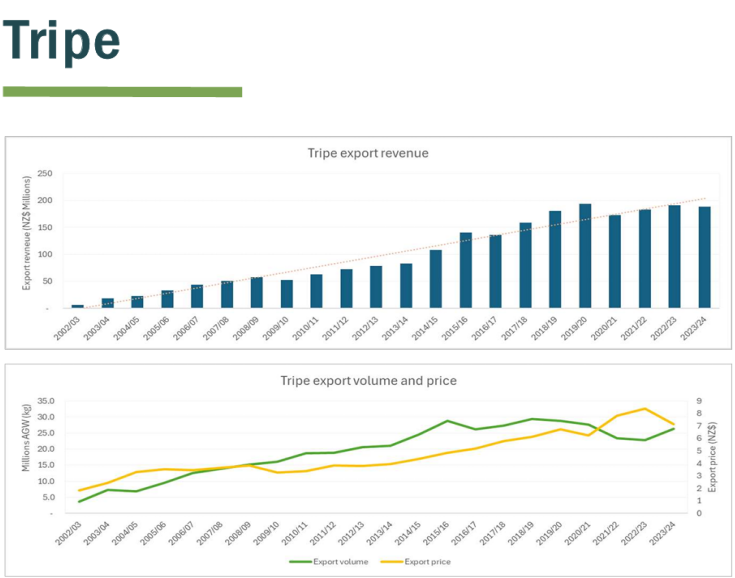
Financial year	Export revenue (NZ$)	Export Volume AGW (KG)	Price (NZ$/kg)
2002/03	1,914,418	66,179.85	28.93
2003/04	16,726,565	2,268,751.85	7.37
2004/05	29,940,720	4,442,639.58	6.74
2005/06	37,203,957	6,484,885.93	5.74
2006/07	21,794,189	4,423,839.95	4.93
2007/08	29,024,497	6,201,518.66	4.68
2008/09	62,020,417	9,895,394.65	6.27
2009/10	51,365,726	9,393,703.36	5.47
2010/11	70,835,207	10,946,115.63	6.47
2011/12	107,859,852	11,157,180.53	9.67
2012/13	90,372,012	10,505,007.10	8.60
2013/14	50,808,629	7,605,648.56	6.68
2014/15	54,210,930	8,450,898.97	6.41
2015/16	42,258,423	8,567,121.05	4.93
2016/17	35,712,612	9,112,783.81	3.92
2017/18	52,302,625	7,404,232.40	7.06
2018/19	40,959,238	6,110,310.40	6.70
2019/20	55,415,260	9,731,013.32	5.69
2020/21	66,036,627	10,199,730.65	6.47
2021/22	85,544,162	10,844,188.64	7.89
2022/23	116,685,047	10,900,101.03	10.70
2023/24	83,321,498	10,634,756.54	7.83

Figure 7., Volume and value of exported stomach products from New Zealand from 2002 to 2024. Data sourced from J Ashby, personal correspondence, July 7, 2025.

Tripe export value and volume

- Value per kg rose from $1.83 (2002) to $7.15 (2024)—a 200% increase.
- Export volume jumped from 3.6 million kg to 26.4 million kg, up 136%. Export Value Growth: From 2003 to 2024, the value of tripe exports rose from $1.83 per kilogram to $7.15, representing a 200% increase
- Export Volume Growth: Export volume expanded from 3,607,962 kilograms to 26,380,262 kilograms, a 136% increase.
  Both value and volume have soared for tripe, reflecting effective market development and broadening demand (Figure 8).

Tripe is the edible lining from the stomach of various farm animals, most commonly cattle. It is considered a type of offal and is used in a variety of cuisines around the world due to its unique texture and ability to absorb flavours from other ingredients. In the context of exports, tripe refers specifically to these processed stomach linings that are cleaned and prepared for culinary use or further processing.



Financial year	Export revenue (NZ$)	Export Volume AGW (KG)	Price (NZ$/kg)
2002/03	6,612,769	3,607,962.35	1.83
2003/04	17,948,356	7,328,964.04	2.45
2004/05	22,732,206	6,843,773.07	3.32
2005/06	33,517,487	9,482,017.14	3.53
2006/07	43,575,009	12,622,312.01	3.45
2007/08	50,557,782	13,939,994.57	3.63
2008/09	57,947,269	15,162,942.69	3.82
2009/10	52,504,903	16,098,088.60	3.26
2010/11	63,098,093	18,732,271.05	3.37
2011/12	72,071,849	18,863,928.85	3.82
2012/13	78,271,568	20,564,490.22	3.81
2013/14	82,525,870	20,989,595.13	3.93
2014/15	107,724,974	24,639,779.08	4.37
2015/16	140,144,017	28,866,278.97	4.85
2016/17	135,834,684	26,165,895.62	5.19
2017/18	158,375,150	27,401,408.55	5.78
2018/19	180,164,716	29,358,440.39	6.14
2019/20	193,964,465	28,839,753.39	6.73
2020/21	172,623,142	27,644,029.47	6.24
2021/22	182,886,748	23,394,464.84	7.82
2022/23	191,293,897	22,765,621.55	8.40
2023/24	188,721,387	26,380,262.26	7.15

Figure 8., Volume and value of tripe products from New Zealand from 2002 to 2024. Data sourced from J Ashby, personal correspondence, July 7, 2025

Global drivers of growth

Several factors contribute to the increasing global demand for edible offal.

Population Growth and Urbanisation

The world's population has exceeded 8 billion, with most individuals now residing in urban areas. As urban populations grow and incomes change, the demand for meat and animal proteins has increased. Due to rising prices of premium cuts, some consumers are choosing offal as an alternative source of nutrition (Food and Agriculture Organisation of United Nations, 2018).

Sustainability and Zero-Waste Movements

Growing environmental concerns and efforts to promote sustainability have led to a focus on utilising all parts of animals. Offal aligns with initiatives to reduce food waste and is being considered by both budget-focused consumers and those interested in sustainable consumption nutrition (Food and Agriculture Organisation of United Nations, 2018).

Culinary Innovation and Celebrity Endorsements

Influential chefs and media figures have contributed to renewed attention toward offal. Some restaurants are introducing offal into their menus, and cooking programs and blogs are exposing more people to different preparation methods and recipes. These trends have sparked interest across diverse demographic groups, as noted by the Food and Agriculture Organisation of the United Nations (2018), which highlights the role of culinary innovation and the influence of prominent personalities in increasing the popularity of offal-based dishes. This renewed interest is also supported by The Good Food Institute, (2019) who discusses how globalisation and cultural exchange, often initiated by celebrity chefs and media exposure, have made offal more accessible and accepted in new markets. (The Good Food Institute, 2019).

Globalisation of Cuisine

Increased movement of people and cultural exchange have introduced offal-based dishes to new regions. Foods such as tripe soup, chicken hearts, and blood sausages are now available in markets beyond their original contexts (The Good Food Institute, 2019).

Nutritional Value and Health Trends

With growing focus on nutrient-rich foods, organ meats are being acknowledged for their concentrations of protein, vitamins (such as A, B12, and folate), iron, and trace minerals.

