SCARLATTI
Evaluation | Analytics | Insights

BIO PACIFIC PARTNERS

August 2025

The future of food and fibre in Northland

Assessing the economic feasibility of seven emerging food and fibre industries in Northland

Scarlatti.co.nz

The following report has been prepared by Scarlatti and BioPacific Partners for Northland Inc. as the final deliverable of the Market Opportunity Studies contract to assess the economic feasibility of the following seven emerging horticultural and arable crops:

1. Banana
2. Pineapple
3. Moringa
4. Soybean
5. Sunflower
6. Ginger
7. Turmeric.

Acknowledgments

Thank you to the industry stakeholders who generously shared their time, experience, and insights during interviews. Their contributions were invaluable in shaping the assumptions and inputs used throughout this report.

Executive summary

Introduction

Northland's land-use mix is shifting: since 2000, the land area used for sheep and beef farming has declined, with the land area used for dairy also declining over the past 5 to 10 years. Climate change, regulation, changing consumer demand, and market access pressures are prompting Northland landowners to reassess the long-term sustainability of traditional farming practices and explore alternative uses for diversifying their land. The anticipated changes to Northland's climate over the next several decades are expected to create opportunities to trial and grow new subtropical and tropical crops across Northland.

In 2023, Northland Inc. launched its Tuputupu Grow Northland Initiative to identify practical opportunities for growth. Under the Initiative, Northland Inc. is assessing the commercially feasible land-use alternatives as opportunities for regional economic diversification and growth. Northland Inc. commissioned four market-opportunity studies in early 2025 for nine new and promising crops, including bananas, pineapples, mango, papaya, moringa, soybeans, sunflowers, ginger and turmeric. This report assesses the economic feasibility of establishing commercial Northland industries for seven of these crops (all except mango and papaya, which have been assessed separately from this report), considering the different forms in which they can be consumed. This report presents our findings as one component of a broader feasibility assessment process. Additional due diligence is essential before making investment, policy or land-use decisions.

Approach and methodology

Across the seven crops, over 40 consumption forms were identified. To ensure resources were effectively allocated, the full list of consumption forms was reduced to the 15 most promising. A detailed assessment of the economic feasibility for each consumption form was completed using a qualitative framework with grower, processor and market components. Drawing on insights collected from a combination of quantitative financial modelling, qualitative interviews and other secondary sources, the components of each consumption form were given an indicative scale of feasibility (not feasible, small-scale, moderate-scale, large-scale). The overall feasibility of each consumption form is the lowest of the three components' feasibility.

The economic assessment of each crop concludes with an estimate for the number of hectares required within Northland to meet the combined demand estimated for each crop's feasible consumption forms (i.e. those for which all components are given at least a small-scale feasibility score).

Crop assessment

The table on the following page presents the key findings for each of the seven crops from their respective economic analyses. While the economic analyses present these findings as a range to account for uncertainty, the expected value (i.e. the middle of the range) is presented in the following table; refer to the respective chapters for more details.

All seven crops are considered feasible at a small scale under current economic conditions, assuming agronomic feasibility. Combined, they create an opportunity to diversify between **375 and 660 hectares** of agronomically appropriate land across Northland over time. This is expected to generate an aggregated gross profit between **$2.9 and $5.2 million annually**. While modest at a regional scale, this does not preclude niche operators from succeeding commercially under favourable conditions.

Particulars	Summary of crop assessment						
	Banana	Pineapple	Moringa	Soybean	Sunflower	Ginger	Turmeric
	Perennial	*Perennial*	*Perennial*	*Annual*	*Annual*	*Annual*	*Annual*
Grower							
Establishment CAPEX ($/ha)	58k to 158k	105k to 188k	120k to 240k	N/A	N/A	N/A	N/A
Required gross profit ($/ha) [1]	$12.5k	$25.1k	$22.1k	N/A	N/A	N/A	N/A
Commercial-grade yield (t/ha/yr)	10.71	26.78	10.00	2.50	3.25	15.00	12.00
Revenue ($/ha)	$40.8k	$52.2k	$61.3k	$4.7k	$4.9k	$75k	$66k
Growing costs ($/ha)	$59.2k	$41.5k	$48.8k	$3.4k	$3.4k	$54.4k	$51.6k
Gross profit ($/ha)	-$18.4k	$10.7k	$12.5k	$1.3k	$1.5k	$20.6k	$14.4k
Gross margin	-45%	21%	20%	28%	31%	28%	22%
Req. gross profit met?	No	No	No	N/A	N/A	N/A	N/A
Req. gross profit within modelled range?	Yes	Yes	Yes	N/A	N/A	N/A	N/A
Probability of negative gross profit	Very high	Low	Low	Low	Low	Very low	Low
Opportunity cost	Very high	High	High	Moderate	Moderate	Very low	Low
Processor							
Feasible consumption forms	Fruit	Fruit	Leaves, oil	Milk, tofu	Kernels, oil	Powder	Root
Most feasible consumption form			Fresh leaves	Tofu	Kernels		
EBIT ($/unit)	$0.33/kg	$1.60/kg	$3.78/kg	$4.64/kg	$3.84/kg	$8.76/kg	$3.33/kg
EBIT margin	6%	29%	23%	56%	42%	17%	23%
Probability of negative EBIT	Moderate	Low	Very low	Very low	Very low	Very low	Low
Market for most feasible form							
Demand (% of NZ consumption)	1% to 2%	10% to 20%	N/A	15% to 20%	5% to 10%	10% to 15%	15% to 20%
Demand (t)	0.8k to 1.6k	1k to 1.75k	30 to 60	56 to 75	80 to 160	30 to 45	9 to 12
Total estimated scale of operation							
Land required (ha)	**75 to 150**	**30 to 50**	**<10**	**50 to 70**	**200 to 360**	**10 to 20**	**<1**
Aggregated gross profit ($m)	$1.1 to $2.3	$1 to $1.8	<$0.12	<$0.09	$0.3 to $0.5	$0.2 to $0.4	<$0.02
Scale of feasibility	Small	Small	Small	Small	Small	Small	Small

[1] The required annual gross profit ($/ha) to justify the expected (i.e. midpoint estimate) scale of investment (i.e. establishment CAPEX) at a 6% rate of return.

Considerations for implementation

The opportunities and limitations for small-scale commercialisation

Increasing the size of a Northland industry beyond a small scale for any of the seven crops will be challenging for the following reasons:

1. A niche group of domestic consumers will pay a premium for NZ-grown crops, valuing provenance, traceability, freshness, and spray-free alternatives.
2. Growing market share and increasing scale require attracting more price-sensitive consumers who are more inclined to choose cheaper imports over domestic produce.
3. Most tropical and subtropical crops (except soybeans and sunflowers) are labour-intensive, and high domestic labour costs are a major barrier to scaling.
4. Without clear comparative advantages such as lower costs, counter-seasonal supply, or unique varieties, small-scale domestic industries face high competition from imports.

Implementation considerations for landowners and regional stakeholders

Diversifying land into a new crop requires more than recognising an opportunity. The crop's success relies on the landowner developing a clear understanding of the economic, operational and market realities for growing, processing and marketing the crop. The following practical considerations have been identified during this work to support landowners and regional stakeholders:

- Northland growers' profitability depends on securing premium prices in the market that return enough value through the supply chain (returned to growers as the farmgate price) to cover high domestic production costs.
- Capturing more of the retail value through value-added processing can lift grower returns, but making the financials work depends on aligning processing scale and product form with associated costs. For example, at low throughput, processing-facility establishment costs are spread over fewer units, increasing the per-unit cost of capital.
- The proportion of Northland consumers willing to pay a premium for domestically grown fruits, vegetables, and grains may be insufficient on its own to sustain regional industries at the estimated scales of operation for each crop. Growing from a very small, regional-based industry towards the suggested scales will require new distribution channels to access the same target market segments in nearby regions, including Auckland, the Waikato and the Bay of Plenty.
- It can take several years for new crop systems to build in maturity to achieve target yields and quality. With an absence of local capability, at least initially, prospective growers should plan for several years of learning before reaching steady commercial performance.
- The success of new crops depends on managing risks like yield variability, production costs, price volatility, and regulation; growers can mitigate these through protected cropping, vertical or shared processing, and low-cost mechanisation.
- Uncoordinated farm-level decisions can create industry-wide issues. Regional stewardship and support can align growth with market demand, manage labour pressures, enable shared processing facilities, avoid price reductions due to oversupply, and mitigate environmental risks from more intensive land-use.

Contents

Chapter 1: Introduction

This chapter outlines the project context, objectives, scope, and deliverables, and clarifies the document's audience, structure, limitations, and its key findings.

Project background

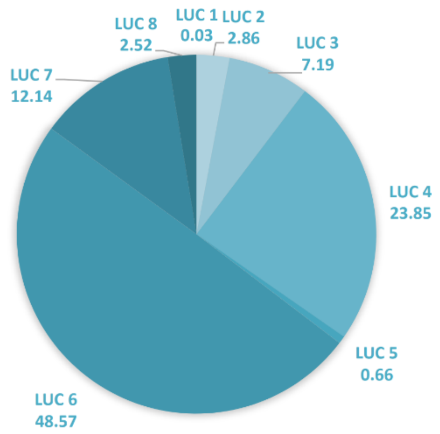
Context

Since 2000, Northland's primary sector has used less land for sheep and beef, and dairy has declined slightly in the past 5 to 10 years. These sectors have traditionally contributed significantly to regional GDP.[1] External pressures, including climate change, environmental regulation, shifting consumer demand, and market access, are increasingly compelling landowners to reassess the sustainability of traditional farming practices and explore alternative uses for their land.

In recognition of the social, environmental and economic challenges landowners across the region face, Northland Inc. developed the Tuputupu Grow Northland Initiative in 2023.[2] While change can be challenging, the Initiative outlines practical opportunities for growth. Under the Initiative, Northland Inc. is assessing the commercially feasible land-use alternatives as opportunities for regional economic diversification and growth.

Land-use capability (LUC) across Northland is somewhat restricted compared with the rest of New Zealand. Just over 60% of Northland's land is LUC Class 6 or higher.[3] LUC Classes 6 to 8 land is generally less suited to horticulture than LUC Classes 1 to 3 land. The availability of suitable land to maximise the productivity of alternative land uses is limited and will face strong competition for optimal use. About 10% of the region is LUC Classes 1 to 3 (highly productive land), typically used for horticultural and cropping activities due to the nutrient-dense and well-drained soil types in these classes.[4]

Figure 1: *LUC % of land area in Northland*



Source: Rachel Weal, 2021

Northland is expected to become warmer over the next few decades, with fewer frost days and more droughts in some parts. NIWA projects up to 1.1°C by 2040 and up to 3.1°C by 2090 under higher-emissions scenarios.[5] This may enable new subtropical crops such as bananas, pineapples, mangoes and papayas to be grown in targeted areas.

Between March and May 2025, Northland Inc. released four requests for proposals for market-opportunity studies covering nine horticultural and arable crops (bananas, pineapples, mango, papaya, moringa, soybeans, sunflowers, ginger, and turmeric), identified by the Tuputupu Steering Group as promising alternative land-use options. The following report presents the market opportunity study for seven of these crops; the equivalent studies for mango and papaya have been completed separately from this report. The market opportunity studies will contribute to the overall feasibility of establishing industries for these crops in Northland. Northland Inc. has explicitly expressed an interest in how value

---

[1] https://www.stats.govt.nz/indicators/agricultural-and-horticultural-land-use/

[2] https://www.northlandnz.com/assets/Files-for-Download/Corporate-Library-Documents/Tuputupu-Grow-Northland-Initiative-Short.pdf

[3] https://ruralleaders.co.nz/wp-content/uploads/2021/11/Rachel-Weal-Land-use-change-diversification-in-Northland-K44-2021.pdf?

[4] https://www.nrc.govt.nz/resource-library-archive/environmental-monitoring-archive2/state-of-the-environment-report-archive/2011/state-of-the-environment-monitoring/our-land-our-air/land-use-and-soil-quality/

[5] https://www.northlandnz.com/assets/NInc-Organisation/What-We-Do/Projects/Tuputupu-Grow-Northland/Te-Tai-Tokerau-Northland-Pineapple-growing-opportunities-community-scan-2024.pdf?utm_source=chatgpt.com

can be added to the harvested product to position it as a premium, Northland-grown product in the market. Similar studies for Northland Inc. support this view, highlighting that Northland-grown crops sold in their commodity form may struggle to compete with low-cost imports.[6]

Project overview

Objectives

The objectives (as set out in the RFPs provided by Northland Inc.) are:

1. Identify the economically promising consumption forms for each crop, especially those involving value-added manufacturing.
2. Identify key industry participants and buyers and assess demand for Northland-grown products relative to imports.
3. Assess the economic benefits of establishing an industry for each of the seven horticultural and arable crops and how the benefits will be realised across the value chain.

Scope

The project scope is limited to assessing the economic feasibility of establishing an industry for each crop and its associated consumption forms in Northland, New Zealand. The economic feasibility analysis assesses:

1. The potential for each crop to be grown and processed sustainably and profitably.
2. The associated risks and sensitivities of key growing, processing and marketing variables from an economic perspective.

The scope of this project does not include the assessment of:

- Agronomic feasibility (e.g. whether the crops can be grown commercially in Northland)
- Workforce feasibility (e.g. whether there is sufficient labour to support alternative land uses)
- Environmental feasibility (e.g. are there negative environmental externalities involved)
- Regulatory and legal feasibility (e.g. how the crops comply with applicable laws and standards)
- Social or cultural feasibility (e.g. how the crops contribute to local communities, iwi and hapū, and other stakeholder groups).

These factors are material and are addressed in qualitative commentary where appropriate.

Deliverables

This report is one of three deliverables; the others include a complete financial model estimating grower and processor profitability for the seven crops in scope for this analysis, and a blank copy of the financial model for replicating the analysis for other crops. Readers can adjust assumptions to reflect their understanding and view updated profitability estimates.

[6] https://www.northlandnz.com/assets/Files-for-Download/Corporate-Library-Documents/Evaluating-the-financial-feasibility-of-a-Northland-peanut-industry-FINAL.pdf

About this document

Audience

This report is intended to support Northland Inc. explore the feasibility of new and promising horticultural and arable crops in Northland, New Zealand. The insights will be used to inform future funding by providing an evidence-based assessment of the economic potential for the seven selected crops. The report is framed to support Northland Inc.'s role in advancing sustainable, market-aligned land-use diversification in Te Tai Tokerau.

Document structure

This document is structured as follows:

- **Chapter 2: Approach and methodology.** An outline of the approach and methodology used to assess economic feasibility, including the key assumptions, data sources, and supporting analyses that underpin our findings.
- **Chapters 3 to 9: Crop feasibility assessments.** Overviews of the analyses undertaken to assess the feasibility of establishing an industry in Northland for each of the seven crops through one or more of the associated consumption forms. The chapters are split into two parts:
  - Insights into the economic feasibility of *growing* each crop in Northland. These analyses will look at the suitability of Northland land, the expected yields and estimates of farmgate prices received and production costs.
  - Insights into the economic feasibility of *processing* each crop into one of the prioritised consumption forms (see Chapter 2). These analyses will look at the conversion efficiency of each crop, processing steps and operating expenditure, capital requirements and market feasibility.

  These chapters will draw on n mixed-methods analysis. Refer to Chapter 2 for more details.
- **Chapter 10: Implementation considerations.** A summary of the findings from chapters 3 to 9, with key considerations for implementation by growers and regional stakeholders to support land-use diversification.

Limitations

While this report provides a structured economic feasibility assessment, the following limitations apply:

- Economic feasibility is just one of the important factors growers and regional councils should consider when exploring land-use diversification opportunities. Additional due diligence is required before making investment, policy or land-use decisions at a land-unit and/or regional level.
- Market dynamics change regularly. Consumer preferences, prices, and cost structures may shift after publication, so quantitative inputs should be treated as indicative ranges only. The market and production data used in the quantitative economic modelling are subject to change following the delivery of this report. Input ranges are used to account for uncertainty.

- While there have been some trials conducted, the costs to grow and process each crop and the expected yields remain uncertain. The quantitative modelling throughout this report draws on a combination of domestic and international sources. Real-world costs and yields in Northland may vary due to factors such as input pricing, labour availability, and infrastructure and machinery. This uncertainty is captured in the modelling by using input ranges (e.g. lower and upper estimates).
- Many qualitative insights come from semi-structured interviews with industry experts, buyers and processors to complement the quantitative analysis. While high-priority stakeholders were targeted to get the best commercial insight possible, the sample size was small, and their insights may not reflect the full diversity of views across the sector. The views of interviewees also represent their views at a point in time and may shift with changing market conditions or regulatory requirements.
- The following report assumes that domestic industries would be producing for domestic consumption only in competition with imported products in the first instance. Building internationally competitive industries where there was previously a lack of a comparative advantage is exceptionally challenging.

In addition to the above, there are several limitations relating to the inclusion of financial estimates throughout this report (refer to page 20).

Disclaimer

This report presents the economic feasibility of establishing banana, pineapple, moringa, soybean, sunflower, ginger and turmeric industries in Northland. The analysis focuses on the commercial and market viability of these crops and their various consumption forms based on currently available information.

The findings and conclusions should not be interpreted in isolation or taken as a definitive recommendation to proceed with crop development. This report operates under the assumption that the crops and their associated consumption forms are feasible in all other respects, including agronomic suitability, environmental impact, workforce availability, regulatory compliance and certification, and cultural or social acceptability. These critical factors have not been independently evaluated in this report.

Readers are advised to consider this economic analysis as one component of a broader feasibility process. Additional due diligence and assessment of the opportunity for specific circumstances is essential before making investment, policy or land-use decisions. Nonetheless, the findings may provide a useful foundation for growers, investors, iwi, regional agencies and researchers to identify and further investigate promising opportunities for land-use diversification and horticultural development. Neither Scarlatti nor BioPacific Partners accepts any liability for any loss, damage or cost arising from reliance on the information or opinions expressed in this report.

Chapter 2:
Approach and methodology

This chapter outlines the approach and methodology used to assess economic feasibility, including the key assumptions, data sources, and supporting analyses that underpin our findings.

Introduction

The project used mixed methods to assess the feasibility of establishing Northland industries for each of the seven horticultural and arable crops across their various consumption forms. The methodology combines qualitative and quantitative methods, and both primary and secondary data. Methods used in this analysis include:

- Online desk research to identify the information already available for each crop
- Financial modelling to assess the feasibility of growing and processing each crop
- Industry interviews to gather insights on feasibility from industry experts, farmgate buyers, and growers.

Data from these activities is used to estimate a realistic scale of operation and to inform the scores assigned to each feasibility criterion for each crop and the associated consumption forms.

The following chapter introduces the criteria and approaches used to assess feasibility and the approaches taken to collect the necessary quantitative and qualitative information to inform the feasibility assessment.

Determining economic feasibility

Across the seven crops, the project team identified more than 40 consumption forms, ranging from fresh produce to value-added products and lower-value by-products (refer to Appendix 1, page 175). The economic feasibility assessment for establishing new horticultural and arable crop industries in Northland was undertaken in two stages:

1. Preliminary screening of all consumption forms based on rapid desk research.
2. Detailed assessment of prioritised consumption forms, based on quantitative financial analysis and qualitative market research.

This approach allocated resources to the most promising combinations and deprioritised those with lower potential or major feasibility concerns.

1. Preliminary feasibility screening

Our preliminary screening framework considered the following for each combination of crop-consumption form:

- The conversion efficiency (e.g. tonnes or litres produced per tonne harvested)
- The per-unit costs (including annualised capital charges) to process the raw crop into the consumption form, including raw inputs
- The estimated retail price for Northland-origin products and the value returned to processors and growers
- The status of the New Zealand market for each consumable form, including the market size/potential, demand elasticity and stability, and competition with low-cost, imported products.

The consumption forms were prioritised using a combination of qualitative judgement and preliminary financial modelling. The preliminary screening prioritised 15 consumption forms (Table 1).

Table 1: *Prioritised consumption forms*

#	Crop	Consumption form	Description
1	Bananas	Fresh fruit	Whole bananas are consumed raw. Typically sold in bunches through retail and wholesale channels for direct consumption.
2	Pineapples	Fresh fruit	Whole pineapples sold for immediate consumption.
3	Pineapples	Cold-pressed juice	Juice extracted from fresh pineapple without heat, retaining natural flavour and nutrients. Often sold as a premium product.
4	Moringa	Fresh leaves	Unprocessed moringa leaves consumed as a fresh leafy green in salads, smoothies, or cooked dishes.
5	Moringa	Dried leaf powder	Moringa leaves are dried and finely ground into a powder. This is used as a nutritional supplement or ingredient in smoothies, capsules, tea bags and food formulations.

6	Moringa	Cold-pressed oil	Cold-pressed oil extracted from moringa seeds, known for its stability and use in cosmetics, cooking, and health products. Marketed for its antioxidant and emollient properties.
7	Soybeans	Soy milk	A plant-based dairy alternative produced by soaking and grinding soybeans, then straining the liquid. Consumed as a beverage or used in cooking and baking.
8	Soybeans	Tofu	A soft, protein-rich food made by coagulating soy milk and pressing the curds into blocks. Common in vegetarian and Asian cuisines.
9	Soybeans	Soy sauce	A fermented condiment made from soybeans, wheat, salt, and water. Used as a flavour enhancer in cooking and dipping sauces.
10	Sunflowers	Whole seeds	Dehulled or roasted seeds consumed as a snack or used in bakery and salad applications.
11	Sunflowers	Cold-pressed oil	An oil pressed from sunflower seeds, used in cooking, food processing, and salad dressings.
12	Ginger	Fresh root	Fresh ginger is a rhizome (stem) and is commonly used in cooking, teas, and natural remedies.
13	Ginger	Powder	Ginger powder is made from drying and grinding the ginger root into a fine powder.
14	Turmeric	Fresh root	Fresh turmeric root is used in traditional cooking, herbal tonics and wellness products.
15	Turmeric	Powder	Turmeric powder is produced by drying and grinding fresh turmeric root. It is used in curry powders, health products, and natural dyes

2. Criteria for economic feasibility

The economic feasibility of establishing new crop-based industries in Northland, for any of the seven horticultural and arable crops, was assessed using the structured feasibility framework outlined below. This framework is organised into the following three components:

1. Grower feasibility (assessed at a crop level),
2. Processor feasibility (assessed at a consumption form level), and,
3. Market feasibility (assessed at a consumption form level).

Each component comprises a set of defined criteria (Table 2). These criteria capture the essential factors required for a crop to succeed in Northland, from the economics of growing each crop to selling its associated consumption forms.

Each criterion is scored on a scale from 0 to 4, where 0 indicates the feasibility criterion is not met and 4 indicates it is met with high confidence. The outputs from the financial model and the insights collected from the customer and market engagement (refer to the following sections for relevant methodologies) are used to inform the scores assigned to each criterion for each crop/consumption form according to detailed scoring definitions (see Appendix 2, page 176). The scoring definitions are used to ensure consistency and objectivity when evaluating each crop's economic feasibility and assigning scores to each criterion.

Table 2: *Economic feasibility framework*

Component	Criterion	Requirement
Grower feasibility Crop level	Output potential	Under realistic Northland conditions, the combination of suitable land area and achievable yields must support the intended industry scale.
	Grower profitability	Base-case grower profit per hectare (after typical production costs) must be positive and should meet the required return on establishment capital expenditure.
	Infrastructure and processes	All critical on-farm infrastructure and technology must exist or be practically attainable at the expected scale.
	Grower profit sensitivities	Grower profit must remain viable under plausible downside movements in yield and farmgate price.
	Grower opportunity cost	Expected profit must be competitive with, and preferably exceed, the next-best land-use.
Processor feasibility Consumption form level	Processor profitability	Facility-level profitability (after paying growers, direct processing costs, overheads, depreciation/amortisation, and other fixed operating costs; excluding financing and tax) must be positive at the base case.
	Processor profit sensitivities	Processor profitability must remain positive under plausible changes in the market price and farmgate price paid.
	Logistics and distribution	End-to-end movement of inputs and products (transport, storage, handling, cold chain as needed) must be workable at target cost and reliable.
	Infrastructure and processes	Essential processing infrastructure and technology must exist or be realistically established with manageable investment.
Market feasibility Consumption form level	Demand	Target markets must demonstrate sufficient current and/or growing demand to absorb projected volumes at viable prices.
	Market access	There must be clear, reliable pathways to reach buyers and convert production into sales at sustainable prices, with minimal regulatory/logistical barriers.
	Competition	The product must offer a defensible advantage versus imports/substitutes (e.g., price, quality, freshness, provenance, sustainability) sufficient to win and retain customers.

Determining feasibility

Each component's feasibility is the average of its criterion scores. The component's feasibility will be qualified using the following scale of feasibility:

- Score 0.00 to 1.00 = Not feasible
- Score 1.01 to 2.50 = Small-scale feasibility
- Score 2.51 to 3.50 = Medium-scale feasibility
- Score 3.51 to 4.00 = Large-scale feasibility

Overall feasibility equals the lowest of the three component scores. Table 3 demonstrates this for an example consumption form.

Table 3: *Example assessment of overall feasibility*

Consumption form	Feasibility component			
	Grower	*Processor*	*Market*	*Overall*
1. Consumption form 1	Medium-scale (2.83)	Small-scale (1.80)	Large-scale (3.60)	Small-scale

Financial modelling

Purpose of the financial model

An Excel-based financial model was developed to support objective and consistent scoring of key economic feasibility criteria for growers and processors. It provides a consistent structure to:

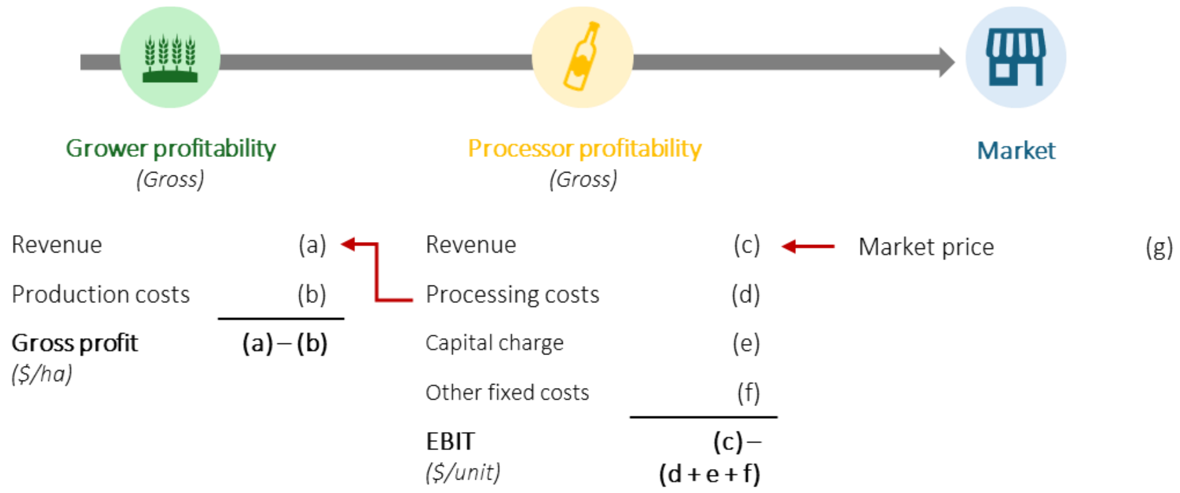
1. Quantify growers' and processors' profitability
2. Compare profitability with alternative land uses (opportunity costs)
3. Test the sensitivity of profitability to changes in key inputs.

This model is used to inform the scores assigned to each criterion for grower and processor economic feasibility (Table 2). Two versions accompany this report: one with all assumptions and inputs for the seven crops, and one blank template.

Model structure

This model is structured to reflect the flow of value from growers to the market, and the flow of money from the market back to growers. The relationship between the three stages of the supply chain considered in this model is illustrated in Figure 2 below. This model has two core modules: one calculates grower profitability ($ per hectare), and another calculates processor profitability (dollars per unit). This integrated approach supports scenario testing by adjusting key inputs to see how profitability changes across the value chain.

Figure 2: *Financial model structure*



Key inputs

This model draws on a range of inputs to calculate the profitability for growers and processors in the value chain (Figure 2). Table 4 below outlines the model's key inputs and how they are used to calculate profitability.

Table 4: *Financial model inputs*

Module	Component	Input	Description
Grower profitability	Set-up costs	Establishment costs	The costs associated with establishing a hectare of each crop with the necessary infrastructure. These are only considered relevant for perennial crops.
	Revenue	Yield *(t/ha)*	Volume (tonnes) of usable crop produced per hectare.
		Farmgate price *($/kg)*	The price received by the grower for their raw product. The farmgate price is set by estimating how value is created and received across the value chain.
	Production costs *($/ha)*	Land preparation	The activities involved in preparing the intended land for planting seeds.
		Planting material	The seeds, seedlings or rootstock required to establish the crop.
		Fertilisers	The nutrient inputs applied to improve soil fertility and crop growth.
		Pesticides	The chemical or biological agents used to protect crops from insect pests and diseases.
		Herbicides	The chemical products used to control weed growth in and around the crop production area.
		Irrigation	The water used to support crop growth during times of drought or low moisture.
		Labour	The human effort required across all crop production activities.
		Machinery/fuel	Use of tractors and other equipment across production activities.
Processor profitability	Set-up costs	Establishment costs	The capital costs associated with establishing a processing facility for the harvested crops.
	Revenue	Conversion efficiency	The volume (kilograms or litres) of raw input (yield) that is processed into the consumable form.
		Sales price *($/unit)*	The price received for the product sold by the processor. The low end of the range used for sales price is aligned with the current market price for imported equivalent products to assess how price-competitive domestic production can be with lower-cost imports, and to estimate a possible scale of operation for a domestic industry.
	Processing costs *($/unit)*	Labour	The human resources directly involved in producing the consumable form.
		Utilities	The cost of essential services (e.g. water and electricity) required for processing operations.
		Ingredients	All inputs (including the raw crop) required to produce the consumable form.

		Packaging	The materials used to contain and preserve the consumable form through to market.
		Distribution	The activities involved with transporting the consumable form to market.
		Maintenance and repair	The ongoing activities associated with maintaining and repairing processing capital.
		Waste/by-product	The disposal of raw input that is not processed into a consumable form.
		Annualised cost of capital[7]	The annualised portion of capital investment required to establish a greenfield processing facility.

All input values are based on crop-specific data collected from a range of sources and informed by stakeholder insights. Initial values are drawn from secondary sources and later calibrated using insights from growers and industry stakeholders. In many cases, this means relying on international estimates and contextualising them to the Northland economy, given the absence of established markets in the region. Uncertainty is addressed by using ranges for key inputs; wider ranges indicate greater uncertainty.

The model outputs are presented in sensitivity tables to illustrate how grower and processor profitability could be expected to fluctuate for different combinations of key inputs. For growers, the most sensitive and uncertain inputs are the annual yield and the farmgate price. For processors, the key sensitivities are the farmgate price paid to growers and the consumer price.

Limitations

In addition to the project's limitations (see page 10), the financial model has the following limitations:

- The model uses profitability as the primary measure of profitability and does not include fixed operating costs. While fixed costs are assumed to be minimal for the average grower, this may overstate feasibility for farms with high fixed costs or capital-intensive systems
- While ranges are used to account for uncertainty in the input values, they are still based on current industry information and are subject to change as economic or climate conditions shift
- Processor profitability at a per-unit level (e.g. per kilogram or litre). Additional economies of scale may exist that this approach does not capture.

[7] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of the asset.

Market and customer engagement

Introduction

A significant proportion of the available resources were dedicated to engaging with industry stakeholders to gather qualitative information that informs model inputs and complements regional quantitative analysis. This component is critical to the analysis, given the absence of established commercial industries domestically for the seven crops being assessed.

That said, there are instances where each of the crops has been trialled in Northland and has become established on a small scale to meet local demand (e.g. Northland-grown bananas). Engaging with industry experts, growers, potential farmgate buyers, and potential processors helps validate the key assumptions (such as crop suitability, market readiness, infrastructure needs, and perceived barriers), which ultimately shape commercial feasibility. Interviews took place between May and July 2025 and were scheduled for 30 to 45 minutes.

Stakeholder engagement

Over 70 stakeholders were identified with relevant industry or crop experience to contribute valuable insights and opinions on the establishment of a new industry for one of the seven crops. 24 interviews were completed with industry experts, growers, potential farmgate buyers, and potential processors of each crop. Several stakeholders provided insights across multiple focus crops. Table 5 below presents the number of stakeholders interviewed for each crop.

Table 5: *Industry stakeholders consulted with by crop*

Crop	Stakeholders engaged
Bananas	12
Pineapples	13
Moringa	2
Soybeans	5
Sunflowers	3
Ginger	11
Turmeric	8
General industry support (no specific expertise)	4

Interview guide

The semi-structured interviews were guided by 10 research questions, which varied in relevance depending on the interviewee's background. These questions were designed to collect practical considerations that may not have been captured through the financial modelling activities, such as capability gaps, regional constraints, and commercial scepticism. This flexible format allowed interviewees to contribute their views in confidence.

The questions asked during the interviews were drawn from the following list:

1. How would you describe the current landscape for these seven crops in New Zealand, particularly in terms of imports versus local production?

2. Which of these seven crops are currently in the highest demand among consumers, and have you noticed any trends or shifts in recent years?
3. Do most consumers prefer to eat the crops fresh or processed (e.g. fruit juice, dried, tinned fruit, etc.)?
4. What are the key limitations or challenges preventing more widespread local cultivation of the seven crops in New Zealand?
5. In your view, what would be the main benefits of producing these seven crops locally, from an economic, environmental, or supply chain perspective?
6. From a logistical and processing standpoint, what infrastructure currently exists, or is lacking, in Northland and New Zealand wide (e.g., packing, cold storage, transport, or processing facilities)?
7. How receptive do you think supermarkets, food processors, or hospitality buyers would be to sourcing locally grown crops, if they were available?
8. Are there particular quality, pricing, or volume expectations that local growers would need to meet to compete with imported crops?
9. Have there been any successful or promising pilot initiatives or businesses attempting to grow these crops locally that you're aware of?
10. What role do you think government policies, trade regulations, or industry associations play in either supporting or hindering local tropical fruit production?

Estimated scale of operation

To aid with the interpretation of the preceding analyses, each chapter concludes with an estimate of the scale of operation for the relevant crop. The estimated scale of operation is the number of commercial hectares that could be planted before output meets market demand.[8] This analysis should be interpreted as a pragmatic regional planning tool to avoid oversupply.

The process of estimating the scale of operation involves aligning the inferred market demand (in kilograms or litres, depending on the feasible consumable forms) with expected on-farm yields per hectare and relevant conversion ratios for post-harvest processing. In most cases, demand data are limited.

The steps to estimate the scale of operation include:

1. Estimating the market demand for the feasible consumable forms,
2. Applying the conversion efficiency rates to estimate the raw product requirement (tonnes) to meet demand, and,
3. Applying the yield assumptions to estimate the number of hectares needed to produce the raw product required to meet demand.

The result is the indicative planted area required to meet future demand. These estimates are not intended as precise targets, but rather as guidance to help inform discussions around land allocation, regional aggregation strategies, and infrastructure requirements.

[8] A commercial grower of either crop is someone growing to generate a profit or earn a living, and who is National Programme 1 (NP1) registered (at a minimum) under New Zealand's Food Act 2014 and/or is New Zealand Good Agricultural Practice (NZGAP) certified.

Chapter 3:
Bananas

This chapter assesses the economic feasibility of growing, processing, and marketing Northland-grown *bananas*, including key cost drivers, market potential, and viability under Northland conditions.

Chapter disclaimer: This section presents indicative results from a simplified financial model, using broad assumptions and input ranges to reflect uncertainty and data limitations. Many figures are drawn from secondary or lower-confidence sources and are not intended to represent precise outcomes. The analysis does not capture the full complexity of on-farm decision-making or site-specific conditions and should not be used as a substitute for detailed business planning or professional advice. The following analysis is intended to be indicative only.

Growing bananas

Introduction

Background

Globally, Cavendish bananas are grown in warm, humid climates like Ecuador, the Philippines and Costa Rica. Cavendish bananas dominate global trade due to their transport resilience and low production costs, particularly for labour, which keeps export prices lower than would be feasible for other potential growing regions. However, the global reliance on this variety leaves the world's supply of bananas vulnerable to pest and disease pressures. New Zealand imports over 80,000 tonnes (valued at approximately NZD$130 million) of Cavendish bananas annually for domestic consumption.

In recent years, New Zealand's domestic banana production has increased, driven by consumers' preference for locally grown fresh produce and rising temperatures in Northland. Growers have had some success growing alternative banana varieties that are better suited to Northland's cooler climate, including the Dwarf Cavendish and various Ladyfinger varieties. While there is limited visibility into the state of the domestic industry, our industry engagement suggests that there may be between 50 and 100 hectares of banana orchards planted across Northland, although a smaller area would be considered 'commercial' for this report.[9]

Bananas are heavy feeders that require nutrient-rich soils and regular fertilising to grow successfully. They are typically planted on Land Use Capability (LUC) classes 1 to 3. They are also in competition with other subtropical fruits established in Northland for the same land. A banana plant typically takes 18 to 24 months from planting to first harvest. Thereafter, new stems yield about 15 to 30 kilograms per plant per year (kg/plant/yr), depending on variety. Bananas can fruit year-round, although winter yields are generally lower, and a higher share of fruit is not fit for consumption. Orchard management activities are labour-intensive and reliant on having physically capable workers year-round to manage plant growth and fruit development. Northland's high rainfall is generally not a concern for growing bananas as long as there is adequate drainage to remove excess water and the temperature is above approximately 15 °C. Colder temperatures slow growth rates, and prolonged temperatures below approximately 10 °C can kill plants. In exposed areas, wind protection may also be necessary to avoid plant damage and fruit loss.

While we appreciate that there are several different varieties of banana being grown across Northland, and around which a domestic industry could be built, we focus on the economic feasibility of growing, processing and marketing ladyfinger varieties for this case study.

Estimated yield

Expected banana yields (tonnes per hectare per year, t/ha/yr) are dependent on several factors, including variety, planting pattern, density, harvest season, site location, and companion planting

---

[9] A commercial grower of bananas is someone growing bananas to generate a profit or earn a living, and who is National Programme 1 (NP1) registered (at a minimum) under New Zealand's Food Act 2014 and/or is New Zealand Good Agricultural Practice (NZGAP) certified.

National Programme 1 (NP1) is the registration process for low-risk food businesses under New Zealand's Food Act 2014 to ensure they are managing food safety risks and producing safe food for sale. The New Zealand Good Agricultural Practice (NZGAP) certifies the safe and sustainable production of fruit and vegetables in New Zealand and is generally required by retailers to supply them.

strategies. For this work, the annual banana yield is estimated to be between 8 and 20 t/ha/yr (midpoint of 14 tonnes), assuming that 800 ladyfinger plants each produce an average of 10 to 25 kg/yr.[10] Not all fruit grown will be saleable, with approximately 10% wastage (1.40 tonnes), and up to 20% of the available fruit for sale after wastage (12.60 tonnes) not reaching commercial standards. The following analysis assesses the financial feasibility through the sale of:

1. **Commercial grade fruit:** Estimated at 80% to 90% (annual average) of the saleable yield, or between 5.44 and 17.10 t/ha/yr (modelled midpoint of 10.71 tonnes).
2. **Non-commercial grade fruit**: Estimated at 10% to 20% (annual average) of the saleable yield, or between 1.36 and 1.90 t/ha/yr (modelled midpoint of approximately 1.89 tonnes). This fruit will receive a 50% discount on the farmgate price ($/kg) compared to commercial grade fruit.

Costs to grow bananas

Estimated set-up costs

Excluding the purchase of land and machinery, a prospective grower could expect to spend between $57,500 and $158,000 to set up a hectare of Ladyfinger bananas. However, the actual costs will vary depending on the characteristics of the intended growing area and the available resources. To better control the growing environment, growers may choose to invest in more elaborate infrastructure, such as polytunnels and greenhouses. Further investment could reduce the competitiveness of domestic production compared to low-cost imported Cavendish bananas.

