

Facilitating growth in the New Zealand Hemp Industry

Ministry for Primary Industries

Final report

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Executive summary

The industrial hemp industry is rapidly developing internationally, driven by recent deregulation and increasing interest in and demand for its use in a range of products. Whilst the industry in most countries is still in its infancy, governments are supporting the industry's development by working with industry to address issues, supporting growth and expansion in processors and investing in research and development in agronomics and innovative uses of hemp.

New Zealand has a number of comparative advantages for hemp production

New Zealand has the opportunity to gain a share of the value-add hemp market by leveraging:

- A strong track record in plant and food science and innovation
- Strong agronomic fundamentals that could support growth of the hemp crop in certain regions
- New Zealand's "Clean and Green" market positioning which aligns with many of the desired characteristics of hemp products and increasing demand for sustainable products
- Availability of water in potential growing regions that can enable higher yields and crop viability, as industrial hemp requires significant amounts of water to grow at scale.

Executive summary cont.

There are lessons from international jurisdictions

There are some learnings for New Zealand from international jurisdictions who have been successful in growing their industrial hemp industries:

- Reliable processors and product manufacturers are key drivers of sustainable industry growth, as they create demand for the crop, ensure farmers get paid and create value-add products
- One of the key investments undertaken by most jurisdictions is the funding and establishment of trials to breed local seed varieties that are best suited for local climatic conditions and the development of approved seeds that ensure assurance of crop quality and reliability
- Few jurisdictions have developed programs or funding specifically for industrial hemp - where government funding has been made available, it is usually as part of a broader agricultural or business grants program
- Cannabidiol (CBD) is a major driver of value in a number of jurisdictions, and the regulatory framework around CBD will determine the scale of the potential market opportunity for the sector in New Zealand
- The majority of jurisdictions reviewed had their agricultural agency responsible for the industrial hemp sector (as opposed to the health agency), though a greater government focus on industry development, as opposed to a strict focus on consumer protection, tended to be a more important factor than the responsible agency (e.g. in Canada).

Executive summary cont.

Extent of the potential market opportunity

We modelled four potential scenarios for the future trajectory of the global industrial hemp market, and the proportion of that global market that New Zealand could potentially capture.

| | Driver of future global growth | Global market CAGR* | 2020 value | NZ market share % |
|------------|--------------------------------|---------------------|------------|-------------------|
| Scenario 1 | Fibre | 13.7% | \$3.6b | 0.1% |
| Scenario 2 | Food | 22.0% | \$3.9b | 0.1% |
| Scenario 3 | Food | 22.0% | \$3.9b | 0.5% |
| Scenario 4 | Food | 34.0% | \$4.2b | 1.0% |

We consider the most likely scenario to be Scenario 2, where New Zealand captures 0.1% share of the estimated global industrial hemp market by 2030, where future growth in market value is driven by food products.

Under this scenario, Sapere estimates New Zealand could generate \$24.9 million and \$5.3 million in export and domestic revenue. This would be dependent on the ability of New Zealand processors and manufacturers to identify, develop and market, value-added products that utilise industrial hemp.

*CAGR = Compound Annual Growth Rate

Executive summary cont.

There are actions the Government could take to support the development of the New Zealand hemp industry

- Support opportunities to help businesses develop new products using industrial hemp or processing practices that could enable more efficient processing and extraction, particularly (but not exclusively) in food or personal care products
- Work with the industry to develop trials of different strains of hemp that are best suited to New Zealand's unique conditions and their highest value applications
- Establish an industrial hemp advisory committee bringing together key industry and government stakeholders to advise on policy, industry and regulatory issues
- Undertake more detailed analysis of the economics of the post-farm gate processing of different hemp products and the competitiveness of New Zealand production options
- Identify gaps in and develop the skillset of workers, services and manufacturing practices to utilise hemp seed (and other) oils in nutraceuticals and personal care products.

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Introduction

Purpose of the report

This report was commissioned by the Ministry for Primary Industries (MPI) to develop a stronger understanding of the potential market opportunities for industrial hemp in the food, seeds and fibre markets. In particular, MPI sought to develop an assessment of the following:

- New Zealand's comparative advantages in the global market for industrial hemp including potential market niches
- Development of robust estimates of the potential size of the market opportunities for New Zealand industrial hemp and high potential geographic markets (based on currently available information and data)
- Identification of the key barriers (regulatory and non-regulatory) for enhancing export revenue growth for the New Zealand industrial hemp industry
- Identification of the options (and relative priorities) for the New Zealand Government to facilitate the growth of the New Zealand industrial hemp industry to pursue the identified market opportunities.

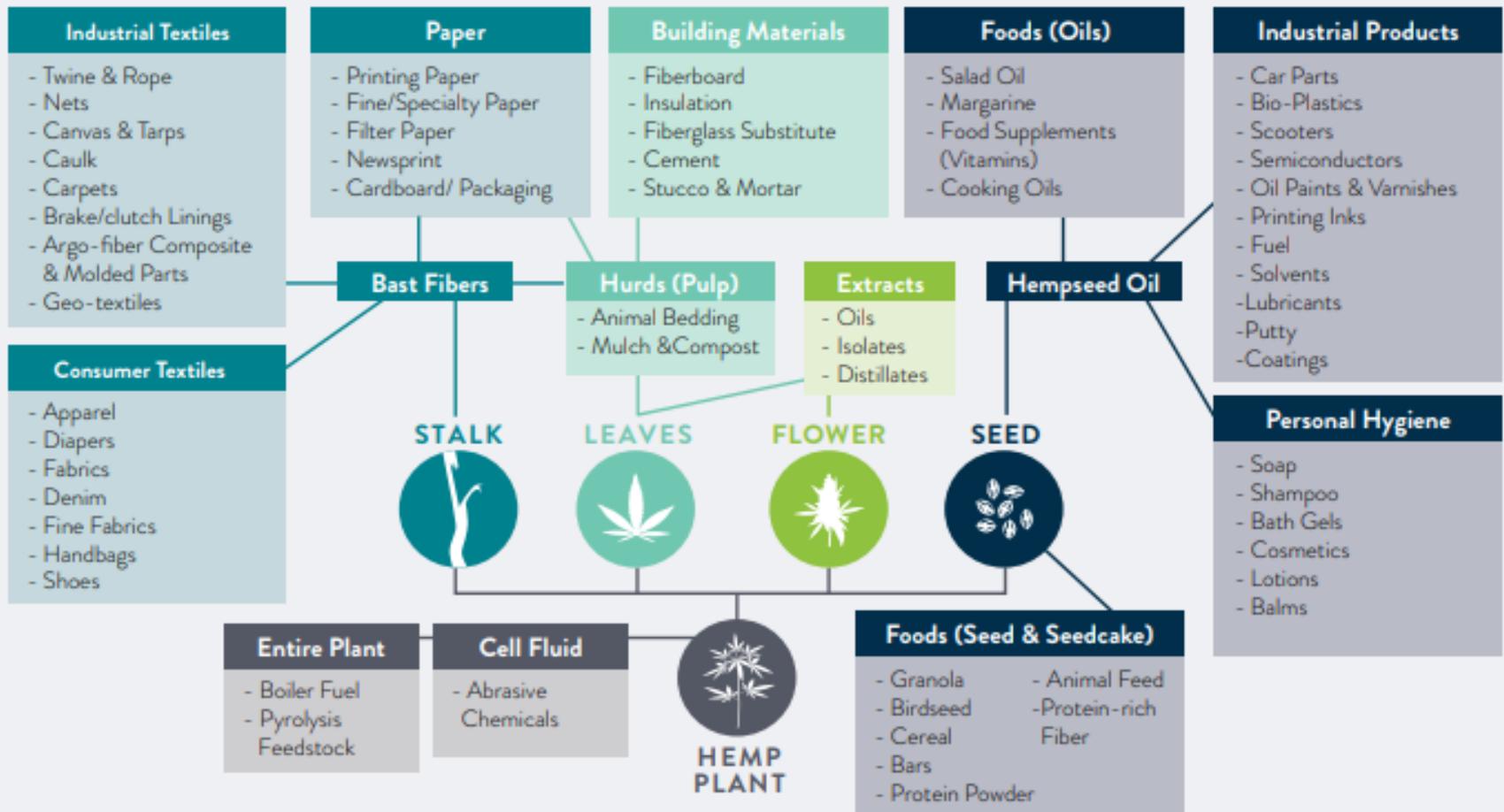
Approach

The key steps in the approach adopted for the preparation for this report were the following:

- A comprehensive desktop review of the available information and data in relation to the size, structure, legal and regulatory frameworks and dynamics of the industrial hemp sector globally
- A review of key international jurisdictions including Canada, Australia, USA, UK and the Netherlands to identify what regulatory and non-regulatory system might be best placed to enable the New Zealand industrial hemp industry to grow
- The modelling of the potential market opportunity based on publicly available forecasts of growth of the global industrial hemp sector.