Nutritionists and some health-conscious consumers are exploring offal as part of dietary choices (United States Department of Agriculture, 2019).

New Zealand export opportunities: Trends, Innovation, and Challenges

Growth of the Pet Food Industry in New Zealand Over the Last 35 Years

Over the past 35 years, New Zealand's pet food industry has evolved from a small, domestically focused sector into a dynamic, export-oriented market. Shifts in domestic pet ownership and global consumer trends have helped drive this transformation (Food and Agriculture Organisation of the United Nations, 2018).

In 1990, New Zealand exported approximately 3.9 million kilograms of pet food valued at $3.96 million. By 2024, exports had increased to 4.7 million kilograms, with a combined value of $59.5 million. This represents a growth of approximately 60% in value over 35 years, highlighting the sector's rapid expansion and growing significance within New Zealand's agri-food exports (New Zealand Meat Industry Association, 2023).

Innovation Beyond Pet Food: Turning Sheepskin into Collagen

Beyond pet food, New Zealand companies are also innovating with animal by-products. For example, a Christchurch-based company, Tertiary Extracts Otautahi (TEO), is transforming local sheepskin once considered an abundant waste product into a premium collagen supplement called Ovitage. This product is formulated to address women's health needs at different life stages and is marketed for its digestibility and nutritional profile, particularly its high cystine, tyrosine, and glutamic acid content, which support metabolism, skin, hair, and brain function (Kissin, 2025).

Regional Markets for Edible Offal

The global trade in edible offal is robust, with New Zealand and other major producers supplying diverse international markets:

Asia-Pacific

Asia is both the largest producer and consumer of edible offal. In China, offal is a valued ingredient in traditional dishes and street foods, with rising incomes fuelling demand (Food and Agriculture Organization of the United Nations, 2018). Similarly, countries like Vietnam,

Thailand, Korea, and the Philippines feature offal prominently in their cuisines. New Zealand, Australia, and the United States are among the leading exporters, consistently shipping significant volumes of offal to Asian markets. (Food and Agriculture Organisation of United Nations, 2018).

Europe

The European market presents a mixed picture. While offal remains a staple in Eastern and Southern Europe featured in dishes from tripe stews to blood sausages consumption in Northern and Western Europe declined in the late 20th century due to changing tastes and food safety concerns. Recently, however, the trend is reversing, with chefs and consumers rediscovering offal's culinary value (Food and Agriculture Organization of the United Nations, 2018).

Africa and the Middle East

In many African countries, offal is a critical source of nutrition and income. Urban street vendors in cities like Lagos and Nairobi sell grilled offal, while traditional recipes incorporate a wide range of organ meats (Food and Agriculture Organization of the United Nations, 2018).

North and South America

In Latin America, offal is central to many beloved dishes, including Argentine chinchulines (grilled intestines) and Brazilian feijoada (bean and offal stew). In North America, overall offal consumption remains comparatively low but is growing in immigrant communities and among advocates of the farm-to-table movement. The expanding pet food sector and export markets have also increased utilisation of offal in processing (United States Department of Agriculture, 2019).

Globally, countries like the United States, Australia, New Zealand, Brazil, and the European Union are major exporters of edible offal, supplying regions with insufficient local production (Food and Agriculture Organization of the United Nations, 2018). For context, New Zealand's offal export receipts were $2.16 billion in 1990 and had grown modestly to $2.35 billion by 2024 a compound annual growth rate of just 0.26% per year. This is notably below the average domestic inflation rate of 4.39% per year over the same period, indicating real-term stagnation in export revenue despite steady demand.

Linking Economic and Social Benefits

The growing trade in edible offal not only minimizes waste but also offers multiple benefits for New Zealand:

- By utilising more parts of each animal, producers and exporters can boost profitability (Food and Agriculture Organization of the United Nations, 2018).
- Offal provides an affordable, nutritious food source, especially in the context of rising meat prices (Beef and Lamb New Zealand, 2025).
  Job creation: Offal processing and distribution generate employment throughout the food chain (Beef and Lamb New Zealand, 2025).

Challenges and how New Zealand exporters respond

Despite the opportunities, the edible offal market faces several challenges. These include persistent negative perceptions, cultural taboos, food safety regulations, particularly stringent for Halal and Kosher markets, logistical hurdles related to perishability and cold chain requirements. (Beef and Lamb New Zealand, 2025).

To address these issues, New Zealand exporters have implemented several strategic responses:

- Food safety and certifications: To meet the strict standards of Halal and Kosher markets, exporters have invested in comprehensive certification programs and built specialized processing facilities. These measures ensure compliance and maintain access to lucrative international markets (Beef and Lamb New Zealand, 2025).
- Consumer education: Industry led campaigns aim to shift public perceptions by highlighting offal's nutritional benefits, culinary versatility and role in reducing food waste. Cooking demonstrations, recipe development and chef endorsements are increasingly used to reach broader audiences. (Beef and Lamb New Zealand, 2025).
- Logistics and innovation: Advances in cold chain technology and packaging have reduced spoilage and improved export logistics, making it easier to reach distant markets while maintaining product quality (Beef and Lamb New Zealand, 2025).

By addressing these challenges proactively, New Zealand's exporters are well-positioned to capture new opportunities in the evolving global market for animal co-products and offal.

Interviews: Sector leaders

In researching this project, I interviewed numerous owners and senior leaders in the meat processing industry.

Auckland processor

Geoff:

"The question concerns the value of the fifth quarter and the reasons why farmers may not receive payment for it"

Auckland Processor:

Around 20% of the meat industry involves co-products, often referred to as the "fifth quarter." There are noticeable trends in the sector, with increasing value being added through the use of these co-products. Industries such as pharmaceuticals and nutrition, particularly in markets with aging populations, are seeing growing demand for products like collagen derived from these sources. Opportunities exist in areas such as developing sustainable sourcing methods and enhancing co-products with additional components. There is potential for further growth in this area within New Zealand.

A key consideration is ensuring a direct connection between supply and financial return, particularly so that value is appropriately reflected in product development. Improved transparency around animal co-products could help realise untapped value; currently, some processes and payments do not consistently match their possible value, as seen in cases where animal skins may be worth more than the meat.

The sector has evolved over time and offers significant potential. Allocation and distribution of value among stakeholders, including farmers, continue to be an important factor in determining overall profitability. Effective management of the fifth quarter can contribute to business outcomes, as illustrated by joint ventures such as an Auckland Processor and a Waikato processing company working together to develop and plant for processing the co-products.
Rendering has historically played a vital role in animal processing, as disposing of co-products through landfills is neither practical nor environmentally responsible. Traditional facilities, such as the former RW site, consolidated processes like skin removal and rendering on location. This integration often resulted in strong odours due to the range of activities conducted simultaneously. To mitigate environmental impacts, sites like Hellaby later decentralised their rendering operations, which enabled collaboration with external partners capable of scaling up rendering processes.

When considering export to China, compliance with Chinese regulatory requirements is essential. Factors like water usage, product presentation, and quality are critical, as discerning buyers will reject substandard products. Additionally, adopting the Halal method of processing not only enhances market appeal particularly in Muslim majority markets but also underpins pricing. Diversifying market options and reducing reliance on any single export destination, such as China, provides stability against market disruptions and ensures consistent demand for fifth-quarter products.