Table 6: *Growing set-up costs: Bananas (Ladyfinger)*

Activity	Estimated cost ($/ha)		Commentary
	Low	*High*	
Land preparation	$5,000	$15,000	Soil clearing, contouring and nutrient improvement.
Planting material	$20,000	$28,000	800 Ladyfinger pups at $25 to $35 per pup.
Irrigation system	$0	$20,000	Depends on seasonal rainfall and water access.
Wind protection	$0	$10,000	Required for growing in exposed areas.
Frost protection	$0	$10,000	Required for growing in colder microclimates.
Security	$3,000	$10,000	Installing perimeter fences, gates and access tracks.
Labour	$10,000	$20,000	Labour is required to complete the set-up activities.
Tools/equipment	$10,000	$20,000	Depends on the tools and equipment available.
Certification[11]	$2,000	$5,000	Food Act (NP1) registered and/or NZGAP certified.
Contingency	$7,500	$16,000	Approximately 15% for unforeseen set-up costs.
Total ($/ha)	**$57,500**	**$158,000**	

[10] While we acknowledge the different potential revenue streams from a hectare of bananas (e.g. sale of whole banana leaves, sale of stems and pups to other growers, particularly as an orchard builds towards maturity), we only model grower financial feasibility for the sale of whole bananas to post-harvest processors. Other revenue sources are considered less sustainable for establishing a commercial industry. For example, as the industry grows, the demand for stems and pups will decrease.

[11] The costs of becoming compliant to achieve certification are not considered in this analysis due to the variable nature of these costs between orchards.

The useful lifetime of banana mats is approximately 12.5 years before they need to be replaced, although this depends on continued performance. At the midpoint estimate to establish a hectare of bananas ($107,750), the annual gross profit must be $12,498 per ha; at this level, the NPV of growing bananas is modelled to be $0 using a 6% required rate of return. To achieve this level of gross profitability, growers will need to receive a farmgate price of $6.15 per kg under the midpoint yield and base cost assumptions (see below).

Annual gross profitability

We use gross profitability as the primary measure of the crop's ongoing economic feasibility, reflecting the difference between revenue earned and the direct and variable costs associated with growing bananas. Fixed costs for growers (i.e. those that do not necessarily scale with the level of production) are assumed to be relatively minimal and vary significantly between growers based on personal preference, so are not considered in the following analysis. Table 7 shows the annual gross profitability for growers on a per-hectare basis for three scenarios. The large spread between the pessimistic and optimistic scenarios reflects differences in yield, farmgate price and labour input.

Table 7: *Grower gross profitability: Bananas (Ladyfinger)*

Particulars	Gross profitability ($/ha)		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$12,240	$40,793	$90,250
Estimated growing costs [2]	$45,536	$59,175	$65,100
Gross profit	**-$33,296**	**-$18,383**	**$25,150**
Gross margin	-272%	-45%	28%

1 Revenue earned is calculated as the product of yield (see above) and the farmgate price received by banana growers for bananas sold (commercial grade = $2.00 to $5.00 per kg, non-commercial grade = $1.00 to $2.50 per kg). The farmgate price is set by estimating how value is created in market and spent across the value chain's stages.

2 The growing cost estimate includes site maintenance, plant replacements, fertiliser applications, water input (as required), labour and machinery/technology use. The cost of labour is approximately 85% of the annual recurring growing costs. Managing bananas is very manual, with an estimated 0.7 to 1 full-time equivalent (FTE) required per hectare. One FTE is estimated at $60,000 (about $28.80 per hour).

Sensitivity of annual gross profitability

A grower's annual gross profitability is particularly sensitive to fluctuations in the expected yield (14 t/ha/yr) and the expected farmgate price ($3.50 per kg). Table 8 demonstrates how our estimated grower's gross profitability varies for all combinations of seven levels of each of these two variables, while keeping the estimated growing costs constant at the *base* estimate; labour costs are an exception, which scale to changes in yield. Of the modelled scenarios around the expected values, 33% result in a positive annual gross profit, 10% achieve a gross margin greater than 25%, and 6% exceed the required level of gross profit per hectare ($14,498).

Table 8: *Sensitivity of grower gross profitability: Bananas (Ladyfinger)*

		Farmgate price received ($/kg) [1]						
		$3.00	$3.50	$4.00	$4.50	$5.00	$5.50	$6.00
Total yield (t/ha/yr)	8.00	-$17,338	-$14,008	-$10,678	-$7,348	-$4,018	-$688	$2,642
	10.00	-$19,629	-$15,466	-$11,304	-$7,141	-$2,979	$1,184	$5,346
	12.00	-$21,919	-$16,924	-$11,929	-$6,934	-$1,939	$3,056	$8,051
	14.00	-$24,210	**-$18,383**	-$12,555	-$6,727	-$900	$4,927	$10,755
	16.00	-$26,501	-$19,841	-$13,181	-$6,521	$139	$6,799	$13,459
	18.00	-$28,791	-$21,299	-$13,806	-$6,314	$1,179	$8,671	$16,164
	20.00	-$31,082	-$22,757	-$14,432	-$6,107	$2,218	$10,543	$18,868

[1] Table 8 uses a wider farmgate price range than the model inputs. While the model runs from $2.00 to $5.00 per kg, we extend this to $6.00 per kg (the price that gives an NPV of $0) to show the full range of possible gross profits for different scales of production. Selecting "Bananas" in the model will not show this extended range.

Opportunity cost of growing bananas

Across Northland, bananas are competing for the same high-quality soils and subtropical climates that are suitable for growing other subtropical fruits and vegetables. Table 9 below presents the estimated gross profitability (dollars per hectare) for several competing crops with similar establishment costs to illustrate the opportunity cost for growing bananas. While land-use decision-making also depends on multiple non-financial factors, this comparison illustrates the scale of the financial incentive to allocate land to other options.

Table 9: *Opportunity cost of growing bananas (Ladyfinger)*

Competing crops	Estimated gross profit ($/ha)			Net benefit/loss
	Low	*Midpoint*	*High*	*of growing bananas*
Bananas	-$33,296	-$18,383	$25,150	N/A
Avocados	$20,000	$27,500	$35,000	**-$45,883**
Tamarillos	$5,000	$12,500	$20,000	**-$30,883**
Oranges	$8,000	$11,500	$15,000	**-$29,883**

Assessment of grower feasibility

We assess the economic feasibility of growing bananas using the five grower-related feasibility criteria below (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for growers presented earlier in this chapter:

1. **Output potential:** Banana varieties like Ladyfinger that are suited to cooler climates could yield between 8 and 20 t/ha/yr in suitable microclimates across Northland. While land is available to grow bananas, it is highly fertile and suitable for many other established and emerging horticultural and arable crops. Northland's cooler conditions will mean that banana yields are lower than international banana orchards (despite growing varieties suitable to Northland), particularly if harvests coincide with the region's cooler months.

2. **Grower profitability:** At the midpoint, a commercial banana orchard is not expected to be profitable. However, the modelling does suggest there are instances where a commercial banana orchard could achieve gross profit above the required annual return ($12,498) to justify set up costs with favourable market conditions and efficient production (Table 7 – Optimistic scenario).
3. **Infrastructure:** Bananas are susceptible to several climatic risks that will need to be mitigated to promote high yields. The necessary (e.g. wind shelters, frost protection and drainage) and optional infrastructure (e.g. polytunnels and greenhouses) are readily available in Northland and can be adapted from comparable horticulture production systems. The scale of investment required for the necessary infrastructure (which we assumed above) is relatively low, but the investment required for optional infrastructure could be significant.
4. **Sensitivity of profitability:** There is considerable variability in the expected gross profitability of Northland banana orchards due to the uncertainty in yield, the farmgate price received and production costs (particularly the cost of labour). For example, a 14% decrease in the farmgate price received from $3.50 to $3.00 per kilogram at the expected yield results in a disproportionate decrease (32%) in gross profitability.
5. **Grower opportunity cost:** The opportunity cost of growing bananas is considered high, with all the competing crops considered in Table 9 generating a better gross profit, on average.

For these reasons, domestically grown bananas are considered feasible for growers at a *small scale* (grower feasibility score of 1.20), provided there are favourable market conditions that result in a high enough farmgate price received (minimum $6.15 per kg) to adequately offset the high costs of domestic production and to justify the level of upfront investment to establish a hectare of bananas (Table 10).

Table 10: *Grower feasibility: Bananas*

Criterion	Score *(from 0 to 4)*
Output potential	2.00
Profitability	0.50
Infrastructure	2.00
Sensitivities	1.00
Opportunity cost	0.50
Average score	**1.20** Small-scale

Bananas: Fresh fruit

Fresh bananas are the only prioritised consumption form for bananas in this market opportunities study (refer to page 14 for more information).

Introduction

Description

New Zealand consumers purchase large volumes of bananas, with over 80,000 tonnes consumed annually, nearly all of which is imported from Ecuador, the Philippines and Mexico. All imported bananas consumed are of the Cavendish variety. The bananas grown and sold in New Zealand, however, could be one of several different varieties. The value proposition of consuming domestically grown bananas is that:

1. They are grown locally and support communities to thrive.
2. They introduce a spray-free option, avoiding offshore phytosanitary treatments.
3. They ripen on the tree, rather than being harvested green and ripened off-plant.
4. There are several alternative banana varieties for consumers to choose from with different appearances and taste profiles.
5. They have a relatively lower sucrose content because they are grown in a cooler climate.

Conversion efficiency

For every tonne of commercial grade bananas harvested, one tonne of bananas is available for sale (note that on-orchard wastage and pack out losses are accounted for before this step).

Processing steps

The steps involved in preparing bananas for consumption are minimal and include:

1. Transporting the harvested bananas to a processing facility.
2. Removing non-commercial grade and damaged fruit.
3. Hanging and separating commercial grade bananas into small bunches, ready for sale.
4. Cleaning and grading bananas for size and quality.
5. Distributing bunches to retailers.

The required investment is low, although specialised cool storage that can handle the temperatures tropical fruits require may be necessary to preserve quality and control ripening, depending on the time to market.

A processing facility could either be established by individual growers near their orchards or by a grower collective or private investor in a peri-urban central location close to utilities, logistics networks, and labour. Given that the scope of this work is to assess the feasibility of establishing a commercial industry across Northland, the latter is prioritised in the following analysis.

Costs to process bananas

Facility establishment costs

The estimated costs to establish a banana processing facility in a peri-urban setting (capital expenditure only) to prepare bananas for consumption are presented in Table 11 for three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility** processing between 500 and 1,500 t/yr of bananas from approximately 50 to 140 hectares of commercial banana orchards. Operations will be largely manual, with limited mechanisation.
- **Medium-scale facility** processing between 1,500 and 3,000 t/yr of bananas from approximately 140 to 300 hectares of commercial banana orchards. Operations will be semi-automated with machinery supporting the grading and handling of fruit.
- **Large-scale facility** processing between 3,000 and 5,000 t/yr of bananas from approximately 300 to 475 hectares of commercial banana orchards. Operations will be heavily automated with machinery supporting all aspects of processing from inwards goods, grading and distribution.

All scales of a processing facility will have tailored cool-storage facilities (i.e. that can cope with the temperature range of subtropical fruits) to control the rate at which bananas ripen, thereby regulating the supply of bananas to market.

Table 11: *Costs to establish a banana processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small facility (500–1500 t/yr)*	*Medium facility (1500–3000 t/yr)*	*Large facility (3,000–5,000 t/yr)*
Site development/buildings	25	500k–1m	1m–1.8m	2m–3m
Processing equipment	15	30k–60k	150k–250k	300k–500k
Packing equipment & benches	15	10k–20k	50k–100k	100k–200k
Storage facilities	15	50k–100k	150k–250k	300k–500k
Palletising & internal logistics	15	20k–40k	50k–100k	80k–130k
Utilities installation	20	10k–30k	30k–90k	70k–120k
Office/staff facilities	20	15k–50k	60k–130k	150k–200k
Compliance & fit out	15	10k–20k	50k–100k	100k–150k
Contingency	20	45k–80k	230k–420k	460k–720k
Total		690k–1.4m	1.77m–3.24m	3.56m–5.52m
Annualised capital charge ($/kg) [1]		**$0.08–$0.12**	**$0.09–$0.10**	**$0.10–$0.10**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of the asset.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput above are presented in Table 12 on a per-kg basis. We assume the cost of bananas (as the raw product) is constant across the three facilities.

Table 12: *Costs to operate a banana processing facility*

Cost category	Operating costs ($/kg)		
	Small facility (500–1500 t/yr)	*Medium facility (1500–3000 t/yr)*	*Large facility (3,000–5,000 t/yr)*
Labour	$0.35–$0.55	$0.25–$0.35	$0.20–$0.30
Utilities (e.g. electricity & water)	$0.02–$0.03	$0.01–$0.03	$0.01–$0.02
Raw product	$1.50–$3.00	$1.50–$3.00	$1.50–$3.00
Packaging & distribution	$0.50–$1.50	$0.30–$1.10	$0.20–$0.80
Maintenance & cleaning	$0.01–$0.02	$0.03–$0.05	$0.03–$0.05
Waste/by-product removal	$0.00–$0.01	$0.00–$0.00	$0.00–$0.02
Total ($/kg)	**$2.38–$5.11**	**$2.09–$4.53**	**$1.94–$4.19**

Earnings before interest and tax (EBIT)

EBIT ($/kg) is used to assess the financial feasibility of a processing facility preparing bananas for sale and consumption (Table 13). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 13: *Estimated EBIT: Processing bananas (medium-scale facility)*

Particulars	EBIT ($/kg) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$2.50	$5.19	$8.33
Processing costs *(including raw product costs)*	$6.53	$4.56	$2.59
Gross profit	-$4.03	$0.63	$5.74
Annualised capital charge	$0.10	$0.10	$0.09
Allowance for annual fixed costs [2]	$0.10	$0.21	$0.33
EBIT	**-$4.23**	**$0.33**	**$5.31**
EBIT %	-169%	6%	64%

[1] Revenue earned is calculated as the product of the volume of bananas sold (see above) and the wholesale banana price. Data on processor wholesale pricing is limited. We therefore estimate from the retail price ($3.50 to $10.00 per kg) *less* an assumed retail markup (20 to 40%). The price received by processors to cover their cost of production, therefore, ranges from $2.50 to $8.33 per kg of bananas sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

EBIT is particularly sensitive to two variables: the price received in the market for New Zealand bananas and the price paid to growers (i.e. farmgate price) for harvested bananas. Table 14 demonstrates how a processor's EBIT fluctuates due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. 55% of the modelled combinations of these variables produce a positive EBIT, with 49% achieving an EBIT margin of at least 7.50%.

Table 14: *Sensitivity of processor EBIT: Bananas*

		Farmgate price paid ($/kg)						
		$5.00	$4.50	$4.00	$3.50	$3.00	$2.50	$2.00
Market price ($/kg)	$3.50	-$3.67	-$3.17	-$2.67	-$2.17	-$1.67	-$1.17	-$0.67
	$4.58	-$2.84	-$2.34	-$1.84	-$1.34	-$0.84	-$0.34	$0.16
	$5.67	-$2.01	-$1.51	-$1.01	-$0.51	-$0.01	$0.49	$0.99
	$6.75	-$1.17	-$0.67	-$0.17	$0.33	$0.83	$1.33	$1.83
	$7.83	-$0.34	$0.16	$0.66	$1.16	$1.66	$2.16	$2.66
	$8.92	$0.49	$0.99	$1.49	$1.99	$2.49	$2.99	$3.49
	$10.00	$1.33	$1.83	$2.33	$2.83	$3.33	$3.83	$4.33

Processor feasibility for bananas

The economic feasibility of preparing bananas for consumption is assessed using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Preparing whole bananas for consumption in a post-harvest facility is expected to be profitable with an EBIT margin of 6%. At this rate, processing bananas is a marginally financially sustainable activity.

2. **Sensitivity of profitability:** There is moderate variability in the expected profitability of a Northland post-harvest facility for banana production. 55% of the modelled scenarios in Table 14 result in a positive EBIT, while 49% result in an EBIT margin of 7.50% or more. This indicates that even minor fluctuations in either of the key variables will have a significant impact on the facility's profitability and financial sustainability. Processor EBIT is proportionately more sensitive to the market price paid by consumers, particularly as it decreases towards the market price of imported Cavendish bananas (e.g. around $3.50 to $4.00 per kg).

3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport harvested bananas between orchards and a processing facility. There are already well-established transportation channels across Northland for other industries (e.g. dairy, sheep and beef), as well as cool-storage distribution channels to markets across Northland and into Auckland. While there may be initial inefficiencies that could add steps or complexity and increase distribution costs, existing logistical processes can likely be adapted to service the Northland banana industry.

4. **Infrastructure:** Establishing a Northland banana industry will require investing in post-harvest processing facilities to prepare the harvested bananas for consumption. The infrastructure

requirements are relatively low as the processing activities are minimal. While some investment would be required to establish a new facility, all the necessary assets are available or easily adaptable from other industries.

For these reasons, we consider domestically grown bananas feasible only at a *small scale* (Processor feasibility score of 2.00), provided the market price remains high enough to adequately offset the relatively higher costs of domestic production (Table 15).

Table 15: *Processor feasibility: Bananas*

Criterion	Score *(from 0 to 4)*
Profitability	2.00
Sensitivities	1.00
Logistics & distribution	2.00
Infrastructure	3.00
Average score	2.00 Small-scale

Market feasibility for bananas

The economic feasibility for bananas in domestic markets is assessed using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic industry:

1. **Supply and demand:** Domestic demand for bananas is generally strong. However, limited access, low customer awareness, and a lack of education or interest in locally grown bananas mean attracting first-time buyers and securing repeat purchases will likely be challenging for the sub-tropical varieties grown in Northland. Certain cultural groups, such as South Africans and Pacific Islanders, may represent the primary customer base, as they are more accustomed to these varieties. Some specialists or boutique grocers and food boxes may have the flexibility and capacity to trial and sell niche banana crops in small volumes. Demand will take some time to grow, and it is important to manage supply growth to avoid an oversupply of domestic bananas in the market and avoid the risk of price crashes. Domestic production further introduces a new market opportunity for consumers valuing spray-free (e.g. avoiding border fumigation and pesticide sprays) and organic production.

2. **Market access:** There are known markets for local bananas, although these are usually restricted to local farmers' markets, farmgate sales and boutique fresh fruit retailers. Some growers already sell their Northland-grown bananas in Auckland and Waikato markets. Some varieties have specific transportation needs as they can bruise easily in transit without the appropriate packaging. Additionally, local storage and transport will have to be organised to reach a bigger operation scale for Northland-grown bananas. To be able to extend the season of New Zealand grown bananas, some stakeholders mentioned the need for storing and ripening facilities. According to other stakeholders, transport of food goods from Northland to other regions of New Zealand is already well operated via dedicated transporters, retailers and intermediates, so transport is unlikely to be an issue.

3. **Competition and market-related risks:** Imported Cavendish bananas are the most consumed fruit in New Zealand, with over 80,000 tonnes consumed annually. The supply chain for imported Cavendish bananas is well-established, with large volumes available in mainstream supermarkets at a comparably low price. Mainstream supermarket chains are unlikely to shift to domestic production, especially if the price and supply volumes cannot compete with low-cost, high-volume imported bananas. However, boutique supermarkets and organic chains expressed an interest in diversity and are more flexible with pricing.

Demand for New Zealand-grown sub-tropical banana varieties is currently limited, as consumers are unfamiliar with their taste and usage, and these niche varieties compete against the low-cost, widely available Cavendish bananas. Opportunities exist through boutique retailers, organic chains, and food box subscriptions, where small volumes can be trialled and marketed with an emphasis on local, organic, and spray-free attributes. Scaling beyond Northland will require investment in storage, ripening facilities, and GAP certification to access larger retail channels. While transport logistics are established, high production costs and low consumer awareness pose adoption challenges. Overall, the market is small but might be a viable niche if targeted toward specialty channels, supported by consumer education, and positioned around local and organic differentiation. For these reasons, domestically grown bananas are assessed to be feasible in the market at a small scale (market feasibility score = 1.67; Table 16).

Table 16: *Market feasibility: Bananas*

Criterion	Score *(from 0 to 4)*
Supply & demand	2.00
Market access	2.00
Competition & market-related risks	1.00
Average score	1.67 Small-scale

Feasibility of a Northland banana industry

Scale of economic feasibility

The economic feasibility of bananas considers the individual feasibility for growers, processors, and the market presented in the previous sections. Table 17 summarises grower, processor and market feasibility for the different consumption forms assessed for bananas (in this case, just fresh fruit).

Table 17: *Feasibility of establishing a banana industry in Northland*

Consumption forms	Feasibility component			
	Grower	*Processor*	*Market*	*Overall*
1. Fresh bananas	Small-scale (1.20)	Small-scale (2.00)	Small-scale (1.67)	Small-scale

Overall, a domestic banana industry is considered economically feasible at a *small scale* under current economic conditions and assuming agronomic feasibility. To build market share beyond the niche scale that we assume, the industry would need to progressively reach more price-sensitive consumers who are less willing to pay higher retail prices for domestically grown bananas. Growing market share would require lowering prices toward imported levels ($3.50 to $4.00 per kilogram). However, reducing retail prices too low compromises grower profitability. For example, the modelling suggests that for growers to be profitable, a minimum retail price of $8.38 per kilogram is required under the midpoint yield and base cost assumptions; at this level, the farmgate price is $5.08 per kilogram. However, to achieve the required gross profit to justify the upfront investment ($12,498), a retail price of $9.77 per kilogram is required under the same conditions.

Estimated scale of operation

We estimate that a domestic banana industry could grow to supply between 1% and 2% of domestic banana consumption (approximately 80,000 tonnes). At the estimated midpoint commercial yield (10.71 tonnes per hectare), this will mean the industry could grow to around 75 to 150 commercial hectares (Table 18). At this scale, commercial banana growers could generate gross profits of around $15,000 per hectare, assuming moderately efficient input costs and a premium retail price of around $10 per kg. Expanding the industry further risks eroding profitability as increased domestic supply would push prices closer to those of imported bananas. In total, an industry of this scale is estimated to generate $1.1 to $2.3 million in gross profit per year.

Table 18: *Estimated scale of the Northland banana industry*

Particulars	Feasible consumption form: Fresh bananas
Estimated demand	800–1,600 t
Conversion efficiency	100%
Raw product required	800–1,600 t
Estimated yield	10.71 t/ha/yr
Land required	**75–150 of commercial hectares**
Aggregated gross profit	**$1.1–$2.3 million**

Chapter 4:
Pineapples

This chapter assesses the economic feasibility of growing, processing, and marketing Northland-grown *pineapples*, including key cost drivers, market potential, and viability under Northland conditions.

Chapter disclaimer: This section presents indicative results from a simplified financial model, using broad assumptions and input ranges to reflect uncertainty and data limitations. Many figures are drawn from secondary or lower-confidence sources and are not intended to represent precise outcomes. The analysis does not capture the full complexity of on-farm decision-making or site-specific conditions and should not be used as a substitute for detailed business planning or professional advice. The following analysis is intended to be indicative only.

Growing pineapples

Introduction

Background

Globally, pineapples are grown in the warm, humid climates around Indonesia, the Philippines, and Costa Rica. The Smooth Cayenne variety dominates global trade due to transport resilience and low production costs, particularly labour, which keeps export prices low. New Zealand imports over 9,000 tonnes (valued at approximately NZD$34 million) of pineapples annually for domestic consumption.

With fewer than 10 hectares in commercial production,[12] domestic pineapple production is considered experimental. The Queen and Red varieties have shown some success in Northland as a cold-tolerant alternative variety. Interest in growing pineapples is increasing, with the crop being promoted as an alternative use of Northland's highly fertile horticultural soils.

Site location is important; depending on the chosen site, growers may need infrastructure to manage growing conditions. Pineapples are heavy feeders and require regular fertilising to grow successfully. They are also in competition with other subtropical fruits established in Northland for the same land. Pineapples are drought-tolerant, although they require moisture to support fruit development. While Northland's annual rainfall is adequate, extended dry and wet periods throughout the year can impact growth rates and fruit maturity. Pineapples are susceptible to various forms of rot during extended wet periods. Therefore, free-draining soils, mounded beds, and sloped growing sites are critical to disperse excess water. Pineapples may also require supplementary irrigation during extended dry periods.

Pineapples thrive when the daily temperature is maintained between 20 and 30 °C, with night temperatures above 15 °C. Sustained temperatures below 15 °C slow growth, and prolonged exposure below 10 °C can be fatal. Wind protection is also necessary in exposed areas to avoid physiological damage and fruit loss.

Estimated yield

Expected pineapple yields (tonnes per hectare per year, t/ha/yr) depend on several factors, including the variety of pineapples grown, the planting pattern and density, harvest season, site location, companion planting strategies and, most importantly for Northland's cooler temperatures, supporting infrastructure and resources. For this work, we estimate the annual pineapple yield to be between 30 and 40 t/ha/yr for an open field system (midpoint of 35 tonnes)[13], assuming approximately 40,000 productive plants per hectare, each producing about 0.75 and 1 kg of fruit annually. Not all fruit grown will be saleable, with approximately 10% wastage (3.50 tonnes), and up to 20% of the available fruit for

[12] A commercial grower of pineapples is someone growing pineapples to generate a profit or earn a living, and who is NP1 registered (at a minimum) under New Zealand's Food Act 2014 and/or is NZGAP certified.
National Programme 1 (NP1) is the registration process for low-risk food businesses under New Zealand's Food Act 2014 to ensure they are managing food safety risks and producing safe food for sale. The New Zealand Good Agricultural Practice (NZGAP) certifies the safe and sustainable production of fruit and vegetables in New Zealand and is generally required by retailers to supply them.
[13] While we acknowledge the different potential revenue streams from pineapple growing (e.g. sale of harvested planting material), we only model grower financial feasibility for the sale of whole pineapples to post-harvest processors. Other revenue sources are considered less sustainable for establishing a commercial industry. As the industry grows, the demand for new planting material will decrease as new growers can supply their own material for replanting. Further, the supply of planting material will increase as more growers will produce planting material in excess of their own requirements.

sale (31.50 tonnes) not reaching commercial standards. The following analysis assesses financial feasibility using the sale of:

1. **Commercial grade pineapples:** Estimated at 80% to 90% of the total yield, or between 20.40 and 34.20 t/ha/yr.
2. **Non-commercial grade pineapples:** Estimated at 10% to 20% of the total yield, or between 3.80 and 5.10 t/ha/yr. This fruit will receive a discounted (50%) farmgate price per kilogram versus commercial grade.

Costs to grow pineapples

Estimated set-up costs

Excluding the purchase of land and machinery, a prospective pineapple grower could expect to spend between $105,000 and $188,000 to set up a hectare of Queen pineapples outdoors. However, the actual costs will vary depending on the characteristics of the intended growing area and the available resources. To better control the growing environment, a grower may choose to invest in more elaborate infrastructure (e.g. low-tech polytunnels; between $400,000 and $600,000 per hectare), although this cost is excluded from the estimates in Table 19.

Table 19: *Growing set-up costs: Pineapples (Queen)*

Activity	Estimated cost ($/ha)		Commentary
	Low	*High*	
Land preparation	$5,000	$15,000	Soil clearing, contouring and nutrient improvement.
Planting material	$32,000	$48,000	1,600 suckers, $20 to $30 per sucker[14].
Irrigation system	$0	$20,000	Depends on seasonal rainfall and water access.
Wind protection	$0	$10,000	Required for growing in exposed areas.
Frost protection	$0	$10,000	Required for growing in colder microclimates.
Security	$3,000	$10,000	Installing perimeter fences, gates and access tracks.
Labour	$20,000	$25,000	Labour required to complete the set-up activities.
Tools/equipment	$10,000	$20,000	Depends on the tools and equipment available.
Certification[15]	$2,000	$5,000	Food Act (NP1) registered and/or NZGAP certified.
Contingency	$30,000	$50,000	Approximately 15% for unforeseen set-up costs.
Total ($/ha)	**$105,000**	**$188,000**	

The case for staged establishment

A staged approach to establishing pineapple production is the most financially sustainable method for developing a hectare of Queen pineapples in Northland. A mature sucker fruits after roughly 18 months and then produces one fruit annually for about four more years via ratooning, before yielding around

[14] We expect that, as the industry grows in scale and matures, the price of new suckers purchased to establish a hectare of pineapples will reduce significantly as they become more accessible and available. For example, the cost of planting material, as a proportion of establishment costs, is much lower in international growing regions.

[15] The costs of becoming compliant to achieve certification are not considered in this analysis due to the variable nature of these costs between orchards.

five usable suckers at the end of its six-year cycle. This growth pattern creates a strong incentive to expand gradually using on-farm planting material, as purchasing the ~40,000 suckers required for a fully allocated hectare upfront is not commercially viable at current prices and results in a negative net present value over a 25-year timeframe. Beginning with 1,600 suckers and scaling as home-grown suckers become available significantly lowers establishment costs and strengthens long-term returns. At this rate, a full producing hectare will be achieved approximately 14 years following the initial establishment.

As the industry grows and sucker supply increases, planting material is expected to become more affordable and accessible, reducing the need for staged establishment; however, under current conditions, staged development remains the only realistic and financially sound pathway to establishment.

Required annual gross profit

At the midpoint establishment cost of approximately $146,500, a grower would require a gross profit of $25,094/ha/yr to justify this scale of investment at a 6% rate of return; at this level, the NPV of growing bananas is modelled to be $0. To achieve this level of gross profitability, growers will need to receive a farmgate price of $2.74 per kg under the midpoint yield and base cost assumptions (see below).

Annual gross profitability

We use gross profitability as the primary measure of the crop's ongoing economic feasibility, reflecting the difference between revenue earned and the direct costs associated with growing pineapples. Fixed costs (i.e. those that do not necessarily scale with the level of production) are assumed to be relatively minimal and vary significantly between growers based on personal preference, so we have not considered them in the following analysis. Table 20 shows the gross profitability for growers on a per-hectare basis for three scenarios. There is a significant range between the pessimistic and optimistic scenarios, mostly due to differences in revenue earned and the labour input.

Table 20: *Grower gross profitability: Pineapple (Queen)*

Particulars	Gross profitability ($/ha)		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$24,863	$52,205	$90,250
Estimated growing costs [2]	$47,613	$41,500	$32,530
Gross profit	**-$22,751**	**$10,705**	**$57,720**
Gross margin	-92%	21%	64%

[1] Revenue earned is calculated as the product of yield (see above) and the farmgate price received by pineapple growers for pineapples sold (commercial grade = $1.30 to $3.00 per kg, non-commercial grade = $0.65 to $1.50 per kg). The farmgate price is set by estimating how value is created in market and spent across the value chain's stages.

[2] The growing cost estimate includes site maintenance, fertiliser applications, water input (as required), labour and machinery/technology use. The cost of labour is approximately 85% of the annual recurring growing costs. Managing pineapples is labour-intensive, with an estimated 0.9 to 0.5 FTE required per hectare. One FTE is estimated to cost $60,000 (about $28.80 per hour). For this analysis, this is slightly above a typical hourly rate for a general horticulture field worker in New Zealand.

Sensitivity of annual gross profitability

A grower's gross profitability is particularly sensitive to fluctuations in the expected yield (35 t/ha/yr) and the expected farmgate price ($2.15 per kg). Table 21 demonstrates how our estimated grower's gross profitability varies for all combinations of seven levels of each of these two variables, while keeping the estimated non-labour growing costs constant at the *base* estimate; labour costs are an exception, which scale to changes in yield. Of the modelled scenarios:

- 71% result in a positive annual gross profit,
- 45% result in an annual gross profit of 25% or more[16],
- 20% result in an annual gross profit greater than the required rate of return ($25,094)

In Table 21, yield is the total harvested fruit. We assume 85% of total saleable yield is sold at the full farmgate price, and 15% is sold at 50% of the farmgate price.

Table 21: *Sensitivity of grower gross profitability: Pineapples (Queen)*

		Farmgate price received ($/kg)						
		$1.30	$1.58	$1.87	**$2.15**	$2.43	$2.72	$3.00
Total yield (t/ha/yr)	30.00	-$9,444	-$3,547	$2,350	$8,247	$14,144	$20,041	$25,938
	31.67	-$9,607	-$3,383	$2,842	$9,066	$15,291	$21,515	$27,740
	33.33	-$9,771	-$3,219	$3,333	$9,885	$16,438	$22,990	$29,542
	35.00	-$9,934	-$3,055	$3,825	**$10,705**	$17,584	$24,464	$31,344
	36.67	-$10,098	-$2,891	$4,317	$11,524	$18,731	$25,939	$33,146
	38.33	-$10,261	-$2,727	$4,808	$12,343	$19,878	$27,413	$34,948
	40.00	-$10,425	-$2,563	$5,300	$13,163	$21,025	$28,888	$36,750

The opportunity cost of growing pineapples

Across Northland, pineapples are competing for the same high-quality soils and subtropical climates that are suitable for growing other subtropical fruits and vegetables. Table 22 presents the estimated gross profitability (dollars per hectare) for several competing crops with similar establishment costs to illustrate the opportunity cost for growing pineapples. While land-use decision-making also depends on multiple non-financial factors, this comparison illustrates the scale of the financial incentive to allocate land to other options.

[16] A 25% gross margin threshold is considered within the normal range for outdoor food producers in New Zealand.

Table 22: *Opportunity cost of growing pineapples (Queen)*

Competing crops	Estimated gross profit ($/ha)			Net benefit/loss
	Low	*Midpoint*	*High*	*If growing pineapples*
Pineapples	-$22,751	$10,705	$57,720	N/A
Kiwifruit (Green)	$10,000	$30,000	$50,000	-$19,295
Avocados	$20,000	$27,500	$35,000	-$16,795
Tamarillos	$5,000	$12,500	$20,000	-$1,795
Oranges	$8,000	$11,500	$15,000	-$795

Assessment of grower feasibility

We assess the economic feasibility of growing pineapples using the five grower-related feasibility criteria below (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for growers presented earlier in this chapter:

1. **Output potential:** Pineapple varieties like Queen that are suited to Northland's cooler climates could yield between 30 and 40 t/ha/yr in microclimates across Northland. While land is available to grow pineapples, it is highly fertile and suitable for many other established and emerging horticultural and arable crops. Northland's cooler conditions will mean that pineapple yields are lower than international pineapple enterprises might experience (despite growing different varieties). Targeting Northland's warmer climates and/or investing in growing infrastructure could increase domestic yields.

2. **Grower profitability:** Managing a commercial pineapple enterprise is expected to generate a healthy annual gross profit (21%). However, it is not expected to exceed the required level of gross profitability to justify the establishment costs.

3. **Infrastructure:** Pineapples are susceptible to several climatic risks that will need to be mitigated to promote high yields. The necessary (e.g. wind shelters, frost protection and drainage) and optional infrastructure (e.g. polytunnels and greenhouses) are readily available in Northland already and can be adapted from comparable horticulture production systems. The scale of investment required for the necessary infrastructure (which we assumed above) is relatively low, but the investment required for optional infrastructure could be significant.

4. **Sensitivity of profitability:** There is substantial variability in the expected profitability of a Northland pineapple grower. For example, a 13% decrease in the farmgate price received from $2.15 to $1.87 per kilogram at the expected yield results in a relatively large decrease (64%) in gross profitability. That said, 71% of the modelled scenarios in Table 21 result in a positive gross profit, 45% result in a gross margin of 25% or more, and 20% exceed the required level of gross profitability.

5. **Grower opportunity cost:** The opportunity cost of growing pineapples is considered moderate to low, with two of the four competing crops considered in Table 4 generating a better gross profit per hectare on average.

For these reasons, we consider domestically grown pineapples to be feasible for growers at a *small scale* (Table 23).

Table 23: *Grower feasibility: Pineapples*

Criterion	Score *(from 0 to 4)*
Output potential	2.00
Profitability	2.00
Infrastructure	2.00
Sensitivities	2.00
Opportunity cost	1.50
Average score	1.90 Small-scale

Pineapples: Fresh fruit

Fresh pineapples are one of the two prioritised consumption forms for pineapples in this market opportunities study (refer to page 14 for more information).

Introduction

Description

Fresh pineapples are widely consumed in New Zealand and are typically available year-round in supermarkets. Approximately 9,000 tonnes of pineapples are imported and consumed annually from countries like Ecuador and the Philippines. The domestic market is stable and well-established. Imports into NZ are predominantly MD2 (also sold as Tropical Gold) and Dole MG3; Smooth Cayenne is no longer predominant. New Zealand-grown pineapples are likely to be a variety that is more productive in cooler climates, such as Queen. The value proposition of consuming domestically grown pineapples is that:

1. They are grown locally and support communities to thrive.
2. They introduce a spray-free option which may avoid offshore phytosanitary treatments.
3. There are several alternative pineapple varieties for consumers to choose from with different appearances and taste profiles.
4. The highly valued bromelain enzyme is easier to consume from the fruit's core.

Conversion efficiency

For every tonne of commercial grade pineapples harvested, one tonne of pineapples is available for sale (note that on-orchard wastage and pack out losses are accounted for before this step).

Processing steps

The steps involved in preparing pineapples for consumption are minimal. The harvested pineapples are transported to a processing facility where they are de-crowned if desired (to reduce transportation costs), cleaned, and graded for size, weight and quality. Specialised cool storage that can support the temperatures tropical fruits require may be necessary to preserve quality and control ripening, depending on the lead time to market. Non-commercial grade and damaged fruit are also removed at the facility and diverted into alternative marketing channels.

A processing facility could either be established by individual growers near their enterprises or by a grower collective/private investor in a peri-urban central location (e.g. close to utilities, transport networks, and labour). Given that the scope of this work is to assess the feasibility of establishing a commercial industry across Northland, the latter is prioritised in the following analysis.

Costs to process pineapples

Facility establishment costs

The estimated costs to establish a pineapple processing facility in a peri-urban setting (capital expenditure only) to prepare pineapples for consumption are presented in All scales of a processing facility will have tailored cool storage facilities (i.e. that can cope with the temperature range of subtropical fruits) to control the rate at which pineapples ripen, thereby regulating the supply of pineapples to market.

Table 24 for three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility** processing between 250 and 750 t/yr of pineapples. Operations will be largely manual, with limited mechanisation.
- **Medium-scale facility** processing between 750 and 1,300 t/yr of pineapples. Operations will be semi-automated with machinery supporting the grading and handling of fruit.
- **Large-scale facility** processing between 1,300 and 2,500 t/yr of pineapples annually. Operations will be heavily automated with machinery supporting all aspects of processing from inwards goods, grading and distribution.

All scales of a processing facility will have tailored cool storage facilities (i.e. that can cope with the temperature range of subtropical fruits) to control the rate at which pineapples ripen, thereby regulating the supply of pineapples to market.

Table 24: *Costs to establish a pineapple processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small facility (250–750 t/yr)*	*Medium facility (750–1,300 t/yr)*	*Large facility (1,300–2,500 t/yr)*
Site development/buildings	25	250k–500k	500k–1m	1m–2m
Processing equipment	15	20k–50k	100k–200k	150k–300k
Packing equipment & benches	15	10k–30k	40k–60k	50k–100k
Storage facilities	15	30k–70k	100k–150k	150k–300k
Palletising & internal logistics	15	20k–40k	50k–80k	60k–120k
Utilities installation	20	10k–20k	20k–60k	60k–120k
Office/staff facilities	20	10k–30k	50k–150k	80k–140k
Compliance & fit-out	15	10k–40k	40k–80k	50k–120k
Contingency	20	50k–90k	150k–300k	250k–500k
Total		410k–870k	1.05m–2.08m	1.85m–3.7m
Annualised cost ($/kg) [1]		**$0.10–$0.14**	**$0.12–$0.14**	**$0.12 – $0.13**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment was annualised using a 6% discount rate over the expected life of the asset.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput above are presented in Table 25 on a per-kilogram basis. Due to the minimal processing steps and the limited opportunity for mechanisation, the operating costs remain relatively consistent across the three facilities, with some small economies of scale to be leveraged while the cost of pineapples (as the raw ingredient) is constant.