Product market and structure

Products derived from hemp

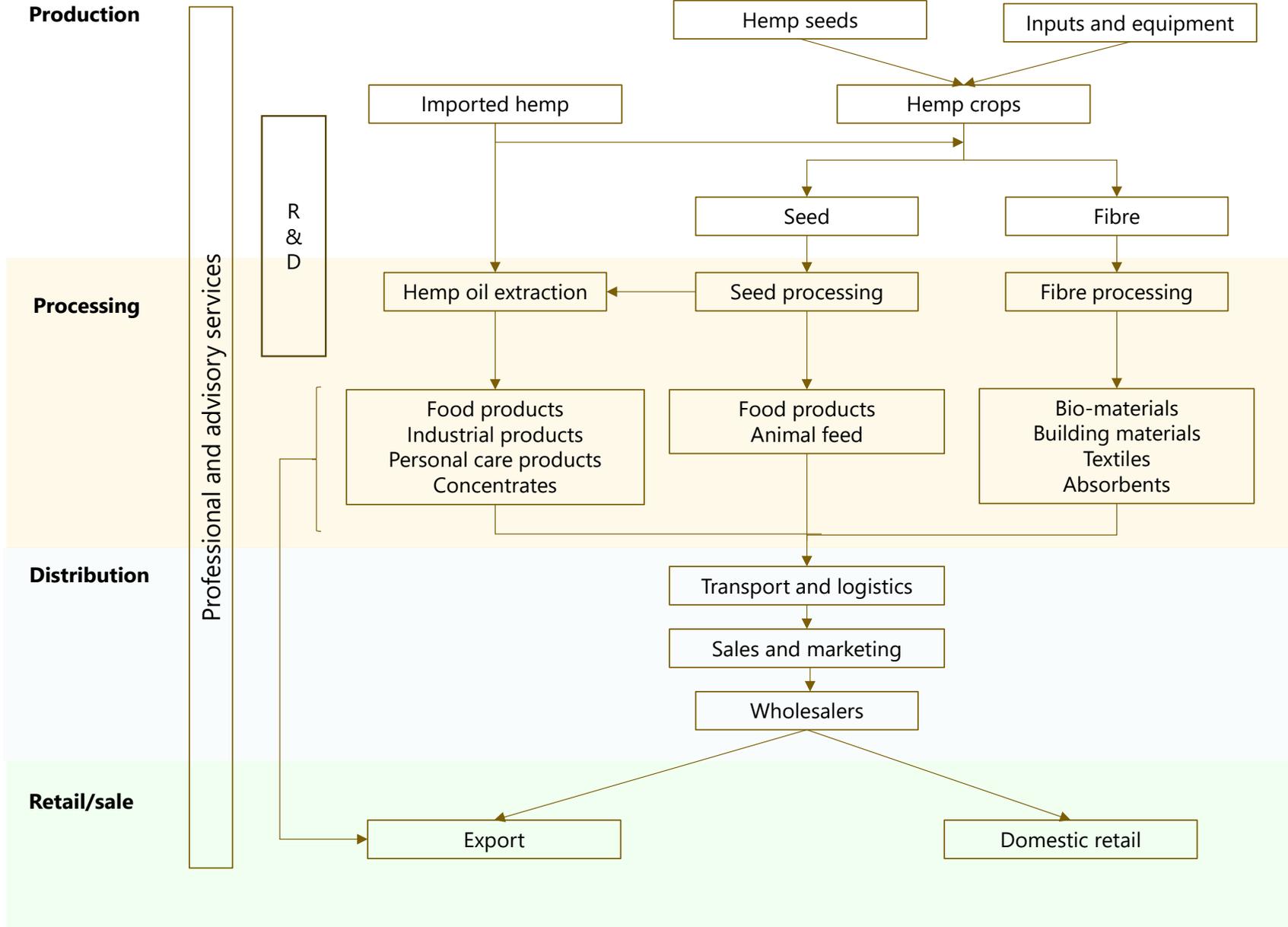


Source: New Frontier Data (2019) The US Hemp Market Landscape - Cannabinoids, Grain & Fibre

Market segmentation

| Product type | Attractive aspects of hemp | Substitutes |
|----------------------------|---|--|
| Grain | | |
| Food products | High protein content, positive fatty acid profile, high levels of antioxidants | Fava beans, rapeseed, flaxseed etc... |
| Stock or pet feed | Improved nutritional characteristics to food derived from animals and added digestibility benefit of feed | Feed fibre sources (e.g. alfalfa hay) |
| Fibre | | |
| Bio-materials, bioplastics | High tensile strength, lightweight, sustainable, impact resistance, good thermal insulation, absorbency | Fibreglass, Kevlar, polystyrene, glass |
| Building materials, pulp | | Concrete, wood, talc, silica |
| Garments, textiles, paper | | Cotton |
| Oil | | |
| Food inputs | High protein content, positive fatty acid profile, high levels of antioxidants | Oils from protein-rich plant foods |
| Personal care products | Variety of reported benefits including improved brain function, muscle fatigue, cardiovascular health | Plant-based oils or derivatives |
| Bio-fuel | Low ignition temperature, good physical attributes, high yields | Feedstock fuels |

The hemp industry supply chain



The evolving market for industrial hemp

The many uses of industrial hemp will likely compete with a range of existing products, and that these competing products such as cotton and synthetic fibres aren't static in their attributes. These products will also evolve and improve their yields and benefits. Industrial hemp's long term viability will be a direct function of the extent that it can retain a competitive edge over these other resources and remain profitable.

"While hemp can be used as an input to produce thousands of items, ultimately, businesses contemplating using hemp in their products must find hemp cost competitive with other competing inputs such as synthetic or other natural fibres, alternative oils, and other dietary/health supplements and therapeutic compounds. **For farmers, hemp must be profitable relative to other potential crops and agricultural enterprises and competitive with hemp imported from competing countries.** Demand for hemp will be shaped by the utility consumers receive from purchasing hemp products, which includes perceived health and environmental benefits, subject to price levels for hemp products and income constraints."

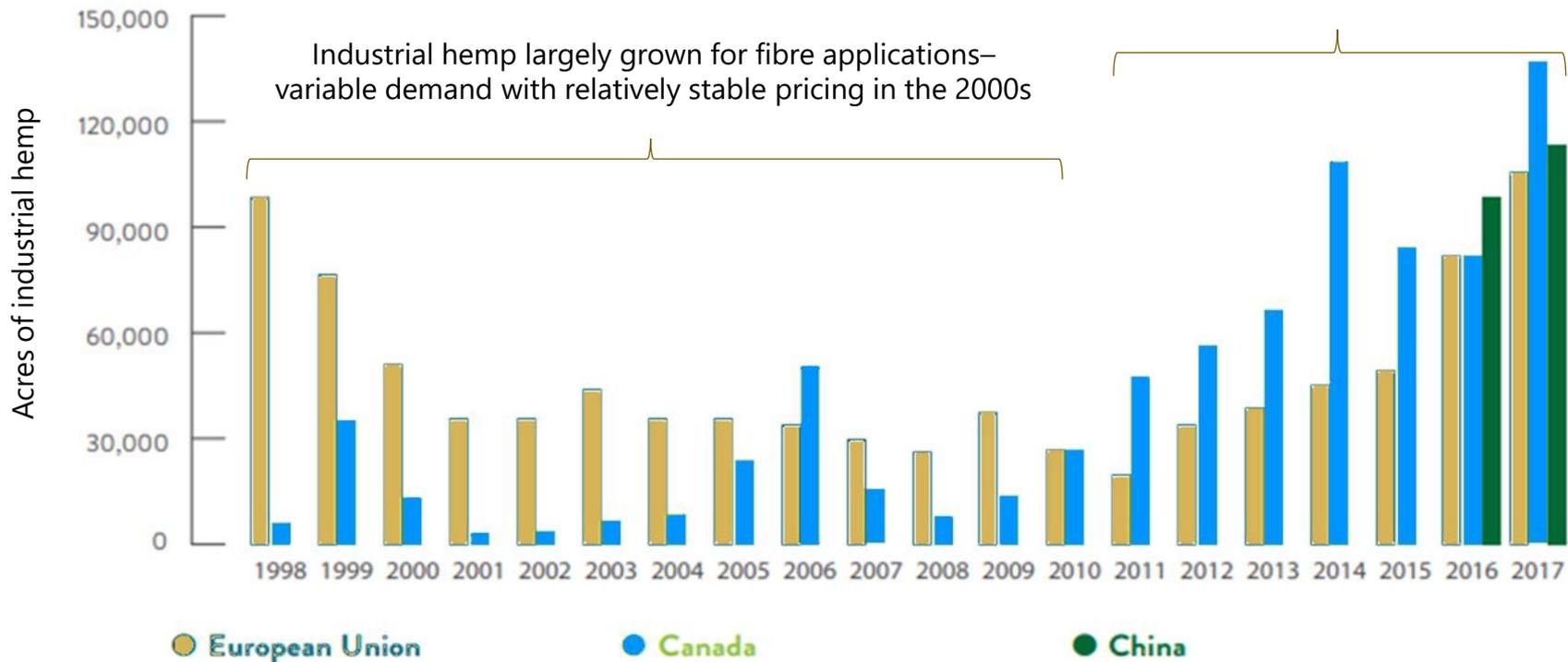
- *University of Kentucky Economic and Policy Update, Feb 2019*

Global hemp market

Global industrial hemp production

Hemp production has grown strongly in recent years but remains dominated in volume by the three largest producers – Canada, China and the EU (France, Netherlands). A number of other jurisdictions (notably the USA) are expected to become major suppliers in the future.