The fifth-quarter market, which differs significantly from the primary meat market, operates under distinct cycles and pricing dynamics. Shortages can drive prices up, encouraging recovery efforts in regions including Australia, South America, and New Zealand. Conversely, when values decline, certain products may become uneconomical to recover. The process of managing, packaging, and exporting these co-products is complex, involving greater cleaning, specialized packaging, and typically freezing, resulting in higher handling costs compared to traditional red meat carcasses.

Understanding total co-product value per animal is crucial; estimates suggest that up to

$220 – $250 per beast can be recovered per animal, reflecting significant effort in collection and processing. In evolving business models, such as that employed by Wilson Helaby, outsourcing hides and pelts to specialist processors initially proved beneficial. Strategic partnerships, like those with Greenlea and Tony Egan, further increased value addition. Recognition of rendering's importance by local authorities led to the construction of a dedicated plant in the 1990s, which processed both abattoir waste and butcher shop by-products, supporting industries such as pastry production during peaks in beef fat demand.

Odour management became a key focus, leading to the installation of high-temperature gas burners and the use of heat exchangers to repurpose energy for cleaning and sterilisation. Comprehensive by-product management is thus essential for industry sustainability. Disruptions to rendering operations, such as facility fires, can quickly affect the entire sector due to the lack of alternative waste disposal solutions.

Co-products including hides, pelts, offal, and blood remain major contributors to the overall economic value of the animal processing industry. High quality bovine hides may command $30 – $45 NZD each, though net returns vary after costs are deducted. Exported co-products account for approximately 20% of total animal value, with recent schedules indicating prices of around $8.40 (July 25) per beast for standard weights. Fluctuations in global demand and quality, however, affect pricing, and premium New Zealand products tend to fetch higher returns internationally.

Limited transparency regarding co-product values poses challenges for producers seeking profitability. Low-grade skins can even have negative value, necessitating payment for disposal rather than generating income. The export market, particularly China, is vital for offal and other co-products less preferred in domestic markets, with steady demand for items like tripe and tongues helping to support overall returns.

Innovation Manager, Meat Industry Association.

His primary responsibility involves managing MIA's research portfolio, particularly collaborative research initiatives aimed at supporting the meat industry in New Zealand. He also plays a critical role in biosecurity efforts, which are crucial for protecting New Zealand's agricultural industry from pests and diseases.

In addition to his scientific and innovation duties, it involved various operational and strategic management roles within the food manufacturing sector. His expertise spans commercial management, stakeholder engagement, and industry related research development.

Geoff:

"The "fifth quarter" by-products like wool, skins, and other non-meat items once contributed significant value to New Zealand's processing companies. However, we've lost much of that value over the years, with returns dropping from wool and pellets to around $1.2 billion in 1985 to only $300 million today".

Innovation Manager, Meat Industry Association:

A primary reason for this decline is our heavy focus on meat itself, neglecting opportunities in co-products. Companies often treat valuable materials such as woollen skins as waste instead of exploring R&D and alternative uses. While these products have great potential, we're not fully capitalising on them or bringing enough value back to New Zealand farmers. Multinationals frequently benefit more because they process and brand these materials, keeping most of the profit.

The industry needs to innovate and create value-added products locally, rather than just exporting raw materials. Success stories are rare, but one example is that New Zealand meat manufacturing generates almost no waste. Still, we need to improve how we communicate the industry's benefits, especially in terms of sustainability and contributions to the economy. Better branding, understanding consumer needs, and focusing on value creation could help recapture lost ground and ensure more profits return to New Zealand producers.

Waikato Processor

Geoff:

I'm researching and examining the significance of the "fifth quarter" and its effects on carcass pricing.

Waikato Processor:

Processing plants has enabled thousands of product specifications, including items such as tallow or meal products, all part of maximising value extraction from each carcass. Over the years, developments like the rise of new export markets (for example, China and Malaysia) and changes in consumer demand have influenced the way products are categorized and valued, with certain cuts now being recognised separately due to market preferences.

A significant portion of payment to farmers may be tied to specific requirements such as Halal certification, depending on market destinations. However, there remains a lack of transparency regarding how processing innovations affect carcass prices and co-product revenue. As the industry evolves, co-products have become mainstream, and some items traditionally not consumed locally such as short ribs, beef cheek, or tongue now find value in global markets like Japan.

Processing techniques involve deconstructing the carcass into numerous individual parts, often between 150 and 300, each finding its own niche market and contributing to overall profitability. This approach requires ongoing analysis and investment to optimise returns, though not every attempt at product innovation yields viable results. Greater clarity and data on co-product revenue and processing methods would help improve understanding of how these factors support operations and influence farmer payments.

Concerning our operations, we prioritise ethical practices, such as adhering to Halal standards. Our profit primarily covers farmer payments and operating costs; any potential surplus is reinvested into the business. For example, with Wallace's, which we fully own, there is a unique opportunity to share future benefits with farmers. In past ventures, we have taken a collaborative approach, such as forming a 50-50 joint venture for Hellaby processing, which allowed us to upgrade facilities while sharing profits equally. This was formalised through a shareholders' agreement, ensuring that profit benchmarks were reasonable and sustainable rather than excessively opportunistic.

Our business structure ensures that after reaching our target price points, additional value is directed back to the supply company, thereby benefiting primary producers. Some parties have chosen not to invest directly, opting instead for returns structured as dividends or service costs. This model deters unsustainable marginal pricing and upholds our philosophy

that these processes should not serve solely as profit centres but rather as extensions of the broader supply chain, supporting ongoing investment and farmer participation.

Historically, "fifth quarter" co-products were referenced on payment schedules, and quality was monitored by inspectors, such as those who evaluated carcass trimming. Nowadays, some companies engage in over-trimming or wasteful practices; however, our approach resists such trends to maintain fair industry standards. Only a limited number of firms, in my opinion, consistently uphold these principles.

Geoff:

"According to export revenue data from MPI, approximately 20% of the export income come from the 5th quarter is attributable meat industry. Considering global trends, there are emerging opportunities to add more value, particularly from the fifth quarter. With an aging population and growing interest in wellness and healthier aging, there is increasing demand in sectors such as pharmaceuticals. This presents potential for New Zealand producers to develop co-products like collagen"

Waikato Processor:

Reports indicate that this is a well-established industry, and New Zealand has the capacity to contribute further, especially as consumers seek sustainable sources. Multiple opportunities exist for diversification within the sector. The country could benefit by optimising connections across the supply chain and improving transparency regarding how value is distributed. Currently, certain co-products, such as skins, may generate higher returns than the primary meat products, but value distribution remains inconsistent.

The industry has evolved significantly over the past forty years, and it will be important to monitor which companies choose to participate in sharing returns to the farming community. From a producer's perspective, maximizing returns is essential for profitability across the sector. Industry responses vary; for example, interviews with representatives from Greenlea highlight a company culture focused on utilising all parts of the animal and managing waste effectively. There are also collaborative projects, such as the Wilson Halleby joint venture. Further insights may be gained by consulting additional industry participants, including Alliance and Silver fern Farms.