Table 25: *Costs to operate a pineapple processing facility*

Cost category	Operating costs ($/kg)		
	Small facility (250–750t/yr)	*Medium facility (750–1,300 t/yr)*	*Large facility (1,300–2,500 t/yr)*
Labour	$0.60–$0.75	$0.58–$0.73	$0.57–$0.71
Utilities (e.g. electricity & water)	$0.03–$0.05	$0.03–$0.05	$0.02–$0.03
Raw ingredient	$1.30–$3.00	$1.30–$3.00	$1.30–$3.00
Packaging & distribution	$0.50–$1.50	$0.30–$1.10	$0.20–$0.80
Maintenance & cleaning	$0.04–$0.06	$0.05–$0.09	$0.04–$0.08
Waste/by-product removal	$0.00–$0.01	$0.00–$0.01	$0.04–$0.07
Total ($/kg)	**$2.47–$5.37**	**$2.26–$4.98**	**$2.16–$4.69**

Earnings before Interest and Tax (EBIT)

EBIT ($/kg) is used to assess the financial feasibility of a processing facility preparing pineapples for sale and consumption (Table 26). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 26: *Estimated EBIT: Processing pineapples (medium-scale facility)*

Particulars	EBIT ($/kg) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$3.21	$5.58	$8.33
Processing costs *(including raw product costs)*	$4.98	$3.62	$2.26
Gross profit	-$1.76	$1.96	$6.07
Annualised capital charge	$0.12	$0.13	$0.14
Allowance for annual fixed costs [2]	$0.13	$0.22	$0.33
EBIT	**-$2.01**	**$1.60**	**$5.60**
EBIT %	-63%	29%	67%

[1] Revenue earned is calculated as the product of the volume of pineapples sold (see above) and the wholesale pineapple price. Data on processor wholesale pricing is limited. It is therefore estimated using the retail price ($4.50 to $10.00 per kilogram) *less* an assumed retail markup (20 to 40%). The price received by processors to cover their cost of production, therefore, ranges from $3.21 to $8.33 per kilogram of pineapples sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

EBIT is particularly sensitive to two variables: the price paid in the market for New Zealand pineapples and the price paid to growers (i.e. farmgate price) for harvested pineapples. Table 27 demonstrates how a processor's EBIT fluctuates due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. 84% of the modelled combinations of these variables result in a positive EBIT, with 73% resulting in an EBIT margin of 7.50% or more.

Table 27: *Sensitivity of processor EBIT: Pineapples*

		Farmgate price paid ($/kg)						
		$3.00	$2.72	$2.43	**$2.15**	$1.87	$1.58	$1.30
Market price ($/kg)	$4.50	-$1.36	-$1.08	-$0.79	-$0.51	-$0.23	$0.06	$0.34
	$5.42	-$0.66	-$0.37	-$0.09	$0.19	$0.48	$0.76	$1.04
	$6.33	$0.05	$0.33	$0.62	$0.90	$1.18	$1.47	$1.75
	$7.25	$0.75	$1.04	$1.32	**$1.60**	$1.89	$2.17	$2.45
	$8.17	$1.46	$1.74	$2.03	$2.31	$2.59	$2.88	$3.16
	$9.08	$2.16	$2.45	$2.73	$3.01	$3.30	$3.58	$3.86
	$10.00	$2.87	$3.15	$3.44	$3.72	$4.00	$4.29	$4.57

Processor feasibility for fresh pineapples

The economic feasibility of preparing pineapples for consumption is assessed using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Preparing whole pineapples for consumption in a post-harvest facility is expected to be profitable with an EBIT margin of 29%.

2. **Sensitivity of profitability:** There is moderate variability in the expected profitability of a Northland post-harvest facility for pineapple production. 84% of the modelled scenarios in Table 14 result in a positive EBIT, while 73% result in an EBIT margin of 7.50% or more. This indicates that even minor fluctuations in either of the key variables will have a significant impact on the facility's profitability and financial sustainability. Processor EBIT is slightly more sensitive to the farmgate price paid.

3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport harvested pineapples between the growing area and a processing facility. There are already well-established transportation channels across Northland for other industries (e.g. dairy, sheep and beef), as well as cool storage distribution channels to markets across Northland and into Auckland. While there may be some inefficiencies initially that could add extra steps or complexity and increase distribution costs, existing logistical processes can likely be adapted to service the Northland pineapple industry.

4. **Infrastructure:** Establishing a Northland pineapple industry will require investing in post-harvest processing facilities to prepare the harvested pineapples for consumption. The infrastructure requirements are relatively low as the processing activities are minimal. While some investment would be required to establish a new facility, all the necessary assets are available or easily adaptable from other industries.

For these reasons, domestically grown pineapples are considered feasible for processors at a *small scale* (processor feasibility score of 2.50), provided the market price remains high enough to adequately offset the relatively higher costs of domestic production (Table 28).

Table 28: *Processor feasibility: Pineapples*

Criterion	Score (from 0 to 4)
Profitability	3.00
Sensitivities	2.00
Logistics & distribution	2.00
Infrastructure	3.00
Average score	**2.50** Small-scale

Market feasibility for fresh pineapples

The economic feasibility for pineapples in domestic markets is assessed using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic industry:

1. **Supply and demand:** While the domestic consumption of pineapples is lower compared to other fruits, there exists a niche for pineapples to be sold at a 'premium' that is well-tolerated by the market. While the Northland-grown variety is different from what is currently available, the taste profiles and freshness have been praised by local consumers. For the most part, Northland-grown pineapples are consumed in the same way as imported varieties, meaning consumers won't need specific education on how they are best consumed. Demand will take some time to grow, and it's important to control the growth of supply to avoid an oversupply of domestic pineapples in the market, driving the price down.

   The bromelain market, derived primarily from pineapple cores (an enzyme that supports digestive system function), is relatively limited in scale, with global demand met by only a small volume of raw material. Given this dynamic, sourcing pineapple waste from regions such as Northland is commercially uncompetitive, as lower-cost supply alternatives are readily available elsewhere.

2. **Market access:** Northland-grown pineapples are likely to achieve a premium market price due to their appearance (they can be sold with the leaves), superior taste, and the fact that they can be harvested ripe. This could distinguish them from imported varieties and help them gain market share. High-end boutique supermarkets and organic stores have expressed interest in trying different pineapple varieties and could market them at a higher price. Due to the lack of pests in New Zealand, these pineapples are not treated and could meet demand in the spray-free niche market and potentially attract customers interested in organic fruits.

   Most retailers will expect growers to organize transport of the crop to their stores. Ripe pineapples may require cold chain storage and transportation to maintain their appearance for customers, but they could likely utilise the existing Northland fruit supply chain.

3. **Competition and market-related risks:** The Dole-developed MG3 and MD2 are the main varieties of pineapple sold in New Zealand. These varieties are marketed for their higher sweetness compared to other varietals, although the quality of this imported fruit can vary considerably. Regardless, major retail stakeholders reported that they are satisfied with the overall quality of the MG3 variety in their product lines.

Boutique stakeholders have reported an active demand for locally produced goods, and the variety grown in Northland has been very popular. Local produce could potentially occupy a niche market by emphasising freshness, ripeness, organic certification, and superior flavour. On the contrary, larger retailers with well-established import supply contracts are unlikely to change their sourcing for local supply as they are generally content with the quality of imported products.

For these reasons, domestically grown pineapples are assessed to be feasible in the market at a *small scale* (Table 29).

Table 29: *Market feasibility: Pineapples*

Criterion	Score *(from 0 to 4)*
Supply & demand	2.00
Market access	2.00
Competition & market-related risks	2.00
Average score	**2.00** Small-scale

Pineapples: Cold-pressed juice

Cold-pressed pineapple juice is one of the two prioritised consumption forms for pineapples in this market opportunities study (refer to page 14 for more information).

Introduction

Description

Consumption of cold-pressed juices has been growing in popularity across New Zealand for several years, and growth is expected to continue in the years to come. Cold-pressed juices have become established as a consistent product offering in mainstream retail channels, including supermarkets. Unlike traditional juices that are processed using heat, cold-pressed juices retain more flavour, nutrients and natural colour – all factors that drive consumer demand. Current processors of cold-pressed pineapple juices are extremely niche and use either imported pineapples or imported fruit concentrate. The value proposition to consumers of cold-pressed juices using locally grown pineapples is that:

- They are grown locally and support communities to thrive.
- The juice concentrate is pressed from fully ripened fruit, maximising the flavour profile.
- The juice concentrate from Queen pineapples contains the bromelain enzyme from pressing the core of domestic pineapple, as well as the flesh.

The pineapples used for cold-pressed juices do not need to meet commercial grade standards (approximately 10 to 20% of the total yield, or 3.80 to 5.10 tonnes per planted hectare, are non-commercial grade). The following analysis assumes that the non-commercial fruit will be used to produce cold-pressed pineapple juice. For example, the price paid for the raw pineapple input is 50% of the price paid for the commercial grade fruit.

Conversion efficiency

For every tonne of non-commercial grade Queen pineapples harvested, 500 to 600 litres of pineapple juice can be pressed (i.e. 50% to 60% recovery rate). The tender core and the high juice content of the Queen cultivar mean it performs well when cold-pressed.

Processing steps

The steps involved in preparing pineapples into a cold-pressed juice ready for consumption are surprisingly minimal, although they require a reasonable amount of capital investment to acquire the necessary processing equipment. The steps include:

1. Washing and sanitising pineapples to remove dirt and any residual product
2. Peeling and coring the pineapples and cutting the flesh into small chunks
3. Cold pressing the pineapple chunks using a hydraulic press to extract the juice
4. Filtering (optional) and bottling the pineapple juice
5. Storing and distributing to customers.

There is an option to extend the shelf-life of cold-pressed juice by several weeks (under refrigeration) without using heat by cold-pasteurising the bottled juice.

Costs to process cold-pressed pineapple juice

Facility establishment costs

The estimated costs to establish a pineapple pressing facility in a peri-urban setting (capital expenditure only) to prepare pineapples for consumption are presented in Table 11 for three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility** processing between 50 and 100 t/yr of pineapples. At this scale, between 27,500 and 55,000 litres of pineapple juice will be pressed (assuming a 55% conversion efficiency).
- **Medium-scale facility** processing between 100 and 200 t/yr of pineapples. At this scale, between 55,000 and 110,000 litres of pineapple juice will be pressed (assuming a 55% conversion efficiency).
- **Large-scale facility** processing between 200 and 400 t/yr of pineapples. At this scale, between 110,000 and 220,000 litres of pineapple juice will be pressed (assuming a 55% conversion efficiency).

All scales of a processing facility will have tailored cool storage facilities (i.e. that can cope with the temperature range of subtropical fruits) to control the rate at which pineapples ripen, thereby regulating the supply of pineapples to market.

Table 30: *Costs to establish a pineapple pressing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small facility (27.5–55 kL/yr)*	*Medium facility (55–110 kL/yr)*	*Large facility (110–220 kL/yr)*
Site development/buildings	25	150k–250k	300k–500k	500k–800k
Processing equipment	15	350k–1.10m	1.12m–2.24m	2.24m–4.46m
Packing equipment & benches	15	5k–10k	10k–20k	20k–40k
Storage facilities	15	10k–30k	30k–60k	60k–120k
Palletising & internal logistics	15	5k–10k	10k–30k	30k–60k
Utilities installation	20	10k–20k	30k–60k	50k–100k
Office/staff facilities	20	10k–20k	20k–40k	30k–60k
Compliance & fit-out	15	20k–50k	50k–100k	100k–200k
Contingency	20	90k–220k	240k–460k	450k–880k
Total		650k–1.71m	1.81m–3.51m	3.48m–6.72m
Annualised cost ($/L) [1]		**$2.24–$3.01**	**$3.09–$3.17**	**$2.98–$3.07**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of each group of assets.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput above are presented in Table 31 on a per-litre basis. Economies of scale are visible across most of the operating costs due to the high reliance on mechanised processes to press pineapples, while the cost of non-commercial grade pineapples (as the raw ingredient) is constant across the three facilities.

Table 31: *Costs to operate a pineapple pressing facility*

Cost category	Operating costs ($/L)		
	Small facility (27.5–55 kL/yr)	*Medium facility (55–110 kL/yr)*	*Large facility (110–220 kL/yr)*
Labour	$3.00–$4.00	$1.50–$2.50	$1.20–$1.60
Utilities (e.g. electricity & water)	$0.04–$0.06	$0.03–$0.05	$0.02–$0.04
Raw ingredient	$1.08–$3.00	$1.08–$3.00	$1.08–$3.00
Other ingredients	$0.02–$0.05	$0.01–$0.03	$0.01–$0.03
Packaging & distribution	$0.70–$1.00	$0.60–$0.80	$0.50–$0.70
Maintenance & cleaning	$1.50–$3.00	$0.90–$1.80	$0.70–$1.50
Waste/by-product removal	$0.05–$0.10	$0.03–$0.07	$0.01–$0.05
Total ($/L)	**$6.39–$11.21**	**$4.15–$8.25**	**$3.52–$6.92**

Earnings before Interest and Tax (EBIT)

EBIT ($/L) is used to assess the financial feasibility of a processing facility producing pineapple juice (**Table 32**). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 32: *Estimated EBIT: Processing cold-pressed pineapple juice (medium-scale facility)*

Particulars	EBIT ($/L) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$4.33	$6.96	$10.00
Processing costs *(including raw product costs)*	$8.25	$6.11	$4.15
Gross profit	-$3.92	$0.85	$5.85
Annualised capital charge	$3.17	$3.13	$3.09
Allowance for annual fixed costs [2]	$0.17	$0.28	$0.40
EBIT	**-$7.26**	**-$2.56**	**$2.35**
EBIT %	-168%	-37%	24%

[1] Revenue earned is calculated as the product of the litres of juice sold (see above) and the wholesale pineapple price. Data on processor wholesale pricing is limited. It is therefore estimated using the retail price ($6.50 to $13.00 per litre) *less* an assumed retail markup (30 to 50%). The price received by processors to cover their cost of production, therefore, ranges from $4.33 to $10.00 per litre of cold-pressed pineapple juice sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

EBIT is particularly sensitive to two variables: the price paid in the market for cold-pressed pineapple juice and the price paid to growers (i.e. farmgate price) for harvested pineapples. Table 33 demonstrates how a processor's EBIT fluctuates due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. Just 6% of the modelled combinations of these variables result in a positive EBIT, with 2% of combinations resulting in an EBIT margin of 7.50% or more.

Table 33: *Sensitivity of processor EBIT: Pressed pineapple juice*

		Farmgate price paid ($/kg)						
		$3.00	$2.72	$2.43	**$2.15**	$1.87	$1.58	$1.30
Market price ($/L)	$6.50	-$5.65	-$5.40	-$5.14	-$4.88	-$4.62	-$4.37	-$4.11
	$7.58	-$4.88	-$4.62	-$4.37	-$4.11	-$3.85	-$3.59	-$3.34
	$8.67	-$4.11	-$3.85	-$3.59	-$3.33	-$3.08	-$2.82	-$2.56
	$9.75	-$3.33	-$3.08	-$2.82	**-$2.56**	-$2.30	-$2.05	-$1.79
	$10.83	-$2.56	-$2.30	-$2.04	-$1.79	-$1.53	-$1.27	-$1.01
	$11.92	-$1.79	-$1.53	-$1.27	-$1.01	-$0.76	-$0.50	-$0.24
	$13.00	-$1.01	-$0.75	-$0.50	-$0.24	$0.02	$0.28	$0.53

Processor feasibility for cold-pressed pineapple juice

The economic feasibility of processing pineapples into a cold-pressed pineapple juice is assessed using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Cold-pressing pineapples into pineapple juice is not expected to generate a positive EBIT under the base revenue and cost estimates due to the high cost of capital for the estimated throughput. However, there are scenarios where profitability could be achieved under favourable market and production conditions.

2. **Sensitivity of profitability:** Processor EBIT is moderately sensitive to fluctuations in the market price and the farmgate price paid for pineapples from the grower. However, just 6% of the modelled combinations generate a positive EBIT, with 2% (i.e. one) of combinations generating an EBIT margin of more than 7.50%.

3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport harvested pineapples between the growing area and a processing facility. There are already well-established transportation channels across Northland for other industries such as dairy, sheep and beef, as well as cool storage distribution channels to markets across Northland and into Auckland. Given the scale of production and the cool storage requirements, there are likely to be added complexities to navigate that could increase the distribution costs (e.g. couriers versus large freight).

4. **Infrastructure:** Establishing a Northland pineapple industry will require reasonable investment in processing equipment, including wash tanks, hydraulic presses, and high-pressure processing

treatment equipment to support longer shelf life. Most of the equipment will be readily available to purchase either new or second-hand from similar fruit pressing systems.

For these reasons, processing cold-pressed pineapple juice using domestically grown pineapples is not considered feasible primarily due to the high per-unit cost of capital required for processing (Table 34).

Table 34: *Processor feasibility: Cold-pressed pineapple juice*

Criterion	Score *(from 0 to 4)*
Profitability	0.50
Sensitivities	0.00
Logistics & distribution	1.00
Infrastructure	1.00
Average score	**0.63** Not feasible

Market feasibility for cold-pressed pineapple juice

The opportunity for a cold-pressed pineapple juice in domestic markets is assessed using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic industry:

1. **Supply and demand:** While there is an established market for cold-pressed juices, there are only a few New Zealand producers supplying consumer demand. A Northland cold-pressed pineapple juice could have a unique advantage with the potential for it to be marketed as an organic product, with the right certifications, for added premium value. One stakeholder suggested that this may be due to New Zealand's cultural preferences, where pineapple and pineapple juice are not widely preferred. Other multinational companies are producing pineapple juice in New Zealand, but these are from imported concentrates.

2. **Market access:** With relatively low demand and several established cold-press juice processors supplying mainstream retailers and supermarkets, it might be challenging to access these channels unless the juice can be presented as a unique product to local Northland supermarkets first, as a 'local range' product. Alternatively, local cafes and boutique retailers could be another channel to reach consumers of cold-pressed juices.

   Local pineapple growers could either supply the established processors (which would require transporting fruit hundreds of kilometres to existing facilities, for example, near Napier) or establish a competing processing facility locally. In either case, it will be necessary to leverage the growing demand (albeit niche) for cold-pressed juices and present pineapple juice as an alternative to apples and oranges. This may require targeted promotional and marketing activities to build consumer awareness of the benefits of consuming cold-pressed juices using locally grown pineapples. Demand will take some time to grow, and it's important to control the growth of supply to avoid an oversupply of pineapple juices in the market, driving the price down.

3. **Competition and market-related risks:** While a cold-pressed pineapple juice using domestically grown pineapples would have no fruit-specific competition, it will be competing in a relatively

competitive cold-pressed juice market where consumers can choose from several different cold-pressed juice options such as apples, oranges and berries.

Additionally, cold-pressed juice has to compete with pasteurised juice products that are common and with low-priced imports. Juice is also likely to be a secondary product in pineapple markets reserved for fruit rejected from wholesale due to inferior appearance/taste. It is interesting to note that locally grown produce is likely to be uncompetitive in the secondary processed market as less premium is afforded for appearance and freshness/ripeness of the fruit, which are the major unique advantages of local whole fruit produce.

Cold-pressed pineapple juice is likely to be an extremely niche market. While it could serve as a secondary revenue stream to the supply of whole fruit, it is unlikely to be feasible as a stand-alone product market. In other words, cold-pressed juice should be considered as a secondary product stream if a viable primary market for locally grown whole fruit is established.

For the above reasons, a cold-pressed juice using domestically grown pineapples is assessed to be feasible in the market at a *small scale* (Table 35).

Table 35: *Market feasibility: Cold-pressed pineapple juice*

Criterion	Score *(from 0 to 4)*
Supply & demand	1.00
Market access	2.00
Competition & market-related risks	2.00
Average score	1.67 Small-scale

Feasibility of a Northland pineapple industry

Scale of feasibility

The economic feasibility of pineapples considers the individual feasibility for growers, processors and the market presented in the previous sections. Table 36 below summarises the feasibility given to each of the three components for the two consumption forms considered for pineapples.

Table 36: *Feasibility of establishing a pineapple industry in Northland*

Consumption forms	Feasibility component			
	Grower	*Processor*	*Market*	*Overall*
1. Fresh pineapple	Small-scale (1.90)	Small-scale (2.50)	Small-scale (2.00)	Small-scale
2. Cold-pressed juice	Small-scale (1.90)	Not feasible (0.63)	Small-scale (1.67)	Not feasible

Overall, a domestic pineapple industry is considered economically feasible at a *small scale* under current economic conditions and assuming agronomic feasibility by supplying fresh, whole pineapples to the market. To build market share beyond the niche scale that we assume (Table 37), the industry would need to progressively reach more price-sensitive consumers who are less willing to pay higher retail prices for domestically grown pineapples (around $4.50 per kilogram). However, reducing retail prices too low compromises grower profitability. For example, the modelling suggests that for growers selling fresh fruit to achieve the required gross profit, a minimum retail price of $5.94 per kilogram is required under the midpoint yield and base cost assumptions; at this level, the farmgate price is $2.74 per kilogram.

Estimated scale of operation

We estimate that a domestic pineapple industry could grow to supply between 10% and 20% of domestic pineapple consumption (approximately 9,000 tonnes). At the estimated midpoint commercial yield (26.78 tonnes per hectare), this will mean the industry could grow to around 30 to 50 commercial hectares (Table 18). At this scale, we expect commercial pineapple growers will generate gross profits of around $35,000 per hectare, achieved by charging a retail price around the middle of this analysis' range of $4.50 to $10.00 per kg. Growing a domestic industry beyond this scale will start to compromise grower profitability, as an increase in domestic supply drives retail prices down towards the current market price for imported pineapples. This quickly pushes profitability below the gross profit threshold to achieve the required return on the upfront investment. In aggregate, we estimate the total gross profit generated from an industry of this scale to be between $1 and $1.8 million annually.

Achieving this scale of production will likely take many years to achieve, especially if prices for planting material remain high, as a staged establishment approach is required for financial viability.

Table 37: *Estimated scale of the Northland pineapple industry*

Particulars	Feasible consumption form: Fresh pineapples
Estimated demand	1,000–1,750 t
Conversion efficiency	100%
Raw product required	1,000–1,750 t
Estimated yield	26.78 t/ha
Land required	**30–50 of commercial hectares**
Aggregated gross profit	**$1–$1.8 million**

Chapter 5:
Moringa

This chapter assesses the economic feasibility of growing, processing, and marketing Northland-grown *Moringa*, including key cost drivers, market potential, and viability under Northland conditions.

Chapter disclaimer: This section presents indicative results from a simplified financial model, using broad assumptions and input ranges to reflect uncertainty and data limitations. Many figures are drawn from secondary or lower-confidence sources and are not intended to represent precise outcomes. The analysis does not capture the full complexity of on-farm decision-making or site-specific conditions and should not be used as a substitute for detailed business planning or professional advice. The following analysis is intended to be indicative only.

Growing moringa

Introduction

Background

Globally, moringa (*Moringa oleifera*, also known as Shigru) grows in tropical and semi-arid regions such as the Philippines, parts of Africa, and India, where warm daytime temperatures between 25 and 35 °C provide optimal conditions for consistent yields and quality. Moringa is recognised for its diverse nutritional profile. High in vitamins A, C, E, B6, iron, calcium, potassium, antioxidants, and complete plant proteins, it is widely consumed across Africa, Southeast Asia, and South Asia. In Ayurveda (the ancient Indian system of medicine), moringa is traditionally used for its anti-inflammatory properties, aiding in digestion, detoxification, and immune system support, alongside other general health benefits.

While moringa is not mainstream in New Zealand, it has a small but growing following among health-conscious consumers who consider the various consumption forms of the moringa leaf to be a versatile superfood with a wide range of culinary and health applications. Moringa is considered a 'novel food' by the Food Standards Australia New Zealand (FSANZ), which restricts how moringa can be promoted and marketed in New Zealand. In 2024, an application to FSANZ sought to authorise moringa as a conventional food and is still under review at the time of writing. While moringa plants can be purchased from local nurseries in small volumes, there are no known commercial growers of moringa in New Zealand, and the agronomic potential of moringa at scale is unclear.[17]

The microclimates across Northland with warmer temperatures and free-draining, nutrient-dense soils would provide the best opportunity to grow moringa commercially in New Zealand. However, investing in polytunnels or greenhouses may be necessary to control the growing environment, particularly to achieve the high daily temperature requirements. Temperatures below 18 °C can slow moringa's growth, while sustained temperatures below 5 °C can kill young trees. Moringa is generally a drought-resistant plant and requires well-draining soil to avoid root damage. Northland's rainfall should be adequate for moringa. During prolonged dry periods, irrigation systems can help improve growth rates and maximise yields.

Moringa plants can deliver their first harvest of fresh leaves 5 to 8 months after planting. Once established, they can be trimmed 3 to 5 times per year for leaf harvest. Alternatively, if the plant is left for longer between harvests, seed pods can be harvested every 8 to 12 months. Harvests will be more frequent in warmer months and less in cooler months as temperatures drop and growth rates slow (without mitigating investments).

---

[17] A commercial grower of moringa is someone growing moringa to generate a profit or earn a living, and who is NP1 registered (at a minimum) under New Zealand's Food Act 2014 and/or NZGAP certified.

National Programme 1 (NP1) is the registration process for low-risk food businesses under New Zealand's Food Act 2014 to ensure they are managing food safety risks and producing safe food for sale. The New Zealand Good Agricultural Practice (NZGAP) certifies the safe and sustainable production of fruit and vegetables in New Zealand and is generally required by retailers to supply them.

Estimated yield

The likely yield for Northland growers is hard to quantify due to the lack of local farms or trials to draw information from. For this work, the estimated annual moringa yields for:

- **Fresh leaves** are between 5 and 15 tonnes per hectare per year (t/ha/yr) with a midpoint of approximately 10 t/ha/yr.
- **Seeds** are between 1 and 3 t/ha/yr with a midpoint of approximately 2 t/ha/yr.

The above yield ranges are estimated using international case studies with consideration of Northland's cooler growing conditions. The per-hectare yield estimate can also depend on several factors, including the planting pattern and density, site location, plant age and management.

The moringa tree is highly regenerative and capable of multi-harvest cycles. Many growers in the tree's native climates, where growth rates are optimised, harvest both leaves and seeds from the same tree, especially after the first year. However, there is a trade-off between the two: maximising one often reduces the yield of the other. The balance depends on the grower's production goals for their farm. In the analysis below, we assume growers will operate solely for fresh leaf production.

Costs to grow moringa

Estimated set-up costs

Excluding the purchase of land and machinery, a prospective grower could expect to spend between $120,000 and $240,000 to set up a hectare of moringa plants. However, the actual costs will vary depending on the characteristics of the intended growing area and the available resources. In addition to the costs presented below, growers may choose to install more elaborate infrastructure, such as greenhouses and polytunnels, to have more control over the growing environment and maximise yield consistency. This would mean significant additional investment, which increases the production costs.

Table 38: *Growing set-up costs: Moringa*

Activity	Estimated cost ($/ha)		Commentary
	Low	*High*	
Land preparation	$6,000	$10,000	Soil clearing, contouring and nutrient improvement.
Planting material[1]	$90,000	$135,000	Approximately 4,500 trees at $20 - $30 per plant.
Irrigation system	$0	$15,000	Depends on seasonal rainfall and water access.
Wind protection	$0	$10,000	Required for growing in exposed areas.
Frost protection	$0	$10,000	Required for growing in colder microclimates.
Security	$2,000	$10,000	Installing perimeter fences, gates and access tracks.
Labour	$4,000	$10,000	Labour required to complete the set-up activities.
Tools/equipment	$2,000	$5,000	Depends on the tools and equipment available.
Certification[18]	$1,000	$5,000	Food Act (NP1) registered and/or NZGAP certified.
Contingency	$15,000	$30,000	Approximately 15% for unforeseen set-up costs.
Total ($/ha)	**$120,000**	**$240,000**	

[1] This cost is estimated for the purchase of established trees from a nursery (e.g. 25 to 40 cm tall). A prospective grower could reduce this cost significantly if they chose to purchase moringa seeds ($2 to $3 per plant) and grow the plants themselves.

The useful lifetime of moringa is approximately 11.5 years; at the midpoint establishment cost of approximately $180,000, a grower would require a gross profit of $22,116/ha/yr to justify this scale of investment at a 6% rate of return; at this level, the NPV of growing bananas is modelled to be $0.

Annual gross profitability

We use gross profitability as the primary measure of a crop's ongoing economic feasibility, reflecting the difference between revenue earned and the direct costs associated with growing moringa. Fixed costs for growers are assumed to be minimal and vary significantly between growers based on personal preference, so they have not been considered in the following analysis.

[18] The costs of becoming compliant to achieve certification are not considered in this analysis due to the variable nature of these costs between orchards.

Table 39 shows gross profitability for growers on a per-ha basis for three scenarios. There is a significant range between the pessimistic and optimistic scenarios, mostly due to the differences in revenue earned and labour inputs.

Table 39: *Grower gross profitability: Moringa*

Particulars	Gross profitability ($/ha)		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$23,750	$61,250	$112,500
Estimated growing costs [2]	$35,350	$48,775	$47,200
Gross profit	**-$11,600**	**$12,475**	**$65,300**
Gross margin	-49%	20%	58%

[1] Revenue earned is calculated as the product of yield (see above) and the farmgate price received by moringa growers (estimated at $4.75 to $7.50 per kg). The farmgate price is set by estimating how value is created and received across the value chain.

[2] The growing cost estimate includes site maintenance, plant replacements, fertiliser applications, water input (as required), labour and machinery/technology use. The cost of labour is approximately 90% of the annual recurring growing costs. Managing moringa is very manual, with an estimated 0.5 to 1.0 FTE required per ha. One FTE is estimated to cost $60,000 (about $28.80 per hour), which, for this analysis, is slightly above a typical hourly rate for a general horticulture field worker in New Zealand.

Sensitivity of annual gross profitability

A grower's gross profitability is particularly sensitive to fluctuations in the expected yield (10 t/ha/yr) and the expected farmgate price ($6.13 per kg). Table 40 demonstrates how our estimated grower's gross profitability varies for all combinations of seven levels of each of these two variables, while keeping the estimated non-labour growing costs constant at the *base* estimate; labour costs scale in proportion to changes in yield. Of the modelled scenarios:

- 84% result in a positive annual gross profit,
- 35% result in an annual gross profit of 25% or more[19],
- 18% result in an annual gross profit greater than the required rate of return.

Table 40: *Sensitivity of grower gross profitability: Moringa*

		Farmgate price received ($/kg)						
		$4.75	$5.21	$5.67	**$6.13**	$6.58	$7.04	$7.50
Yield (t/ha/yr)	5.00	-$2,525	-$233	$2,058	$4,350	$6,642	$8,933	$11,225
	6.67	-$2,108	$947	$4,003	$7,058	$10,114	$13,169	$16,225
	8.33	-$1,692	$2,128	$5,947	$9,767	$13,586	$17,406	$21,225
	10.00	-$1,275	$3,308	$7,892	**$12,475**	$17,058	$21,642	$26,225
	11.67	-$858	$4,489	$9,836	$15,183	$20,531	$25,878	$31,225
	13.33	-$442	$5,669	$11,781	$17,892	$24,003	$30,114	$36,225
	15.00	-$25	$6,850	$13,725	$20,600	$27,475	$34,350	$41,225

[19] A 25% gross margin threshold is considered within the normal range for outdoor food producers in New Zealand.

The opportunity cost of growing moringa

Across Northland, moringa is competing for the same high-quality soils and subtropical climates that are suitable for growing other subtropical fruits and vegetables. Table 41 presents the estimated gross profitability ($ per ha) for competing crops with similar establishment costs to illustrate the opportunity cost for growing moringa. While land-use decision-making also depends on multiple non-financial factors, this comparison illustrates the scale of the financial incentive to allocate land to other options.

Table 41: *Opportunity cost of growing moringa*

Competing crops	Estimated gross profit ($/ha)			Net benefit/loss
	Low	*Midpoint*	*High*	*If growing moringa*
Moringa	-$11,600	$12,475	$65,300	N/A
Kiwifruit (Green)	$10,000	$30,000	$50,000	-$17,525
Avocados	$20,000	$27,500	$35,000	-$15,025
Tamarillos	$5,000	$12,500	$20,000	-$25
Oranges	$8,000	$11,500	$15,000	$975

Assessment of grower feasibility

We assess the economic feasibility of growing moringa using the following five grower-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for growers presented earlier in this chapter:

1. **Output potential:** Northland's cooler climate is expected to slow the growth of moringa trees and reduce the number of annual harvests, ultimately reducing the expected yield compared to international examples. Targeting Northland's warmer microclimates and/or investing in growing infrastructure such as polytunnels and greenhouses could increase yields significantly.

2. **Grower profitability:** Managing a commercial moringa orchard is expected to generate a healthy annual gross profit (20%) at the midpoint estimates; however, it does not meet the gross profitability needed to achieve an adequate return on establishment capital.

3. **Infrastructure:** Moringa growth and yields are most at risk from low temperatures. Polytunnels and greenhouses will best control the growing environment in line with subtropical conditions; however, they will require a significant investment. All other growing infrastructure required, such as wind protection, frost protection and irrigation, is available and adaptable from existing industries.

4. **Sensitivity of profitability:** There is considerable variability in the expected gross profitability of a Northland moringa grower, with small changes in yield or the farmgate price received impacting gross profitability significantly. While many (84%) of the modelled scenarios in Table 21 result in a positive gross profit, 35% result in a gross margin of 25% or more, and 18% exceed the required level of gross profitability.

5. **Grower opportunity cost:** The gross profitability is expected to be comparable to three of the five competing crops considered, with the other two generating significantly better levels of profitability. The opportunity cost of growing moringa is therefore moderate.

For these reasons, we consider domestically grown moringa feasible for growers only at a *small scale* (grower feasibility score of 1.80) while the farmgate price remains high enough to adequately offset the relatively higher costs of domestic production (Table 42).

Table 42: *Grower feasibility: Moringa*

Criterion	Score *(from 0 to 4)*
Output potential	2.00
Profitability	1.50
Infrastructure	2.00
Sensitivities	1.50
Opportunity cost	2.00
Average score	1.80 Small-scale

Moringa: Fresh leaves

Moringa leaves are one of the three prioritised consumption forms for moringa in this market opportunities study (refer to page 14 for more information).

Introduction

Description

The fresh leaves of the moringa plant are highly perishable and therefore not available for purchase in New Zealand. The establishment of a domestic moringa industry would introduce a new product for African, Southeast Asian, and South Asian communities and health-conscious consumers as an alternative to dark leafy green vegetables, such as kale and spinach. Moringa leaves are, however, currently classified as a "novel food" under the Australia and New Zealand Food Standards Code, meaning they cannot be legally marketed as a food or dietary supplement for human consumption; all moringa products must be sold under non-food categories such as cosmetics, herbal extracts and made-to-order products. In their fresh state, moringa leaves hold higher concentrations of vitamins, antioxidants and live enzymes than processed derivatives. Demand for moringa leaves is likely to come initially from existing consumers of moringa-derived products who already appreciate the plant's benefits. Building demand for fresh moringa leaves will take time and require educating the market about moringa. However, educational and promotional activities will be more effective without the restrictions of being classified as a novel food.

Moringa has been under review by FSANZ since January 2024 and is yet to be recognised as safe for human consumption. Although a decision was expected in late 2024, no outcome has been announced at the time of writing. This places restrictions on the packaging and labelling of moringa products. None of the perceived benefits of moringa can be stipulated on the packaging, and no nutritional information can be displayed to avoid breaching the food category regulations.

Conversion efficiency

For every tonne of moringa leaves harvested, one tonne of moringa leaves is available for sale.

Processing steps

The steps involved in preparing moringa leaves for consumption are minimal. Leaves are harvested from the moringa farm and transported to a processing facility for cleaning, grading and packaging. Fresh leaves have a very short shelf life without appropriate cool storage and distribution facilities.

A processing facility could be established by individual growers near their growing area or by a grower collective/private investor in a peri-urban central location (e.g. close to utilities, logistical networks, and labour). Given that the scope of this work is to assess the feasibility of establishing a commercial industry across Northland, the latter is prioritised in the following analysis.

Costs to process moringa leaves

Facility establishment costs

The estimated costs to establish a moringa leaf processing facility in a peri-urban setting (capital expenditure only) and prepare moringa for consumption are presented below for three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility**: Processing between 10 and 50 t/yr of moringa leaves from approximately 1 to 5 ha of commercial moringa farms.
- **Medium-scale facility**: Processing between 50 and 100 t/yr of moringa leaves from approximately 5 to 10 ha of commercial moringa farms.
- **Large-scale facility:** Processing between 100 and 300 t/yr of moringa leaves from approximately 10 to 30 ha of commercial moringa farms.

Table 43: *Costs to establish a moringa leaf processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small (10-50 t/yr)*	*Medium (50–100 t/yr)*	*Large (100–300 t/ yr)*
Site development/buildings	25	100k–250k	250k–500k	500k–1m
Processing equipment	15	5k–15k	20k–50k	50k–150k
Packing equipment & benches	15	5k–15k	20k–50k	50k–100k
Cool storage/cool rooms	15	5k–15k	15k–30k	30k–80k
Palletising & internal logistics	15	1k–5k	5k–15k	15k–30k
Utilities installation	20	2k–5k	5k–10k	10k–25k
Office/staff facilities	20	5k–10k	10k–20k	20k–50k
Compliance & fit-out	15	10k–20k	20k–50k	50k–100k
Contingency	20	20k–50k	50k–110k	110k–230k
Total		**153k–385k**	**395k–835k**	**835k–1.77m**
Annualised cost ($/kg) [1]		**$0.65–$1.29**	**$0.67–$0.71**	**$0.51–$0.71**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of the asset.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput above are presented in Table 44 on a per-kg basis.

Table 44: *Costs to operate a moringa leaf processing facility*

Cost category	Operating costs ($/kg)		
	Small (10–50 t/yr)	*Medium (50–100 t/yr)*	*Large (100–300 t/ yr)*
Labour	$3.00–$6.00	$2.00–$4.00	$1.00–$3.00
Utilities (e.g. electricity & water)	$0.10–$0.20	$0.05–$0.10	$0.01–$0.03
Raw ingredient	$4.75–$7.50	$4.75–$7.50	$4.75–$6.50
Packaging & distribution	$1.50–$3.00	$1.00–$2.00	$0.80–$1.50
Maintenance & cleaning	$0.20–$0.80	$0.10–$0.50	$0.05–$0.20
Waste/ by-product removal	$0.00–$0.05	$0.00–$0.03	$0.00–$0.02
Total ($/kg)	**$9.55–$17.55**	**$7.90–$14.13**	**$6.61–$12.25**

Earnings before Interest and Tax (EBIT)

EBIT ($/kg) is used to assess the financial feasibility of a processing facility preparing moringa leaves for sale and consumption (Table 45). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 45: *Estimated EBIT: Preparing moringa leaves (medium-scale facility)*

Particulars	EBIT ($/kg) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$12.50	$16.13	$20.00
Processing costs *(including raw product costs)*	$14.13	$11.02	$7.90
Gross profit	-$1.63	$5.11	$12.10
Annualised capital charge	$0.67	$0.69	$0.71
Allowance for annual fixed costs [2]	$0.50	$0.65	$0.80
EBIT	**-$2.80**	**$3.78**	**$10.59**
EBIT %	-22%	23%	53%

[1] Revenue earned is calculated as the product of the volume of moringa sold (see above) and the wholesale price of moringa. There is little visibility on the processor's wholesale price for moringa. It is therefore estimated using the retail price ($20.00 to $30.00/kg) *less* an assumed retail markup (50 to 60%). The price received by processors to cover their production costs, therefore, ranges from $12.50 to $20.00/ kg of moringa leaf sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

EBIT is particularly sensitive to two variables: the price paid in the market for New Zealand moringa, and the price paid to growers (i.e. farmgate price) for harvested moringa leaves. Table 46 demonstrates how a processor's EBIT fluctuates due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. 96% of the modelled combinations of these variables result in a positive EBIT, with 84% resulting in an EBIT margin of 7.50% or more.

Table 46: *Sensitivity of processor EBIT: Moringa leaves*

		Farmgate price paid ($/kg)						
		$7.50	$7.04	$6.58	**$6.13**	$5.67	$5.21	$4.75
Market price ($/kg)	$20.00	-$0.82	-$0.37	$0.09	$0.55	$1.01	$1.47	$1.93
	$21.67	$0.25	$0.71	$1.17	$1.63	$2.09	$2.54	$3.00
	$23.33	$1.33	$1.79	$2.24	$2.70	$3.16	$3.62	$4.08
	$25.00	$2.40	$2.86	$3.32	**$3.78**	$4.24	$4.69	$5.15
	$26.67	$3.48	$3.94	$4.39	$4.85	$5.31	$5.77	$6.23
	$28.33	$4.55	$5.01	$5.47	$5.93	$6.39	$6.84	$7.30
	$30.00	$5.63	$6.09	$6.54	$7.00	$7.46	$7.92	$8.38

Processor feasibility for moringa leaves

The economic feasibility of preparing moringa leaves for consumption is assessed using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Preparing moringa leaves for consumption in a post-harvest facility is expected to be profitable with an EBIT margin of 23% due to the low cost of capital required.
2. **Sensitivity of profitability:** While a processor's EBIT is sensitive to changes in the market price received and farmgate price paid, there is a reasonable safety margin available, which means the processor's EBIT remains above the 7.50% threshold for most (84%) of the modelled scenarios in Table 33.
3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport harvested moringa leaves between orchards and a processing facility. There are already well-established transportation channels across Northland for other industries such as dairy, sheep and beef, as well as cool storage distribution channels to markets across Northland and into Auckland. Moringa leaves are highly perishable and have a short shelf life, and will rely on prompt, chilled distribution to maintain quality. Given the scale of production and the cool storage requirements, there are likely to be added complexities to navigate that could increase the distribution costs (e.g. couriers versus large freight).
4. **Infrastructure:** Establishing a Northland moringa leaf industry will require investing in post-harvest processing facilities to prepare the harvested moringa leaves for consumption. The infrastructure requirements are relatively low as the processing activities are minimal; however, specialised cool storage will be required to preserve the leaves' quality before they are distributed. While some investment would be required to establish a new facility, all the necessary assets are available or easily adaptable from other industries.