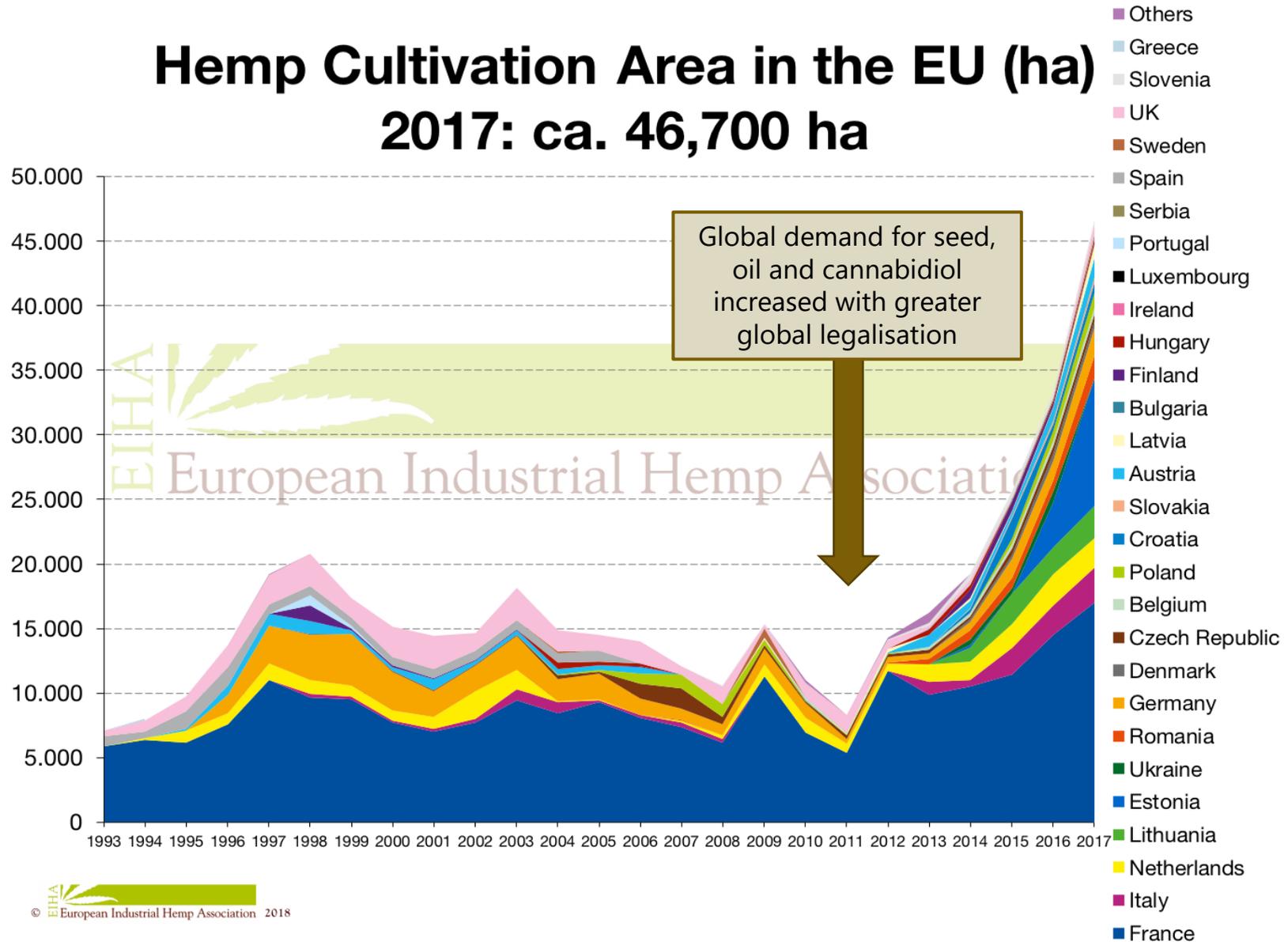
Increased global legalisation and greater product range drives demand growth and higher prices for crops, now primarily grown for seed



Source: New Frontier Data (2019) The Global State of Hemp 2019

Hemp Cultivation Area in the EU (ha)

2017: ca. 46,700 ha



Source: Based on data from European International Hemp Association (2018)

Current demand for industrial hemp products is concentrated in high income western economies

The demand for value-added hemp products at the moment is largely concentrated in high income western countries and this is expected to continue to 2030

- USA, Europe, Canada, Australia
- Largely concentrated in consumables (food, beverages, cosmetics)
- The incorporation and use of cannabidiol (CBD) in products is driving a significant proportion of growth from a value perspective, but an increasingly broad range of products incorporating hemp is making its way onto shelves.

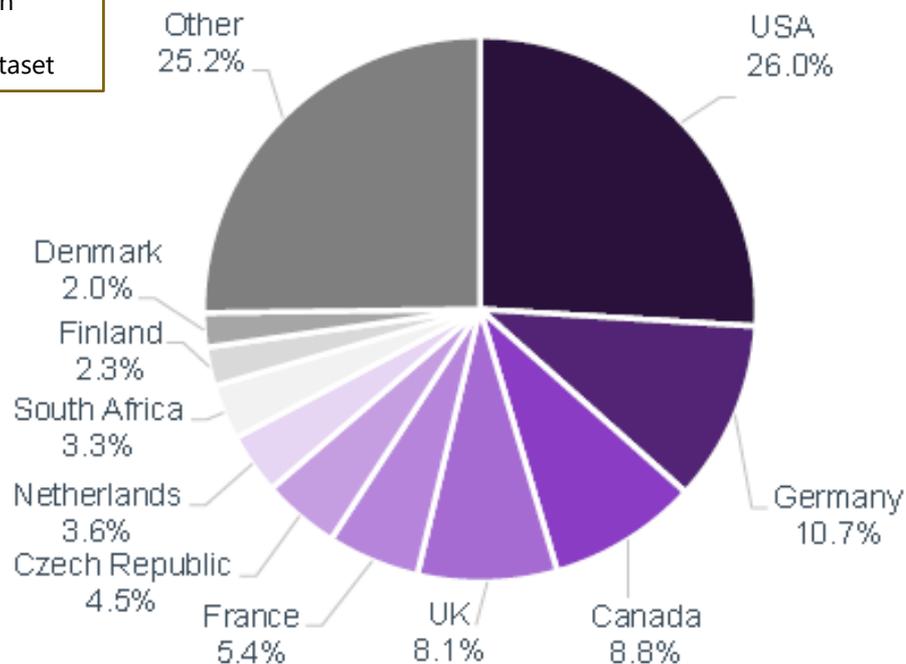
Demand is growing significantly in Asia, in part due to China's major role in the fibre market and the incorporation of increasingly diverse applications of hemp fibre in a range of industrial uses

- China is a major player, but Japan and South Korea are also increasingly importing raw hemp and hemp products
- Increasing number of industrial applications but also strong demand for inclusion of hemp extracts and CBD into health products and cosmetics.