Silver Fern Farms, Value stream specialist

Geoff:

"Traditionally, carcasses account for approximately 85-90% of income for the meat companies. The remainder of revenue is generated from co-products. According to recent data from Statistics New Zealand, about 20% of export income comes from these co-products.

There is an ongoing interest in understanding the various income streams generated by co-products and their financial impact on New Zealand. For example, pet food, which is derived from co-products and is exported overseas, represents one such revenue stream.

"During a government-sponsored visit to Thailand as Chair of the Northland Regional Council, I observed that Thailand imports $740 million worth of products from New Zealand, including pet food. This highlighted the importance of gaining a clear understanding of these markets"

Silver Fern Farms:

Discussion around schedule pricing is sensitive, as it is based on the revenue companies gain from selling products in the market. Only a small percentage of total revenue is represented by headline prices, making it necessary to consider all contributing factors when analysing price structures. The industry does not always provide detailed segmentation of revenues and specific aspects of pricing can be complex and nuanced.

Currently, livestock pricing is around $300 per animal for the co-products in some contexts, discussions regarding detailed pricing strategies or segregation within the industry are approached cautiously to avoid market disruptions. In addition, animal welfare is increasingly becoming a significant concern for global customers, influencing industry practices and transactions.

When market schedules are lower, such as $5.50, earning an additional $300 per animal can be meaningful for farmers. However, this aspect is not widely discussed or promoted within the local farming community, nor is it a common topic at sale yards. Decisions about purchasing heifers for purposes other than breeding are made with consideration for international market expectations and industry standards.

Companies in the sector tend to independently set prices based on market conditions. Having a range of products and trading options is considered beneficial for the industry. The sector also includes processing and trading of derivatives, such as pharmaceuticals produced from blood and related co-products, which add value and complexity to the supply chain. Processing companies aim to optimise outcomes through efficient processing and product development.

About two-thirds of company-generated value returns to farms, though this figure varies. Despite strong investment profits, processing is costly due to expensive equipment and operational demands, resulting in limited profit margins for farmers. New Zealand processors face competition over a small supply of animals, driving innovation and efforts to increase per-kilo returns. Over 34 years, the value of the "fifth quarter" has risen by $200 million (0.26%), while inflation was 4.6%. Although scientific advancements have enabled collagen production, commercial uptake was limited until recently. The main role now is to promote fifth quarter products and develop new income streams, with offal showing the most growth.

The current annual processing capacity is approximately 280,000 metric tons. Government regulations regarding resource consent and associated payments are significantly influencing opportunity costs, prompting accountants to explore alternatives beyond strictly economic activities. This dynamic is largely driven by regulatory frameworks that impact disposal costs, shaping decision-making processes within the industry.

Geoff:

“Do you think Silver Fern Farms would look at buying into a company or a pharmaceutical company as supply chain partner to unlock more value “

Silver Fern Farms:
Major resources processed include products such as bones, skins, and wool, which collectively account for about 30% of outputs. Efficient utilisation and management of these resources are essential. Product streams are evaluated based on their internal value and rendering potential; not all resources find a market directly, requiring strategic allocation and processing decisions.

When considering development or investment, it is vital to assess both the construction costs of new facilities and the cost-to-benefit ratio, ensuring resources are directed toward the sectors with the highest profit margins. Value can be added through customised solutions and enhanced service attributes, especially in high-growth sectors such as medicine, nutraceuticals, personal care and food ingredients.

The government’s policies currently create pressures within the sector, especially for traditional products like red meat and leather. These industries are challenged by shifting consumer preferences, such as declining leather usage due to changing fashion trends. As a result, some segments operate at a loss, highlighting the need for industry adaptation and diversification.

A more sustainable approach involves moving away from bulk commodity sales towards adding value through certification and branding, demonstrating that New Zealand's farms maintain world-class practices. Achieving European certification standards, for example, requires significant long-term investment but can distinguish New Zealand products globally.

Efforts are also underway to diversify product portfolios, such as exploring carbon-neutral leather tanning processes and developing pharmaceutical and food ingredients from by-products. Maintaining a diversified portfolio mitigates risks related to market fluctuations and environmental challenges.

Ultimately, success in this sector depends on controlling the value chain and maintaining flexibility. By continuously reinvesting contribution margins into supply chain improvements, companies like Silver Farms aim to enhance profitability and resilience within the industry.

The future of the 5th quarter products will rely on investment and capital from outside the industry to unlock potential as capital is put back into keeping livestock flowing through processing plants.

New Zealand meat industry is evolving through value creation, diversification, and strategic adaptation. Companies are optimising resources by developing new products and markets particularly from co-products and by-products while responding to regulatory pressures, changing consumer trends, and global standards. The industry's future relies on investment, innovation, and collaboration to unlock further opportunities and maintain resilience amid constant market shifts.

Image from Silver Fern Farms out lining gross margin and percentage of the 5th quarter

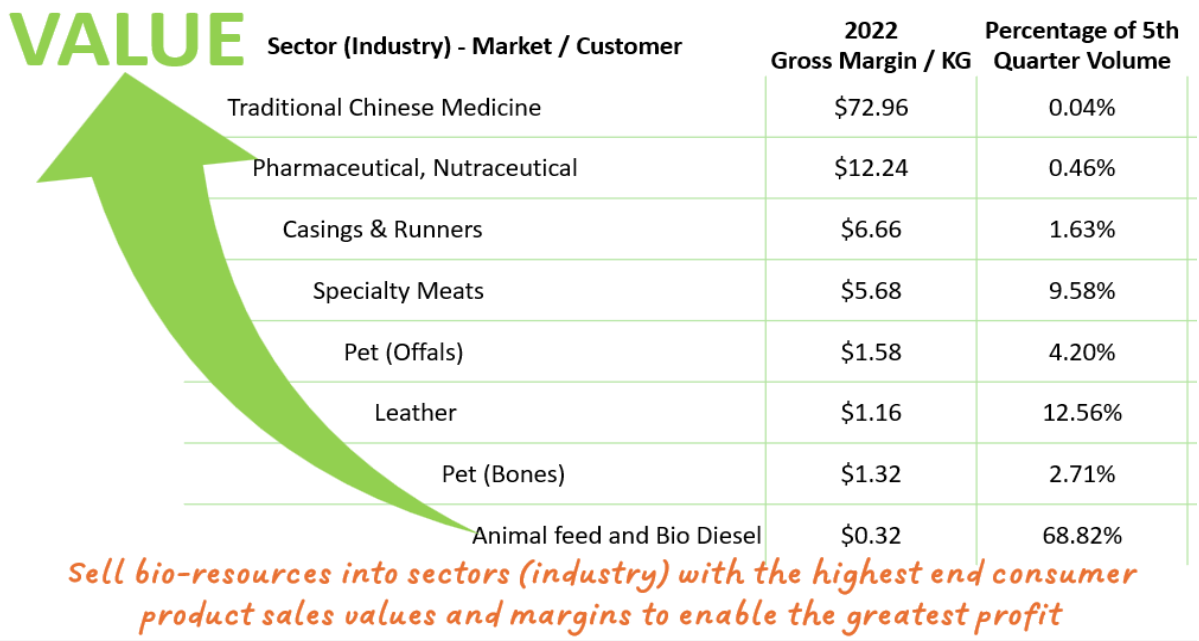


Figure 9., Image from Silver Fern Farms promotion on the Fifth Quarter conference, 2023.