For these reasons, we consider domestically grown moringa leaves feasible for processors only at a *medium-scale* (processor feasibility score of 3.00), provided the market price remains high enough to adequately offset the relatively higher costs of domestic production (Table 47).

Table 47: Processor feasibility: Moringa leaves

Criterion	Score *(from 0 to 4)*
Profitability	4.00
Sensitivities	3.00
Logistics & distribution	2.00
Infrastructure	3.00
Average score	**3.00** Medium-scale

Market feasibility for moringa leaves

The opportunity for moringa leaves in domestic markets is assessed using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about establishing a domestic industry:

1. **Supply and demand:** An online search indicates that demand for fresh moringa leaves in New Zealand is currently very limited. The existing customer base is likely concentrated within African, Southeast Asian, and South Asian communities who are already familiar with how to use fresh moringa leaves, or health-conscious consumers consuming moringa-derived products (e.g. powders and/or oils). Broader consumer awareness of moringa for consumption remains low. Given trends in existing moringa products, such as dried leaf powder and moringa oil, which are typically marketed as organic, it is also likely that any demand for fresh leaves would align with organic-grade expectations.
2. **Market access:** If demand for fresh moringa leaves were to emerge, farmgate sales and local retail outlets would likely serve as the primary distribution channels, given the need to preserve product freshness. For wider distribution beyond the immediate production area, similar packaging and cold-chain logistics used for fresh herbs could potentially be applied. However, the ability of moringa leaves to maintain quality and freshness under these conditions remains uncertain and would require further testing or validation.
3. **Competition and market-related risks:** No commercial producers or retailers of fresh moringa leaves were identified in New Zealand. Importing fresh leaves is not currently feasible due to the country's strict biosecurity regulations for fresh produce, combined with the risk of quality degradation during transport, both of which limit the likelihood of international competition. In the absence of a local supply, consumers interested in fresh moringa leaves may be turning to home cultivation, using seeds or young plants in hobby gardens to meet personal demand. Further, the viability of a fresh moringa leaf industry in Northland hinges on its reclassification as a conventional food by FSANZ, without which it cannot be legally marketed for human consumption.

Fresh moringa leaves are a small, little-known and specialised market. The plant is sold in nurseries, through it is not clear if they are cultivated for ornamental or functional use. Outside of hobbyist growers, there is no evidence of market demand. The leaves are traditionally used in India, and regions of Africa and Asia. Outside of these contexts, and specific ethnic communities, knowledge of the plant and its uses is not widespread. Additionally, retaining freshness to reach customers beyond farm-gate sales appears to be challenging.

For the above reasons, domestically grown moringa leaves are assessed to be feasible in the market at a *small scale* (Table 48).

Table 48: *Market feasibility: Moringa leaves*

Criterion	Score *(from 0 to 4)*
Supply & demand	1.00
Market access	2.00
Competition & market-related risks	4.00
Average score	**2.33** Small-scale

Moringa: Dried leaf powder

Dried moringa leaf powder is one of the three prioritised consumption forms for moringa in this market opportunities study (refer to page 14 for more information).

Introduction

Description

Moringa powder is a finely ground powder made from the dried moringa leaf. While moringa powder is not mainstream in New Zealand, it has a small number of consumers among African, Southeast Asian, and South Asian communities, as well as some health-conscious consumers. Moringa powder is mainly purchased as a loose powder from online retailers and specialist shops, but is often added to smoothies and juices, steeped in teas or infusions, or taken as capsules or tablets.

Along with the other consumption forms of moringa, its dried leaf powder is classified as a "novel food" under the Australia and New Zealand Food Standards Code, meaning it cannot be legally marketed as a food or dietary supplement for human consumption; all moringa products must be sold under non-food categories like cosmetics and herbal extracts.

Moringa has been under review by the FSANZ since January 2024 to be recognised as safe for human consumption. However, although a decision was expected late 2024, no outcome has been announced at the time of writing. This places restrictions on the packaging and labelling of moringa products. None of the perceived benefits of moringa can be stipulated on the packaging, and no nutritional information can be displayed to avoid breaching these regulations.

Conversion efficiency

For every tonne of fresh moringa leaves harvested, 100 to 200 kg of moringa powder can be produced (a 10 to 20% recovery rate).

Processing steps

The steps to process moringa leaves into a dried, ready-to-consume powder include:

1. Washing and sanitising fresh moringa leaves.
2. Sorting and grading the cleaned moringa leaves for quality.
3. Drying moringa leaves, either in the shade or in a low-temperature mechanical drying facility.
4. Destemming and grinding the moringa leaves to a powder.
5. Packaging and storing in a cool, low-humidity environment.

Depending on the scale of operation, most of the five processing steps can be automated to improve efficiency and reduce the time required to convert fresh leaves into a dried powder.

Costs to process moringa leaves

Facility establishment costs

The estimated costs to establish a facility to process moringa leaves into a dried powder in a peri-urban setting (capital expenditure only) are presented in Table 49 for processing facilities with three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility**: Processing between 10 and 30 t/yr of moringa leaves from approximately 1 to 3 ha of commercial moringa farms. At this scale, between 1.5 and 4.5 t/yr of moringa powder will be produced (assuming a 15% conversion efficiency).
- **Medium-scale facility**: Processing between 30 and 100 t/yr of moringa leaves from approximately 3 to 10 ha of commercial moringa farms. At this scale, between 4.5 and 15 t/yr of moringa powder will be produced.
- **Large-scale facility**: Processing between 100 and 300 t/yr of moringa leaves from approximately 10 to 30 ha of commercial moringa farms. At this scale, between 15 and 45 t of moringa powder will be produced.

Table 49: *Costs to establish a moringa powder processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small (1.5–4.5 t/yr)*	*Medium (4.5–15 t/yr)*	*Large (15–45 t/ yr)*
Site development/buildings	25	100k–250k	250k–500k	500k–1m
Processing equipment	15	14k–30k	40k–95k	135k–260k
Packing equipment & benches	15	1k–3k	5k–10k	20k–50k
Storage facilities	15	3k–5k	5k–15k	20k–50k
Palletising & internal logistics	15	1k–3k	5k–10k	20k–40k
Utilities installation	20	5k–10k	10k–30k	30k–60k
Office/staff facilities	20	5k–15k	20k–40k	50k–100k
Compliance & fit-out	15	10k–20k	20k–50k	50k–100k
Contingency	20	20k–50k	50k–110k	120k–250k
Total		**159k–386k**	**405k–860k**	**945k–1.91m**
Annualised cost ($/kg) [1]		**$7.19–$8.95**	**$4.89–$7.61**	**$3.68–$5.45**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of the asset.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput above are presented in Table 50 on a per-kg basis. The largest operating cost is the purchase of moringa leaves as the raw ingredient due to the low conversion rate.

Table 50: *Costs to operate a moringa powder processing facility*

Cost category	Operating costs ($/kg)		
	Small (1.5–4.5 t/yr)	*Medium (4.5–15 t/yr)*	*Large (15–45 t/ yr)*
Labour	$12.00–$20.00	$8.00–$15.00	$5.00–$10.00
Utilities (e.g. electricity & water)	$1.00–$2.00	$0.80–$1.50	$0.50–$1.00
Raw ingredient	$23.75–$75.00	$23.75–$75.00	$23.75–$75.00
Packaging & distribution	$8.00–$15.00	$5.00–$10.00	$3.00–$7.00
Maintenance & cleaning	$1.00–$2.00	$0.50–$1.50	$0.50–$1.00
Waste/ by-product removal	$0.05–$0.20	$0.05–$0.50	$0.05–$0.50
Total ($/kg)	**$45.80–$114.20**	**$38.10–$103.50**	**$32.80–$94.50**

Earnings before Interest and Tax (EBIT)

EBIT ($/kg) is used to assess the financial feasibility of a processing facility preparing moringa powder for sale and consumption (Table 51). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 51: *Estimated EBIT: Processing moringa powder (medium-scale facility)*

Particulars	EBIT ($/kg) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$50.00	$62.86	$76.47
Processing costs *(including raw product costs)*	$103.50	$62.26	$38.10
Gross profit	-$53.50	$0.60	$38.37
Annualised capital charge	$7.61	$6.25	$4.89
Allowance for annual fixed costs [2]	$2.00	$2.51	$3.06
EBIT	**-$63.11**	**-$8.17**	**$30.42**
EBIT %	-126%	-13%	40%

[1] Revenue earned is calculated as the product of the volume of moringa powder sold (see above) and the wholesale moringa powder price. There is little visibility on the processor's wholesale price for moringa powder. It is therefore estimated using the retail price ($90.00 to $130.00/kg) *less* an assumed retail markup (70 to 80%). The price received by processors to cover their cost of production, therefore, ranges from $50.00 to $76.47/kg of moringa powder sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

EBIT is particularly sensitive to two variables: the price paid in the market for moringa powder, and the price paid to growers (i.e. farmgate price) for harvested moringa leaves. Table 52 demonstrates how a processor's EBIT fluctuates due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. 22% of the modelled combinations of these variables result in a positive EBIT, with 12% resulting in an EBIT margin of 7.50% or more.

Table 52: *Sensitivity of processor EBIT: Moringa powder*

		Farmgate price paid ($/kg)						
		$7.50	$7.04	$6.58	**$6.13**	$5.67	$5.21	$4.75
Market price ($/kg)	$90.00	-$28.76	-$25.71	-$22.65	-$19.59	-$16.54	-$13.48	-$10.43
	$96.67	-$24.95	-$21.90	-$18.84	-$15.79	-$12.73	-$9.67	-$6.62
	$103.33	-$21.14	-$18.09	-$15.03	-$11.98	-$8.92	-$5.86	-$2.81
	$110.00	-$17.33	-$14.28	-$11.22	**-$8.17**	-$5.11	-$2.05	$1.00
	$116.67	-$13.52	-$10.47	-$7.41	-$4.36	-$1.30	$1.75	$4.81
	$123.33	-$9.71	-$6.66	-$3.60	-$0.55	$2.51	$5.56	$8.62
	$130.00	-$5.90	-$2.85	$0.21	$3.26	$6.32	$9.37	$12.43

Processor feasibility for moringa powder

The economic feasibility of producing moringa powder is assessed using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Processing moringa leaves into powder is not expected to be profitable in the base case with an EBIT margin of -13%. This is due to the high cost of moringa leaves as the raw ingredient and the low conversion rate of fresh leaves into powder.

2. **Sensitivity of profitability:** Processing moringa leaves into powder is considered risky as both the market price received and the farmgate price paid need to be favourable for a processor to be profitable and generate a healthy EBIT margin (Table 52).

3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport harvested moringa leaves between orchards and a processing facility. There are already well-established transportation channels across Northland for other industries such as dairy, sheep and beef, that could be leveraged. There are no specialised distribution requirements to reach markets, as moringa powder is a more robust product with a longer shelf life. Therefore, more mainstream distribution channels such as couriers may be an option to reach consumers outside of Northland.

4. **Infrastructure:** Processing moringa leaves into a powder for consumption is not a complex process. However, there are no dedicated drying facilities for moringa powder in Northland, so a processing facility will need to be established or acquired. The necessary capital equipment is not expected to be unique to moringa powder production. Therefore, the required assets are available or easily adaptable from other industries.

For these reasons, we consider processing moringa leaves into moringa powder as not feasible (Table 53) due to the high cost of raw ingredients and the low conversion rate.

Table 53: *Processor feasibility: Moringa powder*

Criterion	Score *(from 0 to 4)*
Profitability	0.00
Sensitivities	0.00
Logistics & distribution	1.50
Infrastructure	2.00
Average score	0.88 Not feasible

Market feasibility of moringa powder

The opportunity for moringa powder produced from domestically grown leaves is assessed using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic industry:

1. **Supply and demand:** Stakeholder research indicates that approximately 2 t/yr of moringa powder is imported and consumed. Many New Zealand producers and online retailers offering overseas brands focus exclusively on organically produced moringa, reflecting organic certification as the prevailing market standard. There is an opportunity for a domestic market to compete with imported products if growers can obtain organic certification (or spray-free at a minimum) and compete with the price of imported powder. Although a slight premium reflecting origin may be acceptable. If moringa is reclassified as a supplement by FSANZ, competition from imported products might increase if the domestic supply can't meet demand.

2. **Market access:** The main interviewees import pre-packaged dried moringa leaves, and they do not have the capability or interest to undertake packaging in New Zealand. Moringa powder is generally consumed either as loose powder or in pill form, meaning that packaging plays a critical role in market accessibility. Consequently, Northland growers will likely need to manage packaging to reach customers, align with retailers' preferences, and compete with imported alternatives. However, these importers are accustomed to dealing directly with producers, which presents an opportunity for local growers to establish direct, high-touch supply relationships.

3. **Competition and market-related risks:** The market for moringa powder in New Zealand is small and dominated by a single retailer that operates a direct-to-consumer online sales channel. Currently, moringa products are not stocked by other mainstream health retailers. While international brands are available for purchase online, there are no commercial New Zealand-based suppliers of moringa powder.

The moringa dry leaf powder market is limited and dominated by one main player who imports the product pre-packaged. Growers will have to dry, grind and package the leaves, as well as be price competitive, to enter the market.

For the above reasons, a moringa powder, produced from domestically grown leaves, is assessed to be feasible in the market at a *small scale* (Table 54).

Table 54: *Market feasibility: Moringa powder*

Criterion	Score *(from 0 to 4)*
Supply & demand	1.00
Market access	2.00
Competition & market-related risks	3.00
Average score	2.00 Small-scale

Moringa: Oil

Moringa oil is one of the three prioritised consumption forms for moringa in this market opportunities study (refer to page 14 for more information).

Introduction

Description

Moringa oil[20] (also known as Ben oil) is extracted from the seeds of the mature moringa plant using a cold-pressing approach. Moringa oil is valued for its stability, light texture and perceived health-promoting properties, mainly in the Ayurvedic (ancient Indian system of medicine) context. While moringa oil is not mainstream in New Zealand, it has a small consumer base among African, Southeast Asian, and South Asian communities as well as among health-conscious consumers.

Moringa oil is imported from international producers, although consumer awareness of the product remains low, with less than 40 kg of the oil estimated to be imported annually. While there is little visibility of the industry, international trends for moringa oil suggest that demand is growing slowly in skin care and wellness products.

It is typically applied topically for purposes including cosmetics, skin care, hair care and aromatherapy. As with other moringa products, such as leaves and powder, its oil is considered 'novel food' by the FSANZ. This means that it cannot be legally marketed as a food or dietary supplement for human consumption (e.g. as a cooking oil). Regardless, demand for moringa oil is driven by its topical application opportunities rather than its culinary applications.

Conversion efficiency

For every tonne of moringa seeds harvested, 250 to 350 L (225 to 315 kg) of moringa oil is pressed and available for sale.

Processing steps

The steps involved in processing moringa seeds into moringa oil are substantial. Mature seed pods are harvested from mature trees during the dry season to avoid mould or rot. The seeds are then extracted from the pods, cleaned and dried. There are three main methods for extracting oil from the dried seed:

1. **Cold pressing:** Cold-pressing moringa oil requires a mechanical screw press or hydraulic press to extract virgin moringa oil. Cold-pressed moringa oil is preferred for culinary, cosmetic and therapeutic use.
2. **Solvent extraction:** Extracting moringa oil from the moringa seed using hexane or ethanol in oil extraction units is often used for industrial-scale production. Solvent extraction cannot be marketed as organic due to the risk of residual solvents, and it can severely degrade bioactive compounds like tocopherols and phytosterols, which are valued in skincare.

[20] Moringa oil pressed from the moringa seed is different to the leaf-infused oils. The leaves have a very low lipid content, making oil extraction inefficient and commercially challenging. Leaf-based extracts or infusions are sometimes used for cosmetic or herbal purposes such as balms, salves and tinctures.

3. **Supercritical fluid extraction:** This technique uses carbon dioxide under high pressure and temperature to extract the oil. It is a cleaner and more efficient method than solvent extraction, but it can be more expensive. The use of heat also degrades the bioactive compounds in the oil, yielding a less valuable product.

The raw oil is extracted using one of the three approaches above and then filtered to remove seed particulates and waxes using cloth filters, plate and frame filters, or centrifugation. Further refinement, such as degumming, deodorisation and decolourisation, may be required for cosmetic grade or neutral flavour oil. The product is then packaged in a dark, airtight bottle and stored in a cool, dark, low-humidity environment. For this chapter, we focus on the opportunities created by extracting oil from the moringa seed using cold pressing as the approach that best aligns with market demand.

Costs to process moringa oil

Facility establishment costs

The estimated costs to establish a facility to process moringa seeds into oil in a peri-urban setting (capital expenditure only) are presented in Table 55 for facilities with three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility:** Processing between 1 and 3 t/yr of moringa seeds from between 1 and 3 ha of commercial moringa farms. At this scale, between 300 and 900 L of moringa oil will be produced.
- **Medium-scale facility:** Processing between 3 and 10 t/yr of moringa seeds from between 3 and 10 ha of commercial moringa farms. At this scale, between 900 and 3,000 L of moringa oil will be produced.
- **Large-scale facility:** Processing between 10 and 30 t/yr of moringa seeds annually from approximately 10 and 30 ha of commercial moringa farms. At this scale, between 3,000 and 9,000 L of moringa oil will be produced.

Table 55: *Costs to establish a moringa oil extraction facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small (300–900 L/yr)*	*Medium (900–3000 L/yr)*	*Large (3000–9000 L/y)*
Site development/buildings	25	50k–75k	75k–100k	100k–250k
Processing equipment	15	7k–22k	18k–42k	65k–140k
Packing equipment & benches	15	1k–3k	5k–10k	20k–50k
Storage facilities	15	1k–5k	5k–15k	15k–30k
Palletising & internal logistics	15	1k–2k	2k–5k	10k–20k
Utilities installation	20	2k–5k	5k–15k	15k–30k
Office/staff facilities	20	1k–5k	5k–15k	15k–30k
Compliance & fit-out	15	5k–10k	10k–20k	20k–40k
Contingency	20	10k–20k	30k–40k	40k–90k
Total		**78k–147k**	**155k–262k**	**300k–680k**
Annualised cost ($/L) [1]		**$14.23–$21.96**	**$7.80–$14.97**	**$6.83–$9.10**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of the asset.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput from Table 55 are presented in Table 56 on a per-L basis. The per–unit operating costs are considerably higher than other moringa consumption forms due to low throughput and low conversion rate.

Table 56: *Costs to operate a moringa oil extraction facility*

Cost category	Operating costs ($/L)		
	Small (300–900 L/yr)	*Medium (900–3000 L/yr)*	*Large (3000–9000 L/y)*
Labour	$15.00–$30.00	$8.00–$15.00	$5.00–$10.00
Utilities (e.g. electricity & water)	$0.50–$1.00	$0.30–$0.70	$0.20–$0.50
Raw ingredient	$28.57–$80.00	$28.57–$80.00	$28.57–$80.00
Other ingredients	$0.50–$1.00	$0.30–$0.60	$0.20–$0.50
Packaging & distribution	$12.00–$20.00	$8.00–$12.00	$6.00–$9.00
Maintenance & cleaning	$3.00–$8.00	$2.00–$5.00	$1.00–$4.00
Waste & by-product removal	$0.10–$0.50	$0.10–$0.30	$0.05–$0.10
Total ($/L)	**$59.67–$140.50**	**$47.27–$113.60**	**$41.02–$104.10**

Earnings before Interest and Tax (EBIT)

EBIT ($/L) is used to assess the financial feasibility of a processing facility preparing moringa for sale and consumption (Table 57). EBIT considers how the revenue earned covers variable and fixed costs.

Table 57: *Estimated EBIT: Extracting moringa oil (medium-scale facility)*

Particulars	EBIT ($/L) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$90.00	$112.00	$137.14
Processing costs *(including raw product costs)*	$113.60	$76.15	$47.27
Gross profit	-$23.60	$35.85	$89.87
Annualised capital charge	$14.97	$11.38	$7.80
Allowance for annual fixed costs [2]	$3.60	$4.48	$5.49
EBIT	**-$42.17**	**$19.99**	**$76.59**
EBIT %	-47%	18%	56%

[1] Revenue earned is calculated as the product of the volume of moringa oil sold (see above) and the wholesale moringa oil price. There is little visibility on the processor's wholesale price for moringa oil. It is therefore estimated using the retail price ($180.00 to $240.00/ L) *less* an assumed retail markup (75 to 100%). The price received by processors to cover their production costs, therefore, ranges from $90 to $137.14/ L of moringa oil sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

The EBIT is particularly sensitive to two variables: the price paid in the market for moringa oil, and the price paid to growers (i.e. farmgate price) for harvested moringa seeds ($10.00 to $20.00 per kg). Table 58 demonstrates how a processor's EBIT fluctuates due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. 88% of the modelled combinations of these variables result in a positive EBIT, with 80% resulting in an EBIT margin of 7.50% or more.

Table 58: *Sensitivity of processor EBIT: Moringa oil*

		Farmgate price paid ($/kg)						
		$20.00	$18.33	$16.67	**$15.00**	$13.33	$11.67	$10.00
Market price ($/L)	$180.00	-$12.68	-$7.13	-$1.57	$3.99	$9.54	$15.10	$20.65
	$190.00	-$7.35	-$1.79	$3.76	$9.32	$14.87	$20.43	$25.99
	$200.00	-$2.01	$3.54	$9.10	$14.65	$20.21	$25.76	$31.32
	$210.00	$3.32	$8.87	$14.43	**$19.99**	$25.54	$31.10	$36.65
	$220.00	$8.65	$14.21	$19.76	$25.32	$30.87	$36.43	$41.99
	$230.00	$13.99	$19.54	$25.10	$30.65	$36.21	$41.76	$47.32
	$240.00	$19.32	$24.87	$30.43	$35.99	$41.54	$47.10	$52.65

Processor feasibility for moringa

The economic feasibility of preparing moringa oil for consumption is assessed using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Processing moringa seeds into oil is expected to be profitable with an EBIT margin of 18%.
2. **Sensitivity of profitability:** The EBIT of a moringa oil processing facility is expected to be somewhat resilient to fluctuations in the market price received and the farmgate price paid, with 88% of the modelled combinations resulting in a positive EBIT, and 80% resulting in an EBIT margin of 7.50% or more (Table 14).
3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport harvested moringa leaves between orchards and a processing facility. There are already well-established transportation channels across Northland for other industries such as dairy, sheep and beef, that could be leveraged. There are no specialised distribution requirements to reach markets, as moringa oil is a more robust product with a longer shelf life. Therefore, more mainstream distribution channels such as couriers may be an option to reach consumers outside of Northland.
4. **Infrastructure:** Processing moringa leaves into an oil for consumption is a complex process with extensive machinery and equipment needed to support the conversion. The necessary capital equipment is not unique to moringa, but also not widely used in existing processing facilities. That said, the required assets are easily available via import if domestic suppliers are unavailable.

For these reasons, we consider domestically grown moringa oil to be feasible for processors only at a *small scale* (processor feasibility score of 2.50), provided the market price remains high enough to adequately offset the relatively higher costs of domestic production (Table 59).

Table 59: *Processor feasibility: Moringa oil*

Criterion	Score *(from 0 to 4)*
Profitability	4.00
Sensitivities	3.00
Logistics & distribution	2.00
Infrastructure	1.00
Average score	**2.50** Small-scale

Market feasibility for moringa oil

The opportunity for moringa oil in domestic markets is assessed using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic industry:

1. **Supply and demand:** The moringa oil market in New Zealand is small, with one interviewee indicating annual imports of just 20 to 30 kg. Quality is a critical factor for both retailers and consumers, with a clear preference for cold-pressed oil sourced from certified organic production. Locally grown moringa was seen as a potentially compelling value proposition, particularly among sustainability-minded consumers who prioritise local sourcing and emissions reduction.

2. **Market access:** All moringa oil sold in New Zealand is currently imported. In most cases, the oil arrives in bulk and is repackaged into smaller retail units domestically. One stakeholder reported using moringa oil as an ingredient in their cosmetic product line, including lip balms, creams, and facial oils, which are packaged in-house, while higher-volume items such as shampoos and soaps are produced through a local contract manufacturer. Another interviewee expressed interest in locally grown moringa, noting that domestic supply could help alleviate current supply chain delays, which typically result in lead times of three to four months due to offshore sourcing and shipping. The success of a Northland-based moringa seed oil industry will depend on the ability to deliver cold-pressed, organically produced oil at competitive prices and with a consistent supply

3. **Competition and market-related risks:** A limited number of New Zealand-based retailers supply moringa oil to the domestic market, with retail pricing averaging around $27 per 100 millilitres (mL). Some retailers also offer bulk purchase options, ranging from 1 to 5 litres (L). In addition, consumers have access to a broader selection of international brands through online channels, increasing competitive pressure on local offerings. While there is strong interest in the idea of New Zealand-grown moringa oil, interviewees consistently noted that price competitiveness with existing imported products will be essential for market viability.

Moringa oil has a small cosmetic market in New Zealand, which might be interested in the story of locally grown products if the pricing is competitive. Moringa oil could leverage the current processing facilities and distribution network of the well-established manuka oil market.

For these reasons, domestic moringa oil is assessed to be feasible in the market at a *small scale* (Table 60).

Table 60: *Market feasibility: Moringa oil*

Criterion	Score *(from 0 to 4)*
Supply & demand	1.00
Market access	2.50
Competition & market-related risks	2.00
Average score	**1.83** Small-scale

Feasibility of a Northland moringa industry

Scale of feasibility

The economic feasibility of moringa considers the individual feasibility for growers, processors and the market presented in the previous sections. Table 61 summarises the feasibility given to each of the three components for the three consumption forms considered for moringa.

Table 61: *Feasibility of establishing a moringa industry in Northland*

Consumption forms	Feasibility component			
	Grower	*Processor*	*Market*	*Overall*
1. Fresh leaves	Small-scale (1.80)	Medium-scale (3.00)	Small-scale (2.33)	Small-scale
2. Powder	Small-scale (1.80)	Not feasible (0.88)	Small-scale (2.00)	Not feasible
3. Oil	Small-scale (1.80)	Small-scale (2.50)	Small-scale (1.83)	Small-scale

Overall, a domestic moringa industry is considered economically feasible at a *small scale* under current economic conditions and assuming agronomic feasibility, by creating a market for fresh leaves and building a share of the local moringa oil market. Despite being somewhat competitive on price, the domestic industry would be limited to a small scale due to the very small domestic market for moringa products.

Estimated scale of operation

The estimated scale of operation, expressed as planted hectares to the nearest order of magnitude, required to meet demand for fresh New Zealand-grown moringa is less than **10 hectares** of open field production, mostly driven by the demand for fresh moringa leaves. This is expected to generate an aggregated gross profit of up to $0.12 million annually. This is suggested as the minimum viable scale needed to participate meaningfully in the market without overcommitting land or capital. However, at this scale, the land required could be halved by using controlled environments, such as greenhouses and polytunnels to better align with international yields.

Table 62: *Planted area required to meet demand for moringa products*

Particulars	Feasible consumption forms	
	Fresh leaves	Oil
Estimated demand	30–60 t [1]	20–40 L
Conversion efficiency	100%	30%
Raw product required	30–60 t *(leaves)*	65–130 kg *(seeds)*
Estimated yield	10 t/ha of leaves	2 t/ha of seeds
Land required	**<10.00 commercial hectares**	
Aggregated gross profit	**<$0.12 million**	

[1] Without the existence of a domestic market for fresh moringa leaves, this is a high-level estimate of what demand could be given the cultural significance of moringa and its substitutability for leafy greens (e.g. lettuce, kale and spinach). At this scale, the estimated demand for moringa is less than 0.05% of total leafy green consumption (approximately 130,000 t/yr).

Chapter 6:
Soybeans

This chapter assesses the economic feasibility of growing, processing, and marketing Northland-grown *soybean*, including key cost drivers, market potential, and viability under Northland conditions.

Chapter disclaimer: This section presents indicative results from a simplified financial model, using broad assumptions and input ranges to reflect uncertainty and data limitations. Many figures are drawn from secondary or lower-confidence sources and are not intended to represent precise outcomes. The analysis does not capture the full complexity of on-farm decision-making or site-specific conditions and should not be used as a substitute for detailed business planning or professional advice. The following analysis is intended to be indicative only.

Growing soybeans

Introduction

Background

Soybeans are one of the most globally traded crops and have several uses. It is primarily grown for animal feed, vegetable oil and other food products such as tofu and soy milk. The USA and Brazil produce most of the world's soy, together accounting for approximately 70% of global output. Their soybean crops are almost entirely genetically modified (GM), with the majority containing stacked traits such as herbicide resistance, resistance to viruses and fungi, drought tolerance, and improved protein, oil, or vitamin content.

In contrast, New Zealand health food manufacturers typically seek non-GM and organically grown soybeans. However, due to limited domestic supply, it forces them to source non-GM beans directly from overseas, such as Canada, Australia, or China.

Soybeans have been trialled in New Zealand, but have not become commercially significant.[21] However, recent small-scale trials in Canterbury have shown success. While the agronomic feasibility of soybeans in Northland is unclear, the region's warm summers and mild winters suit growing this annual crop, with planting in late spring and harvesting in late autumn.

Approximately 80% of New Zealand's imported soybeans are used for animal feed. The remaining 20% is a combination of soy milk, tofu, oil, and condiments such as soy sauce and miso, among other products. Renewed regional interest in local soy production has demonstrated a desire, on a small scale, to reduce the reliance on imports.

Estimated yield

Expected soybean yields depend on several factors, including the planting density, pest and disease control, and climatic events such as excessive rain and wind. For this work, the annual yield in Northland is estimated to be between 1.5 and 3.5 tonnes per hectare per year (t/ha/yr, a midpoint of 2.5 t/ha/yr) based on previous trial results and international case studies.

Costs to grow soybeans

Estimated set-up costs

Soybean is an annual crop and has the potential to be included in a regular crop rotation due to its nitrogen-fixing properties. Therefore, there are no specific one-off set-up costs associated with growing soybeans. Site preparation and planting material costs are incurred annually to prepare the land for growing soybeans. However, harvesting may require the purchase of a specialised tractor attachment,

---

[21] A commercial grower of soybean is someone growing soybeans to generate a profit or earn a living, and who is NP1 registered (at a minimum) under New Zealand's Food Act 2014 and/or NZGAP certified.

National Programme 1 (NP1) is the registration process for low-risk food businesses under New Zealand's Food Act 2014 to ensure they are managing food safety risks and producing safe food for sale. The New Zealand Good Agricultural Practice (NZGAP) certifies the safe and sustainable production of fruit and vegetables in New Zealand and is generally required by retailers to supply them.

while other required machinery is assumed to be available through local contractors supporting other local arable production.

Annual gross profitability

We use gross profitability as the primary measure of the crop's ongoing economic feasibility, reflecting the difference between revenue earned and the direct costs associated with growing soybeans. Fixed costs are assumed to be minimal and highly variable between growers, so they are not considered in the following analysis. Table 63 shows gross profitability for growers on a per-hectare basis for three scenarios. There is a significant range between the pessimistic and optimistic scenarios.

Table 63: *Grower gross profitability: Soybeans*

Particulars	Gross profitability ($/ha)		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$1,875	$4,688	$8,750
Estimated growing costs [2]	$3,540	$3,375	$3,190
Gross profit	**-$1,665**	**$1,313**	**$5,560**
Gross margin	-89%	28%	64%

[1] Revenue earned is calculated as the product of yield (see above) and the farmgate price received by soybean growers for their output (estimated at $1.25 to $2.50 per kg). The farmgate price is set by estimating how value is created and received across the value chain.

[2] The growing cost estimate includes site maintenance, plant replacements, fertiliser applications, water input (as required), labour and machinery/technology use. The estimated growing costs are assumed to be based on management activities that are largely mechanised. The costs have been estimated using existing arable production as a reference.

Sensitivity of annual gross profitability

A grower's gross profitability is particularly sensitive to fluctuations in the expected yield (2.50 t/ha/yr) and the expected farmgate price ($1.88 per kg). Table 64 shows how a grower's gross profitability varies for all combinations of seven levels of each of these two variables, while keeping the estimated non-labour growing costs constant at the *base* estimate; labour costs are an exception, which scale to changes in yield. Across the modelled combinations, 78% result in a positive gross profit for soybean growers, with just under half resulting in a gross margin of 25% or more.[22]

[22] A 25% gross margin threshold is considered within the normal range of gross margins for outdoor food producers in New Zealand.

Table 64: *Sensitivity of grower gross profitability: Soybeans*

		Farmgate price received ($/kg)						
		$1.25	$1.46	$1.67	**$1.88**	$2.08	$2.29	$2.50
Yield (t/ha/yr)	1.50	-$1,450	-$1,138	-$825	-$513	-$200	$113	$425
	1.83	-$1,050	-$668	-$286	$96	$478	$860	$1,242
	2.17	-$650	-$199	$253	$704	$1,156	$1,607	$2,058
	2.50	-$250	$271	$792	**$1,313**	$1,833	$2,354	$2,875
	2.83	$150	$740	$1,331	$1,921	$2,511	$3,101	$3,692
	3.17	$550	$1,210	$1,869	$2,529	$3,189	$3,849	$4,508
	3.50	$950	$1,679	$2,408	$3,138	$3,867	$4,596	$5,325

The opportunity cost of growing soybeans

Soybeans are competing for the same high-quality, fertile soils across Northland that are suitable for growing other arable crops. Table 65 presents the estimated gross profitability (dollars per hectare, $/ha) for several competing crops to illustrate the opportunity cost of growing soybeans. While land-use decision-making also depends on multiple non-financial factors, this comparison illustrates the scale of the financial incentive to allocate land to other options.

Table 65: *Opportunity cost of growing soybeans*

Competing crops	Estimated gross profit ($/ha)			Net benefit/loss
	Low	*Midpoint*	*High*	*If growing soybeans*
Soybeans	-$1,665	$1,313	$5,560	N/A
Maize (grain)	$800	$1,375	$1,950	-$63
Maize (silage)	$3,000	$3,500	$4,000	-$2,188
Pasture (silage)	$750	$1,125	$1,500	$188
Kūmara	$7,000	$11,000	$15,000	-$9,688

Assessment of economic feasibility

The economic feasibility of growing soybeans is assessed using the following five grower-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model presented for growers earlier in this chapter:

1. **Output potential:** With suitable varieties making the most of Northland's warm summers and long sunshine hours, Northland growers could expect moderate soybean yields, albeit lower than international growers.
2. **Grower profitability:** Growing soybeans commercially is expected to generate a healthy gross profit at the midpoint estimates of revenue and costs of production. The expected gross margin of 28% is within the 'safe' range for outdoor food producers.
3. **Infrastructure:** No crop-specific infrastructure is required to grow soybeans in Northland. However, management of soybeans is expected to be highly mechanised at all stages from land

preparation to harvest. The required machinery aligns with other local arable production, except for a soybean harvest tractor attachment.

4. **Sensitivity of profitability:** The sensitivity of a grower's gross profitability to fluctuations in the yield, the farmgate price received, and production costs is moderate. Nearly 80% of modelled scenarios resulted in a positive gross profit, and nearly half with a gross margin above 25%.

5. **Grower opportunity cost:** The opportunity cost of growing soybeans is considered moderate, with two of the four competing crops generating a substantially better gross profit per ha on average, while the other two have comparable gross profits on average.

For these reasons, domestically grown soybeans are considered feasible for growers at a *small scale* (grower feasibility score of 2.10) while the farmgate price remains high enough to offset the relatively higher costs of domestic production (Table 66).

Table 66: *Grower feasibility: Soybeans*

Criterion	Score *(from 0 to 4)*
Output potential	2.00
Profitability	2.00
Infrastructure	3.00
Sensitivities	2.00
Opportunity cost	1.50
Average score	2.10 Small-scale

Soybeans: Soy milk

Soymilk is one of the three prioritised consumption forms for soybean in this market opportunities study (refer to page 14 for more information).

Introduction

Description

In New Zealand, soy milk consumption is increasing as a dairy alternative, supported by health and environmental considerations as well as growing rates of lactose intolerance. Two main formats are available in the market: long-life soy milk, which is ultra-high temperature (UHT) treated, and fresh soy milk.

1. **Long-life soy milk (UHT treated):** Commercial soy milk is made directly from soybeans by extracting soluble proteins, oils and carbohydrates. It is processed specifically for human consumption and designed to mimic the nutritional and sensory characteristics of dairy milk with various additives to improve taste.

2. **Fresh soy milk:** This soy milk is generally produced as a by-product or alongside tofu production. It is extracted from ground, soaked soybeans before any coagulant is added. It is regarded as less palatable than long-life soy milk because it skips the processing steps that reduce off-flavours and improve texture. It is, however, preferred by a small number of consumers who also consider it a premium product.

There are several small soy milk processing facilities scattered across New Zealand. For this analysis, we focus on the production of long-life soy milk directly from soybeans due to the control over taste, nutritional profile, and shelf stability in retail markets. The value proposition of consuming soy milk using domestically grown soybeans revolves around the provenance factor and supporting local growers and communities. For local markets, there could also be an opportunity for fresh soy milk that skips the UHT treatment, although shelf life is severely impacted.

Conversion efficiency

For every tonne of soybeans harvested, between 5,000 and 8,000 L of commercial soy milk can be produced (i.e. 500% to 800% conversion rate). In other words, every litre of soy milk requires 125 to 200 grams (g) of soybeans.

Processing steps

The steps involved in processing whole soybeans into soy milk are resource-intensive and require a reasonable level of capital investment in equipment to support some activities, even at the smallest scales of production. The steps include:

1. Cleaning and dehulling the soybeans to remove stones, dirt, dust and damaged soybeans.
2. Soaking dried soybeans for up to 12 hours to raise their moisture content.
3. Rinsing and blanching the hydrated soybeans to prepare for extraction.
4. Extracting slurry from the soybeans using about 7 L of water for every 1 kg of soybeans.
5. Cooking the slurry to inactivate enzymes and denature proteins to improve digestibility.

6. Separating the liquids, solids and fibre from the slurry.
7. Deodorising and deaerating the isolated liquid.
8. Homogenising the liquid to stabilise the protein and oil emulsion for a similar palate to dairy milk.
9. Formulating the homogenised liquid to have the desired viscosity, flavour and nutrition.
10. Finishing the soy milk with one of two optional thermal treatments:
    a. UHT treatment for a consumer-ready product with a long shelf-life (similar to the imported soy milk options)
    b. High-temperature short-time pasteurisation (HTST) for a fresh, chilled alternative to long-life soy milk.

    For this work, we prioritise UHT treatments in favour of the extended shelf life and broader market reach.
11. Packaging soy milk in appropriate containers (e.g. polyethylene terephthalate, PET).

Given the complexity involved in processing soybeans into soy milk, we assume a centrally located processing facility will be established by a private investor or grower collective that sources soybeans from across the region.

Costs to process soy milk

Facility establishment costs

The estimated costs to establish a facility to process soybeans into soy milk in a peri-urban setting (capital expenditure only) are presented in Table 67 for processing facilities with three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility:** Processing between 10 and 30 t/yr of soybeans from approximately 4 to 12 ha of commercial soybean farms. At this scale, between 65,000 and 195,000 L of soy milk will be produced.
- **Medium-scale facility:** Processing between 30 and 100 t/yr of soybeans from approximately 12 to 40 ha of commercial soybean farms. At this scale, between 195,000 and 650,000 L of soy milk will be produced.
- **Large-scale facility:** Processing between 100 and 300 t/yr of soybeans from approximately 40 to 120 ha of commercial soybean farms. At this scale, between 650,000 and 1,950,000 L of soy milk will be produced.