The USA is the largest and fastest growing consumer market for hemp products

Hemp product launches – 2012-2018

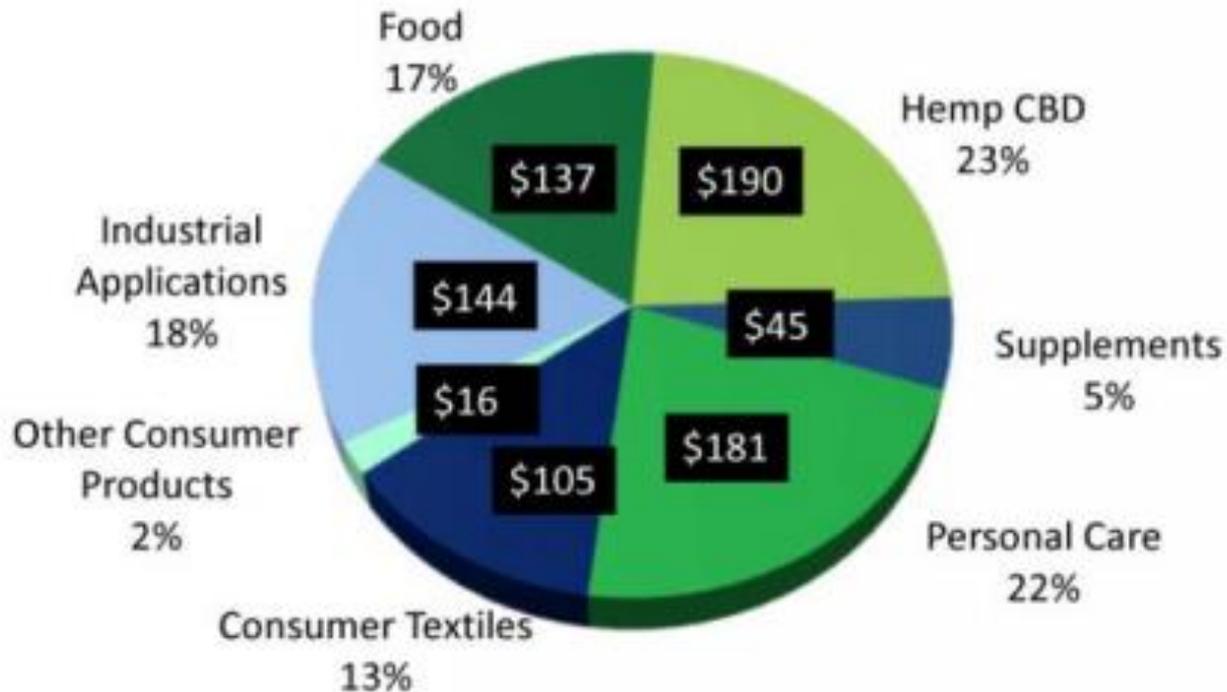
The US is the largest market for hemp based products with over one-quarter of all product launches captured in MPI's Economist Intelligence Unit dataset



Source: MPI (2019) Global Hemp Markets Product and Consumer Landscapes

Consumer spending across product types is broad based

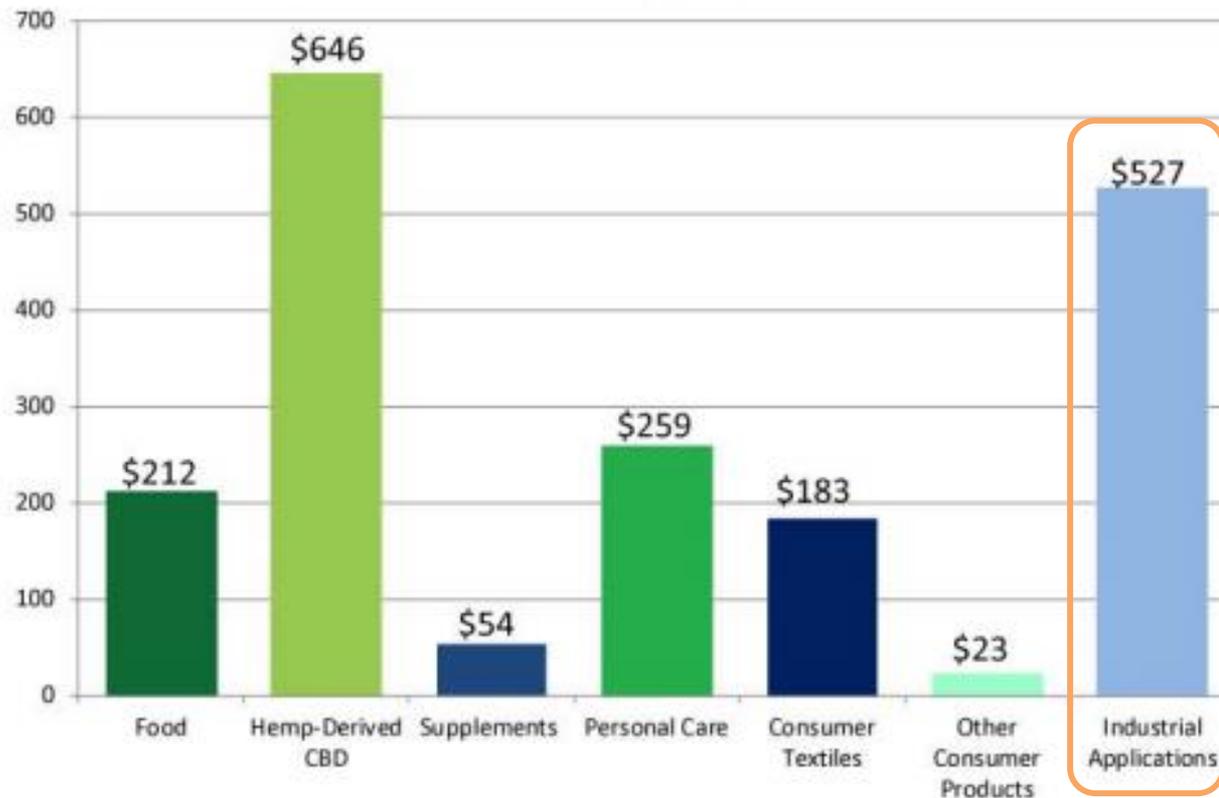
\$820 Million U.S. Hemp-Based Product Sales by Category in 2017



Source: Hemp Business Journal (2018)

Future growth is expected to be driven by CBD and industrial fibre applications

Forecast of expected US hemp-based product sales by category



New Frontier forecasts \$318m of the industrial applications to be in automobiles

Comparison of international
jurisdictions – market structure,
regulatory framework and industry
support

Overview of international jurisdictions – summary

Industrial hemp and industry support

While an increasing number of countries have shown an interest in the potential of developing industrial hemp industries, the majority of these countries are still in the early stages of legalising industrial hemp and the development of the supply chain and supporting elements for the industry.

Government support varies across the different jurisdictions, usually based on the relative level of maturity of the hemp industry and the market position and niche of the jurisdiction in question.

Support provided in the jurisdictions studied for this report include:

| Form of support | Relevant jurisdictions |
|---|-----------------------------------|
| Development of industrial hemp strategies in collaboration with industry | Colorado |
| Investment into hemp seed trials | Australia, Kentucky |
| Grants for commercial R&D and investment into hemp businesses | Canada |
| Development of investigative taskforces or advisory committees to advise on the hemp industry | Australia, UK, Kentucky, Colorado |
| Tax incentives and subsidies for hemp growers | Netherlands |
| Investment to support the hemp industry demonstrate quality and grow exports | Canada |
| Establishment of an innovation centre to undertake R&D into hemp applications | Canada |

Links to descriptions and details of some of these interventions are provided in the references of this report.

Key themes from international review

Processors drive industry viability

In Canada and the Netherlands, the most successful hemp businesses tend to be vertically integrated, with downstream processors actively involved with the cultivation of industrial hemp. This is because these structures provide stronger assurance of price and demand for growers.

Situations such as the price crashes in the US in 2019 and Canada in 1996 and 2001 (when Canada primarily sold to the US) highlight the dangers of a disconnect between supply and demand in emerging markets.

Currently, there is considerable risk to farmers who grow without first contracting with a reliable processor who will pay them for their crop. Supporting good processors and connecting them to growers is key for the whole supply chain.

Developing local approved seeds

One of the key investments undertaken by most jurisdictions is the funding and establishment of trials to breed local seed varieties that are best suited for local climactic conditions.

In the case of Canada and the Netherlands, the development and use of a set of an approved cultivars has reduced the regulatory requirement for permits and testing. Colorado is working on developing a similar set of approved seeds.

It is likely raw hemp will become an increasingly commoditised crop in the future, and as such, crop viability will be dependent on scale and yield. Increased assurance of seed quality which drives the reliability of the crop grown will be key.

CBD is a major driver of growth

While there is growing interest in the different applications of industrial hemp across seed, fibre and extract, CBD (and the price for CBD extract) has been a major driving force in the increased interest in farmers for growing industrial hemp.

This is particularly the case in the USA where the majority of industrial hemp crops grown have been for the purposes of producing CBD.

Given New Zealand's current prohibition on the use of CBD (which is likely to continue given the result of the recent referendum on marijuana), caution should be exercised when comparing with jurisdictions where demand for industrial hemp is driven by a market that doesn't presently exist for New Zealand growers.

Key themes from international review

Industrial hemp has traditionally been localised

Despite being a general hardy plant that can grow under a number of different climates and conditions, industrial hemp tends to only be grown in particular locations and regions across the majority of jurisdictions around the world. Traditionally, this has been due to the high cost associated with transporting industrial hemp (in the case of fibre).

With rapid growth being seen across most states in the USA, as well as a number of Canadian provinces (though production is still dominated by four major provinces), it is possible that industrial hemp crops will become more widespread in the short to medium term.

However, as the crop becomes more commoditised, prices drop and import competition increases, it is expected that cultivation of the crop will concentrate in only the highest yield and most efficient locations.