Interview with Investment specialist at Forsyth Barr and Value stream specialist, Silver Fern Farms

Looking at unlocking capital options to grow the wealth of the 5th Quarter

Silver fern Farms:

44% of an animal is co-product, the rest is saleable red meat. I aim to return value to farmers by sharing the value stream fairly. Processing coproducts needs additional resources, but red meat companies focus on rapid primary processing and paying for animals within 14 days.

Forsyth Barr:

I'll briefly outline the types of capital, along with the relevant knowledge, skills, or access each provides, depending on your needs.

Silver Fern Farms:

Silver Fern has partnered with Tertiary Extracts Otautahi (TEO) to form a new value stream that uses skin to make collagen and wool to keratin. Achieving large scale sales requires time and

adequate capital to unlock the product, and both companies currently face challenges due to limited capital.

Forsyth Barr:

That is a relevant example because of the cash flow considerations. As asset managers in New Zealand, there are two main sources available for this type of situation. The first is private credit and the second is equity investment. Equity investors fall into two groups, equity partners for less risky more developed value stream and venture capitalists for more high risk top of the line commercialisation value streams.

Private Credit

Where lenders offer facilities and charge interest to fill financing gaps that banks in New Zealand, being rather restrictive currently, may not cover such as acquisitions, cash flow needs, or situations outside standard banking criteria. Additionally, New Zealand has a relatively large private equity industry compared to its global position. These investors may take an equity stake to become partners, contributing both capital and expertise, and potentially providing support with distribution or governance management. Private equity involvement depends on factors such as the timeline required, for example, if it takes four years to build a factory.

Equity Partners

Equity investments in late-stage New Zealand businesses function as strategic partnerships. Investors assess your business objectives, may assist with your business plan, and often appoint representatives to serve on your advisory board or oversee operations. The negotiation process determines the equity you relinquish; specialised banking advisors can provide guidance on these matters. Additional partners (Cameron Partners is one that specialises in this area) may help you build out your business operations for a fee, offering valuable expertise and long-term capital necessary for growth and risk management.

Selecting the right investor depends on your specific needs, such as the scale and experience required. Partners bring more than capital they offer assistance in facility design, product development, and distribution. In New Zealand, there is limited precedent for certain investment models, but investors are attracted to ventures with clear revenue projections and scalable products. Typically, they seek a three-to-four-year development period before potentially divesting their interests back to you.

Venture Capitalists

Riskier ventures, such as those involving scientific breakthroughs, may attract venture capitalists willing to undertake greater risks. These investors often collaborate, pooling funds and resources. Firms like Pacific Channel frequently invest in university spin-offs and require a substantial timeline usually three to five years to realise returns.

When seeking investment, it is crucial to identify suitable partners and understand the costs involved, which may range from $10,000 to $15,000 to prepare an investment package. You should approach multiple firms to ensure alignment with your business goals. Experienced partners can provide market insights, support deal structuring, and offer reputational reassurance. Managing reputational risk and securing reputable partners are essential for successful capital raising. Venture capital firms such as New Zealand Pacific are recognised for their commitment to supporting innovative projects. Thoughtful partnership selection, detailed contracts including buyback provisions and strong advisory support are critical elements for safeguarding shareholder interests and ensuring sustainable business growth. Thank you for considering these perspectives.

Expert Perspectives and Industry Innovation

General Manager, Beef and Lamb - Insights and Strategic Planning

Quote 2023: "Maximising the value derived from co-products such as tallow, hides, blood, offal, and bones, already in demand across industries like pet food, pharmaceuticals, cosmetics, biofuels and renewable energy requires investment. Forming strategic partnerships with global firms like Darling Ingredients and Nestlé Purina can unlock new product development opportunities and market access. Expanding R&D into emerging uses such as bioplastics or nutraceuticals will future proof the sector against global shifts."

- In 2023, a New Zealand processor partnered with Darling Ingredients to supply collagen-rich bovine hides for the booming health supplement market, boosting coproduct value by 30% over two years.
- Wilson Hellaby's adoption of advanced sorting and traceability for blood products enabled access to EU pharmaceutical markets, leading to contract growth worth over $5 million annually.

Maximising whole carcass value is vital for New Zealand's red meat sector. As demonstrated by co-products sometimes exceeding the price of prime red meat, strategic processing and smart marketing can strengthen processor margins and, eventually, farmgate returns. This relationship supports the resilience and competitiveness of the entire industry.

In Summary:

- Processors benefit from maximising co-product value to cover fixed costs and boost profitability.
- Farmers ultimately gain as higher co-product revenues enable more competitive weekly livestock schedule prices.

- The industry's future lies in innovation, quality assurance, and global and local strategic partnerships.

Bio Resource specialist, Alliance

Geoff:

"Your thoughts on the 5th Quarter of the meat industry and opportunities with product development"

Bio Resource specialist, Alliance

The research community supporting the Buyer Resource Processing Alliance (BPA) is widely regarded as the premier team in New Zealand. Depending on the project, experts may be drawn from institutions such as the Auckland Medical School or other relevant organisations to ensure each funded initiative is matched with the most qualified researchers. However, there appears to be a shortfall in direct applications from meat companies seeking to advance their own projects. This could stem from limited industry awareness of the BPA, concerns around privacy, or apprehension about competition.

A more significant issue is that companies are often hesitant to collaborate on processing similar products, despite the real competition being from international markets rather than domestic rivals. Collaborative models where companies join forces to address common goals can be highly effective. It is also crucial for the industry to invest in fundamental scientific research. Major industries consistently fund foundational science, which may not yield immediate results but builds a long-term reservoir of ideas, expertise, and innovation potential. Increased investment in basic research would facilitate the discovery of new co-products and support a robust innovation pipeline.

<u>Collaboration and Investment</u>

To summarise, the sector would benefit from establishing a dedicated "discovery engine" for research and innovation, ideally co-funded by meat companies and government sources to explore longer-term opportunities beyond immediate commercial gains. Such engines are hallmarks of thriving industries and can exist in various collaborative forms. While collaboration traditionally occurs along the value chain, cross-value chain cooperation can be productive, particularly on non-competitive matters like food safety and automation areas where joint funding is necessary due to high development costs.

One major concern is the declining number of industry-led research initiatives. Looking ahead, it is likely that the meat and dairy sectors will need to evolve into broader protein industries, encompassing novel products such as fermented proteins and hybrids combining plant and animal ingredients. Such transformation requires a cultural shift, which can be

challenging given natural resistance to change. Encouraging an influx of innovative ideas will help position these industries to adapt and thrive. Market trends, such as the rise of convenient meal solutions, underscore the importance of flexibility and competitive advantage. Leveraging scientific intellectual property in product development provides sustainable long-term value and strengthens market positioning.