Table 67: *Costs to establish a soy milk processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small (65–195 kL/yr)*	*Medium (195–650 kL/yr)*	*Large (650–1950 kL/yr)*
Site development/buildings	25	100k–250k	250k–500k	500k–1m
Processing equipment	15	50k–110k	290k–585k	820k–1.31m
Packing equipment & benches	15	20k–50k	150k–300k	500k–1m
Storage facilities	15	200k–300k	500k–700k	1.2m–1.8m
Palletising & internal logistics	15	2k–5k	30k–50k	80k–150k
Utilities installation	20	30k–50k	100k–150k	200k–400k
Office/staff facilities	20	20k–50k	150k–200k	200k–400k
Compliance & fit-out	15	50k–100k	180k–250k	250k–400k
Contingency	20	70k–140k	250k–410k	560k–970k
Total		542k–1.06m	1.90m–3.15m	4.31m–7.43m
Annualised cost ($/L) [1]		**$0.51–$0.79**	**$0.46–$0.93**	**$0.37–$0.64**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of each group of assets.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput above are presented in Table 68 on a per-litre basis ($/L).

Table 68: *Costs to operate a soy milk processing facility*

Cost category	Operating costs ($/L)		
	Small (65–195 kL/yr)	*Medium (195–650 kL/yr)*	*Large (650–1950 kL/yr)*
Labour	$0.50–$0.80	$0.30–$0.60	$0.20–$0.40
Utilities (e.g. electricity and water)	$0.03–$0.06	$0.02–$0.04	$0.01–$0.03
Raw ingredient	$0.16–$0.50	$0.16–$0.50	$0.16–$0.50
Other ingredients	$0.05–$0.10	$0.04–$0.08	$0.03–$0.06
Packaging and distribution	$0.25–$0.35	$0.20–$0.30	$0.15–$0.25
Maintenance and cleaning	$0.05–$0.12	$0.05–$0.09	$0.04–$0.08
Waste/by-product removal	$0.01–$0.03	$0.01–$0.02	$0.01–$0.03
Total ($/L)	**$1.05–$1.96**	**$0.77–$1.63**	**$0.60–$1.35**

Earnings before Interest and Tax (EBIT)

We use EBIT (dollars per litre, $/L) to assess the financial feasibility of a facility processing soybeans into soy milk (Table 69). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 69: *Estimated EBIT: Processing soy milk (medium-scale facility)*

Particulars	EBIT ($/L) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$2.50	$3.73	$5.22
Processing costs *(including raw product costs)*	$1.63	$1.16	$0.77
Gross profit	$0.87	$2.56	$4.45
Annualised capital charge	$0.93	$0.70	$0.46
Allowance for annual fixed costs [2]	$0.10	$0.15	$0.21
EBIT	**-$0.16**	**$1.72**	**$3.78**
EBIT %	-6%	46%	72%

[1] Revenue earned is calculated as the product of the volume of soy milk sold (see above) and the wholesale soy milk price. There is little visibility of the processor's wholesale price for soy milk. It is therefore estimated using the retail price ($3.50 to $6.00 per litre) *less* an assumed retail markup (15 to 40%). The price received by processors to cover their production costs, therefore, ranges from $2.50 to $5.22 per litre of soy milk sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

The EBIT is particularly sensitive to two variables: the price paid in the market for soy milk, and the price paid to growers (i.e. farmgate price) for harvested soybeans. Table 70 demonstrates how a processor's EBIT fluctuates due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. All modelled combinations of these variables result in an EBIT above 7.50%.

Table 70: *Sensitivity of processor EBIT: Soy milk*

		Farmgate price paid ($/kg)						
		$2.50	$2.29	$2.08	**$1.88**	$1.67	$1.46	$1.25
Market price ($/L)	$3.50	$0.64	$0.68	$0.71	$0.74	$0.77	$0.80	$0.84
	$3.92	$0.97	$1.00	$1.03	$1.07	$1.10	$1.13	$1.16
	$4.33	$1.30	$1.33	$1.36	$1.39	$1.42	$1.46	$1.49
	$4.75	$1.62	$1.66	$1.69	**$1.72**	$1.75	$1.78	$1.82
	$5.17	$1.95	$1.98	$2.01	$2.05	$2.08	$2.11	$2.14
	$5.58	$2.28	$2.31	$2.34	$2.37	$2.41	$2.44	$2.47
	$6.00	$2.60	$2.64	$2.67	$2.70	$2.73	$2.76	$2.80

Processor feasibility for soy milk

The economic feasibility of preparing soy milk for consumption is assessed using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Preparing soy milk for consumption in a post-harvest facility is expected to be profitable with a strong EBIT margin of 46%.
2. **Sensitivity of profitability:** There is moderate variability in the expected profitability of a Northland post-harvest facility for soymilk, although it is more variable for changes in the market price than changes in the farmgate price paid. 100% of the combinations modelled in Table 70 result in a positive EBIT margin above 7.50%. This indicates the consumption form is resilient, and the profitability of a soy milk processor is maintained within the ranges used for yield and market price.
3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport harvested soybeans between farms and a processing facility. There are already well-established transportation channels across Northland for other industries such as dairy, sheep and beef, that could be leveraged for soybeans. Distributing soy milk, however, has its challenges. Fresh soy milk (e.g. without UHT treatment) has a short shelf-life, needing to be kept chilled in storage and in transit to maintain its quality. UHT-treated soy milk will have a longer shelf life and have fewer storage requirements. Given the scale of production and the cool storage requirements, there are likely to be added complexities to navigate that could increase the distribution costs, such as couriers versus large freight.
4. **Infrastructure:** Establishing a Northland soy milk processing facility will require significant investment in processing equipment, including cookers, grinders and equipment for UHT treatment, homogenisation and dehulling. Most equipment is readily available to purchase, but may need to be imported in the absence of a domestic supplier or second-hand market.

For these reasons, we consider domestically grown soy milk feasible for processors only at a *medium-scale* (processor feasibility score of 2.75), provided the market price remains high enough to adequately offset the relatively higher costs of domestic production (Table 71).

Table 71: *Processor feasibility: Soy milk*

Criterion	Score *(from 0 to 4)*
Profitability	4.00
Sensitivities	4.00
Logistics and distribution	2.00
Infrastructure	1.00
Average score	**2.75** Medium-scale

Market feasibility

The market opportunity for soy milk using domestically grown soybeans in Northland is assessed using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic industry:

1. **Supply and demand:** Based on current trends, the opportunity for Northland-produced soy milk is moderate. There is a growing consumer interest in plant-based dairy alternatives across New Zealand, driven by health, sustainability, and dietary preferences. Most soy milk available in New Zealand has received UHT treatment to improve its shelf life. Domestic production could open opportunities to supply both fresh soy milk to local consumers and long-life soy milk to wider markets. Current demand for fresh soy milk is highly niche, and consumption is largely limited to the local New Zealand Chinese community. Fresh soy milk is difficult to commercialise due to its short shelf life and the strong 'beany' flavour, which many Western consumers find off-putting. UHT-treated soy milk appears to have the most opportunity domestically, although it needs to compete on price with imported alternatives.

2. **Market access:** There are already a few small-scale producers making fresh soy milk, but their products are only sold to a limited, niche market. Local markets can be supplied with fresh soy milk, while UHT-treated soy milk can be used to access markets outside of Northland, such as Auckland, Tauranga and Hamilton. Market access depends on setting up appropriate distribution channels to maintain product quality in transit.

3. **Competition and market-related risks:** Long-life imported soy milk is widely available in supermarkets across the country and is competitively priced. It typically remains shelf-stable for 6 to 12 months from its manufacturing date. A variety of brands are on the market, including Vitasoy, Macro, and Pams, offering both conventional and organic options. Western consumers generally prefer long-life soy milk for its milder taste, often achieved through lower soybean content or blending with other ingredients like oats.

The opportunity for Northland-produced soy milk is small, with growth underpinned by rising consumer interest in plant-based dairy alternatives but constrained by structural and competitive dynamics. While fresh soymilk production could serve niche local markets, primarily within the Chinese community, its short shelf life and polarising flavour limit scalability. The greater potential lies in UHT-treated soy milk, which could reach wider domestic markets, provided robust distribution channels are established. However, competition is strong, as long-life imported soy milk is widely available, competitively priced, and tailored to mainstream consumer preferences through milder formulations. To succeed, a Northland soymilk industry would need to strategically differentiate on quality, sustainability, and provenance while addressing cost competitiveness to capture share from entrenched multinational brands.

For the reasons above, a UHT-treated soy milk, made from domestically grown soybeans, is assessed to be feasible in the market at a *small scale* (Table 72).

Table 72: *Market feasibility: Soy milk*

Criterion	Score (from 0 to 4)
Supply and demand	2.00
Market access	2.00
Competition and market-related risks	1.00
Average score	1.67 Small-scale

Soybeans: Tofu

Tofu is one of the three prioritised consumption forms for soybean in this market opportunities study (refer to page 14 for more information).

Introduction

Description

In New Zealand, tofu is increasingly popular as a plant-based source of protein, driven by health benefits and environmental considerations. There are a few small domestic producers of tofu based in Auckland, and the rest of New Zealand's supply relies on imports from the United States and East Asia. Tofu is produced by coagulating pure soy milk and pressing the resulting curds into blocks. It has become a staple in many Asian cuisines and is popular in vegetarian and vegan diets worldwide. It has several culinary uses, making it a versatile alternative to animal-based protein sources.

The value proposition of consuming tofu from domestically grown soybeans revolves around the provenance factor, supporting local growers and communities to thrive, and the shorter supply chain, all of which improve access to fresh tofu.

Conversion efficiency

For every tonne of soybeans harvested, 1.5 to 2.5 tonnes of tofu can be produced (i.e. a conversion rate of 150% to 250%).

Processing steps

The steps involved in processing whole soybeans into tofu are resource-intensive and require a reasonable level of capital investment in equipment to support activities, even at the smallest scales of production. The steps include:

1. Cleaning and dehulling the soybeans to remove stones, dirt, dust and damaged soybeans.
2. Soaking dried soybeans for up to 12 hours to raise their moisture content.
3. Rinsing and blanching the hydrated soybeans to prepare them for extraction.
4. Extracting slurry from soybeans using about 7 L of water for every 1 kg of soybeans.
5. Cooking the slurry to inactivate enzymes and denature proteins to improve digestibility.
6. Separating the liquids, solids and fibre from the slurry.
7. Cooling the liquid and dosing the coagulant to form the soy milk curds.
8. Breaking and pressing the curds to remove whey and define the tofu's texture.
9. Cooling and removing the pressed curds.
10. Treating the pressed curds with one of two heat treatment options:
    a. Pasteurisation for a fresh, chilled tofu product with a 2 to 3 week shelf life
    b. UHT to extend tofu's ambient shelf-life up to 9 months.

For this work, the preferred temperature treatment is pasteurisation for its sensory quality.

11. Packing tofu into consumer-ready packaging.

Given the complexity involved in processing soybeans into tofu, despite the process from step 3 only taking several hours, we assume a centrally located processing facility will be established by a private investor or grower collective that sources soybeans from across the region. The following analysis is prepared accordingly.

Costs to process tofu

Facility establishment costs

- The estimated costs to establish a facility to process soybeans into tofu in a peri-urban setting (capital expenditure only) are presented in **Small-scale facility**: Processing between 10 and 30 t/yr of soybeans from approximately 4 to 12 ha of commercial soybean farms. At this scale, between 20,000 and 60,000 kg of tofu will be produced.
- **Medium-scale facility:** Processing between 30 and 100 t/yr of soybeans from approximately 12 to 40 ha of commercial soybean farms. At this scale, between 60,000 and 200,000 kg of tofu will be produced.
- **Large-scale facility**: Processing between 100 and 300 t/yr of soybeans from approximately 40 to 120 ha of commercial soybean farms. At this scale, between 200,000 and 600,000 kg of tofu will be produced.

Table 73 for processing facilities with three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility**: Processing between 10 and 30 t/yr of soybeans from approximately 4 to 12 ha of commercial soybean farms. At this scale, between 20,000 and 60,000 kg of tofu will be produced.
- **Medium-scale facility:** Processing between 30 and 100 t/yr of soybeans from approximately 12 to 40 ha of commercial soybean farms. At this scale, between 60,000 and 200,000 kg of tofu will be produced.
- **Large-scale facility**: Processing between 100 and 300 t/yr of soybeans from approximately 40 to 120 ha of commercial soybean farms. At this scale, between 200,000 and 600,000 kg of tofu will be produced.

Table 73: *Costs to establish a tofu processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small (20–60 t/yr)*	*Medium (60–200 t/yr)*	*Large (200–600 t/yr)*
Site development/buildings	25	100k–250k	250k–500k	500k–1m
Processing equipment	15	21k–55k	105k–305k	305k–840k
Packing equipment &benches	15	3k–10k	20k–50k	50k–150k
Storage facilities	15	5k–20k	30k–80k	80k–150k
Palletising & internal logistics	15	2k–10k	10k–20k	20k–50k
Utilities installation	20	5k–15k	30k–60k	60k–100k
Office/staff facilities	20	5k–15k	20k–30k	30k–60k
Compliance & fit-out	15	10k–30k	20k–30k	30k–50k
Contingency	20	20k–60k	70k–160k	160k–360k
Total		171k–465k	555k–1.24m	1.24m–2.76m
Annualised cost ($/kg) [1]		**$0.67–$0.73**	**$0.55–$0.82**	**$0.42–$0.55**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of each group of assets.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput above are presented in Table 74 on a per-kg basis.

Table 74: *Costs to operate a tofu processing facility*

Cost category	Operating costs ($/kg)		
	Small (10–30 t/yr)	*Medium (30–100 t/yr)*	*Large (100–300 t/yr)*
Labour	$1.50–$2.50	$0.50–$1.00	$0.40–$0.80
Utilities (e.g. electricity and water)	$0.30–$0.50	$0.20–$0.30	$0.10–$0.20
Raw ingredient	$0.50–$1.67	$0.50–$1.67	$0.50–$1.67
Other ingredients	$0.05–$0.10	$0.03–$0.07	$0.02–$0.05
Packaging and distribution	$0.40–$0.60	$0.30–$0.50	$0.20–$0.40
Maintenance and cleaning	$0.20–$0.80	$0.10–$0.40	$0.05–$0.30
Waste/by-product removal	$0.05–$0.10	$0.02–$0.05	$0.01–$0.03
Total ($/kg)	**$3.00–$6.27**	**$1.65–$3.99**	**$1.28–$3.45**

Earnings before Interest and Tax (EBIT)

We use EBIT (dollars per kilogram, $/kg) to assess the financial feasibility of a facility processing soybeans into tofu (Table 75). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 75: *Estimated EBIT: Processing tofu (medium-scale facility)*

Particulars	EBIT ($/kg) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$6.25	$8.33	$10.71
Processing costs *(including raw product costs)*	$3.99	$2.67	$1.65
Gross profit	$2.26	$5.66	$9.06
Annualised capital charge	$0.82	$0.69	$0.55
Allowance for annual fixed costs [2]	$0.25	$0.33	$0.43
EBIT	**$1.20**	**$4.64**	**$8.08**
EBIT %	19%	56%	75%

[1] Revenue earned is calculated as the product of the volume of tofu sold (see above) and the wholesale tofu price. There is little visibility of the processor's wholesale price for tofu. It is therefore estimated using the retail price ($10.00 to $15.00 per kg) *less* an assumed retail markup (40 to 60%). The price received by processors to cover their production costs, therefore, ranges from $6.25 to $10.71 per kg of tofu sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

EBIT is particularly sensitive to two variables: the price paid in the market for tofu, and the price paid to growers (i.e. farmgate price) for harvested soybeans. Table 76 demonstrates how a processor's EBIT fluctuates due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. All modelled combinations of these variables result in a positive EBIT above 7.50%.

Table 76: *Sensitivity of processor EBIT: Tofu*

		Farmgate price paid for whole soybeans ($/kg)						
		$2.50	$2.29	$2.08	**$1.88**	$1.67	$1.46	$1.25
Market price ($/kg)	$10.00	$2.66	$2.77	$2.87	$2.97	$3.08	$3.18	$3.29
	$10.83	$3.22	$3.32	$3.43	$3.53	$3.63	$3.74	$3.84
	$11.67	$3.77	$3.88	$3.98	$4.09	$4.19	$4.29	$4.40
	$12.50	$4.33	$4.43	$4.54	**$4.64**	$4.75	$4.85	$4.95
	$13.33	$4.88	$4.99	$5.09	$5.20	$5.30	$5.41	$5.51
	$14.17	$5.44	$5.54	$5.65	$5.75	$5.86	$5.96	$6.07
	$15.00	$6.00	$6.10	$6.20	$6.31	$6.41	$6.52	$6.62

Processor feasibility for tofu

The economic feasibility of preparing tofu for consumption is assessed using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Preparing tofu for consumption in a post-harvest facility is expected to be profitable with a strong EBIT margin of 56%.
2. **Sensitivity of profitability:** There is moderate variability in the expected profitability of a tofu facility; however, 100% of the modelled combinations in Table 76 result in a positive EBIT margin above 7.50%. This indicates the consumption form is resilient, and the profitability of a tofu processor is maintained within the ranges used for yield and market price.
3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport harvested soybeans between farms and a processing facility. There are already well-established transportation channels across Northland for other industries, such as dairy, sheep and beef, that could be leveraged for soybeans. Distributing tofu, however, has its challenges as the tofu needs to be kept chilled in storage and in transit to maintain its quality before consumption. Given the scale of production and the cool storage requirements, there are likely to be added complexities to navigate that could increase the distribution costs, such as couriers versus large freight.
4. **Infrastructure:** Establishing a Northland tofu processing facility will require significant investment in processing equipment, including cookers, grinders and equipment for dehulling, UHT treatment and pasteurisation. Most of the equipment should be readily available to purchase, but it may need to be imported to New Zealand in the absence of a domestic supplier or second-hand market.

For these reasons, we consider domestically produced tofu feasible for processors only at a *medium-scale* (processor feasibility score of 2.75), provided the market price remains high enough to adequately offset the relatively higher costs of domestic production (Table 77).

Table 77: *Processor feasibility: Tofu*

Criterion	Score *(from 0 to 4)*
Profitability	4.00
Sensitivities	4.00
Logistics and distribution	2.00
Infrastructure	1.00
Average score	**2.75** Medium-scale

Market feasibility

The market opportunity for tofu using domestically grown soybeans in Northland is assessed using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic industry:

1. **Supply and demand:** Whole-food manufacturers in New Zealand are interested in sourcing locally grown, non-genetically modified (non-GM) organic soybeans for tofu production. However, limited availability and cost pressures mean that all tofu manufacturers currently rely on imported soybeans. As one interviewee noted, it is extremely difficult for local production

to compete with imports, as domestically grown soybeans can cost nearly twice as much as the landed price of imported product

2. **Market access:** There are a few tofu manufacturers in New Zealand. Most of them source their organic soybeans from Canada, Australia, or China. Tofu demand in New Zealand is reliable and increasingly mainstream as a plant-based protein alternative. Consumers across Northland, Auckland, the Waikato and the Bay of Plenty can be accessed, provided that appropriate distribution channels are set up to maintain quality in transit.

3. **Competition and market-related risks:** Domestically produced tofu is highly competitive, with the dominance of a few established brands supplying large supermarket chains. While niche opportunities exist in specialty stores and local supermarkets, breaking into the mainstream will be challenging. This makes it difficult for new entrants to compete effectively, particularly in terms of price. All local whole-food manufacturers expressed support for a domestic industry but noted it would need to be price-competitive to be successful.

New Zealand's tofu market presents a clear tension between opportunity and feasibility: while demand for tofu is steadily growing as a mainstream plant-based protein, and manufacturers express strong support for a local, non-GM organic soybean supply, imports from Canada, Australia, and China are the norm. For local industry development to be viable, a strategic focus on cost competitiveness, supply chain resilience, and targeted market entry will be essential to overcome structural barriers and capture meaningful share.

For these reasons, domestically produced tofu is assessed to be feasible in the market at a *small scale* (Table 78).

Table 78: *Market feasibility: Tofu*

Criterion	Score *(from 0 to 4)*
Supply and demand	2.00
Market access	2.00
Competition and market-related risks	2.00
Average score	**2.00** Small-scale

Soybeans: Soy sauce

Soy sauce is one of the three prioritised consumption forms for soybean in this market opportunities study (refer to page 14 for more information).

Introduction

Description

Soy-based condiments, including soy sauce, miso, tamari, and shoyu, have become pantry staples in New Zealand. For example, 2023 customs data suggest that approximately 4,400 t of soy sauce was imported from China, Singapore and Japan. There are a few small producers domestically of soy-based condiments, mostly soy sauce, although domestic consumption relies on imported products. Helped by New Zealand's growing enthusiasm for Asian cuisine and plant-based diets, demand for soy-based condiments is expected to increase. While all of the condiments are promising to some extent, the following analysis focuses on the production of soy sauce specifically. This is because it is the most familiar soy-based condiment in New Zealand. The value proposition of consuming soy sauce with domestically grown soybeans revolves around the provenance factor, supporting local growers and communities to thrive.

Conversion efficiency

For every tonne of soybeans harvested, 1,000 to 1,300 L of soy sauce can be produced (i.e. a conversion rate of 100% to 130%).

Processing steps

Processing whole soybeans into soy sauce is resource-intensive and requires a reasonable level of capital investment in equipment to support some activities, even at the smallest scales of production. The steps include:

1. Cleaning, steam-cooking and roasting soybeans, then blending with wheat.
2. Inoculating this cooled mix with *Aspergillus oryzae* spores to make the koji.
3. Blending the koji with salt brine to create a mash called moromi.
4. Fermenting the moromi for six months to two years to build flavour.
5. Pressing the moromi and separating the raw soy sauce liquor.
6. Filtering the raw soy sauce liquor to remove fine solids and polish the colour (i.e. clarity).
7. Pasteurising the soy sauce liquor to kill microbes, stop fermentation, develop aroma and darken the colour.
8. Resting the pasteurised liquor for several weeks in ambient tanks while formulating for flavour and style.
9. Bottling and labelling soy sauce into the appropriate packaging in glass or PET to sell.

Given the complexity involved in processing soybeans into soy sauce, we assume a centrally located processing facility will be established by a private investor or grower collective that sources soybeans from across the region. There may be opportunities to leverage existing processing facilities in Northland, such as the Ngawha Innovation and Enterprise Park,[23] when operating on a small scale. The following analysis is prepared accordingly.

Costs to process soy sauce

Facility establishment costs

The estimated costs to establish a facility to process soybeans into soy sauce in a peri-urban setting (capital expenditure only) are presented in Table 79 for processing facilities with three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility:** Processing between 10 and 30 t/yr of soybeans from approximately 4 to 12ha of commercial soybean farms. At this scale, between 11,500 and 34,500 L of soy sauce will be produced.
- **Medium-scale facility:** Processing between 30 and 100 t/yr of soybeans from approximately 12 to 40ha of commercial soybean farms. At this scale, between 34,500 and 115,000 L of soy sauce will be produced.
- **Large-scale facility**: Processing between 100 and 300 t/yr of soybeans from approximately 40 to 120 ha of commercial soybean farms. At this scale, between 115,000 and 345,000 L of soy sauce will be produced.

Table 79: *Costs to establish a soy sauce processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small (12–35 kL/yr)*	*Medium (35–115 kL/yr)*	*Large (115–345 kL/yr)*
Site development/buildings	25	100k–250k	250k–500k	500k–1m
Processing equipment	15	45k–145k	180k–650k	650k–1.6m
Packing equipment & benches	15	5k–20k	20k–100k	100k–300k
Storage facilities	15	5k–15k	10k–50k	50k–150k
Palletising & internal logistics	15	3k–10k	5k–40k	20k–100k
Utilities installation	20	10k–30k	30k–100k	100k–250k
Office/staff facilities	20	5k–20k	20k–80k	80k–200k
Compliance & fit-out	15	20k–60k	60k–150k	150k–300k
Contingency	20	30k–80k	90k–250k	250k–540k
Total		**223k–630k**	**665k–1.92m**	**1.9m–4.44m**
Annualised cost ($/L) [1]		**$1.64–$1.72**	**$1.55–$1.74**	**$1.21–$1.53**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of each group of assets.

[23] The shared food and beverage manufacturing facility is designed for local value-added processing, with shared brewing and fermentation explicitly mentioned as a target development and is highly relevant for soy sauce fermentation.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput mentioned previously are presented in Table 80 on a per-L basis.

Table 80: *Costs to operate a soy sauce processing facility*

Cost category	Operating costs ($/L)		
	Small (12–35 kL/yr)	*Medium (35–115 kL/yr)*	*Large (115–345 kL/yr)*
Labour	$2.00–$4.00	$1.00–$3.00	$0.50–$1.50
Utilities (e.g. electricity and water)	$0.10–$0.25	$0.05–$0.15	$0.03–$0.10
Raw ingredient	$0.96–$2.50	$0.96–$2.50	$0.96–$2.50
Other ingredients	$0.50–$0.70	$0.40–$0.60	$0.30–$0.50
Packaging and distribution	$1.00–$1.50	$0.80–$1.20	$0.50–$0.80
Maintenance and cleaning	$1.00–$3.00	$0.50–$1.50	$0.40–$1.00
Waste/by-product removal	$0.02–$0.05	$0.02–$0.04	$0.01–$0.02
Total ($/L)	**$5.58–$12.00**	**$3.73–$8.99**	**$2.70–$6.42**

Earnings before Interest and Tax (EBIT)

We use EBIT ($/L) to assess the financial feasibility of a facility processing soybeans into soy sauce (Table 81). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 81: *Estimated EBIT: Processing soy sauce (medium-scale facility)*

Particulars	EBIT ($/L) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$5.00	$8.46	$12.50
Processing costs *(including raw product costs)*	$8.99	$6.26	$3.73
Gross profit	-$3.99	$2.20	$8.77
Annualised capital charge	$1.74	$1.65	$1.55
Allowance for annual fixed costs [2]	$0.20	$0.34	$0.50
EBIT	**-$5.93**	**$0.22**	**$6.72**
EBIT %	-119%	3%	54%

[1] Revenue earned is calculated as the product of the volume of soy sauce sold (see above) and the wholesale soy sauce price. There is little visibility of the processor's wholesale price for soy sauce. It is therefore estimated using the retail price ($7.00 to $15.00 per L) *less* an assumed retail markup (20 to 40%). The price received by processors to cover their production costs, therefore, ranges from $5.00 to $12.50 per L of soy sauce sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

The EBIT is particularly sensitive to two variables: the price paid in the market for soy sauce, and the price paid to growers (i.e. farmgate price) for harvested soybeans. Table 82 demonstrates how a processor's EBIT fluctuates due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. 53% of the modelled combinations of these variables result in a positive EBIT, with 45% resulting in an EBIT margin of 7.50% or more.

Table 82: *Sensitivity of processor EBIT: Soy sauce*

		Farmgate price paid ($/kg)						
		$2.50	$2.29	$2.08	**$1.88**	$1.67	$1.46	$1.25
Market price ($/L)	$7.00	-$3.40	-$3.22	-$3.04	-$2.86	-$2.68	-$2.50	-$2.32
	$8.33	-$2.38	-$2.20	-$2.02	-$1.84	-$1.65	-$1.47	-$1.29
	$9.67	-$1.35	-$1.17	-$0.99	-$0.81	-$0.63	-$0.45	-$0.27
	$11.00	-$0.33	-$0.15	$0.03	**$0.22**	$0.40	$0.58	$0.76
	$12.33	$0.70	$0.88	$1.06	$1.24	$1.42	$1.60	$1.78
	$13.67	$1.72	$1.90	$2.09	$2.27	$2.45	$2.63	$2.81
	$15.00	$2.75	$2.93	$3.11	$3.29	$3.47	$3.65	$3.84

Processor feasibility for soy sauce

The economic feasibility of preparing soy sauce for consumption is assessed using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Preparing soy sauce for consumption in a post-harvest facility is expected to be marginally profitable with an EBIT margin of 3%.

2. **Sensitivity of profitability:** There is considerable variability in the expected profitability of a Northland post-harvest facility processing soybeans into soy sauce, particularly for changes in the market price. 53% of the modelled scenarios in Table 82 result in a positive EBIT, while 45% result in an EBIT margin of 7.50% or more. This indicates that even minor fluctuations in the key variables significantly affect profitability and financial sustainability. Processor EBIT is proportionately more sensitive to the market price paid by consumers, especially if the price falls below $11.00/L.

3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport harvested soybeans between farms and a processing facility. There are already well-established transportation channels across Northland for other industries such as dairy, sheep and beef, that could be leveraged to source soybeans and distribute soy sauce to market. While there may be some inefficiencies initially that could add extra steps or complexity and increase distribution costs, existing logistical processes can likely be adapted to service a Northland soybean industry.

4. **Infrastructure:** Establishing a Northland soy sauce processing facility will require significant investment in processing equipment, including cookers, grinders and equipment for dehulling, UHT treatment and pasteurisation. Most of the equipment should be readily available to

purchase, but it may need to be imported to New Zealand in the absence of a domestic supplier or second-hand market.

For these reasons, we consider processing soy sauce using domestically grown soybeans not feasible (Table 83) due to the high per-unit processing costs.

Table 83: *Processor feasibility: Soy sauce*

Criterion	Score *(from 0 to 4)*
Profitability	1.00
Sensitivities	1.00
Logistics and distribution	1.00
Infrastructure	0.50
Average score	0.88 Not feasible

Market feasibility

The market opportunity for soy sauce using domestically grown soybeans in Northland is assessed using the following three market-related feasibility criteria (see Appendix 2, page 176). The criteria draw on the insights collected from stakeholders interviewed about growing a domestic industry:

1. **Supply and demand:** Boutique manufacturers are interested in sourcing locally grown non-GM organic soybeans for producing their soy-based condiments. The companies pride themselves on using New Zealand ingredients to produce their artisanal products. One interviewee mentioned he wanted to create a 100% New Zealand product using locally sourced soybeans, water, and salt. However, the challenges facing domestic producers are the cost of domestically grown soybeans and the market price of imported soy sauce alternatives. There is likely to be a small segment of New Zealand soy sauce consumers willing to pay a price premium, although the demand curve (e.g. reflecting consumers' sensitivity to price) is expected to be steep.
2. **Market access:** Consumers across Northland, Auckland, the Waikato and the Bay of Plenty can be accessed, provided that the appropriate distribution channels are set up to maintain product quality in transit. Fortunately, soy sauce with its extended shelf-life is a transport-resilient product, creating an opportunity to reach consumers further afield, provided that appropriate and sustainable distribution channels can be negotiated.
3. **Competition and market-related risks:** The artisan food producers acknowledged that using New Zealand-grown soybeans would be more expensive than imported alternatives, but they were committed to maintaining a locally sourced product. If a locally produced soy sauce can be priced competitively with low-cost imported alternatives, consumers may be willing to pay slightly more for the New Zealand-grown product.

There is demand for locally produced soybeans from artisan food manufacturers; however, Northland must be prepared to invest in soybean farming incentives and infrastructure to promote this nascent sector. The New Zealand arable industry stated that many New Zealand farmers are not interested in growing soybeans due to high input costs and competition from cheaper imports.

For these reasons, we consider domestically produced soy sauce feasible at a *small scale* (Table 84).

Table 84: *Market feasibility: Soy sauce*

Criterion	Score *(from 0 to 4)*
Demand	2.00
Market access	2.00
Competition and market-related risks	1.00
Average score	1.67 Small-scale

Feasibility of a Northland soybean industry

Scale of feasibility

The economic feasibility of soybeans considers the individual feasibility for growers, processors and the market presented in the previous sections. Table 85 summarises the feasibility given to each of the three components for the three consumption forms considered for soybeans.

Table 85: *Feasibility of establishing a soybean industry in Northland*

Consumption forms	Feasibility component			
	Grower	*Processor*	*Market*	*Overall*
1. Soy milk	Small-scale (2.10)	Medium-scale (2.75)	Small-scale (1.67)	Small-scale
2. Tofu	Small-scale (2.10)	Medium-scale (2.75)	Small-scale (2.00)	Small-scale
3. Soy sauce	Small-scale (2.10)	Not feasible (0.88)	Small-scale (1.67)	Not feasible

Overall, a domestic soybean industry is considered economically feasible at a small scale under current economic conditions (assuming agronomic feasibility) by building market share in soy milk and tofu. To build market share, the industry would need to progressively reach more price-sensitive consumers who are less willing to pay higher retail prices for soy-based products using domestically grown soybeans. Therefore, growing market share will likely require price reductions to better align with lower-cost imports and attract more consumers. As the previous analysis highlights, without reducing production costs, such price reductions would erode grower profitability.

While there is growing demand for non-GM soybeans, local producers of soy products import non-GM soybeans from Australia. It is unlikely that domestic production will be able to compete on price at the estimated scale of operation (see below). For example, Australia's total production area is approximately 21,000 ha; the proposed domestic scale is less than 1% of this.

Estimated scale of operation

The estimated scale of operation required to meet demand for fresh New Zealand-grown soybeans is approximately **50 to 70 hectares**. This is expected to generate an aggregated gross profit between $0.07 and $0.09 million annually. This is the indicative scale to meet the estimated future demand for each of the feasible consumption forms.

Table 86: *Planted area required to meet demand for soybean products*

Particulars	Feasible consumption forms	
	Soy milk	Tofu
Estimated demand	375,000–625,000 L *(~3%–5% of annual consumption)*	112–150 t *(~15%–20% of annual demand)*
Conversion efficiency	650% *(midpoint)*	200% *(midpoint)*
Raw product required	58–96 t	56–75 t
Estimated yield	2.50 t/ha *(midpoint)*	
Land required	**50–70 commercial hectares**	
Aggregated gross profit	**\$0.07–\$0.09 million**	

Chapter 7:
Sunflowers

This chapter assesses the economic feasibility of growing, processing, and marketing Northland-grown *sunflowers*, including key cost drivers, market potential, and viability under Northland conditions.

Chapter disclaimer: This section presents indicative results from a simplified financial model, using broad assumptions and input ranges to reflect uncertainty and data limitations. Many figures are drawn from secondary or lower-confidence sources and are not intended to represent precise outcomes. The analysis does not capture the full complexity of on-farm decision-making or site-specific conditions and should not be used as a substitute for detailed business planning or professional advice. The following analysis is intended to be indicative only.

Growing sunflowers

Introduction

Background

Globally, sunflowers grow in temperate and subtropical regions with warm summers, high sunshine hours, and moderate rainfall. Depending on the variety, sunflower seeds can be consumed as a snack or used to produce sunflower oil for cooking. Russia and Ukraine are the world's two largest sunflower producers globally, and Ukraine dominates exports.[24] However, sunflower seeds consumed in New Zealand are imported from other countries, including Bulgaria (some of which may be of Ukrainian origin), China, Argentina and Australia (valued at approximately NZD$30 million). In contrast, sunflower oil is imported primarily from Malaysia and Spain.

High-oleic sunflowers have been grown in Canterbury for several years, with more than 400 hectares planted annually. While this is small compared with major New Zealand crops such as wheat or barley, it represents a genuinely sustainable establishment driven by demand for local produce and supply chain security. Regional growth has been driven by a local oil processor selling bulk cold-pressed sunflower oil. Canterbury's warm, dry summers with long sunshine hours create favourable spring and summer conditions with low disease pressure. In Northland, there is no known commercial production, although some sunflowers are grown for animal feed.[25]

Sunflowers thrive in regions with warm days, long sunshine hours, well-drained soils and moderate rainfall. In general, Northland's climate should be well-suited to growing sunflowers, provided they can be grown as an early-harvest crop to mitigate the risks of late-season disease pressure as humidity rises. Choosing the right variety of sunflowers to grow will be critical to maximise yields. Hybrid varieties with a shorter growing cycle are best suited to the Northland climate, although medium to slow hybrids planted in early spring with effective disease management could deliver higher yields. Sunflowers are also generally tolerant of dry conditions, although they may require irrigation during extended dry periods.

Estimated yield

Expected sunflower yields (tonnes per hectare per year, t/ha/yr) depend on several factors, including the planting density, pest and disease control, and climatic events (e.g. excessive rainfall and high winds). For this work, the annual yield in Northland, net of reasonable bird losses, is estimated to be between 2 and 4.5 t/ha/yr (midpoint 3.25 t/ha/yr) based on regional trials and international case studies.

[24] Note that Ukraine's exports of sunflower products have varied since 2022 due to the war.

[25] A commercial grower of sunflowers is someone growing sunflowers to generate a profit or earn a living, and who is NP1 registered (at a minimum) under New Zealand's Food Act 2014 and/or NZGAP certified.

National Programme 1 (NP1) is the registration process for low-risk food businesses under New Zealand's Food Act 2014 to ensure they are managing food safety risks and producing safe food for sale. The New Zealand Good Agricultural Practice (NZGAP) certifies the safe and sustainable production of fruit and vegetables in New Zealand and is generally required by retailers to supply them.

Cost of growing sunflowers

Estimated set-up costs

Sunflowers are an annual crop and therefore have no one-off set-up costs to prepare the site for growing. Site preparation and planting material are recurring annual activities. For harvesting, sunflowers may require the purchase of a specialised tractor attachment, while other required machinery is available through local contractors supporting other local arable production.

Annual gross profitability

We use gross profitability as the primary measure of the crop's ongoing economic feasibility, reflecting the difference between revenue earned and the direct costs associated with growing sunflowers. Fixed costs for growers are assumed to be minimal and vary significantly between growers based on personal preference, so they are not considered in the following analysis. Table 87 shows gross profitability per hectare for growers under three scenarios. There is a significant range between the pessimistic and optimistic scenarios, mostly due to differences in revenue earned and the labour inputs.

Table 87: *Grower gross profitability: Sunflowers*

Particulars	Gross profitability ($/ha)		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$2,000	$4,875	$9,000
Estimated growing costs [2]	$3,542	$3,375	$3,188
Gross profit	**-$1,542**	**$1,500**	**$5,812**
Gross margin	-77%	31%	65%

[1] Revenue earned is calculated as the product of yield (see above) and the farmgate price received by sunflower growers for sunflower seeds (estimated at $1.00 to $2.00 per kg). The farmgate price is set by estimating how value is created and captured across the value chain.

[2] The growing cost estimate includes site maintenance, planting material, fertiliser applications, water input (as required), labour and machinery/technology use. The estimated growing costs are assumed to be based on management activities that are largely mechanised. Costs have been estimated using existing arable production as a reference.

Sensitivity of annual gross profitability

A grower's gross profitability is particularly sensitive to fluctuations in the expected yield (3.25 t/ha/yr) and the expected farmgate price ($1.50/kg). Table 88 demonstrates how our estimated gross profitability for growers varies for all combinations of seven yield levels and price points, while keeping the estimated non-labour growing costs constant at the *base* estimate; labour costs scale in proportion to yield. 80% of the combinations modelled result in a positive gross profit for sunflower growers, with just over half resulting in a gross margin of 25% or more. [26]

[26] A 25% gross margin threshold is considered within the normal range of gross margins for outdoor food producers in New Zealand.

Table 88: *Sensitivity of grower gross profitability: Sunflowers*

		Farmgate price received ($/kg)						
		$1.00	$1.17	$1.33	**$1.50**	$1.67	$1.83	$2.00
Yield (t/ha/yr)	2.00	-$1,327	-$994	-$660	-$327	$6	$340	$673
	2.42	-$926	-$524	-$121	$282	$685	$1,088	$1,490
	2.83	-$526	-$53	$419	$891	$1,363	$1,835	$2,308
	3.25	-$125	$417	$958	**$1,500**	$2,042	$2,583	$3,125
	3.67	$276	$887	$1,498	$2,109	$2,720	$3,331	$3,942
	4.08	$676	$1,357	$2,037	$2,718	$3,399	$4,079	$4,760
	4.50	$1,077	$1,827	$2,577	$3,327	$4,077	$4,827	$5,577

The opportunity cost of growing sunflowers

Sunflowers are competing for the same high-quality, fertile soils across Northland that are suitable for growing other arable crops. Table 89 presents the estimated gross profitability ($/ha) for several competing crops to illustrate the opportunity cost of growing sunflowers. While land-use decision-making also depends on multiple non-financial factors, this comparison illustrates the scale of the financial incentive to allocate land to other options.

Table 89: *Opportunity cost of growing sunflowers*

Competing crops	Estimated gross profit ($/ha)			Net benefit/loss
	Low	*Midpoint*	*High*	*If growing sunflowers*
Sunflowers	-$1,542	$1,500	$5,812	N/A
Maize (grain)	$800	$1,375	$1,950	$125
Maize (silage)	$3,000	$3,500	$4,000	-$2,000
Pasture (silage)	$750	$1,125	$1,500	$375
Kūmara	$7,000	$11,000	$15,000	-$9,500

Economic feasibility of growing sunflowers

We assess the economic feasibility of growing sunflowers using the following five grower-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model presented for growers earlier in this chapter:

1. **Output potential:** With suitable varieties making the most of Northland's warm summers and high sunshine hours, Northland growers could expect moderate sunflower yields, albeit less than what international growers might expect. According to growers and arable crop levy bodies, sunflower crops grown on less than 20 ha are particularly vulnerable to bird pressure, with crop losses of up to 50% not uncommon. However, larger-scale plantings could mitigate these losses. Although this loss is accounted for in the estimated yields for this analysis.