Different approaches to government support

Collaboration between the hemp industry and government is a hallmark of a number of emerging (and established) jurisdictions, such as Canada, Colorado and Kentucky. As it is still early days for the industry, and its market structure and dynamics are still unclear, many governments have opted to play a facilitating role, working with industry bodies to support marketing, research and business investment.

Fewer jurisdictions have developed programs or funding specifically for industrial hemp. Where government funding has been made available, it is usually as part of a broader agricultural or business grants program.

Some exceptions include:

- New York has funding allocated specifically to support R&D/processing in the state
- Montana exempted hemp processing equipment from tax
- Canada has provided funding to develop a set of industry-wide standards for Canadian industrial hemp.

Agencies responsible for industrial hemp

The majority of jurisdictions manage industrial hemp via their agricultural agencies, as these agencies are usually involved with industry development – but not apparent that it matters a great deal.

| Jurisdiction | Agriculture | Health | Other |
|----------------|-------------|--------|--|
| Canada | ✓ | ✓ | Canadian Food Inspection Agency regulates the use of hemp in food products |
| Australia | | | FSANZ regulates the use of hemp in food products |
| Tasmania | ✓ | | |
| NSW | ✓ | | |
| VIC | ✓ | | |
| Queensland | ✓ | | |
| WA | ✓ | | |
| SA | ✓ | | |
| United States | ✓ | | Federal Dept of Agriculture provides legislation for industrial hemp, but state agricultural offices manage growers and licenses within their borders Food and Drug Administration regulates hemp food products and consumables |
| United Kingdom | | | Home Office manages regulation, import, export, production and licensing |
| Netherlands | ✓ | ✓ | Ministry of Justice and Security also administers the <i>Dutch Opium Act</i> |

Canada

Overview

- The largest producer of hemp-based food products in the world – major seed producer and exporter
- 37,435 hectares of hemp in 2019 concentrated in four provinces
- Estimated 2016 value (from CHTA estimates)
 - Exports: \$NZD166 million
 - Domestic: \$NZD40 million
 - Jobs: 1,253 FTE
- Major export destination is USA (>70%), EU and South Korea
- Significant investment by local hemp industry (\$53 million in private capital invested in 2018) – modern decortication plants being built to process fibre at scale
- Hemp usually grown as a rotational crop with other broadacre grains

Regulatory framework

Regulation

- Hemp seed, fibre, flowers, leaves, and branches are permitted to be cultivated and processed (but high-CBD cultivars are not yet permitted)
- Hemp farmers are required to purchase “clean” seed every year from a registered seed establishment and from a list of government approved cultivars
- The sale of natural health products containing CBDs are prohibited
- THC threshold of 0.3% but no THC testing if plants are from certified seed.

Governance

Licensing and control of production is under the control of Health Canada, while R&D and certification and inspections are under the remit of Agriculture Canada.

Industry overview

Characterised by a number of major companies which are fully vertically integrated, such as Hemp Oil Canada and Manitoba Harvest (which now operate under the same parent company). The largest companies in the industry control every stage of the supply chain from cultivation to sale.

While the industry currently enjoys a first-mover advantage, inconsistent demand for hemp led to oversupply and price crashes in industrial hemp crops in 1999 and 2006. The Canadian Hemp Trade Alliance (CHTA), established in 2003, is the industry body and works closely with the federal government on matters of hemp industry marketing, policy, research and governance.

Canada – government initiatives

The Canadian Government has invested and supported the industrial hemp industry in a number of ways, which focused on improving processor capabilities and investment into R&D.

Federal Government

2010: The federal government invested \$728,000 to increase production capacity and improve processing practices in the hemp industry and “make new inroads into the US market”, including investment into two processors’ facilities and \$18,625 to enhance the CHTA website and taking steps to remove trade barriers to the US.

2011: Through its AgriMarketing Program, the federal government invested \$55,000 for the Canadian Hemp Trade Alliance to “promote the high quality of Canadian hemp to international markets”. This included placing the Canada Brand and new CHTA logo on promotional materials as well as a trade show booth.

2018: The federal government invested \$330,550 CAD to develop industry-wide grading standards so that Canadian hemp products could be recognised globally for their quality and consistency.

Provincial Governments

Since 2007: \$12.5 million of federal and provincial funding has been invested into four Diversification Centres in Manitoba, which are research organisations developing better hemp cultivars and improving agronomics.

2009: The Alberta Provincial Government, along with local industry, investors and innovators, established the \$15 million (exact investment by government not specified) Alberta Biomaterials Development Centre (ABDC) which is a virtual innovation centre developing new products using biomaterials including hemp

2010: The Federal and Manitoba government announced combined funding of \$5.3 million (\$4.7 million from the Federal Government) to help set up a hemp fibre decortication plant in the province

2015: The Ottawa Provincial Government provided \$4.5 million in funding to support the creation of Canada’s first facility to manufacture bio-composite fibre mats using hemp

Australia - Tasmania

Overview

- The largest producer of industrial hemp in Australia, primarily in hemp seed for food
- 1,600 hectares of hemp in 2019
- Estimated value of \$NZD 5.4 million (from DPIPW)
- Tasmanian hemp growers have developed a set of seed varieties suited to the region's climate
- CBD extraction is not permitted for any purpose
- Hemp usually grown as a rotation crop with potatoes, poppies and grains

Regulatory framework

Regulation

- Hemp seed, fibre and extracts are legal to be produced but flowering heads and leaves cannot be sold or used for human consumption
- Unless industrial hemp straw has been subject to a process that renders the seed non-viable, industrial hemp straw cannot be sold as garden mulch
- THC threshold of 1.0% - plants sampled at expense of the grower

Governance

The Tasmanian Department of Primary Industries, Parks, Water and Environment is responsible for administration of the *Industrial Hemp Act 2015* which authorises the cultivation and supply of industrial hemp

Recent government initiatives

A partnership exists between the Industrial Hemp Association of Tasmania, the Tasmanian Institute of Agriculture (TIA), and supported by the Tasmanian Government to research crop varieties and trials for improving yields from industrial hemp in Tasmania.

Industry overview

Despite accounting for 80% of total industrial hemp seed production, the industry remains relatively small – with an estimated 49 growers in 2019. Despite the first-mover advantage compared to the mainland states, Tasmanian hemp production is limited by only having one growing season and the majority of processors being located on the mainland.

Australia - other

Overview

- The mainland states of Australia are not as far advanced as Tasmania in industrial hemp production and research
- Most major processors are located on mainland Australia, but import most of their supply from Tasmania
- Production and processing of flowering heads or leaves (and thus, the production of CBD) is not permitted in any state
- A number of states are undertaking seed trials and developing local seed cultivars

Regulatory framework

Regulation

- Typically, hemp seed, fibre and extracts are legal to be produced but flowering heads and leaves cannot be sold or used for human consumption
- Most states have THC threshold of 1.0%, except for Victoria which has a threshold of 0.35%
- Some states require that seeds used to grow industrial hemp cannot come from a plant with a THC concentration of more than 0.5%.

Governance

The state Department of Primary Industries (or equivalent) is responsible for enforcing the relevant legislation relating to industrial hemp in every state in Australia.

Recent government initiatives

Victoria - In 2019, The Victorian Government established a Taskforce to explore the challenges and opportunities facing the industrial hemp industry.

Queensland – The Queensland Department of Primary Industries has set up an Industrial Hemp Advisory Committee

South Australia - The SA Government has recently invested in a fourth season of industrial hemp trials to see how different varieties react in South Australian conditions.

Western Australia – \$300,000 was invested by the state government in the Industrial Hemp Grant Scheme. The scope of the successful projects included investments to improve exporting, seed viability, local processing hubs and food production.

USA - Kentucky

Overview

- Kentucky is the leading state in the USA for industrial hemp production and R&D
- 10,724 hectares of hemp (92% for CBD) in 2019
- Estimated value of \$NZD71 million of hemp crop in 2019 (from KDA)
- Processors and handlers reported \$NZD 270 million in gross product sales in 2019 (from KDA)
- State legislation permits the consumption and retail sale of CBD products in Kentucky

Regulatory framework

Regulation

- Hemp seed, fibre and extracts (including CBD) are permitted to be cultivated and processed but only licensed growers and processors are permitted to buy and sell raw hemp (fibre/seed/extracts), so farmers can only sell to in-state processors
- CBD products cannot be transported and sold out of state
- THC threshold of 0.3%

Governance

The Kentucky Department of Agriculture (KDA) is responsible for the management of industrial hemp within the state, but it is required to develop and submit an industrial hemp strategy to the USDA for approval.

While states regulate food alongside and in cooperation with the FDA, states are responsible for food safety within state borders while the FDA's mandate is to regulate interstate food and drug safety.

Recent government initiatives

In 2018, the Kentucky Economic Development Finance Authority provided \$300,000 in tax incentives to a private company to establish a \$5.8 million factory in the state to produce hempwood.