ANZCO processor

Quote from ANZCO executive: The fifth quarter is worth about 10% to the revenue stream for both beef and lamb weekly schedule.

Our company has explored various ways to add value, including evaluating startups as part of our business strategy. For example, we participated in a significant project with PGP partnerships around 2010, aiming to apply products from different streams to new uses some succeeded, many did not. We've built a team dedicated to developing new ideas, regularly monitor industry trends, and seek opportunities for commercialising innovative extractions. We strive to be proactive but ensure ventures are commercially viable and self-sustaining. Amalgamations are helping achieve scale in the fifth quarter, with several outside players consolidating products. We're collaborating on healthcare products to overcome material shortages. In the past six months, we've discussed opportunities with other companies that are open to exploring this area, including some more aggressive strategies. The edible segment is easier to shift, while hides and pelts remain challenging due to processing costs and fluctuating demand particularly as furniture markets move toward fabric. Despite these challenges, edibles have consistently been popular.

Edible offal has long been valued in the industry. Offal is sought after by certain markets, including some French buyers, as well as demand from other regions such as Brazil and India. However, when the costs of processing such as labour, packaging, and freezing outweigh the benefits, these products are often directed to rendering instead, balancing revenue with operational costs.

Our company has not established its own pet food business; instead, we contract a third-party provider who processes our raw materials into pet food products, which are then sold to customers. We have recently explored the possibility of developing our own pet food operations, but our current model leverages aggregation, where we pay a processing fee and subsequently sell the finished product ourselves. Similarly, for rendering, we handle this in-house in the North Island but also collaborate with partners who process the material on our behalf, allowing us to focus on sales.

Currently, prices for sheep and beef coproducts remain relatively strong. While primary meat products may fluctuate in value, the ongoing sustainability of processing facilities is

supported by growth in coproduct revenues. Although our company is not a major global player, diversifying our product offerings including processing pelts and wool has contributed to overall on-farm performance and provides an additional revenue stream, helping to mitigate risk associated with market volatility. It is important to acknowledge that product markets can be unpredictable, so pursuing multiple avenues remains essential for stability.

Market performance can fluctuate depending on global buyers' needs and overall demand; it's important that these factors operate in tandem. Exploring alternatives outside traditional sources can help drive revenue growth. For instance, repurposing co-products or selling edible products could increase value, but this alone may not ensure a company's success it might contribute approximately 10%. With red meat currently strong, it is a good time to develop products that provide greater resilience during market fluctuations. Building up alternative income streams has been a gradual process, and the full potential remains uncertain.

Take the example of meat cuts: products like T-bone or ribeye steak with the bone have different market dynamics compared to lamb, which is often sold whole. The challenge is determining how to cover costs (such as for processing) and generate adequate revenue from alternative markets this is an ongoing concern in the industry.

Geoff:

"According to MIA statistics and New Zealand overseas data, in 1990 bovine offal exports totalled 15,000,000 kg with a value of $44 million; today, exports have doubled to 38,000,000 kg, now worth $252 million. In contrast, ovine skins are valued at $39 million 2024, down significantly from $393 million 1990. These figures reflect broader shifts in product usage from clothing to new food markets which have influenced both volume and value. Industry wide, fifth quarter exports in 1990 totalled 227,887,446 kg and were worth $2.1 billion; currently, exports have increased to 380,000,000 kg, valued at $2.3 billion a $200 million gain despite a significant rise in volume. This suggests less rendering and more direct export of products. Pet food, another sector mentioned, illustrates how evolving market uses impact industry statistics over time".

ANZCO executive:

I have identified significant potential in finding valuable applications for organs that are traditionally considered edible, particularly in the pharmaceutical and healthcare sectors. For example, we have explored whether certain extracts can be obtained from pelts and have been closely monitoring our ongoing research into collagen and similar products. Achieving advancements in this area could lead to substantial breakthroughs.

Recently, I read an article describing innovative uses for sheepskin including the production of high-quality collagen, specialty extracts, hotel amenities, and collagen-based sausage casings. When analysing our past work, it is evident which products and markets have gained traction, highlighting opportunities for further innovation. By continually seeking new ways to utilize these resources, we can maximise their value.

However, selling these by-products remains challenging on a global scale due to competition such as the strong market presence of Brazil. Standing out in this environment presents difficulties but continued research and product development will be key.

Insights from Industry Leaders interviewed above

Auckland Processor.

Auckland Processor emphasises that co-products represent about one fifth of the meat industry, with significant opportunities emerging in the pharmaceutical and nutrition sectors. He highlights the importance of transparency and fair distribution of value, especially as some co-products, such as edible offal, may exceed the value of meat itself. Their stewardship in joint ventures and rendering operations showcases how strategic collaborations and decentralisation can reduce environmental impacts and add value.

Meat Industry Association of New Zealand.

MIA NZ points to a marked decline in the value captured from co-products, citing the drop from $1.2 billion in 1985 to $300 million today in sheep skins and wool. He attributes this to the industry's historical focus on meat at the expense of co-product innovation. McColl advocates for increased local processing and product development to ensure more of the value remains with New Zealand producers.

Waikato Processor.

They describe how sophisticated processing plants enable the extraction of value from hundreds of product specifications, adapting to new market demands and maximising returns from all parts of the animal. He stresses the importance of ethical practices and transparent value-sharing models, such as joint ventures, to ensure that additional profits are directed back to supply companies and ultimately to farmers.

Forsyth Barr and Silver Fern Farms.

This section explores investment strategies with insights from Forsyth Barr and Silver Fern Farms for instance, estimates that 44% of an animal is comprised of co-products, with major resources including bones, skins, and wool representing about 30% of outputs. Crawford discusses the spectrum of capital options available for scaling value streams, from private credit to equity and venture capital, each with different implications for risk, governance, and growth timelines. Both highlight the necessity of securing suitable partners and managing reputational risk within new and innovative business models.

Bio Resource, Alliance.

Alliance advocates for greater industry investment in foundational research and cross-value chain collaboration, suggesting that a "discovery engine" co-funded by companies and government could unlock long-term opportunities. He notes that resistance to change and limited industry-led research are ongoing challenges, especially as the sector likely shifts toward broader protein industries encompassing alternative and hybrid products.

ANZCO Foods.

ANZCO reflects on the role of amalgamations and collaborations in achieving scale and value from fifth quarter products. He highlights the challenge of fluctuating demand and processing costs, particularly for hides, as well as the importance of developing alternative income streams such as pet food or specialty extracts to sustain operations amid market volatility.

Innovation, Collaboration, and Future Opportunities.

The sector's future depends on continuous innovation, diversification, and investment. Experts call for more collaboration across companies and with research institutions to accelerate product development, address regulatory challenges, and unlock new income streams especially in high-value markets like pharmaceuticals, nutraceuticals, and personal care. Collaborative ventures, such as Auckland and a Waikato processor doing a joint project and Silver Fern Farms' partnerships, illustrate successful approaches to maximising both financial and environmental returns.

Opportunities also arise from changing global trends: there is increasing demand for sustainably sourced ingredients, wellness products for aging populations, and certified products meeting Halal or Kosher standards. At the same time, new government regulations and evolving consumer preferences push companies to transition away from commodity

sales toward branded, value-added products that differentiate New Zealand on the global stage.