2. **Grower profitability:** Growing sunflowers commercially is expected to generate a healthy gross profit at the midpoint estimates of revenue and costs of production. The expected gross margin of 31% is considered within the 'safe' range for outdoor food producers.

3. **Infrastructure:** There is no crop-specific infrastructure required to grow sunflowers in Northland. However, the management of sunflowers is expected to be highly mechanised at all stages from land preparation through to harvest. The required machinery will be the same as for other local arable production, except for a tractor attachment used to harvest sunflower seeds from the seed head.

4. **Sensitivity of gross profitability:** Gross profitability depends on fluctuations in yield, farmgate price, and production costs. Modelling suggests this is moderate, with 80% of modelled scenarios resulting in a positive gross profit, and just over half with a gross margin above 25%.

5. **Grower opportunity cost:** The opportunity cost of growing sunflowers is considered moderate, with two of the four competing crops comprehensively generating a better gross profit on average, while the other two have comparable gross profits.

For these reasons, we consider domestically grown sunflowers feasible for growers only at a *small scale* (grower feasibility score of 2.10), provided the farmgate price remains high enough to offset the relatively higher costs of domestic production (Table 90).

Table 90: *Grower feasibility: Sunflower*

Criterion	Score *(from 0 to 4)*
Output potential	2.00
Profitability	2.00
Infrastructure	3.00
Sensitivities	2.00
Opportunity cost	1.50
Average score	**2.10** Small-scale

Sunflowers: Seed kernels

Sunflower seed kernels are one of the two prioritised consumption forms for sunflower in this market opportunities study (refer to page 14 for more information).

Introduction

Description

Sunflower seeds are consumed raw as a snack food or used as an ingredient in cooking and baking. The hull is usually discarded; the edible kernel is rich in healthy fats, protein, vitamin E and minerals such as magnesium and selenium. Seeds grown for raw consumption are generally from a variety with lower oil content and a more palatable texture.

New Zealand-grown sunflower seeds could offer a clean, traceable, and food-safe alternative to imported seeds, benefiting from the country's strict biosecurity and non-GMO standards. Their freshness, low food miles, and potential for organic or regenerative certification could be a selling point for health-conscious and environmentally aware consumers. With local production supporting New Zealand farmers, these seeds could be marketed as a premium product with a reduced environmental footprint.

Conversion efficiency

For every tonne of whole sunflower seeds harvested, 700 to 800 kilograms (kg) of sunflower seed kernels are typically recovered (i.e. recovery rate of 70 to 80%).

Processing steps

The steps involved in dehulling whole sunflower seeds to prepare *kernels* for sale are minimal. They include:

1. Cleaning the whole seed to remove dirt and other debris.
2. Preconditioning the seed by heating it to make the hull brittle.
3. Dehulling the seed by crushing the hull and isolating the kernels.
4. Packaging, storing and distributing the kernels.

Cost to process sunflower seed kernels

Facility establishment costs

The estimated costs to establish a sunflower processing facility in a peri-urban setting (capital expenditure only) to prepare whole sunflower seeds for consumption are presented in Table 91 for three different levels of annual throughput. The three levels of annual throughput considered are for a:

1. **Small-scale facility** processing between 30 and 100 t/yr of sunflower seeds from approximately 9 to 30 ha of commercial sunflower crops. At this scale, between 22.5 and 75 t of sunflower seed kernels will be available for sale.

2. **Medium-scale facility** processing between 100 and 300 t/yr of sunflower seeds from approximately 30 to 92 ha of commercial sunflower crops. At this scale, between 75 and 225 t of sunflower seed kernels will be available for sale.
3. **Large-scale facility** processing between 300 and 1,000 t/yr of sunflower seeds from approximately 92 to 307 ha of sunflower crops. At this scale, between 225 and 750 t of sunflower seed kernels will be available for sale.

Table 91: *Costs to establish a sunflower processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small (22.5–75 t/yr)*	*Medium (75–225 t/yr)*	*Large (225–750 t/yr)*
Site development/buildings	25	250k–500k	500k–1m	1m–2m
Processing equipment	15	30k–80k	110k–240k	230k–410k
Packing equipment & benches	15	5k–10k	20k–50k	50k–100k
Storage facilities	15	5k–15k	20k–50k	80k–150k
Palletising & internal logistics	15	5k–15k	40k–60k	80k–120k
Utilities installation	20	5k–15k	20k–40k	50k–80k
Office/staff facilities	20	20k–50k	50k–100k	100k–200k
Compliance & fit-out	15	30k–60k	80k–150k	150k–250k
Contingency	20	50k–110k	130k–250k	260k–500k
Total		**400k–855k**	**970k–1.94m**	**2m–3.81m**
Annualised cost ($/kg) [1]		**$0.97–$1.50**	**$0.75–$1.12**	**$0.44–$0.78**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of the asset.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput above are presented in Table 92 on a per-kg basis.

Table 92: *Costs to operate a sunflower kernel processing facility*

Cost category	Operating costs ($/kg)		
	Small (22.5–75 t/yr)	*Medium (75–225 t/yr)*	*Large (225–750 t/yr)*
Labour	$1.00–$2.00	$0.70–$1.50	$0.30–$0.80
Utilities (e.g. electricity and water)	$0.04–$0.08	$0.03–$0.06	$0.02–$0.05
Raw ingredient	$1.25–$2.86	$1.25–$2.86	$1.25–$2.86
Other ingredients	$0.02–$0.05	$0.01–$0.03	$0.01–$0.02
Packaging and distribution	$0.50–$0.80	$0.40–$0.60	$0.30–$0.50
Maintenance and cleaning	$0.20–$0.50	$0.10–$0.30	$0.05–$0.15
Waste/by-product removal	$0.03–$0.06	$0.02–$0.04	$0.01–$0.03
Total ($/kg)	**$3.04–$6.35**	**$2.51–$5.39**	**$1.94–$4.41**

Earnings before Interest and Tax (EBIT)

We use EBIT ($/kg) to assess the financial feasibility of a processing facility preparing sunflower kernels for sale and consumption (Table 93). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 93: *Estimated EBIT: Processing sunflower seed kernels (medium-scale facility)*

Particulars	EBIT ($/kg) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$7.50	$9.03	$10.67
Processing costs *(including raw product costs)*	$5.39	$3.90	$2.51
Gross profit	$2.11	$5.14	$8.16
Annualised capital charge	$1.12	$0.94	$0.75
Allowance for annual fixed costs [2]	$0.30	$0.36	$0.43
EBIT	**$0.69**	**$3.84**	**$6.98**
EBIT %	9%	42%	65%

[1] Revenue earned is calculated as the product of the volume of sunflower seed kernels sold (see above) and the wholesale sunflower kernel price. There is little visibility on the processor's wholesale price for sunflower kernels. It is therefore estimated using the retail price ($12.00 to $16.00/kg) less an assumed retail markup (50 to 60%). The price received by processors to cover their cost of production, therefore, ranges from $7.50 to $10.67/kg of sunflower seed kernels sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

EBIT is particularly sensitive to two variables: the price paid in the market for sunflower seed kernels, and the price paid to growers (i.e. farmgate price) for harvested whole sunflower seeds. Table 94 demonstrates how a processor's EBIT ($/kg) could be expected to fluctuate due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. All modelled combinations of these variables result in an EBIT above 7.50%.

Table 94: *Sensitivity of processor EBIT: Sunflower seed kernels*

		Farmgate price paid ($/kg)						
		$2.00	$1.83	$1.67	**$1.50**	$1.33	$1.17	$1.00
Market price ($/kg)	$12.00	$1.88	$2.10	$2.33	$2.55	$2.77	$2.99	$3.21
	$12.67	$2.31	$2.53	$2.76	$2.98	$3.20	$3.42	$3.64
	$13.33	$2.74	$2.96	$3.19	$3.41	$3.63	$3.85	$4.07
	$14.00	$3.17	$3.39	$3.62	**$3.84**	$4.06	$4.28	$4.51
	$14.67	$3.60	$3.82	$4.05	$4.27	$4.49	$4.71	$4.94
	$15.33	$4.03	$4.25	$4.48	$4.70	$4.92	$5.14	$5.37
	$16.00	$4.46	$4.68	$4.91	$5.13	$5.35	$5.57	$5.80

Processor feasibility for sunflower seed kernels

We assess the economic feasibility of preparing sunflower kernels for consumption using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Processing whole sunflower seeds into sunflower kernels ready for sale is expected to be profitable with a strong EBIT margin of 42%.
2. **Sensitivity of profitability:** There is substantial variability in the expected profitability of a sunflower seed facility; however, 100% of the modelled combinations in Table 14 result in a positive EBIT margin above 7.50%. This indicates that the consumption form is resilient, and the profitability of a sunflower processor is maintained within the ranges used for yield and market price.
3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, so regional infrastructure can be challenging from a supply chain perspective to transport whole sunflower seeds between farms and a processing facility. There are well-established transportation channels across Northland for other industries such as dairy, sheep and beef farming that could be leveraged to source whole sunflower seeds and distribute the kernels to market. While there may be some inefficiencies initially that could add extra steps or distribution complexity and increase costs, existing processes can likely be adapted to serve a Northland sunflower industry.
4. **Infrastructure:** The steps involved in processing whole sunflower seeds into sunflower kernels are minimal and require the shell of the sunflower seed to be removed to expose the kernel inside (i.e. dehulling). This process requires some preconditioning equipment to make the extraction easier and a dehulling machine. Storage will also be required for the whole sunflower seeds upon arrival, and for the packaged kernels before distribution. While some investment would be required to establish a new facility, all the necessary assets are available or easily adaptable from other industries.

For these reasons, we consider domestic sunflower kernel production feasible for processors only at a *medium-scale* (processor feasibility score of 3.25), provided the market price remains high to adequately offset the relatively higher costs of domestic production (Table 95).

Table 95: *Processor feasibility: Sunflower seed kernels*

Criterion	Score *(from 0 to 4)*
Profitability	4.00
Sensitivities	4.00
Logistics and distribution	2.00
Infrastructure	3.00
Average score	3.25 Medium-scale

Market feasibility for sunflower kernels

We assess the market opportunity for sunflower kernels using domestically grown whole sunflower seeds in Northland using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic sunflower industry:

1. **Supply and demand:** There is consumer demand for sunflower seeds as snacks in local retail stores. Organic sunflower seeds are also of interest for large and niche supermarket chains. However, shoppers tend to choose the more affordable organic options, regardless of their origin. As a result, according to stakeholder feedback, New Zealand-grown sunflower seeds are often overlooked in favour of imported alternatives and risk remaining unsold on shelves.

   Sunflower seeds can also be used in bakery applications; however, stakeholder feedback indicated that margins in the sector are tight, making buyers highly price sensitive. Moreover, local or organic provenance appears to hold limited value in this market segment.

2. **Market access:** The absence of local storage facilities presents a logistical constraint. Developing a North Island-based supply chain, including appropriate storage and distribution modes, will be necessary to reach more consumers beyond Northland.

3. **Competition and market-related risks:** Imported sunflower seeds currently dominate the New Zealand market, and domestic production will need to be price-competitive to be feasible. Thus, locally organic sunflower seeds could be a point of difference for Northland growers.

Competition in the sunflower seed snack market is significant. New Zealand-grown products are likely to differentiate themselves primarily through an organic or local provenance story, targeting boutique and specialised retailers. However, it is important to recognise that consumers generally prioritise affordability when selecting organic options, regardless of origin, making price point a critical criterion. While Northland-grown sunflower seeds are likely to capture only a small share of the snack market, it is important to note that achieving economic viability will require large-scale cultivation, partly to mitigate risks such as bird pressure, which introduces certain operational considerations for the venture.

For these reasons, domestically grown sunflower kernels are assessed to be feasible in the market at a *small scale* (Table 96).

Table 96: *Market feasibility: Sunflower seed kernels*

Criterion	Score *(from 0 to 4)*
Supply and demand	2.00
Market access	2.00
Competition and market-related risks	1.00
Average score	**1.67** Small-scale

Sunflowers: Cold-pressed oil

Cold-pressed sunflower oil is one of the two prioritised consumption forms for sunflowers in this market opportunities study (refer to page 14 for more information).

Introduction

Description

Sunflower oil is extracted from the sunflower kernels. Depending on how it is processed, it can be consumed as either a cold-pressed (virgin) or refined oil. Valued for its mild flavour and high smoke point, sunflower oil is widely used for frying, roasting, salad dressings and as a base in processed foods. It is naturally rich in vitamin E and unsaturated fats, particularly linoleic acid (omega-6) or oleic acid (omega-9), depending on the variety of sunflower kernels used.

Not all sunflower oils are valued equally, with locally grown high-oleic, cold-pressed sunflower oil being sold at premium prices in New Zealand supermarkets. High-oleic sunflower oil is considered a premium, healthier option because it is high in heart-friendly monounsaturated fats, low in saturated fats and has excellent stability for high-heat cooking. It also offers a longer shelf life without needing hydrogenation, has a neutral flavour, and fits well with clean-label and health-conscious food trends.

The production of sunflower oil in New Zealand remains niche, with the majority being imported from Malaysia and Spain. All cold-pressed sunflower oil is produced domestically using Canterbury-grown sunflower seeds, with refined oil being the primary imported product. Approximately 6,000 tonnes (t), or about 6.5 million litres (L) of refined sunflower oil, are imported into New Zealand each year.

Conversion efficiency

For every tonne of whole sunflower seeds harvested, between 300 and 400 L of cold-pressed sunflower oil can be produced (i.e. a recovery rate of 30 to 40%).

Processing steps

The steps involved in processing whole sunflower seeds into sunflower oil are substantial. The sunflower kernels are extracted from the whole sunflower seeds through a dehulling process. Two types of processing are used:

1. **Cold pressing:** Cold-pressing sunflower oil requires a mechanical screw press or hydraulic press to extract virgin sunflower oil at low temperatures.
2. **Solvent extraction:** Hot pressing or solvent extraction produces refined oil. The seeds are pressurised under heat, and then the remaining oil is extracted using hexane solvent. This results in a higher conversion efficiency.

The raw oil extracted using either of these approaches is then filtered to remove seed particulates and waxes using cloth filters, plate and frame filters, or centrifugation. The product is then bottled and stored in a cool, dark, low-humidity environment.

The following analysis focuses on the opportunities created by extracting oil from the sunflower seeds using cold pressing, as it best aligns with market demand and has the greatest opportunity for value creation.

Cost to process sunflower seeds

Facility establishment costs

The estimated costs to establish a facility to process sunflower seeds into cold-pressed sunflower oil in a peri-urban setting (capital expenditure only) are presented in Table 97 for processing facilities with three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility** processing between 100 and 300 t/yr of sunflower seeds from approximately 30 to 92 ha of commercial sunflower farms. At this scale, between 35,000 and 105,000 L of cold-pressed sunflower oil will be produced.
- **Medium-scale facility** processing between 300 and 1,000 t/yr of sunflower seeds from approximately 92 to 307 ha of commercial sunflower farms. At this scale, between 105,000 and 350,000 L of cold-pressed sunflower oil will be produced.
- **Large-scale facility** processing between 1,000 and 3,000 t/yr of sunflower seeds from approximately 307 to 923 ha of commercial sunflower farms. At this scale, between 350,000 and 1,050,000 L of cold-pressed sunflower oil will be produced.

Table 97: *Costs to establish a cold-pressed sunflower oil processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small (35–105 kL/yr)*	*Medium (105–350 kL/yr)*	*Large (350–1,050 kL/yr)*
Site development/buildings	25	500k–1m	1m–2m	2m–2.50m
Processing equipment	15	20k–36k	95k–160k	155k–410k
Packing equipment & benches	15	3k–5k	20k–50k	50k–150k
Storage facilities	15	5k–15k	20k–50k	50k–150k
Palletising & internal logistics	15	3k–5k	10k–30k	30k–80k
Utilities installation	20	5k–15k	20k–50k	50k–100k
Office/staff facilities	20	50k–80k	100k–180k	200k–350k
Compliance & fit-out	15	20k–50k	50k–100k	100k–250k
Contingency	20	90k–180k	200k–390k	250k–450k
Total		696k–1.39m	1.52m–3.01m	2.89m–4.44m
Annualised cost ($/L) [1]		**$1.08–$1.63**	**$0.72–$1.20**	**$0.36–$0.68**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of each group of assets

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput above are presented in Table 98 on a per-L basis.

Table 98: *Costs to operate a cold-pressed sunflower oil processing facility*

Cost category	Operating costs ($/L)		
	Small (35–105 kL/yr)	*Medium (105–350 kL/yr)*	*Large (350–1,050 kL/yr)*
Labour	$0.50–$1.50	$0.40–$0.90	$0.30–$0.60
Utilities (e.g. electricity and water)	$0.03–$0.05	$0.02–$0.04	$0.02–$0.03
Raw ingredient	$2.50–$6.67	$2.50–$6.67	$2.50–$6.67
Other ingredients	$0.02–$0.05	$0.01–$0.02	$0.01–$0.01
Packaging and distribution	$1.00–$1.50	$0.80–$1.20	$0.60–$1.00
Maintenance and cleaning	$0.10–$0.20	$0.05–$0.20	$0.05–$0.15
Waste/by-product removal	$0.02–$0.05	$0.01–$0.02	$0.01–$0.02
Total ($/L)	**$4.17–$10.02**	**$3.79–$9.05**	**$3.48–$8.48**

Earnings before Interest and Tax (EBIT)

EBIT ($/L) is used to assess the financial feasibility of a processing facility cold pressing sunflower seeds into sunflower oil (Table 99). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 99: *Estimated EBIT: Processing cold-pressed sunflower oil (medium-scale facility)*

Particulars	EBIT ($/L) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$6.15	$8.16	$10.43
Processing costs *(including raw product costs)*	$9.05	$6.12	$3.79
Gross profit	-$2.89	$2.04	$6.64
Annualised capital charge	$1.20	$0.96	$0.72
Allowance for annual fixed costs [2]	$0.25	$0.33	$0.42
EBIT	**-$4.34**	**$0.76**	**$5.51**
EBIT %	-71%	9%	53%

[1] Revenue earned is calculated as the product of the volume of sunflower oil sold (see above) and the wholesale sunflower oil price. There is little visibility on the processor's wholesale price for sunflower oil. It is therefore estimated using the retail price ($8.00/L to $12.00/L) *less* an assumed retail markup (15 to 30%). The price received by processors to cover their cost of production, therefore, ranges from $6.15/L to $10.43/L of sunflower oil sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

EBIT is particularly sensitive to two variables: the price paid in the market for sunflower oil, and the price paid to growers (i.e. farmgate price) for whole sunflower seeds. Table 100 demonstrates how a processor's EBIT ($/L) could be expected to fluctuate due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. 69% of the modelled combinations of these variables result in a positive EBIT, with 55% resulting in an EBIT margin of 7.50% or more.

Table 100: *Sensitivity of processor EBIT: Sunflower oil*

		Farmgate price paid ($/kg)						
		$2.00	$1.83	$1.67	**$1.50**	$1.33	$1.17	$1.00
Market price ($/L)	$8.00	-$2.30	-$1.83	-$1.35	-$0.88	-$0.40	$0.08	$0.55
	$8.67	-$1.76	-$1.28	-$0.81	-$0.33	$0.14	$0.62	$1.10
	$9.33	-$1.22	-$0.74	-$0.26	$0.21	$0.69	$1.17	$1.64
	$10.00	-$0.67	-$0.20	$0.28	**$0.76**	$1.23	$1.71	$2.19
	$10.67	-$0.13	$0.35	$0.82	$1.30	$1.78	$2.25	$2.73
	$11.33	$0.42	$0.89	$1.37	$1.85	$2.32	$2.80	$3.27
	$12.00	$0.96	$1.44	$1.91	$2.39	$2.87	$3.34	$3.82

Processor feasibility for sunflower oil

We assess the economic feasibility of preparing sunflower oil for consumption using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Processing sunflower seeds into sunflower oil is expected to be profitable with an EBIT margin of 9%.

2. **Sensitivity of profitability:** The EBIT of a sunflower oil processing facility will be profitable at the expected variables, although small fluctuations in either variable quickly push profitability negative (Table 100). For example, a 10% increase in the farmgate price paid (from $1.50 to $1.67 per kg) results in a 63% reduction in the processor's EBIT at the expected market price (from $1.76 to $0.28 per L).

3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport whole sunflower seeds between farms and a processing facility. There are well-established transportation channels across Northland used for other industries, such as dairy or sheep/beef farming, that could be leveraged. There are no specialised distribution requirements to reach markets, as sunflower oil is a stable product without any special storage requirements. Therefore, more mainstream distribution channels may be an option to reach consumers outside of Northland.

4. **Infrastructure:** Processing whole sunflower seeds into sunflower oil for consumption is a complex process with extensive machinery and equipment needed to support the conversion. The necessary capital equipment is not unique to sunflower seeds but is also not widely used in existing processing facilities. That said, the required assets are readily available from international suppliers if new or second-hand equipment is unavailable domestically.

For these reasons, we consider domestically grown sunflower oil feasible for processors only at a *small-scale* (processor feasibility score of 1.63), provided the market price remains high enough to offset the relatively higher costs of domestic production (Table 101).

Table 101: *Processor feasibility: Sunflower oil*

Criterion	Score *(from 0 to 4)*
Profitability	2.00
Sensitivities	1.50
Logistics and distribution	2.00
Infrastructure	1.00
Average score	1.63 Small-scale

Market feasibility

We assess the market opportunity for cold-pressed sunflower oil using domestically grown whole sunflower seeds in Northland using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic sunflower oil industry:

1. **Supply and demand:** New Zealand consumers face two main options in the sunflower oil market: an affordable, imported oil and a premium locally produced alternative priced at approximately double the cost ($1 per 100 mL). Customers choosing the premium segment often do so for perceived quality benefits, such as cold-pressed processing that preserves flavour and nutritional value. Brands like *The Good Oil* appeal to health-conscious buyers by using specially bred sunflower varieties high in oleic acid, reinforcing their reputation as a healthier, premium choice.

2. Market access: The absence of local infrastructure for oilseed processing in Northland poses a major challenge to developing a sunflower oil industry. The only sizeable oil crusher is based in Canterbury in the South Island, and transporting seeds that far is not economically viable due to high freight costs. Without a cost-effective local processing solution, Northland producers would struggle to compete.

3. **Competition and market-related risks:** For Northland to establish a successful local brand of sunflower oil, it will need to differentiate itself from the low-cost imported alternatives that dominate the market. If Northland is looking to produce its own premium brand of sunflower oil, it will also have to compete against *The Good Oil*, a successful South Island brand that produces high-oleic sunflower oil from seeds grown in Canterbury. *The Good Oil* is readily available in retail outlets throughout New Zealand and has established relationships in the arable industry, seed companies and South Island farmers. Northland growers would likely need to target the premium sunflower oil segment to offset production costs. Alternatively, collaboration with *The Good Oil* could present an opportunity to develop a fully New Zealand-grown and processed product, leveraging existing market presence. According to the scores given to each of the three market feasibility criteria (Table 102), the Northland-grown sunflower oil is assessed to have *small-scale* market feasibility.

The success of the Northland sunflower oil industry would be dependent on Northland's ability to establish a local organic brand that differentiates itself from the readily available, cheap imported varieties. If Northland is looking to produce its own premium brand of sunflower oil, it will also have to compete against Good Oil, a successful South Island brand that produces high oleic sunflower oil with seeds grown in Canterbury. Good Oil is readily available in retail outlets throughout New Zealand and has established relationships in the arable industry, seed companies and South Island farmers. Northland growers would likely need to target the premium sunflower oil segment to offset production costs. Alternatively, collaboration with an established brand such as The Good Oil could present an opportunity to develop a fully New Zealand–grown and processed product, leveraging existing market presence.

For these reasons, domestically produced cold-pressed sunflower oil is assessed to be feasible in the market at a *small scale* (Table 102).

Table 102: *Market feasibility: Sunflower oil*

Criterion	Score *(from 0 to 4)*
Supply and demand	3.00
Market access	2.00
Competition and market-related risks	2.00
Average score	**2.33** Small-scale

Feasibility of a Northland sunflower industry

Scale of feasibility

The economic feasibility of a Northland sunflower industry considers the individual feasibility for growers, processors and the market in the previous sections. Table 103 summarises the feasibility given to each of the three components for the two consumption forms considered for sunflowers.

Table 103: *Feasibility of establishing a sunflower industry in Northland*

Consumption forms	Feasibility component			
	Grower	*Processor*	*Market*	*Overall*
1. Sunflower seed kernels	Small-scale (2.10)	Medium-scale (3.25)	Small-scale (1.67)	Small-scale
2. Cold-pressed sunflower oil	Small-scale (2.10)	Small-scale (1.63)	Small-scale (2.33)	Small-scale

Overall, a domestic sunflower industry appears economically feasible at a *small scale* under current economic conditions and assuming agronomic feasibility, either via sunflower seed kernels or cold-pressed sunflower oil. To build market share, the industry would need to reach progressively more price-sensitive consumers who are less willing to pay higher retail prices for sunflower products made from domestically grown sunflowers. Growing market share would require reducing the market price to better align with lower-cost imports to attract more consumers. As the previous analysis highlights, without reducing production costs, growers and processors become less profitable as the market price decreases.

Estimated scale of operation

The estimated scale of operation required to meet demand for New Zealand-grown sunflower products is between **200 and 360 hectares** (Table 104). This is suggested as the minimum viable scale needed to participate meaningfully in the market without overcommitting land or capital. This is expected to generate an aggregated gross profit between $0.3 and $0.5 million annually.

Table 104: *Planted area required to meet demand for sunflower products*

Particulars	Feasible consumption forms	
	Sunflower kernels	Cold-pressed sunflower oil
Estimated demand	60–120 t *(~5–10% of domestic consumption)*	200,000–350,000 L [1]
Conversion efficiency	75% *(midpoint)*	35% *(midpoint)*
Raw product required	80–160 t	570–1,000 t
Estimated yield	3.25 t/ha/yr	
Land required	**200–360 commercial hectares**	
Aggregated gross profit	**$0.30–$0.5 million**	

[1] The estimated demand assumes a Northland facility reaches a scale of production slightly less than half what has been achieved in Canterbury due to market saturation and the different production potential between the two regions.

Chapter 8:

Ginger

This chapter assesses the economic feasibility of growing, processing, and marketing Northland-grown *ginger*, including key cost drivers, market potential, and viability under Northland conditions.

Chapter disclaimer: This section presents indicative results from a simplified financial model, using broad assumptions and input ranges to reflect uncertainty and data limitations. Many figures are drawn from secondary or lower-confidence sources and are not intended to represent precise outcomes. The analysis does not capture the full complexity of on-farm decision-making or site-specific conditions and should not be used as a substitute for detailed business planning or professional advice. The following analysis is intended to be indicative only.

Growing ginger

Introduction

Background

Globally, ginger is grown in warm, humid regions. India, Nigeria, and China dominate the world supply of ginger. New Zealand relies on imported ginger products, such as fresh root and powder. Between 1,800 and 2,300 tonnes of ginger are imported annually from Thailand, China, Fiji and Turkey (valued at approximately NZD$10 million). Imports have risen slowly over the past decade and are likely to continue increasing without a domestic industry as an alternative source.

Although New Zealand trials have shown that ginger can be grown successfully in greenhouses or sheltered microsites, particularly in Northland, no known commercial open-field plantings have been established. Several niche (i.e., non-commercial)[27] growers around New Zealand supply a small number of local markets. There is growing interest in ginger as an alternative use for higher-quality land in Northland.

Ginger is propagated from rhizome pieces rather than from seeds. Rhizome pieces are planted 5 to 10 centimetres (cm) deep in well-drained raised beds, about 20 to 30 cm apart. In the right conditions (e.g. warm and wet), ginger typically has a growing cycle of 8 to 10 months, although this might be slightly longer in Northland conditions. The harvested product is an enlarged, aromatic rhizome. Successfully growing ginger relies heavily on site and climate management. Ginger thrives in daytime temperatures of 22 to 30 degrees Celsius (°C) and ideally should not drop below 15 °C at night. Sustained temperatures below 10 °C, waterlogging, and strong winds can severely reduce expected yields. Investing in infrastructure such as greenhouses, polytunnels, and shade structures can help maximise yields while managing temperature, water, wind and disease risks.

Estimated yield

Expected ginger yields (tonnes per hectare per year, t/ha/yr) depend on planting pattern and density, harvest season, site location, and supporting infrastructure. For this work, the annual commercial yield is estimated to be between 10 and 20 t/ha/yr. Ginger yields are expected to be most sensitive to the risk-mitigating infrastructure in place. For example, ginger grown in polytunnels could yield up to 30 t/ha/yr or more. This analysis considers the yield of a sheltered field as the base estimate and comments on the level of investment necessary to attain the higher yield estimates.

[27] A commercial grower of ginger is someone growing ginger to generate a profit or earn a living, and who is NP1 registered (at a minimum) under New Zealand's Food Act 2014 and/or NZGAP certified.

National Programme 1 (NP1) is the registration process for low-risk food businesses under New Zealand's Food Act 2014 to ensure they are managing food safety risks and producing safe food for sale. The New Zealand Good Agricultural Practice (NZGAP) certifies the safe and sustainable production of fruit and vegetables in New Zealand and is generally required by retailers to supply them.

Costs to grow ginger

Estimated set-up costs

Ginger is an annual crop and can be grown every two to four years as part of a rotation to mitigate the risks of soil-borne diseases. There are no crop-specific set-up costs for already sheltered fields, unless the grower invests in infrastructure to mitigate Northland's variable weather (for example, low-tech polytunnels at approximately $400,000 to $600,000 per hectare). Site preparation and planting material are annual inputs for growing ginger.

Annual gross profitability

We use gross profitability as the primary measure of a crop's ongoing economic feasibility, reflecting the difference between revenue earned and the direct costs associated with growing ginger. Fixed costs for growers are assumed to be minimal and vary significantly between growers based on personal preference, so they are not considered in the following analysis. Table 105 shows the growers' gross profitability per hectare for three scenarios. There is a significant range between the pessimistic and optimistic scenarios, mostly due to differences in revenue earned and the labour input.

Table 105: *Grower gross profitability: Ginger*

Particulars	Gross profitability ($/ha)		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$40,000	$75,000	$120,000
Estimated growing costs [2]	$56,500	$54,375	$48,250
Gross profit	**-$16,500**	**$20,625**	**$71,750**
Gross margin	-41%	28%	60%

[1] Revenue earned is calculated as the product of yield (see above) and the farmgate price received by ginger growers for ginger root (estimated at $4.00 to $6.00 per kg). The farmgate price is set by estimating how value is created and captured across the value chain.

[2] The growing cost estimate includes site maintenance, planting material, fertiliser applications, water input (as required), labour, and machinery/technology use. Production is assumed to be largely manual.

Sensitivity of annual gross profitability

A grower's gross profitability is particularly sensitive to fluctuations in the expected yield (15 t/ha/yr) and the expected farmgate price ($5.00/kg). Table 106 demonstrates how our estimated grower's gross profitability varies for all combinations of the two variables, while non-labour growing costs are constant at the *base* estimate; labour costs are an exception, which scale in proportion to changes in yield. Of the combinations modelled, 98% result in a positive gross profit for ginger growers, with just over half resulting in a gross margin of 25% or more.[28]

[28] A 25% gross margin threshold is considered within the normal range of gross margins for outdoor food producers in New Zealand.

Table 106: *Sensitivity of grower gross profitability: Ginger*

		Farmgate price received ($/kg)						
		$4.00	$4.33	$4.67	**$5.00**	$5.33	$5.67	$6.00
Yield (t/ha/yr)	10.00	-$2,375	$958	$4,292	$7,625	$10,958	$14,292	$17,625
	11.67	$292	$4,181	$8,069	$11,958	$15,847	$19,736	$23,625
	13.33	$2,958	$7,403	$11,847	$16,292	$20,736	$25,181	$29,625
	15.00	$5,625	$10,625	$15,625	**$20,625**	$25,625	$30,625	$35,625
	16.67	$8,292	$13,847	$19,403	$24,958	$30,514	$36,069	$41,625
	18.33	$10,958	$17,069	$23,181	$29,292	$35,403	$41,514	$47,625
	20.00	$13,625	$20,292	$26,958	$33,625	$40,292	$46,958	$53,625

The opportunity cost of growing ginger

Ginger is competing for the same high-quality, fertile soils across Northland that are suitable for growing other annual crops. Table 107 presents the estimated gross profitability ($/ha) for several competing crops to illustrate the opportunity cost of growing ginger in a field. While land-use decision-making also depends on multiple non-financial factors, this comparison illustrates the scale of the financial incentive to allocate land to other options. For the most part, these competing crops can also be grown under cover with higher gross profitability due to high yields.

Table 107: *Opportunity cost of growing ginger*

Competing crops	Estimated gross profit ($/ha)			Net benefit/loss
	Low	*Midpoint*	*High*	*If growing ginger*
Ginger	-$16,500	$20,625	$71,750	N/A
Kūmara	$6,000	$15,500	$25,000	$5,125
Capsicums	$3,000	$9,000	$15,000	$11,625
Tomatoes	$5,000	$7,500	$10,000	$13,125
Cucumbers	$15,000	$20,000	$25,000	$625

Economic feasibility of growing ginger

We assess the economic feasibility of growing ginger using the following five grower-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for growers presented earlier in this chapter:

1. **Output potential:** The estimated yield (10 to 20 t/ha/yr) is slightly below the average yield in international growing regions, with some regions yielding up to 40 t/ha/yr. Northland's cooler climate may affect growth rates, but investing in polytunnels or greenhouses could improve yields with a more controlled growing environment.

2. **Grower profitability:** Growing ginger commercially is expected to generate a healthy gross profit at the midpoint estimates of revenue and costs of production. The expected gross margin of 28% is considered within the 'safe' range for outdoor food producers.

3. **Infrastructure:** Ginger should be grown in rotation with other crops to mitigate the risk of soil-borne diseases becoming an issue. This means ginger can be grown in open fields with no crop-specific infrastructure. However, yields can be improved if they are grown under cover.
4. **Sensitivity of gross profitability:** There is substantial variability in the expected profitability of a Northland ginger grower; however, nearly all modelled scenarios result in a positive gross profit, and just over half achieve a gross margin above 25%.
5. **Grower opportunity cost:** The opportunity cost of growing ginger is low, as it is expected to generate a high level of gross profitability compared to the four competing crops considered.

For these reasons, we consider domestically grown ginger for growers only at a *medium-scale* (grower feasibility score of 2.60), provided the farmgate price offsets the relatively higher domestic production costs (Table 108).

Table 108: *Grower feasibility: Ginger*

Criterion	Score *(from 0 to 4)*
Output potential	2.50
Profitability	2.00
Infrastructure	2.50
Sensitivities	3.00
Opportunity cost	3.00
Average score	**2.60** Medium-scale

Ginger: Fresh root

Fresh root is one of the two prioritised consumption forms for ginger in this market opportunities study *(refer to page 14 for more information).*

Introduction

Description

Fresh ginger root is the harvested rhizome of the *Zingiber officinale* plant. It is an irregularly shaped, knobbly, finger-like branching structure, with a thin, beige skin and pale yellow to golden, aromatic flesh.

Fresh ginger root is widely consumed in New Zealand and is typically available year-round in supermarkets. While there is some small-scale production in Northland, most of the fresh ginger root consumed is imported from Thailand (approximately 75%). In total, an estimated 1,800 to 2,300 t of ginger root is imported annually. The domestic market for ginger root appears stable and well-established, with a consistent and reliable supply.

Fresh ginger root is valued for its spicy, aromatic flavour and its anti-inflammatory and digestive properties. In comparison to ginger powder, fresh ginger root is considered to have a better flavour profile when used in cooking.

The value proposition of consuming domestically grown ginger is that:

1. It is grown locally and supports communities to thrive.
2. It offers a spray-free option. Unlike many imports, New Zealand-grown ginger could be certified low-input or organically grown and would avoid the need for border fumigation.
3. Food producers may value specific ginger varieties, such as young/pink ginger and mild aromatic types that are hard to import in fresh condition.
4. Local production means fresher ginger with better appearance and taste appeal compared to imports, as there is less time between harvest and sale.

Conversion efficiency

For every tonne of commercial-grade fresh ginger root harvested, between 950 and 970 kilograms of fresh ginger root are available for sale after defective parts of the root have been removed.

Processing steps

The steps involved in preparing fresh ginger root for consumption are minimal. They include:

1. Transporting harvested ginger root to a processing facility where roots are cleaned and graded for size, weight, and quality.
2. Trimming the root to remove the fibrous roots and any defective parts.
3. Keeping roots in specialised cool storage that maintains temperature and humidity. This helps to preserve quality and prevent shrivelling, depending on the lead time to market.

A processing facility could either be established by individual growers near their fields or by a grower collective or private investor in a peri-urban central location, for example, close to utilities, logistical networks, and labour. Because this work assesses the feasibility of establishing a commercial industry across Northland, the latter is prioritised in the following analysis.

Costs to process fresh ginger root

Facility establishment costs

The estimated costs to establish a fresh ginger root processing facility in a peri-urban setting (capital expenditure only) and prepare ginger root for consumption are presented in Table 109 for three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility** processing between 10 and 30 t/yr of fresh ginger root from approximately 0.70 to 2.00 ha of commercial ginger farms.
- **Medium-scale facility** processing between 30 and 100 t/yr of fresh ginger root from approximately 2.00 to 6.70 ha of commercial ginger farms.
- **Large-scale facility** processing between 100 and 300 t/yr of fresh ginger root from approximately 6.70 to 20.00 ha of commercial ginger farms.

All scales of a processing facility will have tailored storage facilities to control the humidity and temperature, thereby regulating the supply of fresh ginger root to the market.

Table 109: *Costs to establish a fresh ginger root processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small (10–30 t/yr)*	*Medium (30–100 t/yr)*	*Large (100–300 t/yr)*
Site development/buildings	25	100k–250k	250k–500k	500k–1m
Processing equipment	15	10k–25k	40k–90k	130k–250k
Packing equipment & benches	15	3k–5k	5k–15k	15k–50k
Storage facilities	15	10k–30k	30k–80k	80k–200k
Palletising & internal logistics	15	5k–15k	10k–30k	30k–40k
Utilities installation	20	10k–20k	20k–50k	50k–100k
Office/staff facilities	20	5k–15k	20k–50k	50k–100k
Compliance & fit-out	15	20k–40k	40k–80k	80k–150k
Contingency	20	25k–60k	60k–130k	130k–280k
Total		**188k–460k**	**475k–1.03m**	**1.07m–2.17m**
Annualised cost ($/kg)[1]		**$1.32–$1.63**	**$0.90–$1.37**	**$0.64–$0.94**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of the asset.

Facility operating costs

Annual recurring costs are presented on a per-kg basis to operate a facility with the three different levels of throughput are presented in Table 110.

Table 110: *Costs to operate a fresh ginger root processing facility*

Cost category	Operating costs ($/kg)		
	Small (10–30 t/yr)	*Medium (30–100 t/yr)*	*Large (100–300 t/yr)*
Labour	$2.00–$5.00	$2.00–$4.00	$1.00–$2.00
Utilities (e.g. electricity & water)	$0.02–$0.05	$0.01–$0.03	$0.01–$0.02
Raw ingredient	$4.12–$6.32	$4.12–$6.32	$4.12–$6.32
Packaging &distribution	$0.40–$0.60	$0.30–$0.50	$0.20–$0.40
Maintenance & cleaning	$0.30–$0.60	$0.30–$0.60	$0.20–$0.40
Waste/by-product removal	$0.05–$0.10	$0.02–$0.05	$0.01–$0.03
Total ($/kg)	**$6.89–$12.67**	**$6.75–$11.50**	**$5.54–$9.17**

Earnings before Interest and Tax (EBIT)

We use EBIT ($/kg) to assess the financial feasibility of preparing ginger root for sale (Table 111). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 111: *Estimated EBIT: Processing fresh ginger root (medium-scale facility)*

Particulars	EBIT ($/kg) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned[1]	$5.00	$6.91	$8.89
Processing costs *(including raw product costs)*	$11.50	$9.11	$6.75
Gross profit	-$6.50	-$2.20	$2.14
Annualised capital charge	$1.37	$1.13	$0.90
Allowance for annual fixed costs[2]	$0.20	$0.28	$0.36
EBIT	**-$8.07**	**-$3.61**	**$0.88**
EBIT %	-161%	-52%	10%

[1] Revenue earned is calculated as the product of the volume of ginger sold (see above) and the wholesale ginger price. There is limited visibility on the processor's wholesale price for ginger. It is therefore estimated using the retail price ($7.00 to $12.00/kg) *less* an assumed retail markup (35 to 40%). The price received by processors to cover their cost of production, therefore, ranges from $5.00 to $8.89/kg of ginger root sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

EBIT is particularly sensitive to two variables: the price paid in the market for ginger, and the price paid to growers (i.e. farmgate price) for harvested ginger. Table 112 demonstrates how a processor's EBIT could be expected to fluctuate due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. In all modelled combinations, EBIT remains negative.