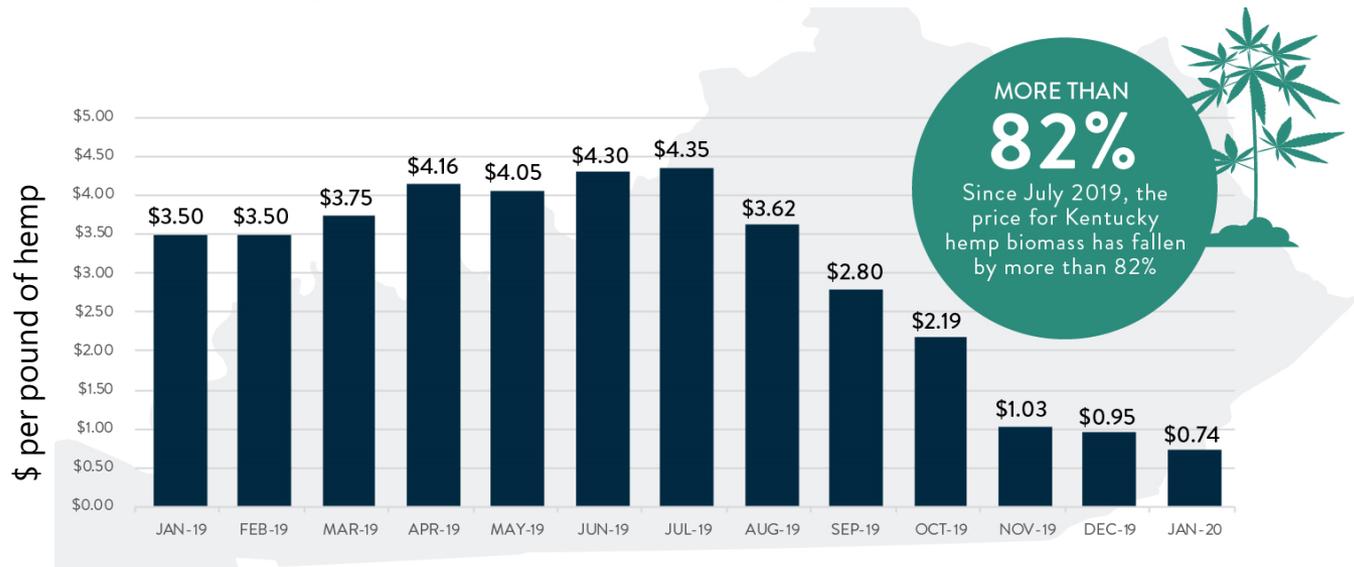
The Kentucky State Government has established the Industrial Hemp Advisory Board as a statutory body that advises the Kentucky Department of Agriculture on policy and administration of the state's hemp program. This group includes a number of farmers, academics and processors.

USA - Kentucky

Industry overview

Kentucky was a major hemp growing region in the past but declined in the 1930s. Since the change in the Farm Bill in 2018, the state has grown rapidly both in cultivation and processing. The KDA says processors reported spending \$207.3 million on capital investment projects in 2019, up from \$23.4 million in 2018. Due to the recent changes in the Farm Bill, vertically integrated companies are less common.

One important event that occurred in 2019 was the oversupply of Kentucky hemp fibre, which resulted in the collapse of the hemp price in 2019. This left many farmers unable to recuperate their investments into the crop and being forced to either find storage for their crops or sell at a significant loss.



Source: New Frontier Data (2019) The US Hemp Market Landscape - Cannabinoids, Grain & Fibre

USA - Colorado

Overview

- Colorado is the current leading producer of industrial hemp in the USA, the majority of which is raised for CBD
- 32,374 hectares of hemp in 2019 – total value of production not reported
- One of the first states to establish its state-wide strategy for industrial hemp

Regulatory framework

Regulation

- Hemp seed, fibre and extracts (including CBD) are permitted to be cultivated and processed within the state
- All parts of the plant, including CBD, are allowed as food ingredients
- CBD products cannot be transported and sold out of state
- THC threshold of 0.3%

Governance

The Colorado Department of Agriculture has jurisdiction over industrial hemp growers and the issuing of licenses, while the Colorado Department of Public Health and Environment (CDPHE) regulates the processing, sale or distribution of industrial hemp and its products for human use or consumption within the state.

Recent government initiatives

The Colorado Government developed the Colorado Hemp Advancement and Management Plan in 2018, which was submitted to the USDA in 2019 and approved in 2020.¹ The CHAMP outlines the roadmap and development pathways needed for industrial hemp to succeed in Colorado and represents consultation with over 100 different industry and government stakeholders.

The Colorado Department of Agriculture works closely with the Colorado Seed Growers Association on its certified hemp seed program, developing cultivars suited for Colorado's climate.

Industry overview

The Colorado hemp industry remains in its early stages, with a number of distinct but largely unconnected suppliers and processors.

¹ <https://ag.colorado.gov/plants/industrial-hemp/champ-initiative>

United Kingdom

Overview

- Home to the largest CBD market in Europe, but has a largely underdeveloped industrial hemp industry
- 800 hectares of hemp in 2019 – total value of production not reported
- Home to a number of processors, but mostly imports hemp
- Hemp is primarily grown for oil and fibre production

Regulatory framework

Regulation

- Hemp seed, fibre and extracts are permitted to be cultivated and processed
- Processing of flowers and leaves is prohibited, and must be destroyed on-site
- Cultivation is restricted to EU-certified cultivars
- THC threshold of 0.2% as per previous EU requirement, with hemp-containing food treated as a 'novel food' per the EU definition.

Governance

Licensing and oversight of the industrial hemp industry in the UK is overseen by the Home Office.

Recent government initiatives

The UK has recently announced the formation of a taskforce to review, amongst other things, the potential for the UK to legalise CBD for use in over-the-counter goods

Growers can claim a subsidy from the government for growing industrial hemp, but this does not apply if it is grown solely for food.

Industry overview

A number of vertically integrated companies cultivating industrial hemp are already based in the UK - East Yorkshire Hemp provides fibre and on-site processing and Good Hemp produces hemp seed milk products. The majority of raw hemp is imported from outside the UK.

Netherlands

Overview

- The world's largest exporter of hemp fibre in 2019 and the second largest hemp producer in Europe
- Major producer of hemp fibre products and exporter of seed
- 1,877 hectares of hemp in 2019
- Estimated value of hemp exports of \$NZD 85 million in 2019 (from USDA estimates)
- Hemp typically grown as a rotational crop with sugar beets and potatoes

Regulatory framework

Regulation

- Hemp seed, fibre and extracts are permitted, as is the consumption and sale of food containing hemp
- Production of CBD from Dutch hemp is not permitted, however as an ingredient, CBD is recognized as a food supplement rather than a medicine
- Farmers do not require a permit to cultivate approved varieties of hemp
- THC threshold of 0.2% as per EU requirement.

Governance

The Dutch Opium Act which governs hemp is under the purview of three ministries: the Ministry of Health, Welfare and Sport, Ministry of Justice and Security and the Ministry of Agriculture, Nature and Food Quality

Recent government initiatives

In 2016, the Dutch government recognised hemp as an eligible crop to help farmers meet their greening obligations as hemp is recognised for biodiversity benefits for which they could receive subsidies.

In the past, the Dutch government and the EU subsidised the production of fibre products using hemp and some reports suggest this subsidy was critical in keeping the sector viable during this time.

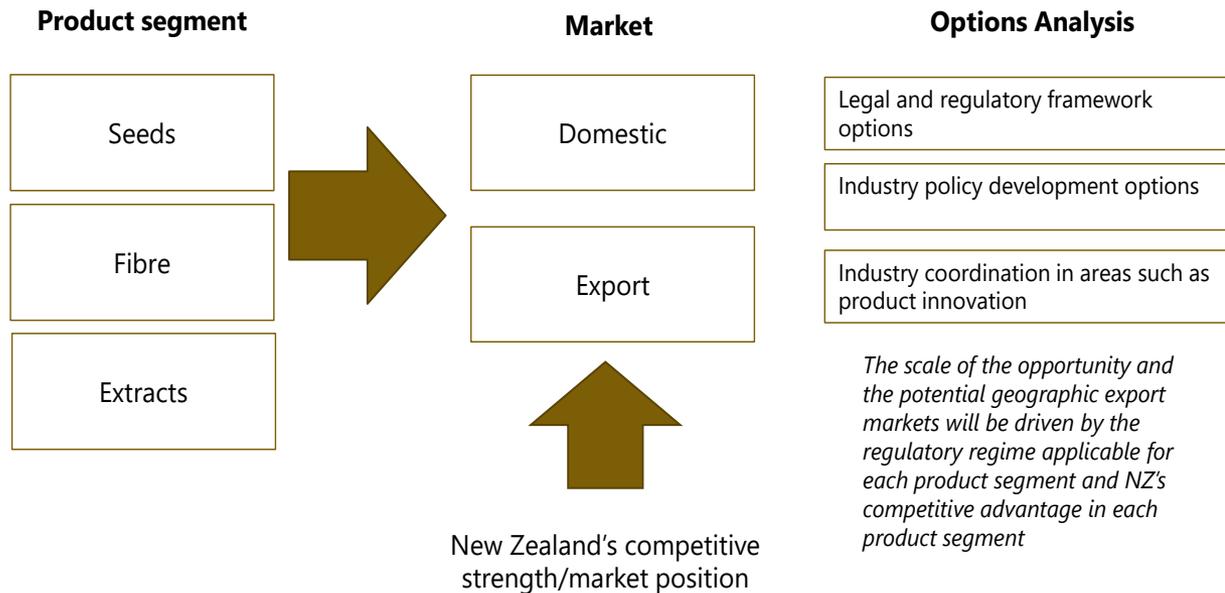
Industry overview

The Dutch industrial hemp industry has two processors – Dun Agro, which produces hemp fibre, hurd, seed and CBD products and Hempflax, which produce industrial products primarily using hemp fibre, and begun to produce extracts and harvest CBD outside the Netherlands. Both companies source hemp from domestic and international sources.