Recurring Theme from the Interviews

A recurring theme throughout the interviews is the critical importance of innovation, collaboration, and value maximisation within the co-products sector of New Zealand's red meat industry. Industry leaders consistently highlight that co-products, which comprise a significant portion of the industry's value, present substantial opportunities for growth in areas such as pharmaceuticals, nutrition, and alternative markets. However, realising this potential requires a shift from the traditional focus on primary meat cuts to a more holistic approach, one that includes advanced processing, transparent value sharing, and joint ventures to reduce environmental impacts and ensure equitable returns to producers and farmers.

Another key theme is the need for greater investment in research and product development, as well as the importance of forming strategic partnerships both within the industry and with external investors. This collaborative approach is seen as essential for overcoming market volatility, fluctuating demand, and the challenges of regulatory compliance. Another key theme from the interviews is the necessity of adapting to global trends, such as the demand for sustainably sourced, high value products that meet specific consumer and certification requirements (e.g., Halal, Kosher, wellness, and personal care markets).

Overall, the sector's future resilience and growth depend on ongoing innovation, diversification and the willingness to embrace new business models and collaborative ventures, positioning New Zealand as a leader in the global market for value-added co-products.

The Value and Future of New Zealand's Fifth Quarter

New Zealand's red meat sector is a powerhouse of export earnings, with beef, lamb, and associated co-products underpinning the nation's agrarian prosperity. While prime cuts often capture the spotlight, coproducts collectively known as the "fifth quarter" play an essential but sometimes overlooked role in industry success.

Co-products: Economic Significance

Co-products account for about 20% of export receipts from the meat industry, amounting to $10.4 billion for the first 11 months of the 2024-25 year alone. Wool, a joint product with sheep

meat, has seen fluctuating fortunes: peaking above $1.2 billion in the 1990s, then falling to $388 million by 2020, before rebounding to just under $500 million in recent years. This rise and fall reflect broader shifts in global demand and consumer preference.

Adding Value through Innovation and investment

New Zealand has moved beyond exporting raw materials. Companies like Tertiary Extracts Otautahi (TEO) are leading the charge, turning what was once waste like sheepskin into premium products such as Ovitage collagen supplements. Such developments highlight the potential for innovation in adding value to co-products, whether for human nutrition, pharmaceuticals, or the booming pet food sector, which has grown from modest beginnings to a $59 million export industry over the last 35 years. As highlighted by Forsyth Barr and Silver Fern Farms, sourcing private credit, equity partners or venture capitalists is necessary to scale up new processing streams from collagen to pharmaceuticals. Such investment brings not just funding but also expertise and market access, accelerating the transition to a diversified, high value product mix.

Global Demand and Market Trends

Worldwide, edible offal and other coproducts are rising in popularity. Population growth, urbanisation, sustainability movements, and changing culinary fashions have all increased demand. In Asia, offal is a prized culinary ingredient; in Europe and the Americas, changing attitudes and the influence of chefs have spurred renewed interest. New Zealand, as a major exporter, benefits from these trends, particularly in fast-growing Asian markets.

However, the sector also faces challenges. Negative perceptions, regulatory requirements (especially for Halal or Kosher markets), and the logistical hurdles of preserving perishable goods all require ongoing attention. Overcoming these barriers will depend on continued improvements in processing, packaging, and consumer education.

Industry Perspectives: Insights from Sector Leaders

The importance of transparency and collaboration across the value chain. While co-products such as hides, pelts, offal, and blood can command high prices, their value can fluctuate dramatically depending on global supply and demand. Strategic partnerships and investment in rendering, processing, and research ensure co-products return greater value to both processors and farmers.

The Meat Industry Association of New Zealand notes much value is lost when materials are simply exported in raw form. Innovation and branding especially in sustainable, high-value product segments can keep more profit within New Zealand.

My findings on New Zealand's fifth quarter

To unlock greater economic, environmental, and social benefits from the "fifth quarter" co-products in New Zealand's meat industry, a strategic approach is needed. Drawing on insights from sector leaders, research, and market trends outlined above, the following recommendations aim to strengthen innovation, transparency, and collaboration ultimately ensuring that value flows more equitably from processor to farmgate from the weekly schedule.

Recommendations

1. Improve Transparency in Value Distribution

- Meat Industry Association establish clear reporting and benchmarking standards for co-product revenue so that farmers and other stakeholders can understand how value is allocated throughout the supply chain.
- Develop regular industry wide reports detailing volumes, prices, and margins for all major co-products, enabling informed negotiations and fairer pricing structures.

2. Foster Collaborative Research and Innovation

- Encourage joint ventures and alliances across processors, exporters, and research institutions to pool resources and expertise for developing new products and technologies.
- Expand industry investment in fundamental research, including partnerships with universities and Crown Research Institutes, to create a "discovery engine" for co-product innovation.

3. Strengthen Local Value-Addition and Branding

- Support the development of value-added products such as collagen supplements, pharmaceuticals, and certified Halal co-products within New Zealand, keeping more profit onshore.
- Promote strong branding and storytelling around sustainable, high quality New Zealand co-products to secure premium positioning in global markets.

4. Expand Access to Investment and Capital

- Facilitate access to private credit, equity partners, and venture capital for processing companies seeking to scale up new co-product ventures.

- Look at creating a share option for farmers to be able to invest, be a part of the development of unlocking wealth through the 5th Quarter.
- Provide targeted government grants or incentives for innovative processing facilities and product development, particularly in areas with high employment or export potential.

5. Diversify Product Portfolio and Markets

- Encourage diversification beyond traditional commodities by developing new applications for co-products in pet food, nutraceuticals, biologics, personal care, and construction materials.
- Explore new export markets, especially in regions where demand for edible offal, certified Halal co-products, and sustainable products is rising.

6. Enhance Sustainability and Waste Reduction

- Prioritise circular economy principles by ensuring that every part of the animal including low value or currently underutilised materials is processed and marketed where possible.
- Invest in technologies and systems that minimise environmental impact, such as energy efficient rendering, eco-friendly packaging, and carbon neutral leather tanning.
- This industry should be celebrated for creating no waste every part of the animal is used in some way

7. Build Industry Capability and Education

- Develop training programmes for farmers, processors and exporters focused on co-product handling, compliance (e.g., Halal certification), and market trends.

  Strengthen consumer education campaigns to improve public perception and understanding of co-products, highlighting their nutritional, environmental, and economic value.

Insights

- During interviews, a repeated topic was the transparency in allocating value to co-products. Both Greenlea and Silver Fern Farm indicated that improved reporting could clarify how returns are calculated in the weekly schedule and potentially affect farmer returns and industry trust. Increased visibility regarding global prices for key products would allow farmers to better understand the sources of revenue. Additionally, the need for sustained innovation and collaboration especially in

research, product development, and investment emerges as a common thread. To maintain globally competitiveness and reflect to suppliers, the industry must optimise value extraction at every stage of the supply chain, invest in science and branding, and ensure that benefits are distributed equitably among all stakeholders.