Table 112: *Sensitivity of processor EBIT: Ginger*

		Farmgate price paid ($/kg)						
		$6.00	$5.67	$5.33	$5.00	$4.67	$4.33	$4.00
Market price ($/kg)	$7.00	-$6.47	-$6.13	-$5.78	-$5.43	-$5.09	-$4.74	-$4.39
	$7.83	-$5.87	-$5.52	-$5.17	-$4.83	-$4.48	-$4.13	-$3.78
	$8.67	-$5.26	-$4.91	-$4.57	-$4.22	-$3.87	-$3.53	-$3.18
	$9.50	-$4.66	-$4.31	-$3.96	**-$3.61**	-$3.27	-$2.92	-$2.57
	$10.33	-$4.05	-$3.70	-$3.36	-$3.01	-$2.66	-$2.31	-$1.97
	$11.17	-$3.44	-$3.10	-$2.75	-$2.40	-$2.05	-$1.71	-$1.36
	$12.00	-$2.84	-$2.49	-$2.14	-$1.80	-$1.45	-$1.10	-$0.75

Processor feasibility for fresh ginger root

We assess the economic feasibility of preparing ginger for consumption using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Preparing ginger root for sale is not expected to be profitable with an EBIT margin of -52%.
2. **Sensitivity of profitability:** The EBIT of a facility preparing ginger root for sale is expected to remain negative for all modelled scenarios due to the high cost of labour to clean and prepare ginger root for sale, even under favourable circumstances within the set ranges of input and output prices. In addition to the market price received and the farmgate price received, a processor's EBIT is sensitive to the costs of production, and in particular, the cost of labour. The preparation process is labour-intensive, particularly with the root needing to be manually trimmed to improve appearance, marketability and reduce contamination. While labour can be reduced, doing so may compromise marketability.
3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport ginger root between farms and a processing facility. There are well-established transportation channels across Northland for other industries such as dairy, sheep and beef farming that could be leveraged. Ginger will require specialised storage facilities at the processing facility and during distribution over long distances to help preserve quality until the crop reaches the market. A Northland ginger industry could also likely leverage existing supply chains to reach markets in other regions. Maintaining product freshness is critical, as it represents a core value proposition for New Zealand-grown ginger.
4. **Infrastructure:** Preparing ginger for sale is largely manual (e.g. cleaning, trimming and packaging) with little opportunity for mechanisation except at a large-scale. The required equipment (e.g. preparation benches and knives) is readily available in New Zealand at a relatively low cost.

For these reasons, we consider preparing domestically grown ginger root for sale as not feasible (Table 113).

Table 113: *Processor feasibility: Ginger*

Criterion	Score *(from 0 to 4)*
Profitability	0.00
Sensitivities	0.00
Logistics and distribution	1.50
Infrastructure	2.00
Average score	**0.88** Not feasible

Market feasibility for fresh ginger root

The feasibility of fresh ginger root in domestic markets is assessed using the following three market-related criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic ginger industry:

1. **Supply and demand:** While there is consistent demand for fresh ginger in New Zealand, the market is currently well served by established import channels that offer competitive pricing. Price sensitivity remains a key barrier for locally grown ginger, with one stakeholder noting that New Zealand ginger was offered to their supermarket, but the cost was too high to justify stocking. Among stakeholders who stocked organic products, there is some recognition of a niche market; however, the origin alone is not a strong selling point. To gain meaningful traction, Northland-grown ginger would need to offer a clear and differentiated value proposition. One potential avenue is exploring how alternative ginger varieties could appeal to specific consumer preferences or fill unmet needs in the current crowded market.

2. **Market access:** Stakeholders suggested that beginning with a small-scale cultivation of a few hectares could be an effective way to enter the market and gradually establish the Northland brand. Direct-to-consumer channels such as farmgate sales offer a low-risk path to build awareness and test market response. However, fresh ginger root has a relatively short shelf life compared to processed forms such as powders or extracts. Preserving product quality will require careful attention to post-harvest handling, particularly refrigeration, which may introduce additional logistical steps and costs for small-scale growers to access domestic markets without product loss.

3. **Competition and market-related risks:** Currently, all fresh ginger stocked by major retailers in New Zealand is imported, with stakeholders generally satisfied with both the quality and price. However, supply from countries such as Fiji and Vanuatu is often inconsistent due to shipping delays. This creates an opportunity for New Zealand-grown ginger to compete, if it can offer a stable, high-quality supply. Stakeholders acknowledged that consistent availability could justify a moderate price premium, though competitiveness ultimately depends on the final retail price relative to imports. A reliable domestic supply could position New Zealand ginger as a strategic alternative, particularly during periods of import disruption.

Fresh ginger root presents a viable market opportunity in New Zealand, particularly within niche retail areas that have shown interest in locally grown products. However, this demand is tempered by the relatively high price point of New Zealand-grown ginger, which limits its appeal to larger food processors and major supermarket chains that continue to favour imported alternatives due to cheaper costs. The market is well supplied by imported ginger, which typically offers good quality at competitive prices. That said, the key vulnerability of imports lies in their shipping reliability. In this context, locally produced ginger holds a strategic advantage as its proximity to the market allows for faster delivery, ensures a fresher product and offers greater supply chain certainty for buyers sensitive to disruptions.

For these reasons, domestically grown ginger root is assessed to be feasible in the market at a *small scale* (Table 114).

Table 114: *Market feasibility: Ginger*

Criterion	Score *(from 0 to 4)*
Supply and demand	2.00
Market access	3.00
Competition and market-related risks	1.50
Average score	**2.17** Small-scale

Ginger: Powder

Ginger powder is one of the two prioritised consumption forms for ginger in this market opportunities study (refer to page 14 for more information).

Introduction

Description

Powdered ginger is widely consumed in New Zealand as a longer-lasting alternative to fresh ginger root in cooking, but nearly all of it (between approximately 150 and 250 tonnes, t) is imported from China, India, Thailand and Fiji.[29] While there is some small-scale production of ginger powder in Northland, there is currently no commercial-scale production of ginger powder domestically. Ginger powder has a milder and sweeter taste compared to fresh ginger root, and is typically used in baking, cooking, herbal teas, and wellness products. There is also growing demand for it, driven by consumers' interest in natural remedies and functional foods. The value proposition of consuming domestically grown ginger powder centres on provenance and supporting local growers and communities. Domestic production may also introduce a spray-free and/or organic ginger powder product.

Conversion efficiency

For every tonne of ginger root harvested, 200 to 250 kg of ginger powder can be produced (i.e. a 20% to 25% recovery rate).

Processing steps

The steps involved in processing fresh ginger root into a powder ready for consumption include:

1. Washing and sanitising the ginger root to remove dirt and any residual product.
2. Trimming the fibrous roots, stems and damaged parts.
3. Peeling the skin to improve the colour and hygiene of the final product.
4. Slicing the ginger into thin slices to support uniform drying and reduce drying time.
5. Drying the slices of ginger using mechanical dryers. The gingerol content (responsible for the powder's flavour) can degrade at high temperatures, so drying must be controlled.
6. Grinding the dried slices into a fine powder using grinders or pulverisers.
7. Sieving the ground powder to ensure uniform particle size.
8. Packaging ginger powder into moisture-proof, airtight containers to protect against humidity and light.
9. Storing in a cool, dry environment to prevent clumping or spoilage until distribution.

[29] Approximately 300 tonnes of crushed and ground ginger products are imported annually, although it's unclear how that splits between crushed ginger and ground ginger (i.e. ginger powder). The assumption made is that crushed ginger is consumed more widely and therefore makes up a larger proportion of the imported volumes.

The capital requirements to produce ginger powder are relatively low in its simplest form for small-scale production. As the throughput of a processing facility increases, there is an opportunity to introduce more automation to improve efficiency.

Costs to process ginger powder

Facility establishment costs

The estimated costs to establish a ginger production facility in a peri-urban setting (capital expenditure only) to prepare ginger powder for consumption are presented in Table 115 for three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility** processing between 10 and 30 t/yr of fresh ginger root from approximately 0.67 to 2.00 ha of commercial ginger farms. At this scale, between 2.25 and 6.75 t of ginger powder will be produced.
- **Medium-scale facility** processing between 30 and 100 t/yr of fresh ginger root from approximately 2.00 to 6.67 ha of commercial ginger farms. At this scale, between 6.75 and 22.50 t of ginger powder will be produced.
- **Large-scale facility** processing between 100 and 300 t/yr of fresh ginger root from approximately 6.67 to 20.00 ha of commercial ginger farms. At this scale, between 22.50 and 67.50 t of ginger powder will be produced.

Table 115: *Costs to establish a ginger powder processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small (2.3–6.8 t/yr)*	*Medium (6.8–22.5 t/yr)*	*Large (22.5–67.5 t/yr)*
Site development/buildings	25	100k–250k	250k–500k	500k – 1m
Processing equipment	15	22k–70k	85k–175k	240k–490k
Packing equipment & benches	15	2k–10k	10k–30k	30k–70k
Storage facilities	15	2k–10k	20k–50k	50k–100k
Palletising & internal logistics	15	2k–5k	10k–30k	30k–60k
Utilities installation	20	5k–20k	20k–50k	50k–100k
Office/staff facilities	20	5k–15k	10k–30k	30k–60k
Compliance & fit-out	15	10k–30k	50k–100k	100k–200k
Contingency	20	20k–60k	70k–145k	150k–310k
Total		**168k–470k**	**525k – 1.11m**	**1.18m – 2.39m**
Annualised cost ($/kg) [1]		**$6.03–$6.38**	**$4.37–$6.86**	**$3.17–$4.69**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of each group of assets.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput above are presented in

Table 116 on a per-kg basis.

Table 116: *Costs to operate a ginger powder processing facility*

Cost category	Operating costs ($/kg)		
	Small (2.3–6.8 t/yr)	*Medium (6.8–22.5 t/yr)*	*Large (22.5–67.5 t/yr)*
Labour	$10.00–$20.00	$6.00–$12.00	$3.00–$6.00
Utilities (e.g. electricity and water)	$1.00–$1.50	$0.70–$1.20	$0.40–$0.80
Raw ingredient	$16.00–$30.00	$16.00–$30.00	$16.00–$30.00
Other ingredients	$0.00–$0.00	$0.00–$0.00	$0.00–$0.00
Packaging and distribution	$3.00–$4.00	$2.00–$3.00	$1.00–$2.00
Maintenance and cleaning	$1.00–$3.00	$1.00–$2.00	$0.50–$1.50
Waste/by-product removal	$0.10–$0.20	$0.05–$0.10	$0.05–$0.10
Total ($/kg)	**$31.10–$58.70**	**$25.75–$48.30**	**$20.95–$40.40**

Earnings before Interest and Tax (EBIT)

We use EBIT ($/kg) to assess the financial feasibility of a processing facility drying ginger into a powder (Table 117). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 117: *Estimated EBIT: Processing ginger powder (medium-scale facility)*

Particulars	EBIT ($/kg) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$46.43	$52.73	$59.26
Processing costs *(including raw product costs)*	$48.30	$36.25	$25.75
Gross profit	-$1.87	$16.48	$33.51
Annualised capital charge	$6.86	$5.62	$4.37
Allowance for annual fixed costs [2]	$1.86	$2.11	$2.37
EBIT	**-$10.59**	**$8.76**	**$26.77**
EBIT %	-23%	17%	45%

[1] Revenue earned is calculated as the product of the volume of ginger powder sold (see above) and the wholesale ginger powder price. There is little visibility on the processor's wholesale price for ginger powder. It is therefore estimated using the retail price ($65.00 to $80.00/kg) *less* an assumed retail markup (35 to 40%). The price received by processors to cover their production costs, therefore, ranges from $46.43 to $59.26 per kg of ginger powder sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

EBIT is particularly sensitive to two variables: the price paid in the market for ginger powder, and the price paid to growers for ginger root (i.e. farmgate price). Table 118 demonstrates how a processor's EBIT could be expected to fluctuate due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. Of the combinations modelled, 98% result in a positive EBIT, with 84% resulting in an EBIT margin of 7.50% or more.

Table 118: *Sensitivity of processor EBIT: Ginger powder*

		Farmgate price paid ($/kg)						
		$6.00	$5.67	$5.33	**$5.00**	$4.67	$4.33	$4.00
Market price ($/kg)	$65.00	-$1.14	$0.34	$1.82	$3.30	$4.78	$6.26	$7.75
	$67.50	$0.67	$2.16	$3.64	$5.12	$6.60	$8.08	$9.56
	$70.00	$2.49	$3.97	$5.46	$6.94	$8.42	$9.90	$11.38
	$72.50	$4.31	$5.79	$7.27	**$8.76**	$10.24	$11.72	$13.20
	$75.00	$6.13	$7.61	$9.09	$10.57	$12.06	$13.54	$15.02
	$77.50	$7.95	$9.43	$10.91	$12.39	$13.87	$15.36	$16.84
	$80.00	$9.77	$11.25	$12.73	$14.21	$15.69	$17.17	$18.65

Processor feasibility for ginger powder

We assess the economic feasibility of drying ginger into a powder using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Processing ginger root into powder is expected to be profitable with a strong EBIT margin of 17%.
2. **Sensitivity of profitability:** There is substantial variability in the expected profitability of a ginger powder facility; however, 98% of the modelled combinations in Table 33 result in a positive EBIT, with 84% having an EBIT margin above 7.50%. This indicates that the consumption form is resilient, and the profitability of a ginger powder facility is maintained within the ranges used for yield and market price.
3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport ginger root between farms and a processing facility. There are well-established transportation channels across Northland for other industries such as dairy, sheep and beef farming that could be leveraged. While there may be some inefficiencies initially that could add extra steps, distribution complexity and increase costs, existing logistical processes can likely be adapted to service a Northland ginger industry.
4. **Infrastructure:** Turning ginger root into a powder is a relatively straightforward process, although the process requires several specialised machines to dry the ginger root and grind it. The necessary capital equipment is not considered unique to grinding ginger. That said, the required assets are readily available from international suppliers if new or second-hand equipment is unavailable domestically.

For these reasons, we consider domestically grown ginger powder feasible for processors only at a *medium scale* (processor feasibility score of 2.88).

Table 119: *Processor feasibility: Ginger powder*

Criterion	Score *(from 0 to 4)*
Profitability	4.00
Sensitivities	3.50
Logistics and distribution	2.00
Infrastructure	2.00
Average score	**2.88** Medium-scale

Market feasibility for ginger powder

We assess the market opportunity for ginger powder using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic ginger industry:

1. **Demand:** There is a clear demand for ginger powder among spice distributors and niche premium retailers, with some specifically seeking New Zealand-grown products that can command a modest premium based on provenance and organically grown credentials. The market is predominantly supplied by imported ginger powder, which is usually brought as finished powder rather than processed locally. However, imported supplies are subject to shipping inconsistencies, creating an opportunity for locally grown and processed ginger powder, which currently represents only a small share of the market. Processors and distributors favour purchasing ginger powder over raw ginger due to its longer shelf life and reduced processing requirements, highlighting the importance of local processing capacity to capture this demand effectively.

2. **Market access:** There are already established distribution channels in place to supply spice distributors, processors, and retailers with powdered ginger. New Zealand-grown ginger powder could integrate into these systems with minimal disruption.

3. **Competition and market-related risks:** Imported ginger powder remains more cost competitive than New Zealand-grown alternatives, which is a key consideration for consumers. However, higher consumer trust in locally made and grown products presents an opportunity to command a premium for New Zealand-origin ginger powder. Despite this, manufacturers, who primarily use ginger powder as a minor ingredient, are highly price sensitive. Many final products, such as sauces, do not highlight New Zealand-sourced ingredients and cannot leverage provenance as a marketing point. Justifying the higher cost of local ginger powder is challenging within large-scale food manufacturing.

Ginger powder has an established and stable market in New Zealand that is widely used by both individual consumers and food manufacturers. This market is currently dominated by imports, which offer reliable quality at competitive prices. While most manufacturers show limited interest in locally sourced ginger powder, primarily due to cost and the inability to promote New Zealand provenance when used as an ingredient, there is notable interest from spice distributors. One stakeholder indicated that New Zealand-grown ginger powder could command a premium in the retail spice segment, where trust in local origin is valued. Without this capacity, access to key distribution channels would be constrained.

For these reasons, ginger powder is assessed to be feasible in the market at a *small scale* (Table 120).

Table 120: *Market feasibility: Ginger powder*

Criterion	Score *(from 0 to 4)*
Supply and demand	2.50
Market access	3.00
Competition and market-related risks	2.00
Average score	2.50 Small-scale

Feasibility of a Northland ginger industry

Scale of feasibility

The economic feasibility of a Northland ginger industry considers the individual feasibility for growers, processors and the market presented in the previous sections. Table 121 summarises the feasibility given to each of the three components for two consumption forms.

Table 121: *Feasibility of establishing a ginger industry in Northland*

Consumption forms	Feasibility component			
	Grower	*Processor*	*Market*	*Overall*
1. Ginger root	Medium-scale (2.60)	Not feasible (0.88)	Small-scale (2.17)	Not feasible
2. Ginger powder	Medium-scale (2.60)	Medium-scale (2.88)	Small-scale (2.50)	Small-scale

Overall, a domestic ginger industry is considered economically feasible at a *small scale* under current economic conditions, assuming agronomic feasibility, by supplying ginger powder into existing retail markets to compete with imported alternatives. The reason for ginger root not being feasible is due to the lack of market value available to filter back to processors and growers (i.e. the market price is too low to cover the processor costs and leave enough to pay growers a fair farmgate price). Industry growth depends on financial sustainability at market prices better aligned with imported ginger products (e.g. by achieving a gross margin above 25%). While there is known demand for ginger and market access is relatively straightforward, the competition in the market (particularly in larger retail outlets) and the lack of a clear competitive advantage (other than provenance) constrain the domestic market to a small scale.

Estimated scale of operation

The estimated scale of operation to meet demand for domestically grown ginger is between **10 and 20 ha**. This is suggested as the minimum viable scale needed to participate meaningfully in the market without overcommitting land or capital. This is expected to generate an aggregated gross profit of between $0.2 and $0.4 million annually.

To mitigate soil-borne disease risks, it is recommended that ginger be grown in a 2 to 4-year rotation with other annual crops. To meet the estimated annual demand (Table 122), Northland would need between 20 ha (for a 2-year rotation) and 60 ha (for a 4-year rotation) growing ginger as part of a rotation with other crops.

Table 122: *Planted area required to meet demand for ginger products*

Particulars	Feasible consumption form: Ginger powder
Estimated demand	30–45 t *(~10%–15% of domestic consumption of ginger powder)*
Conversion efficiency	22.50% *(midpoint)*
Raw product required	133–200 t
Estimated yield	13.25 t/ha/yr *(midpoint – commercial grade)*
Land required	**10–20 commercial hectares**
Aggregated gross profit	**$0.2–$0.4 million**

Chapter 9: Turmeric

This chapter assesses the economic feasibility of growing, processing, and marketing Northland-grown *turmeric* including key cost drivers, market potential, and viability under Northland conditions.

Chapter disclaimer: This section presents indicative results from a simplified financial model, using broad assumptions and input ranges to reflect uncertainty and data limitations. Many figures are drawn from secondary or lower-confidence sources and are not intended to represent precise outcomes. The analysis does not capture the full complexity of on-farm decision-making or site-specific conditions and should not be used as a substitute for detailed business planning or professional advice. The following analysis is intended to be indicative only.

Growing turmeric

Introduction

Background

Turmeric is native to the warm, humid tropics of the Indian subcontinent and Southeast Asia. India dominates the global supply of turmeric, exporting approximately 160,000 tonnes annually (t/yr). New Zealand has no commercial production of turmeric and relies on an estimated 300 to 400 t/yr of imported turmeric products from India, Fiji, and Australia (valued at approximately NZD$1 million).[30] A niche grower network has demonstrated that turmeric can be grown in Northland, provided the right crop protection is available. However, there are no known examples of this crop being grown on a commercial scale in open fields.

Turmeric is propagated from rhizome pieces rather than from seeds. Rhizome pieces are planted 5 to 10 centimetres (cm) deep in well-drained raised beds, approximately 20 to 30 cm apart. In the ideal conditions, turmeric typically has a growing cycle of 8 to 10 months, although this might be slightly longer in Northland. The crop is an enlarged underground stem with a fleshy orange-yellow colour at harvest.

Successfully growing turmeric relies heavily on site and climate management. Turmeric thrives at 22 to 30 °C by day. Night temperatures ideally should not drop below 17 °C. Turmeric's growth rates slow when temperatures drop below 15 °C, and frosts can be lethal. Microclimates across Northland align reasonably well with these thresholds for turmeric to be grown outdoors in protected areas. However, the region's variable rainfall and occasional cool nights mean that commercial growers may choose to invest in infrastructure such as greenhouses, polytunnels, and shade structures to maximise yield and manage temperature, water, wind, and disease risks.

Estimated yield

Expected turmeric yields (tonnes per hectare annually, t/ha/yr) depend on the planting pattern and density, harvest season, site location, and supporting infrastructure in place. For this work, the annual commercial yield is estimated to be between 6 and 18 t/ha/yr in a sheltered field block. Yields are most sensitive to the level of risk-mitigating infrastructure in place. For example, turmeric grown in a polytunnel could yield up to 30 t/ha/yr. This analysis uses sheltered-field yield as the base estimate and notes the investment required to reach higher yields.

[30] A commercial grower of turmeric is someone growing turmeric to generate a profit or earn a living, and who is NP1 registered (at a minimum) under New Zealand's Food Act 2014 and/or is NZGAP certified.

National Programme 1 (NP1) is the registration process for low-risk food businesses under New Zealand's Food Act 2014 to ensure they are managing food safety risks and producing safe food for sale. The New Zealand Good Agricultural Practice (NZGAP) certifies the safe and sustainable production of fruit and vegetables in New Zealand and is generally required by retailers to supply them.

Costs to grow turmeric

Estimated set-up costs

Turmeric is an annual crop and can be grown every two to four years as part of a regular rotation to mitigate the risks of soil-borne diseases. There are no crop-specific set-up costs for already sheltered fields, unless the grower invests in infrastructure to mitigate Northland's variable weather (for example, low-tech polytunnels at approximately $400,000 to $600,000 per hectare). Site preparation and planting material are annual inputs for growing turmeric.

Annual gross profitability

We use gross profitability as the primary measure of a crop's ongoing economic feasibility, reflecting the difference between revenue earned and the direct costs associated with growing turmeric. Fixed costs for growers are assumed to be minimal and vary significantly between growers based on personal preference, so they are not considered in the following analysis. Table 123 shows growers' gross profitability per hectare for three scenarios. There is a significant range between the pessimistic and optimistic scenarios, mostly due to differences in revenue earned and the labour input.

Table 123: *Grower gross profitability: Turmeric*

Particulars	Gross profitability ($/ha)		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$24,000	$66,000	$126,000
Estimated growing costs [2]	$44,000	$51,625	$53,250
Gross profit	**-$20,000**	**$14,375**	**$72,750**
Gross margin	-83%	22%	58%

[1] Revenue earned is calculated as the product of yield (see above) and the farmgate price received by turmeric growers for turmeric root (estimated at $4.00 to $7.00 per kg). The farmgate price is set by estimating how value is created and captured across the value chain.

[2] The growing cost estimate includes site maintenance, planting material, fertiliser applications, water input (as required), labour, and machinery/technology use. Production is assumed to be largely manual.

Sensitivity of annual gross profitability

A grower's gross profitability is particularly sensitive to fluctuations in the expected yield (12 t/ha/yr) and the expected farmgate price ($5.50/kg). Table 124 demonstrates how our estimated grower's gross profitability varies for all combinations of the two variables, while non-labour growing costs are constant at the *base* estimate; labour costs are an exception, which scale in proportion to changes in yield. Of the combinations modelled, 80% result in a positive gross profit for turmeric growers, with 37% resulting in a gross margin of 25% or more.[31]

[31] A 25% gross margin threshold is considered within the normal range of gross margins for outdoor food producers in New Zealand.

Table 124: *Sensitivity of grower gross profitability: Turmeric*

		Farmgate price received ($/kg)						
		$4.00	$4.50	$5.00	**$5.50**	$6.00	$6.50	$7.00
Yield (t/ha/yr)	6.00	-$9,625	-$6,625	-$3,625	-$625	$2,375	$5,375	$8,375
	8.00	-$7,625	-$3,625	$375	$4,375	$8,375	$12,375	$16,375
	10.00	-$5,625	-$625	$4,375	$9,375	$14,375	$19,375	$24,375
	12.00	-$3,625	$2,375	$8,375	**$14,375**	$20,375	$26,375	$32,375
	14.00	-$1,625	$5,375	$12,375	$19,375	$26,375	$33,375	$40,375
	16.00	$375	$8,375	$16,375	$24,375	$32,375	$40,375	$48,375
	18.00	$2,375	$11,375	$20,375	$29,375	$38,375	$47,375	$56,375

The opportunity cost of growing turmeric

Turmeric is competing for the same high-quality, fertile soils across Northland that are suitable for growing other annual crops. Table 125 presents the estimated gross profitability for several competing crops to illustrate the opportunity cost of growing turmeric in a field. While land-use decision-making also depends on multiple non-financial factors, this comparison illustrates the scale of the financial incentive to allocate land to other options. For the most part, these competing crops can also be grown under cover with much higher gross profitability due to high yields.

Table 125: *Opportunity cost of growing turmeric*

Competing crops	Estimated gross profit ($/ha)			Net benefit/loss
	Low	*Midpoint*	*High*	*If growing turmeric*
Turmeric	-$25,000	$14,375	$72,750	N/A
Kūmara	$6,000	$15,500	$25,000	-$1,125
Capsicums	$3,000	$9,000	$15,000	$5,375
Tomatoes	$5,000	$7,500	$10,000	$6,875
Cucumbers	$15,000	$20,000	$25,000	-$5,625

Assessment of grower feasibility

We assess the economic feasibility of growing turmeric using the following five grower-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for growers presented earlier in this chapter:

1. **Output potential:** The estimated yield (6 to 18 t/ha/yr) is slightly below the average yield in international growing regions, with some regions yielding up to 30 t/ha/yr. Northland's cooler climate may affect growth rates, but investing in polytunnels and greenhouses could improve yields by providing a more controlled and warmer growing environment.

2. **Grower profitability:** Growing turmeric commercially is expected to generate a healthy gross profit at the midpoint estimates of revenue and costs of production. The expected gross margin of 22% is at the lower end of what might be considered a 'safe' range for outdoor food producers.

3. **Infrastructure:** Turmeric should be grown in rotation with other crops to mitigate the risk of soil-borne diseases becoming an issue. This means turmeric can be grown in open fields with no crop-specific infrastructure. However, yields can be improved if they are grown under cover.
4. **Sensitivity of gross profitability:** There is a low to moderate chance that a grower's gross profitability would be negative due to fluctuations in the yield and the farmgate price received. Small fluctuations in yield or the farmgate price received have a proportionately greater impact on gross profitability. 80% of modelled scenarios result in a positive gross profit, with 37% above a gross margin of 25%.
5. **Grower opportunity cost:** The opportunity cost of growing turmeric is moderate, as it generates a gross profit that is better than two of the competing crops considered and less than the others.

For these reasons, we consider domestically grown turmeric feasible for growers only at a *small scale* (grower feasibility score of 2.40), provided the farmgate price offsets the relatively higher domestic production costs (Table 126).

Table 126: *Grower feasibility: Turmeric*

Criterion	Score *(from 0 to 4)*
Output potential	2.50
Profitability	2.00
Infrastructure	2.50
Sensitivities	3.00
Opportunity cost	2.00
Average score	**2.40** Small-scale

Turmeric: Fresh root

Fresh root is one of the two prioritised consumption forms for turmeric in this market opportunities study (refer to page 14 for more information).

Introduction

Description

Fresh turmeric root is the harvested rhizome of the *Curcuma longa* plant. It is an irregularly shaped, knobbly, finger-like branching structure, with a light brown skin and bright orange/deep yellow flesh.

Fresh turmeric root is widely consumed in New Zealand and is typically available year-round in supermarkets, though consumption is concentrated in niche segments. In total, an estimated 300 to 400 t/yr of turmeric root is imported. While there is some small-scale non-commercial production occurring in Northland, most of the fresh turmeric root consumed domestically is imported from Fiji or India. The domestic market for turmeric root appears stable and well-established, with a consistent and reliable supply. There is a rising global trend for turmeric across the food, wellness, and cosmetics industries. These trends are seen in New Zealand through increased powder and extract imports and are a strong indicator of broader turmeric consumption.

Fresh turmeric root is used for culinary and health purposes, valued for its spicy, aromatic flavour and perceived anti-inflammatory and immune support properties. Fresh turmeric root, as opposed to powdered turmeric, is bitter when raw but has a more vibrant flavour and volatile oils not found in powder. It is often combined with black or cayenne pepper to enhance absorption of curcumin (the primary bioactive compound responsible for its health-promoting properties).

The value proposition of consuming domestically grown turmeric is that:

1. Locally grown turmeric supports communities to thrive.
2. It introduces a spray-free option. Unlike many imports, New Zealand-grown turmeric could be certified low-input or organically grown and would avoid the need for border fumigation.
3. Food producers may value particular varieties, such as young or pink turmeric and mild, aromatic types that are hard to import in fresh condition.
4. Locally grown turmeric is fresh and has a better appearance and taste appeal compared to imports, as there is less time between harvest and sale.

Conversion efficiency

For every tonne of commercial-grade fresh turmeric root harvested, between 950 and 970 kilograms of fresh turmeric root is available for sale after defective parts of the root have been removed.

Processing steps

The steps involved in preparing fresh turmeric root for consumption are minimal. They include:

1. Transporting harvested turmeric to a processing facility where roots are cleaned and graded for size, weight, and quality.
2. Trimming the root to remove the fibrous roots and any defective parts.

3. Keeping the roots in specialised cool storage that maintains the temperature and humidity. This helps to preserve quality and prevent shrivelling, depending on the lead time to market.

A processing facility could either be established by individual growers near their fields or by a grower collective or private investor in a peri-urban central location (e.g. close to utilities, logistical networks, and labour). Because this work assesses the feasibility of establishing a commercial industry across Northland, the latter is prioritised in the following analysis.

Costs to process fresh turmeric root

Facility establishment costs

The estimated costs to establish a fresh turmeric root processing facility in a peri-urban setting (capital expenditure only) to prepare turmeric root for consumption are presented below for three different levels of annual throughput. The three levels of annual throughput considered are for a:

- **Small-scale facility** processing between 10 and 30 t/yr of fresh turmeric root from approximately 0.80 to 2.50 ha of commercial turmeric farms.
- **Medium-scale facility** processing between 30 and 100 t/yr of fresh turmeric root from approximately 2.50 to 8.30 ha of turmeric farms.
- **Large-scale facility** processing between 100 and 300 t/yr of fresh turmeric root from approximately 8.30 to 25.00 ha of turmeric farms.

Each size of processing facility will have tailored storage facilities to control the humidity and temperature, thereby regulating the supply of fresh turmeric root to the market.

Table 127: *Costs to establish a fresh turmeric root processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small (10–30 t/yr)*	*Medium (30–100 t/yr)*	*Large (100–300 t/yr)*
Site development/buildings	25	100k–250k	250k–500k	500k–1m
Processing equipment	15	10k–25k	40k–90k	130k–250k
Packing equipment & benches	15	3k–5k	5k–15k	15k–50k
Storage facilities	15	10k–30k	30k–80k	80k–200k
Palletising & internal logistics	15	5k–15k	10k–30k	30k–40k
Utilities installation	20	10k–20k	20k–50k	50k–100k
Office/staff facilities	20	5k–15k	20k–50k	50k–100k
Compliance & fit out	15	20k–40k	40k–80k	80k–150k
Contingency	20	25k–60k	60k–130k	130k–280k
Total		**188k–460k**	**475k–1.03m**	**1.07m–2.17m**
Annualised cost ($/kg) [1]		**$1.32–$1.63**	**$0.90–$1.37**	**$0.64–$0.94**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of the asset.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput above are presented in Table 128 on a per-kg basis.

Table 128: *Costs to operate a fresh turmeric root processing facility*

Cost category	Operating costs ($/kg)		
	Small (10–30 t/yr)	*Medium (30–100 t/yr)*	*Large (100–300 t/yr)*
Labour	$3.00–$6.00	$2.00–$4.00	$1.00–$3.00
Utilities (e.g. electricity & water)	$0.05–$0.10	$0.03–$0.07	$0.02–$0.05
Raw ingredient	$4.12–$7.37	$4.12–$7.37	$4.12–$7.37
Packaging & distribution	$0.50–$1.00	$0.30–$0.60	$0.20–$0.40
Maintenance & cleaning	$0.20–$0.40	$0.15–$0.30	$0.10–$0.25
Waste/by-product removal	$0.05–$0.10	$0.02–$0.07	$0.01–$0.05
Total ($/kg)	**$7.92–$14.97**	**$6.62–$12.41**	**$5.45–$11.12**

Net operating profit after capital charges

EBIT ($/kg) is used to assess the financial feasibility of preparing turmeric root for sale (Table 129). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 129: *Estimated EBIT: Processing fresh turmeric root (medium-scale facility)*

Particulars	EBIT ($/kg) *Rounding errors may apply*		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$10.71	$14.55	$18.52
Processing costs *(including raw product costs)*	$12.41	$9.50	$6.62
Gross profit	-$1.69	$5.05	$11.89
Annualised capital charge	$1.37	$1.13	$0.90
Allowance for annual fixed costs [2]	$0.43	$0.58	$0.74
EBIT	**-$3.49**	**$3.33**	**$10.26**
EBIT %	-33%	23%	55%

[1] Revenue earned is calculated as the product of the volume of turmeric root sold (see above) and the wholesale turmeric price. There is limited visibility on the processor's wholesale price for turmeric. It is therefore estimated using the retail price ($15.00 to $25.00 per kg) *less* an assumed retail markup (35% to 40%). The price received by processors to cover production costs, therefore, ranges from $10.71 to $18.52 per kilogram of turmeric root sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

The EBIT is particularly sensitive to two variables: the price paid in the market for turmeric root, and the price paid to growers for turmeric root harvested (i.e. farmgate price). Table 130 demonstrates how a processor's EBIT could be expected to fluctuate due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. 88% of the combinations modelled result in a positive EBIT, with 76% resulting in an EBIT margin of 7.50% or more.

Table 130: *Sensitivity of processor EBIT: Turmeric*

		Farmgate price paid ($/kg)						
		$7.00	$6.50	$6.00	**$5.50**	$5.00	$4.50	$4.00
Market price ($/kg)	$15.00	-$1.87	-$1.35	-$0.83	-$0.31	$0.22	$0.74	$1.26
	$16.67	-$0.66	-$0.13	$0.39	$0.91	$1.43	$1.95	$2.47
	$18.33	$0.56	$1.08	$1.60	$2.12	$2.64	$3.16	$3.68
	$20.00	$1.77	$2.29	$2.81	**$3.33**	$3.85	$4.37	$4.89
	$21.67	$2.98	$3.50	$4.02	$4.54	$5.06	$5.58	$6.11
	$23.33	$4.19	$4.71	$5.23	$5.76	$6.28	$6.80	$7.32
	$25.00	$5.40	$5.93	$6.45	$6.97	$7.49	$8.01	$8.53

Processor feasibility of fresh turmeric root

We assess the economic feasibility of preparing turmeric for consumption using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Preparing turmeric root for sale is expected to be profitable with a strong EBIT margin of 23%.
2. **Sensitivity of profitability:** There is substantial variability in the expected profitability of a turmeric root facility; however, 88% of the combinations modelled result in a positive EBIT, with 76% resulting in an EBIT margin of 7.50% or more. This indicates that the consumption form is somewhat resilient, and the profitability of a turmeric preparation facility is maintained, for the most part, within the ranges used for yield and market price.
3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport turmeric root between farms and a processing facility. There are well-established transportation channels across Northland for other industries such as dairy, sheep and beef farming that could be leveraged. Turmeric will require specialised storage facilities at the processing facility and during long-distance distribution to help preserve quality until the crop reaches the market. A Northland turmeric industry could likely leverage existing supply chains to reach markets in other regions. Maintaining product freshness is critical, as it represents a core value proposition for New Zealand-grown turmeric.
4. **Infrastructure:** Preparing turmeric for sale is largely manual (e.g. cleaning, trimming and packaging) with little opportunity for mechanisation except at a large scale. The required equipment (e.g. preparation benches and knives) is readily available in New Zealand at a relatively low cost.

For these reasons, we consider preparing domestically grown turmeric root for sale for processors only at a *medium-scale* (processor feasibility score of 3.13).

Table 131: *Processor feasibility: Turmeric root*

Criterion	Score *(from 0 to 4)*
Profitability	4.00
Sensitivities	3.00
Logistics and distribution	2.00
Infrastructure	3.50
Average score	**3.13** Medium-scale

Market feasibility for fresh turmeric root

We assess the opportunity for fresh turmeric root in domestic markets using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic industry:

1. **Supply and demand:** The market for New Zealand-grown fresh turmeric is limited and highly niche, primarily comprising individual consumers from ethnic communities and health-conscious segments. Current demand is largely satisfied by imported turmeric, which offers acceptable quality at a lower price point. However, there may be potential to command a modest premium for locally grown turmeric by leveraging provenance, perceived quality, and health-related positioning. Some niche retailers could be open to stocking New Zealand-grown turmeric, though this would be closely tied to the sustained momentum of the health and wellness trend. To gain traction, building a loyal customer base will be critical. One strategic approach would be to differentiate through varietal selection (such as cultivars with enhanced taste or elevated curcumin content) to create a distinctive value proposition that sets New Zealand-grown turmeric apart from imported alternatives.
2. **Market access:** Retailers, processors, and manufacturers already have established channels to exporters and produce distributors, so growers of fresh turmeric would have access to already established channels to get their product into the market stream.
3. **Competition and market-related risks:** Imported turmeric root currently meets consumer expectations in New Zealand, offering a strong balance of quality and affordability. While a New Zealand-grown product could offer advantages in terms of reduced shipping times and potentially improved freshness, these benefits alone are unlikely to drive significant market share gains, as consumers are generally satisfied with existing options. There may be scope for a modest premium based on provenance, particularly among niche or health-focused buyers; however, this price elasticity is limited, as end consumers remain highly price sensitive. Any strategy to introduce fresh, locally grown turmeric should carefully weigh the marginal value of freshness and origin against the established price-performance benchmark set by imports.

Fresh turmeric grown in Northland is unlikely to gain meaningful traction in New Zealand's limited and price-sensitive turmeric root market, which is currently well-served by imports offering acceptable quality at lower cost. While a fresher, higher-quality local product may appeal to some consumers, the added value is diminished once the turmeric is incorporated into processed goods, where provenance cannot be leveraged as a marketing advantage. As a result, processors and manufacturers have little incentive to pay a premium for a local supply. Given the current market size and subdued demand, large-scale cultivation of fresh turmeric in Northland does not appear to be commercially viable at this stage.

For these reasons, domestically grown turmeric is assessed to be feasible in the market at a *small scale* (Table 132).

Table 132: *Market feasibility: Turmeric fresh root*

Criterion	Score *(from 0 to 4)*
Supply and demand	1.00
Market access	3.00
Competition and market-related risks	1.50
Average score	**1.83** Small-scale

Turmeric: Powder

Turmeric powder is one of the two prioritised consumption forms for turmeric in this market opportunities study (refer to page 14 for more information).

Introduction

Description

Powdered (or ground) turmeric is widely consumed in New Zealand as a longer-lasting alternative to fresh turmeric. It is primarily used in cooking and food preparation as a bitter, slightly peppery-tasting spice. There is no known commercial production of turmeric powder in New Zealand, with approximately 200 to 280 tonnes imported from India and Fiji.[32] The value proposition of consuming domestically grown turmeric powder centres on provenance and supporting local growers and communities. Domestic production may also introduce a spray-free and/or organic turmeric powder product.