Market opportunity

Analytical framework applied for assessing the market opportunity for a New Zealand hemp industry

Analytical framework for market assessment



Our assessment of the market opportunity for the development of a hemp industry in New Zealand is based on the following:

- Review of the available data and information available globally on the hemp sector and product markets
- Assessment of the market structure legal and regulatory environment and barriers to entry in each part of the industrial hemp market
- Review of New Zealand's comparative advantages and how they align with industrial hemp market dynamics.

Market dynamics – implications for New Zealand

Market opportunity for the New Zealand hemp industry

Food and personal care products using hemp grain and extracts has the greatest potential for New Zealand

Development of IP and/or products using hemp-derived inputs

Key geographic regions for food and personal care products will include Australia, parts of Asia, USA and possibly Europe.

New Zealand's comparative advantage

Strong track record in plant and food science and innovation

Regions such as Canterbury have strong agronomic fundamentals that could support growth of hemp crop and be used in rotation with other arable crops

New Zealand's "Clean and Green" brand aligns with many of the desired characteristics of hemp products and increasing demand for sustainable products

Availability of water in potential growing regions to meet the amount required to grow industrial hemp at scale.

Factors influencing industry development

Regulations relating to industrial hemp (excluding CBD) not likely to be a major inhibitor

Poor perception of hemp and its association with cannabis still dampens demand

Low awareness of the benefits and potential substitution associated with hemp for growers and processors

Development of unique strains of hemp best suited for New Zealand's climate needed to maximise yield and viability

Development and investment in local supply chain will drive demand.

What type of hemp could be grown in New Zealand?

| Feasibility of crop in the medium term | |
|---|---|
| Grain | Medium – Canterbury’s climactic and soil conditions, combined with irrigation, has the potential to produce viable grain crop and a strong food sector could process and market these products. |
| Fibre | Low – New Zealand’s lack of broadacre agriculture, a major competitor in China, limited buyers and a need for specialised processing and machinery makes this more likely to be a complementary use for plants. |
| Extracts | Low – Oilseed hemp is currently not economically viable against other vegetable oils, and would likely need improved agronomic practices and varieties bred for New Zealand to become viable. Potential for use in personal care goods but would require fairly sophisticated supply chain to develop at scale. |

What products could be feasible in New Zealand?

| Product type | Feasibility of product in the medium term |
|---------------------------|---|
| Grain | |
| Food products | High – NZ has a strong reputation for clean and green food produce that is well respected globally, and a strong and innovative food sector that could take advantage of hemp grain. |
| Stock or pet feed | Low/medium – Large numbers of livestock create baseline demand and would represent another alternative use for grains grown, but hemp residues in meat and milk could create export issues. |
| Fibre | |
| Bio-materials | Low/medium – Nearby fibre powerhouse in China, but opportunities could exist for NZ innovation to develop IP and products such as sustainable packaging and plastic substitutes from hemp. |
| Building materials, pulp | Low/medium – Potential to replace existing materials, but would need specialist equipment, scale – is it better than importing? |
| Garments, textiles, paper | Low – Not industries that NZ has comparative advantages in. |
| Extracts | |
| Food inputs | Medium – Innovative food practices could find uses for hempseed oil, but would likely need to be imported initially. |
| Personal care products | Low – Clean and green reputation and growing demand for organic care products play to NZ's comparative advantages but would need a sophisticated vertically integrated supply chain. |
| Bio-fuel | Low – Yields are not significantly better than competing feedstock matter and would require specialised equipment. |

Key issues and barriers for the development of the industrial hemp industry in New Zealand

- R&D and extension services in hemp needed to identify most suitable varieties to grow in a New Zealand context to maximise yield and identify highest value use
- No local varieties – all seeds need to be imported, which can create reliability or timing issues
- Specific machinery, storage needed – specialised processing facilities are needed to treat hemp that would need to be imported
- Who is buying the hemp? Need assured and reliable processors and value-add manufacturers to drive sustainable demand for any locally grown industrial hemp crop
- Financial market products for hemp – crop insurance, access to credit, futures not yet present or immature makes it a riskier investment for farmers
- Lack of knowledge and expertise in hemp cultivation and in the development of more sophisticated manufacturing/ processing to develop products such as nutraceuticals.

Size of the potential
market opportunity

Considering the future trajectory of industrial hemp and the development of the New Zealand hemp industry

The rapid growth in demand for hemp-based products domestically and globally means that there is some potential for the New Zealand industry to tap into that growth. There is also clearly a motivation and energy from prospective growers and entrepreneurs who are excited about the possibility of a new crop and a growing market.

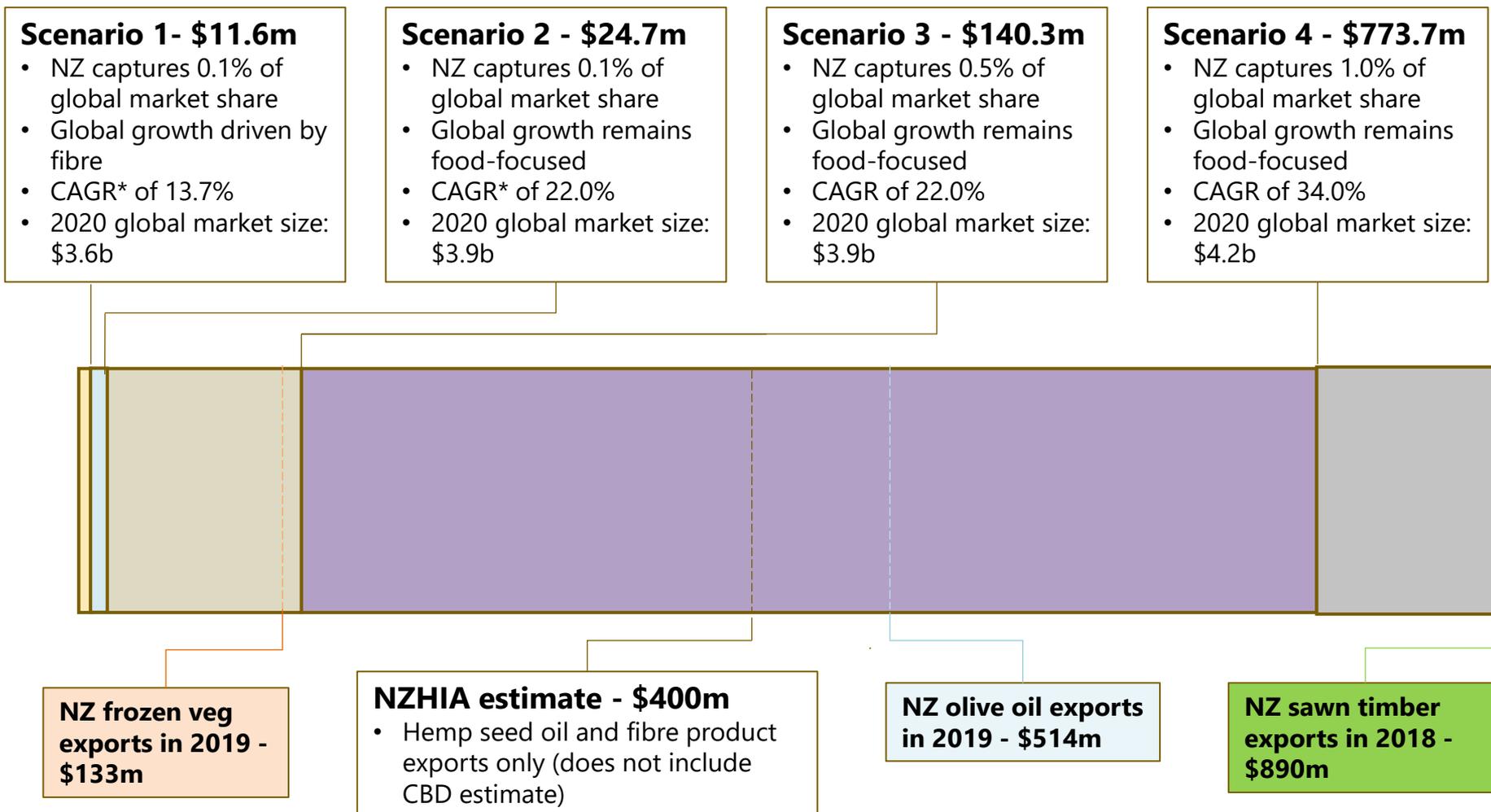
However, many international competitors have a number of strengths that make it harder for New Zealand to compete in areas where scale economies act as a comparative edge, such as in the cultivation of hemp in a broadacre fashion. This is particularly true for hemp grown for fibre, whose bulky nature makes it expensive to transport. However, even hemp grown for seed may not be feasible if over time, it becomes more cost competitive to import hemp seed rather than growing it locally.