- By weaving together these expert perspectives and contextualising key industry data, this report aims to provide a clearer, more integrated understanding of the challenges and opportunities shaping New Zealand's meat co-products sector.

Conclusion

The resilience and ongoing innovation of New Zealand's meat sector depend on clear responsibilities and collaborative investment strategies. While processors play a pivotal role in adding value to coproducts, they often face constraints in accessing capital needed for innovation and infrastructure improvements. This challenge is particularly evident among smaller processors, whose limited financial resources can hinder their ability to implement new technologies or expand product offerings.

To address these constraints, group investing presents a viable solution. Group investing involves multiple stakeholders such as processors, farmers and external investors pooling resources to fund innovation initiatives. For example, a co-operative model could enable farmers and processors to jointly invest in a B share that would set up an advanced rendering plant and advanced packaging systems. This approach not only distributes financial responsibility more equitably but also fosters greater transparency and trust among participants, as investment decisions and returns are shared openly.

Added value businesses are enterprises that transform traditional co-products into higher value items, thereby increasing sector profitability and sustainability. Examples include the conversion of lower value animal parts into premium pet food, nutraceuticals or specialty leather goods. By promoting such businesses, processors can attract investment from both within the agricultural community and from outside capital sources, such as private equity or impact investors interested in sustainable food systems.

The impact of optimising co-product value is significant. The data presented show co-product sales account for approximately 10% of the weekly schedule value for farmers and represent 20% of total red meat sector export revenues. For example, the development of export markets for edible offal and specialty fats has contributed to notable revenue increases, reinforcing the importance of co-product innovation. As competition for livestock intensifies, processors who maximise co-product value are positioned to offer more

competitive prices to farmers, ensuring that the benefits of innovation are reflected in farmgate returns.

In summary, strengthening New Zealand's meat sector requires a coordinated approach: clarifying the roles and responsibilities of processors and investors, leveraging group investing to overcome capital constraints and promoting added value businesses to capture new markets. By integrating these strategies, the sector can continue to enhance national prosperity, sustainability and competitiveness in the global marketplace.

References

Beef and Lamb New Zealand. (2020). Offal – almost a superfood. https://www.beeflambnz.co.nz/news/2020/6/28/almost-a-superfood?rq=offal%20-%20almost%20a%20superfood

Beef and Lamb New Zealand. (2020); and Meat Industry Association (2020). Growing sustainable value together: Red Meat Sector Strategy. https://mia.co.nz/protected-download.php?token=HJ15850M

Beef and Lamb New Zealand. (2021). The little-known world of beef and sheep byproducts and co-products. https://www.beeflambnz.co.nz/news/2021/7/16/the-little-known-world-of-beef-and-sheep-co-products#:~:text=Referred%20to%20in%20the%20indus

Beef and Lamb New Zealand. (2025). Mid-Season update 24-25. https://beeflambnz.com/knowledge-hub/PDF/mid-season-update-2024-2025.pdf

Beef and Lamb New Zealand. (2025). New Zealand meat prices and profitability. https://beeflambnz.com/news/red-meat-prices-and-farm-profitability-rebounding#:~:text=New%20Zealand%E2%80%99s%20red%20meat%20sector%20is%2

Beef and Lamb New Zealand. (2025). New Season Outlook 2024-2025. https://beeflambnz.com/knowledge-hub/PDF/new-season-outlook-2024-25.pdf

Farm Credit Knowledge Centre. (2023). Pinterest (photograph). https://mx.pinterest.com/pin/792352128205373805/

Food and Agriculture Organization of the United Nations, (2018). Asia and Pacific Regional overview of food security and nutrition: accelerating progress towards the SDG's. https://openknowledge.fao.org/server/api/core/bitstreams/25a5f0d7-ae53-42b2-8c8e-d8a5ca967bea/content

Kissun, S. (2024, November 1). GCC trade deal to boost red meat exports. Rural News. https://www.ruralnewsgroup.co.nz/rural-news/rural-general-news/gcc-trade-deal-to-boost-red-meat-exports

Kissun, S. (2025, July 2). NZ Startup Turns Sheepskin into World-Leading Collagen Supplement. Rural News. https://www.ruralnewsgroup.co.nz/rural-news/rural-general-news/nz-sheepskin-collagen-ovitage-teo-innovation

Maleny Black Angus Beef. (2025). https://malenyblackangusbeef.com.au/product/offal/?srsltid=AfmBOorl252PkvxqiwfqVi1X2iQiivEsFou2d3UWsGk0HMy_2h1NvTFI

Nature Tech Collective. (2024). Challenges and Opportunities in the US Market. https://www.naturetechcollective.org/stories/advancing-sustainable-beef-production-cattle-tech

New Zealand Meat Industry Association. (2023). Red Meat Sector Summary Manifesto. https://mia.co.nz/red-meat-sector-summary-manifesto/#:~:text=The%20Meat%20Industry%20Association%20and%20Beef%20%2B%20Lamb,relations%2C%20trade%2C%20biosecurity%2C%20and%20innovation%2C%20research%20and%20development.

New Zealand Meat Industry Association. (2025). New red meat export strategy launched as latest analysis reveals $1.5 billion annual cost of non-tariff trade barriers. https://mia.co.nz/

Parsons Creek Steak. (2022). Cattletales. Pinterest (photograph). https://www.bing.com/images/search?view=detailV2&ccid=%2fM34Ew3H&id=3A6DC1888B3CD6B96851FA28373EF44A0B57F8E7&thid=OIP._M34Ew3HbUmeMahvyL8l5AHaJR&mediaurl=https%3a%2f%2flookaside.fbsbx.com%2flookaside%2fcrawler%2fmedia%2f%3fmedia_id%3d621358123985540&cdnurl=https%3a%2f%2fth.bing.com%2fth%2fid%2fR.fccdf8130dc76d499e31a86fc8bf25e4%3frik%3d5%252fhXC0r0Pjco%252bg%26pid%3dImgRaw%26r%3d0&exph=1164&expw=930&q=cattle+more+than+beef+%23cattle+tales&FORM=IRPRST&ck=FA3FC289A7D1B9C7EE4DC741E972624C&selectedIndex=0&itb=0&idpp=overlayview&mode=overlay

Staff Reporters. (2021, February 5). Red meat exports reached historic high in 2020. Rural News. https://www.ruralnewsgroup.co.nz/rural-news/rural-general-news/rred-meat-exports-reached-historic-high-in-2020

The Good Food Institute, (2019). 2019 State of the Industry Report: Cultivated meat. https://gfi.org/wp-content/uploads/2021/01/INN-CM-SOTIR-2020-0512.pdf

United States Department of Agriculture. (2019). Economic Information Bulletin. *Economic Research Service, 208*. https://ers.usda.gov/sites/default/files/_laserfiche/publications/93026/EIB-208.pdf?v=64492

United States Department of Agriculture. (2019). FY 2021 Annual Performance Plan. https://www.usda.gov/sites/default/files/documents/fy19-appr-final-3-26-2020.pdf#:~:text=In%20accordance%20with%20the%20Government%20Performance%20and%20Results,Priority%20Goals%20%28APG%29%20and%20Cross%20Agency%20Priority%20Goals.