Conversion efficiency

For every tonne of turmeric root harvested, 200 to 250 kg of turmeric powder can be produced (i.e. 20 to 25% recovery rate).

Processing steps

The steps involved in processing fresh turmeric root into a powder ready for consumption include:

1. Washing and sanitising the turmeric root to remove dirt and any residual product.
2. Trimming the fibrous roots, stems and damaged parts.
3. Peeling the skin to improve the colour and hygiene of the final product.
4. Slicing the turmeric into thin slices to support uniform drying and reduce drying time.
5. Drying the slices of turmeric using mechanical dryers. The curcumin content, which is responsible for the powder's colour and anti-inflammatory qualities, can degrade at high temperatures, so drying must be controlled.
6. Grinding the dried slices into a fine powder using grinders or pulverisers.
7. Sieving the ground powder to ensure uniform particle size.
8. Packaging turmeric powder into moisture-proof, airtight containers to protect against humidity and light.
9. Storing in a cool, dry environment to prevent clumping or spoilage until distribution.

[32] Approximately 280 tonnes of crushed and ground turmeric products are imported annually, although it's unclear how that splits between crushed turmeric and ground turmeric (i.e. turmeric powder). The assumption made is that turmeric powder is consumed more widely and therefore makes up a larger proportion of the imported volumes.

The capital requirements to produce a turmeric powder are relatively low in its simplest form for small-scale production. As the throughput of a processing facility increases, there is an opportunity to introduce more automation to improve efficiency.

Costs to process turmeric powder

Facility establishment costs

The estimated costs to establish a turmeric production facility in a peri-urban setting (capital expenditure only) to prepare turmeric powder for consumption are presented in Table 133 for three different levels of annual throughput. The three levels of annual throughput considered are a:

- **Small-scale facility** processing between 10 and 30 t/yr of fresh turmeric root from approximately 0.80 to 2.50 ha of commercial turmeric farms. At this scale, between 2 and 6 t of turmeric powder will be produced.
- **Medium-scale facility** processing between 30 and 100 t/yr of fresh turmeric root from approximately 2.50 to 8.30 ha of turmeric farms. At this scale, between 6 and 20 t of turmeric powder will be produced.
- **Large-scale facility** processing between 100 and 300 t/yr of fresh turmeric root from approximately 8.30 to 25.00 ha of turmeric farms. At this scale, between 20 and 60 t of turmeric powder will be produced.

Table 133: *Costs to establish a turmeric powder processing facility*

Cost category	Expected lifetime	Upfront cost		
	Years	*Small (2–6 t/yr)*	*Medium (6–20 t/yr)*	*Large (20–60 t/yr)*
Site development/buildings	25	100k–250k	250k–500k	500k–1m
Processing equipment	15	22k–70k	85k–175k	240k–490k
Packing equipment & benches	15	2k–10k	10k–30k	30k–70k
Storage facilities	15	2k–10k	20k–50k	50k–100k
Palletising & internal logistics	15	2k–5k	10k–30k	30k–60k
Utilities installation	20	5k–20k	20k–50k	50k–100k
Office/staff facilities	20	5k–15k	10k–30k	30k–60k
Compliance & fit out	15	10k–30k	50k–100k	100k–200k
Contingency	20	20k–60k	70k–145k	150k–310k
Total	**N/A**	**168k–470k**	**525k–1.11m**	**1.18k–2.40k**
Annualised cost ($/kg) [1]	**N/A**	**$6.78–$7.18**	**$4.92–$7.72**	**$3.57–$5.27**

[1] To express the facility establishment costs as an annualised cost, the present value of the required investment is annualised using a 6% discount rate over the expected lifetime of each group of assets.

Facility operating costs

The annual recurring costs to operate a facility with the three different levels of throughput above are presented in Table 134 on a per-kg basis.

Table 134: *Costs to operate a turmeric powder processing facility*

Cost category	Operating costs ($/kg)		
	Small (2–6 t/yr)	*Medium (6–20 t/yr)*	*Large (20–60 t/yr)*
Labour	$8.00–$15.00	$5.00–$10.00	$2.00–$5.00
Utilities (e.g. electricity & water)	$1.00–$2.00	$0.80–$1.50	$0.50–$1.00
Raw ingredient	$16.00–$35.00	$16.00–$35.00	$16.00–$35.00
Packaging & distribution	$3.00–$5.00	$2.00–$4.00	$1.00–$3.00
Maintenance & cleaning	$1.00–$2.00	$0.50–$1.50	$0.30–$0.80
Waste/by-product removal	$0.10–$0.30	$0.10–$0.40	$0.10–$0.50
Total ($/kg)	**$29.10–$59.30**	**$24.40–$52.40**	**$19.90–$45.30**

Earnings before Interest and Tax (EBIT)

EBIT ($/kg) is used to assess the financial feasibility of a processing facility drying turmeric into a powder (Table 135). EBIT considers how the revenue earned is used to cover the variable and fixed costs.

Table 135: *Estimated EBIT: Processing turmeric powder (medium-scale facility)*

Particulars	EBIT ($/kg)		
	Pessimistic	*Base*	*Optimistic*
Revenue earned [1]	$35.71	$40.00	$44.44
Processing costs *(including raw product costs)*	$52.40	$37.34	$24.40
Gross profit	-$16.69	$2.66	$20.04
Annualised capital charge	$7.72	$6.32	$4.92
Allowance for annual fixed costs [2]	$1.43	$1.60	$1.78
EBIT	**-$25.83**	**-$5.26**	**$13.35**
EBIT %	-72%	-13%	30%

[1] Revenue earned is calculated as the product of the volume of turmeric powder sold (see above) and the wholesale turmeric powder price. There is little visibility on the processor's wholesale price for turmeric powder. It is therefore estimated using the retail price ($50.00 to $60.00 per kg) *less* an assumed retail markup (35% to 40%). The price received by processors to cover production costs, therefore, ranges from $35.71 to $44.44/kg of turmeric powder sold.

[2] The allowance for annual fixed costs is estimated as 4% of revenue earned.

Sensitivity of EBIT

EBIT is particularly sensitive to two variables: the price paid in the market for turmeric powder, and the price paid to growers for turmeric root (i.e. farmgate price). Table 136 demonstrates how a processor's

EBIT could be expected to fluctuate due to changes in these two variables while holding all other costs of production constant at the midpoint estimate. Just 18% of the modelled combinations of these variables result in a positive EBIT, with 4% resulting in an EBIT margin of 7.50% or more.

Table 136: *Sensitivity of processor EBIT: Turmeric powder*

		Farmgate price paid ($/kg)						
		$7.00	$6.50	$6.00	**$5.50**	$5.00	$4.50	$4.00
Market price ($/kg)	$50.00	-$15.56	-$13.34	-$11.12	-$8.90	-$6.68	-$4.45	-$2.23
	$51.67	-$14.35	-$12.13	-$9.91	-$7.69	-$5.46	-$3.24	-$1.02
	$53.33	-$13.14	-$10.92	-$8.70	-$6.47	-$4.25	-$2.03	$0.19
	$55.00	-$11.93	-$9.71	-$7.48	**-$5.26**	-$3.04	-$0.82	$1.41
	$56.67	-$10.72	-$8.49	-$6.27	-$4.05	-$1.83	$0.40	$2.62
	$58.33	-$9.50	-$7.28	-$5.06	-$2.84	-$0.62	$1.61	$3.83
	$60.00	-$8.29	-$6.07	-$3.85	-$1.63	$0.60	$2.82	$5.04

Processor feasibility for turmeric powder

We assess the economic feasibility of drying turmeric into a powder using the following four processor-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the outputs from the financial model for processors presented earlier in this chapter:

1. **Processor profitability:** Processing turmeric into powder is not expected to be profitable with an EBIT margin of -13%.

2. **Sensitivity of profitability:** The EBIT of a facility producing turmeric powder is expected to be negative for the most part, except for when the market price and farmgate price paid are highly favourable. The process is largely manual, with labour being a significant proportion of the operating costs per unit. The low conversion rate also means the cost of raw product is high compared to the market price range.

3. **Logistics and distribution:** Northland is sparsely populated and geographically dispersed, and regional infrastructure can be challenging from a supply chain perspective to transport turmeric root between farms and a processing facility. There are well-established transportation channels across Northland for other industries such as dairy, sheep and beef farming that could be leveraged. While there may be some inefficiencies initially that could add extra steps or distribution complexity and increase costs, existing logistical processes can likely be adapted to service a Northland turmeric industry.

4. **Infrastructure:** Drying turmeric and grinding it into a powder is a relatively straightforward process, although it requires several specialised machines to dry the turmeric root and grind it into a powder. The necessary capital equipment is not considered unique to grinding turmeric. That said, the required assets are readily available from international suppliers if new or second-hand equipment is unavailable domestically.

For these reasons, we consider domestically grown turmeric powder *not feasible* for processors (Table 137).

Table 137: *Processor feasibility: Turmeric powder*

Criterion	Score *(from 0 to 4)*
Profitability	0.00
Sensitivities	0.50
Logistics and distribution	1.50
Infrastructure	1.50
Average score	**0.88** Not feasible

Market feasibility for turmeric powder

We assess the market opportunity for turmeric powder using the following three market-related feasibility criteria (see Appendix 2, page 176). Each criterion draws on the insights collected from stakeholders interviewed about growing a domestic turmeric industry:

1. **Supply and demand:** The New Zealand market for turmeric powder is primarily supplied by imports, which currently meet the majority of demand. Unlike fresh turmeric, powdered turmeric has a broader appeal, extending beyond ethnic and health food markets into general consumer use. Its versatility in cooking, longer shelf life, and growing public awareness of its health benefits (particularly its purported anti-inflammatory properties) have contributed to increasing demand. If current health and wellness trends persist, the turmeric powder market is expected to grow further. This presents a potential opportunity for domestic producers, provided they can deliver a competitively priced, high-quality product that aligns with consumer expectations.

2. **Market access:** Established distribution channels are already in place to supply spice distributors, processors, and retailers with imported turmeric powder. New Zealand-grown turmeric powder could integrate into these systems with minimal disruption. However, local investment in infrastructure and machinery that processes the raw product, introduces a capital and operational cost component that must be factored into the go-to-market strategy.

3. **Competition and market-related risks:** Imported turmeric powder currently offers strong quality at competitive prices, effectively meeting consumer expectations. While a locally produced turmeric powder could leverage advantages in the added trust associated with New Zealand-made products, these factors alone may be insufficient to justify a significant price premium. For domestic producers to compete effectively, they will need to balance these perceived benefits against the price sensitivity of the market.

Turmeric powder produced from Northland-grown turmeric presents a more viable market opportunity than fresh root, given its broader market appeal and established demand across both mainstream and niche consumer segments. Powdered turmeric benefits from ease of use, longer shelf life, and growing consumer awareness of its health benefits, making it a staple in both home cooking and wellness-focused diets. While provenance is lost once turmeric is used as an ingredient in processed foods, it retains value when sold directly to consumers as a spice, particularly if linked to a strong New Zealand-grown, organic or sustainable narrative. This provenance story may support a price premium.

There is also potential to further differentiate through the cultivation of high-curcumin or specialty turmeric varieties, such as Ryudai Gold, which may offer additional health positioning. However, certain visually distinct varieties, such as "blue" turmeric, are unlikely to succeed in powder form due to consumer unfamiliarity. A key operational consideration is processing: most distributors and retailers require turmeric in powdered form and will not process it themselves. Despite these challenges, the existing import-based supply chains demonstrate that effective distribution channels are in place, which local producers could tap into if quality, consistency, and processing capabilities are aligned.

For the above reasons, a turmeric powder, made from domestically grown turmeric root, is assessed to be feasible in the market at a *small scale* (Table 138).

Table 138: *Market feasibility: Turmeric powder*

Criterion	Score *(from 0 to 4)*
Supply and demand	2.00
Market access	2.00
Competition and market-related risks	1.00
Average score	**1.67** Small-scale

Feasibility of a Northland turmeric industry

Scale of feasibility

The economic feasibility of a Northland turmeric industry considers the individual feasibility for growers, processors and the market presented in the previous sections. Table 139 summarises the feasibility given to each of the three components for the two consumption forms considered for turmeric.

Table 139: *Feasibility of establishing a turmeric industry in Northland*

Consumption forms	Feasibility component			
	Grower	*Processor*	*Market*	*Overall*
1. Fresh turmeric root	Small-scale (2.40)	Medium-scale (3.13)	Small-scale (1.83)	Small-scale
2. Turmeric powder	Small-scale (2.40)	Not feasible (0.88)	Small-scale (1.67)	Not feasible

Overall, a domestic turmeric industry is considered economically feasible at a *small scale* under current economic conditions and assuming agronomic feasibility, by supplying turmeric root to existing retail markets to compete with imported alternatives. Turmeric powder is not feasible because insufficient market value filters back to processors and growers (i.e. the market price is too low to cover the processor costs in the first instance and leave enough to pay growers a fair farmgate price). While demand exists and market access is straightforward, competition (particularly in larger retail outlets) and the lack of a clear competitive advantage (other than provenance) constrain the domestic market to a small scale.

Estimated scale of operation

The estimated scale of operation required to meet demand for fresh domestically grown turmeric is less than **1.00 hectare**. This is suggested as the minimum viable scale needed to participate meaningfully in the market without overcommitting land or capital. This is expected to generate an aggregated gross profit of approximately $0.02 million annually.

To mitigate the risks of soil-borne diseases, it is recommended that turmeric be grown in a 2-to-4-year rotation with other annual crops. To meet the estimated annual demand (Table 140), Northland would need between 1.50 ha (2-year rotation) and 4 ha (4-year rotation) growing turmeric as part of a rotation with other crops.

Table 140: *Planted area required to meet demand for turmeric products*

Particulars	Feasible consumption form: Turmeric root
Estimated demand	9–12 t *(~15%–20% of domestic consumption)*
Conversion efficiency	96%
Raw product required	9–13 t
Estimated yield	12 t/ha/yr *(midpoint, commercial grade)*
Land required	**<1.00 commercial hectare**
Aggregated gross profit	**<$0.02 million**

Chapter 10:

Considerations for implementation

This chapter summarises the economic feasibility findings and outlines key implementation insights for growers and regional stakeholders.

Small-scale commercialisation: opportunities and limitations

This section explores why small-scale industries can succeed, and why the same conditions constrain growth into larger-scale operations.

There is a small segment of domestic consumers willing to pay a premium to consume domestically grown crops.

In New Zealand, there is a niche but valuable consumer segment that actively seeks out domestically grown fruit and vegetables, or products that use domestically grown crops as ingredients. These consumers place a high value on provenance, traceability, quality and freshness, and availability of spray-free alternatives to imported equivalent products. They may also value the personal relationship with the producer. These consumers are often engaged at local farmers' markets or through boutique food retailers. For these consumers, the value of 'buying local' may extend beyond their direct benefit to support local growers and communities. This segment of consumers provides a solid foundation for a small scale, domestic industry to sell to.

Growing demand means competing on price with lower-cost imports.

Growing the market share of a domestic industry, relative to imported alternatives, will mean engaging consumers who are more price sensitive. These consumers will be progressively less willing to pay a price premium for domestically grown fruits and vegetables, often considering the trade-off between provenance, traceability and freshness, against the lower cost of imported alternatives. To grow market share, a domestic industry may need to lower its market price to compete with imported products, which erodes the premium that makes small-scale commercialisation viable.

Domestic costs of production are significantly higher than those of international counterparts, mostly due to the high labour requirement.

Most of the tropical and subtropical crops analysed in this report (except for soybeans and sunflowers) are labour-intensive relative to existing crops across Northland. Coupled with the high cost of domestic labour compared to international competitors, the costs of growing these crops domestically are among the most significant barriers to scaling. The limited opportunity to mechanise or automate the growing activities for these crops compounds this challenge, as labour costs are spread across lower production volumes.

Without an existing comparative advantage, a small-scale domestic industry will regularly be competing with imported alternatives.

For a domestic industry to thrive at scale, it needs a clear comparative advantage over international competitors. For example, a domestic industry might have a lower cost structure, have counter-seasonal production, or produce unique varieties. In the case of the seven crops analysed, neither of these advantages apply strongly for Northland production. International suppliers can provide produce year-round at a lower cost.

Over time, reducing prices to attract more consumers, combined with the high costs of domestic production, puts downward pressure on margins, making it increasingly difficult for domestic growers to maintain profitability at larger scales. Without the ability to sustain a market premium and with the high costs of production, scaling up squeezes margins, making it hard to compete with low-cost import alternatives and limiting the domestic industry to supply small, high-value market niches.

Considerations for implementation by landowners and regional stakeholders

Diversifying land into a new crop requires more than recognising an opportunity. The crop's success relies on the landowner developing a clear understanding of the economic, operational and market realities for growing, processing and marketing the crop. The economic feasibility analyses completed in Chapters 3 to 9, to establish banana, pineapple, moringa, soybean, sunflower, ginger and turmeric industries, highlight a range of practical considerations to support decision-making for landowners (referred to as 'growers') considering land-use diversification, and the regional stakeholders supporting them. This section highlights practical considerations that may be overlooked when identifying an opportunity.

Grower profitability depends on receiving a premium market price.

Northland growers' profitability depends on securing premium prices in the market that return enough value through the supply chain (returned to growers as the farmgate price) to cover high domestic production costs. However, a premium price in the market is not guaranteed for every crop grown and can depend on several factors outside the grower's control. Landowners must consider *where* and *how* value is created along the supply chain to determine which crop and consumption forms create the best opportunity. Growers may benefit from a collaborative approach, including vertically integrating processing activities and collective market efforts to ensure a fair share of downstream returns. Ultimately, this means matching crops and consumption forms with the market segments that recognise its domestic value and are willing to pay the necessary premium for it.

Value-added processing can improve returns, but scale matters

Capturing more of the retail value through value-added processing can lift grower returns, but making the economics work depends on aligning processing scale and product form with associated costs.

At low throughput, processing facility establishment costs (e.g. buildings, processing equipment, storage, etc.) are spread over fewer units, increasing the per-unit cost of capital. One rule of thumb suggests that doubling production volume adds approximately 60% to the capital costs of a processing facility (e.g. the sixth-tenths rule of scale). Applied in reverse, this economies-of-scale rule highlights the disadvantages that small-scale processing has against larger, international operations.

Processor feasibility then depends on whether processing can be done manually or at a low cost (i.e. reducing the purchase of processing equipment). Some of the consumption forms analysed in this report fit this model (e.g. fresh-pack, simple cutting, dehulling, grinding), while others require specialist equipment regardless of throughout (e.g. pasteurisation, oil extraction and filtering, cold pressing liquids). Unless the value created in the market reflects small-batch production, this can make small-scale processing prohibitively expensive. Choosing the right consumption form means targeting either (1) a high price market price to processing ratio, and/or (2) using shared or contract facilities to reduce capital costs per-unit for value-added processing.

Market reach must extend beyond local buyers

The proportion of Northland consumers willing to pay a premium for domestically grown fruits, vegetables, and grains may be insufficient on its own to sustain regional industries at the estimated scales of operation for each crop. Growing from a very small, regional-based industry towards the suggested scales will require new distribution channels to access the same target market segments in nearby regions, including Auckland, the Waikato and Bay of Plenty, where more than 50% of New Zealanders live. For some crops, this will require specialised distribution to prioritise quality and freshness in transit, although several boutique and mainstream operators may be able to support this. With already sensitive profit margins, distributing outside Northland could increase distribution costs; however, coordinated efforts could help negotiate lower prices. There is a risk that distributing too widely could affect the price premium received, as the relationship-driven appeal that contributes to the price premium is weakened.

Building capability and capacity takes time and collaboration

It can take several years for new crop systems to build in maturity to achieve target yields and quality. With an absence of local capability, at least initially, prospective growers should plan for several years of learning (e.g. variety choice, planting density, management approach, etc.) before reaching the steady commercial performance modelled throughout this report. Pre-competitive collaboration can help a domestic industry grow quickly with knowledge-sharing events to improve regional capability and production efficiency.

Successful implementation requires suitable management of *grower*-related risks

At the grower level, the successful implementation of a new crop is dependent on a number of different variables, several of which are largely outside of the grower's control, although there are mitigations available. Key exposures include yield variability, costs of production, market price volatility and a challenging regulatory environment (e.g. environmental management, biosecurity, etc). Practical mitigations are available but may involve investing in capital equipment as a form of insurance. For example:

- Polytunnels and greenhouses can control the growing environment better, protecting crops from adverse weather and climatic events, reducing the variability in annual yields.
- Vertically integrating with processing facilities or using shared/contract facilities can help reduce the processing costs per-unit for value-added processing, creating more value along the supply chain to flow back to growers.
- Low-cost mechanisation and automation can help offset the costs of labour during growing and processing activities.

While this report presents modelled estimates of financial performance, they are based on several broad-level assumptions and intended to be indicative only. It is important for growers to fully assess the economic feasibility of growing a new crop for their unique circumstances to ensure the relevant risks can be mitigated effectively to support success.

Individual landowners acting independently can create adverse collective outcomes. Regional stewardship may support successful implementation.

Independent decisions made farm by farm can unintentionally create collective problems affecting the success of a domestic industry. Collaborative oversight by Northland Inc., the Northland Regional Council and industry partners (e.g. Horticulture New Zealand, Foundation for Arable Research, etc.) can align plans without encroaching on grower autonomy, while responding to market demand. A few of the material risks identified in the preceding chapters include:

- **Demand for regional labour could increase.** New land-uses that are more labour-intensive per hectare than the previous land-use (e.g. dairy vs bananas) could mean an increase in demand for regional labour. If supply is tight, wages can rise, increasing the costs of production.
- **Centrally funded processing facilities could support emerging industries.** Small, standalone processing facilities carry high establishment costs, meaning uncompetitive unit costs at low levels of throughput. Centralised, shared facilities supporting different types of processing can spread the capital expenditure, increase utilisation and reduce per-unit processing costs.
- **Rapid growth can lead to an oversupply in the market.** At a small scale, and for emerging industries, there is a greater risk that supply and demand become misaligned. There is a risk that, building on initial interest, an emerging industry grows too quickly, causing supply to outpace demand after a few seasons. An oversupply would reduce market prices, decreasing grower margins. Lags between planting and harvesting can exaggerate the boom-bust cycle, creating volatility for growers and processors, and increasing the risk of unsustainable profitability. For industries involving the growth of a perennial crop, this may mean significant sunk costs also.
- **More intensive systems increase the risk of negative environmental outcomes.** Several of the crops explored throughout this report are, by nature, more intensive uses of land (per hectare) than the land-uses they are proposed to replace. Subtropical and tropical crops can be heavy feeders with higher nutrient requirements. Being grown on free-draining soils and sloped sites to avoid frost and waterlogging, the risk of nitrogen losses and leaching is greater. Exceeding catchment limits can trigger regulatory consequences, harm the region's natural resources, and add material compliance costs.

Chapter 11:
Appendices

This section contains the appendices, providing additional data to support the assessment of the seven crops' economic feasibility presented in chapters 3 to 9.

Appendix 1: Consumption forms

The full list of consumption forms identified and that went through the preliminary screening phase is presented in Table 141 with the prioritised forms from Table 1 in bold.

Table 141: *Full list of consumption forms identified*

Crop	Consumption forms
Banana	• Fresh fruit • Dried • Puree • Frozen Fruit • Flour • Beverages • Animal feed
Pineapple	• Fresh fruit • Canned • Juice • Dried
Moringa	• Fresh leaves • Dried leaf powder • Capsules/tablets • Tea (bagged) • Green pods • Oil
Soybean	• Whole beans • Soy milk • Tofu • Protein isolates • Flour • Edamame • Oil • Soy Sauce • Animal feed
Sunflower	• Seed kernels • Oil • Sprouted shoots • Animal feed
Ginger	• Fresh root • Powder • Candied • Paste/puree • Juice • Essential oil
Turmeric	• Fresh root • Powder • Capsules • Paste • Oil

Appendix 2: Feasibility criteria & scoring

Grower feasibility criteria & scoring

Given the underlying assumption in this report that each crop is agronomically feasible, the five criteria for grower feasibility focus on the financial aspects of growing each crop.

1. Output potential

Estimates the potential production output of the crop in Northland, based on suitable land area and yield – essentially how much can be grown/produced under realistic conditions. Higher scores reflect a strong output potential that can support a viable industry.

Category	Score	Definition
Not feasible	0	The crop can't be grown at any meaningful scale due to poor land or climate suitability, or extremely low yields. It would only work at a hobby or backyard level.
Low feasibility	1	Some land might work, but the area or yield is too small to support commercial production or justify significantly value-added processing.
Moderate feasibility	2	Enough land and yield for a small or boutique industry, but total output is limited, and scaling would be difficult.
High feasibility	3	Plenty of suitable land and good yields allow for commercial production and efficient processing at scale.
Very feasible	4	Northland is ideal for the crop, with high yields and land availability to support large-scale, stable, and competitive production.

2. Grower Profitability

This criterion assesses grower profitability per hectare after typical production costs (e.g., inputs, hired labour, contracting, routine overheads), reflecting the operating surplus available to the grower before financing and other fixed costs, owner drawings, and tax. Results are reported in $/ha and are tested against a required level of profitability to achieve an adequate return on capital outlay to establish each production hectare.

Category	Score	Definition
Not feasible	0	Grower Profit Margin < 10% or fails the required rate of return hurdle under realistic assumptions; financially unsustainable for most growers.
Low feasibility	1	10–19% margin. Thin buffer; profitability is fragile and often insufficient to meet the required rate of return except under favourable conditions.
Moderate feasibility	2	20–29% margin. Marginal but positive; may meet the required rate of return depending on set-up costs and management performance; still sensitive to volatility.
High feasibility	3	30–39% margin. Generally meets the required rate of return for typical set-up profiles; financially viable for most growers.
Very feasible	4	≥40% margin. Comfortably exceeds the required rate of return with strong headroom for shocks and reinvestment; attractive and resilient.

3. Infrastructure and processes

Looks at whether the necessary infrastructure and technology are available (or attainable) for the cultivation and processing of the crop use case. This criterion focuses on on-farm infrastructure and the required investment to successfully grow the crop.

Category	Score	Definition
Not feasible	0	Growers lack critical on-farm infrastructure and acquiring it would be impractical or prohibitively expensive for the expected scale.
Low feasibility	1	Some basic tools or infrastructure may exist, but major on-farm investments (e.g. machinery, equipment, facilities) are missing and would be costly or difficult for growers to access.
Moderate feasibility	2	Key infrastructure is partially available or adaptable, but growers would still need moderate investment in equipment or facilities to make the crop viable.
High feasibility	3	Most required infrastructure is available or easily accessible to growers, with only minor upgrades or purchases needed.
Very feasible	4	All necessary on-farm infrastructure is already in place or readily obtainable, enabling immediate and low-cost adoption of the crop.

4. Sensitivity of profitability

This criterion looks at how sensitive a crop's profit is to changes in things like yield, price, or input costs. A crop that stays profitable under varying conditions scores well; one that only works in ideal scenarios scores poorly.

Category	Score	Definition
Not feasible	0	The crop is extremely risky—small changes in yield, price, or cost quickly lead to losses.
Low feasibility	1	Profit is highly sensitive to normal fluctuations; even minor issues can wipe out earnings.
Moderate feasibility	2	Some buffer exists, but larger swings in key factors could still push the grower into a loss.
High feasibility	3	The crop stays profitable under typical variations in yield or price, with a fair safety margin.
Very feasible	4	The crop is very resilient. Profitability holds up even under challenging conditions.

5. Grower opportunity cost

This criterion assesses whether the crop is more profitable than a grower's next-best land-use. If it doesn't outperform alternatives like dairy, beef, or horticulture, growers are unlikely to adopt it—even if it's technically profitable.

Category	Score	Definition
Not feasible	0	The crop earns far less than current land-uses, making it financially irrational to switch.
Low feasibility	1	The crop brings in less profit than alternatives, so growers would only try it for non-financial reasons.
Moderate feasibility	2	The crop's profit is similar to other options; switching might make sense if other benefits apply.
High feasibility	3	The crop offers equal or slightly better profit than current uses, making it financially worthwhile to consider.
Very feasible	4	The crop clearly outperforms other land-uses financially, giving growers a strong reason to switch.

Processor feasibility criteria & scoring

The five criteria for processor feasibility focus on the financial and supply chain factors for moving raw product from the farm to the consumer.

1. Processor profitability

This criterion evaluates the operating profitability of the processing operation by measuring Earnings Before Interest and Tax (EBIT) after paying growers and covering processing costs. EBIT includes operating overheads and depreciation/amortisation attributable to the facility (i.e. capital charges) and an allowance for other fixed costs to operate the facility. It excludes financing costs and income taxes.

Category	Score	Definition
Not feasible	0	The processor operates at a loss on an EBIT basis, with EBIT margin ≤ 0%. The business is not financially viable under realistic assumptions.
Low feasibility	1	0–5% EBIT margin. Barely profitable; results are easily erased by small changes in input costs, yields, or prices. Insufficient to justify investment or sustained operation.
Moderate feasibility	2	5–10% EBIT margin. Limited but positive operating profit. Potentially viable when supported by strategic, environmental, or social co-benefits, yet returns remain modest and vulnerable.
High feasibility	3	10–15% EBIT margin. Solid operating performance that meets or slightly exceeds typical processing benchmarks, providing a sound basis for investment and continued operation.
Very feasible	4	>15% EBIT margin. Strong, stable operating profits with headroom for shocks and reinvestment; indicative of top-tier operating efficiency and attractive to investors and regional stakeholders.

2. Sensitivity of EBIT

This criterion looks at how sensitive a processor's profit is to changes in things like the market price for the consumed product and the price paid to growers for the raw crop input. A consumption form that stays profitable under varying conditions scores well; one that only works in ideal scenarios scores poorly.

Category	Score	Definition
Not feasible	0	The consumption form is extremely risky—small changes in revenue and costs quickly lead to losses.
Low feasibility	1	Profit is highly sensitive to normal fluctuations; even minor issues can wipe out earnings.
Moderate feasibility	2	Some buffer exists, but larger swings in key factors could still push the processor into a loss.
High feasibility	3	The consumption form stays profitable under typical variations in yield or price, with a fair safety margin.
Very feasible	4	The consumption form is very resilient. Profitability holds up even under challenging conditions.

3. Logistics and distribution

Assesses whether there are appropriate distribution channels and logistics to move inputs and outputs through the supply chain to market. This includes transportation, storage, and any handling from farm to processor to end market.

Category	Score	Definition
Not feasible	0	Major logistical barriers prevent the product from reaching market reliably or affordably. Infrastructure is missing or inadequate, making distribution practically unworkable.
Low feasibility	1	Logistics are possible but costly or unreliable, with significant gaps like poor storage, high transport costs, or lack of local buyers. These challenges threaten the viability of the venture.
Moderate feasibility	2	Logistics work but involve inefficiencies or extra steps that add cost or complexity. The product can reach market with planning, though distribution isn't seamless.
High feasibility	3	The product can move through established channels with minimal issues, and transport and storage are generally available. Any logistical challenges are minor and manageable.
Very feasible	4	Distribution is smooth, cost-effective, and well-supported by existing infrastructure. The product can reach multiple markets easily with minimal risk or extra cost.

4. Infrastructure and processes

Looks at whether the necessary infrastructure and technology are available (or attainable) for processing crops into their consumption forms. This criterion focuses on processing infrastructure and the required investment to successfully prepare it for consumption

Category	Score	Definition
Not feasible	0	Essential processing infrastructure doesn't exist and would be too expensive or impractical to establish. The crop cannot be processed into a consumable form at any realistic scale.
Low feasibility	1	Some basic infrastructure exists, but key processing equipment or facilities are missing and would require major investment. The cost and effort needed to enable processing would significantly limit feasibility.
Moderate feasibility	2	Partial or adaptable infrastructure is in place, but moderate upgrades or additions are needed for processing. These investments are manageable, though they add complexity and cost to the venture.
High feasibility	3	Most processing infrastructure is already available and can be used with only minor modifications or additions. The crop can be prepared for consumption with relatively low investment.
Very feasible	4	All required processing infrastructure is in place and ready to use. The crop can be efficiently processed into its consumption form without any major upgrades or delays.

Market feasibility criteria & scoring

Market feasibility assesses customer/market-side viability: is there demand for the product, can it compete, can it reach the market, and what are the market-related risks? The criteria include Demand, Competition, Market Access & Distribution, and Market Risk Management. Below are the scoring definitions for each criteria.

1. Demand

Evaluates whether there is sufficient and/or growing demand for the crop's product (use case) in the target markets. A high score means strong, sustainable market pull for the product.

Category	Score	Definition
Not feasible	0	Demand is virtually non-existent or declining, with no realistic chance of selling the product at viable prices. The market is saturated, uninterested, or simply doesn't exist.
Low feasibility	1	Demand is weak, uncertain, or highly niche, with limited volume potential. Sales may rely on novelty, special conditions, or small, unstable markets.
Moderate feasibility	2	Some steady demand exists, but it's modest, seasonal, or depends on further market development. The product sells, but volumes are constrained, and growth prospects are limited.
High feasibility	3	There is strong and growing demand, with solid evidence the product can be sold reliably in significant volumes. The market is well-established and willing to pay viable prices.
Very feasible	4	Demand is very strong and likely to exceed available supply, with clear evidence of rapid growth or unmet need. The product can scale confidently into an eager market at profitable prices.

2. Market access

Checks whether potential supply can meet market demand, and conversely that demand can absorb the supply at a profitable level. Essentially, this gauges the balance: not over-producing beyond what can be sold and not under-producing such that economies of scale or market needs aren't met.

Category	Score	Definition
Not feasible	0	There is no viable market for the crop or product — either demand is absent, buyers are inaccessible, or entry is blocked by trade, regulatory, or logistical barriers. Even if the product is produced, there is no clear pathway to sell it at a sustainable price.
Low feasibility	1	Some demand or potential buyers may exist, but access is limited or unreliable. Market participation would require significant effort to establish relationships, meet niche standards, or overcome competitive or regulatory barriers.
Moderate feasibility	2	A workable market exists, but access may be restricted by factors like low volumes, uncertain pricing, or competition. The crop or product can be sold with effort, but consistent sales and fair pricing aren't guaranteed without additional development.
High feasibility	3	There is a clear, active market with identifiable buyers and relatively straightforward access. Demand is strong enough to support sales at sustainable prices, and pathways to market (e.g. distributors, processors, export agents) are already operating.
Very feasible	4	Strong, reliable market access is in place, with established buyers and robust demand. Growers or processors can easily sell into multiple channels with minimal barriers, and pricing conditions are attractive and stable.

3. Competition and market-related risks

Assesses whether the use case has a competitive advantage over existing alternatives or substitutes in the market. Higher scores mean a more favourable competitive position.

Category	Score	Definition
Not feasible	0	The market is saturated with dominant competitors or cheaper substitutes, and the product has no meaningful point of difference. It cannot compete on price, quality, or uniqueness.
Low feasibility	1	The product faces strong competition and is clearly disadvantaged on cost or performance. Any competitive edge is weak, uncertain, or not enough to gain market traction.
Moderate feasibility	2	The product has some niche appeal or partial advantages but still competes with established players. It could gain market share, but only with effort and differentiation.
High feasibility	3	A clear competitive edge exists, whether through cost, quality, sustainability, or uniqueness. The product can hold its own in the market and capture a solid share.
Very feasible	4	The product is highly differentiated or faces little to no effective competition. It offers unique value or fills a market gap, allowing it to dominate or displace existing options.

Appendix 3: Financial model dashboard

NorthlandInc

Market Opportunity Studies / Financial Feasibility Model / Dashboard

Consumption form selection: Pineapple - Fresh fruit

Grower feasibility

Crop grown: **Pineapple**

Estimated yield (tonnes/ha): 30 - 40 tonnes
Harvest multiplier: 0.83

Partial budget ($/ha) - Annualised	*From*	⟷	*To*
Revenue earned from growing Pineapple	$24,863	$52,205	$90,250
Costs associated with growing Pineapple	$47,613	$41,500	$32,530
Gross profitability of growing Pineapple	**-$22,751**	**$10,705**	**$57,720**
Gross Margin %	*-92%*	*21%*	*64%*

Required rate of return *(Only relevant for perrenial crops)*

Establishment costs (midpoint):	$146,500
Required rate of return:	6%
Useful lifetime of establishment costs (years):	
Minimum gross profit required (NPV = $0):	$25,094
Required farmgate price received for current yield/cost assumptions:	$2.74
Required retail price for current processing assumptions:	$5.94

Midpoint sensitivity of farmer gross profitability to Annual Yield and Farm Gate Price ($/ha)
Holding production costs constant at the midpoint estimate

Gross profitability of next best land use ($/ha): $0 *Default value to $0 if N/A*

Annual yield (t/ha)	Farm gate price received ($/kg)						
	$1.30	$1.58	$1.87	**$2.15**	$2.43	$2.72	$3.00
30.00	-$9,444	-$3,547	$2,350	$8,247	$14,144	$20,041	$25,938
31.67	-$9,607	-$3,383	$2,842	$9,066	$15,291	$21,515	$27,740
33.33	-$9,771	-$3,219	$3,333	$9,885	$16,438	$22,990	$29,542
35.00	-$9,934	-$3,055	$3,825	**$10,705**	$17,584	$24,464	$31,344
36.67	-$10,098	-$2,891	$4,317	$11,524	$18,731	$25,939	$33,146
38.33	-$10,261	-$2,727	$4,808	$12,343	$19,878	$27,413	$34,948
40.00	-$10,425	-$2,563	$5,300	$13,163	$21,025	$28,888	$36,750

Proportion of scenarios with a positive gross profit		**71%**
Proportion of scenarios that are more profitable than the next best land use		**71%**
Proportion of scenarios with a gross margin greater than	25%	**45%**
Proportion of scenarios that are more profitable than the required rate of return		**20%**

Processor feasibility

Input crop: **Pineapple**

Conversion efficiency (avg.) 100%

Earnings Before Interest and Tax - EBIT ($/Kilograms)	*From*	⟷	*To*
Revenue earned	$3.21	$5.58	$8.33
Processing costs (inc. cost of raw ingredient)	$4.98	$3.62	$2.26
Gross profit	-$1.76	$1.96	$6.07
Annualised cost of capital	$0.12	$0.13	$0.14
Allowance for annual fixed costs 4.00% *of revenue earned*	$0.13	$0.22	$0.33
EBIT	**-$2.01**	**$1.60**	**$5.60**
EBIT %	*-63%*	*29%*	*67%*

Sensitivity of processor EBIT to the Retail Price and the Farm Gate Price paid ($/Kilograms)
Holding all other inputs constant at the midpoint estimate

Retail Price paid by consumers	Farm gate price paid ($/kg)						
	$3.00	$2.72	$2.43	**$2.15**	$1.87	$1.58	$1.30
$4.50	-$1.36	-$1.08	-$0.79	-$0.51	-$0.23	$0.06	$0.34
$5.42	-$0.66	-$0.37	-$0.09	$0.19	$0.48	$0.76	$1.04
$6.33	$0.05	$0.33	$0.62	$0.90	$1.18	$1.47	$1.75
$7.25	$0.75	$1.04	$1.32	**$1.60**	$1.89	$2.17	$2.45
$8.17	$1.46	$1.74	$2.03	$2.31	$2.59	$2.88	$3.16
$9.08	$2.16	$2.45	$2.73	$3.01	$3.30	$3.58	$3.86
$10.00	$2.87	$3.15	$3.44	$3.72	$4.00	$4.29	$4.57

Proportion of scenarios with a positive EBIT		**84%**
Proportion of scenarios with a EBIT margin greater than	7.50%	**73%**

Opportunity cost of growing Pineapple

Copy and paste the gross profit of the next best alternative crop (i.e. the alternative crop with the lowest net benefit) into cell H21 to test the sensitivity of gross profit to exceed this threshold.

#	Alternative crops	Gross profit estimate – Low	Gross profit estimate – Average	Gross profit estimate – High	Net benefit of growing Pineapple compared to alternative crop - Avg.
1	Pineapple	-$ 22,751	$ 10,705	$ 57,720	
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

Potential scale of a Northland Pineapple industry

Particulars	Consumption form 1		Consumption form 2		Consumption form 3	
Consumption form						
Annual consumption (Kg/L)						
	Low	High	Low	High	Low	High
Demand (%)						
Demand (Kg/L)	0	0	0	0	0	0
Conversion efficiency						
Raw product required (Kg)						
Raw product required (tonnes)						
Avg. yield estimate (tonnes)						
Growing hectares required						
Total growing hectares required:	**0 - 0 Hectares**					
Aggregated gross profitability:	**$00 - $00**					