A number of analysts expect industrial hemp to eventually become a commodity resource, and if so, the price of the crop is likely to fall from the returns that are presently being seen (which are heavily driven by the current price for CBD). In light of this, evaluating the prospects of the industry based on current returns may not be robust.

The extent to which New Zealand can create value-added products demanded by the market will be a key determinant in the development of an industrial hemp industry. This means that processors and manufacturers who can create innovative new products using industrial hemp and their success in global markets will likely be the key success factor for the development of the New Zealand industrial hemp industry.

Scenario analysis for exports by 2030

Estimated total value of the New Zealand hemp industry as of 2020 is between **\$3-5 million** (see modelling assumptions)



**Industry export estimates are based on Stats NZ compiled overseas merchandise data

*CAGR = Compound Annual Growth Rate

What is the most likely outcome for New Zealand?

While we have modelled four scenarios for exports, these scenarios are based on the low, medium and high ranges for:

- Compounded annual growth rate (CAGR)
- Proportion of the global market that New Zealand captures
- Estimated value of global industrial hemp market in 2020
- Whether the future growth of the global industrial hemp market is driven by food or fibre (as New Zealand will be more likely to be able to capture more value if food is the main driver)

Of the four scenarios, we consider Scenario 2 to be the most likely scenario to occur. We explain our reasoning on the following page.

| | Driver of future global growth | Global market CAGR | 2020 value | NZ market share % |
|------------|---------------------------------------|---------------------------|-------------------|--------------------------|
| Scenario 1 | Fibre | 13.7% | \$3.6b | 0.1% |
| Scenario 2 | Food | 22.0% | \$3.9b | 0.1% |
| Scenario 3 | Food | 22.0% | \$3.9b | 0.5% |
| Scenario 4 | Food | 34.0% | \$4.2b | 1.0% |

Determining the parameters for Scenario 2

Comparisons to other industries global market shares

While it could be argued that New Zealand claiming 0.1% of the industrial hemp market share is too small, consider the global market share that New Zealand holds in the following industries:

- Seafood: 0.2% of total global market trade
- Vegetable products: 0.5% of total global market trade
- Wine: 1.0% of total global market trade.

The proportion of the global market captured reflects the ability of New Zealand to capture a niche in the global markets for these products. We are focused not only on the potential size of the prize, but also how likely it is that New Zealand will be able to capture a significant proportion of that prize given the dynamics of that market.

We also note that it took 10+ years for these markets to arrive at their present market shares, and their product types are significantly different to the type of products that are produced from industrial hemp.

Given these differences, we consider a more conservative estimate of the likely proportion of the global market that New Zealand could capture.

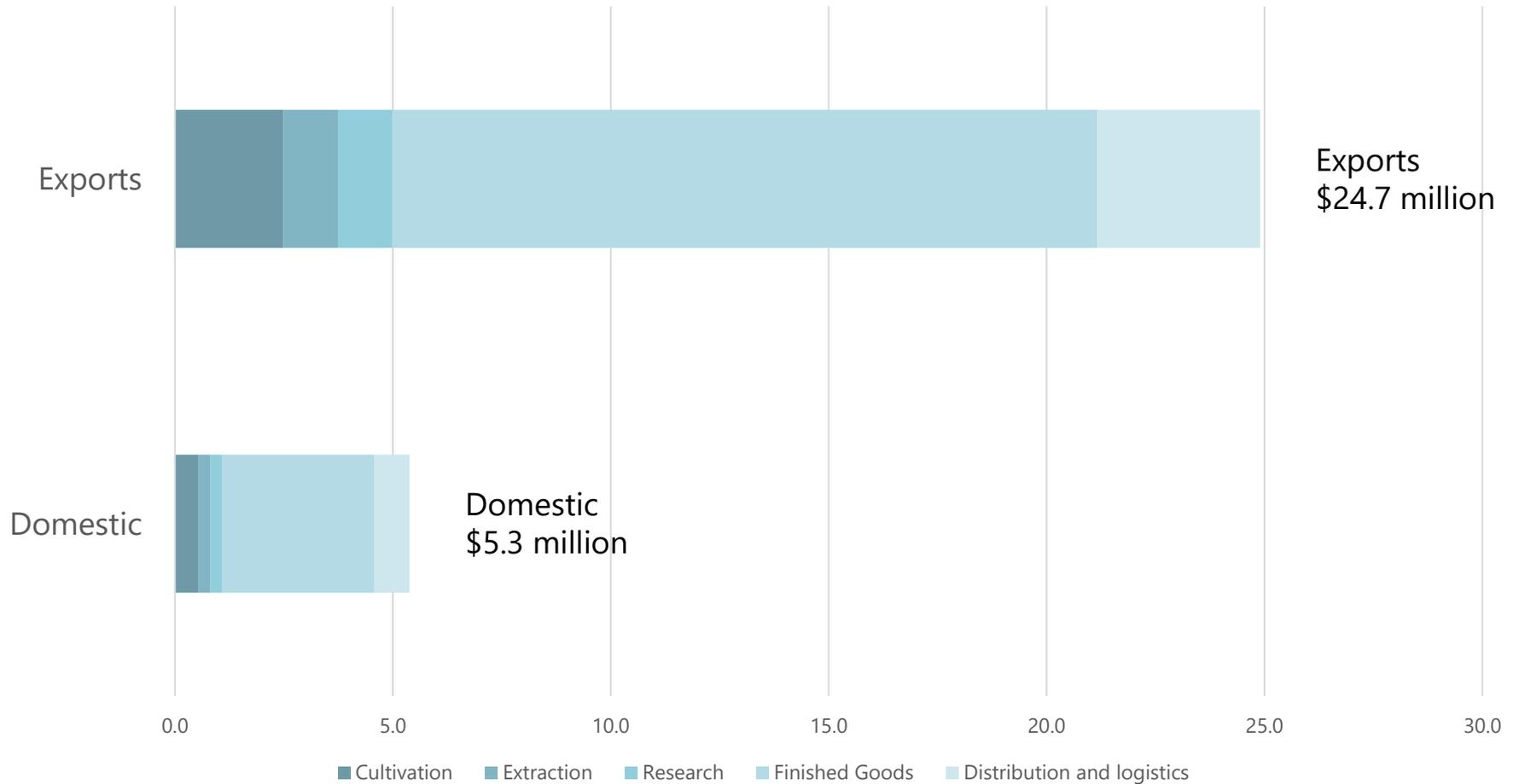
Comparisons to other estimates

We consider a sense check of the potential size of the market opportunity for New Zealand against other publicly available forecasts. In Australia, market research by Coriolis in 2017 expected turnover for industrial hemp seed products in Australia to reach between \$15-\$20 million by 2025 (Coriolis, 2017).

We would expect that the value of industrial hemp products in New Zealand would likely be smaller than this: New Zealand has less ability to scale up its industry due to a smaller economy and population, less experience in the development of broadacre cropping compared to Australia and is currently behind the curve in industry development compared to states such as Tasmania, Australia's leading hemp growing state.

Based on our high-level calculation, if New Zealand were to capture 0.1% of the global market for hemp food products, that would be equivalent to \$9-16 million in exports by 2025, which aligns with the values expected in Australia by the Coriolis report. In contrast, if New Zealand captured 0.5% of the global market, this would result in an estimated value of between \$45-80 million in exports by 2025, which would be 3-4 times more than Australia for the same period.

If New Zealand is able to capture 0.1% of the industrial hemp market by 2030...



Value chain analysis - segmentation

For our analysis, we consider five parts of the value chain where revenue can be generated from industrial hemp. We define these below.

Distribution and logistics: Activities relating to the transport and distribution of finished industrial hemp products to retailers or for export

Finished goods: Activities relating to the production and sale of finished industrial hemp products

Research: Activities relating to research and development activities relating to the cultivation and processing of industrial hemp

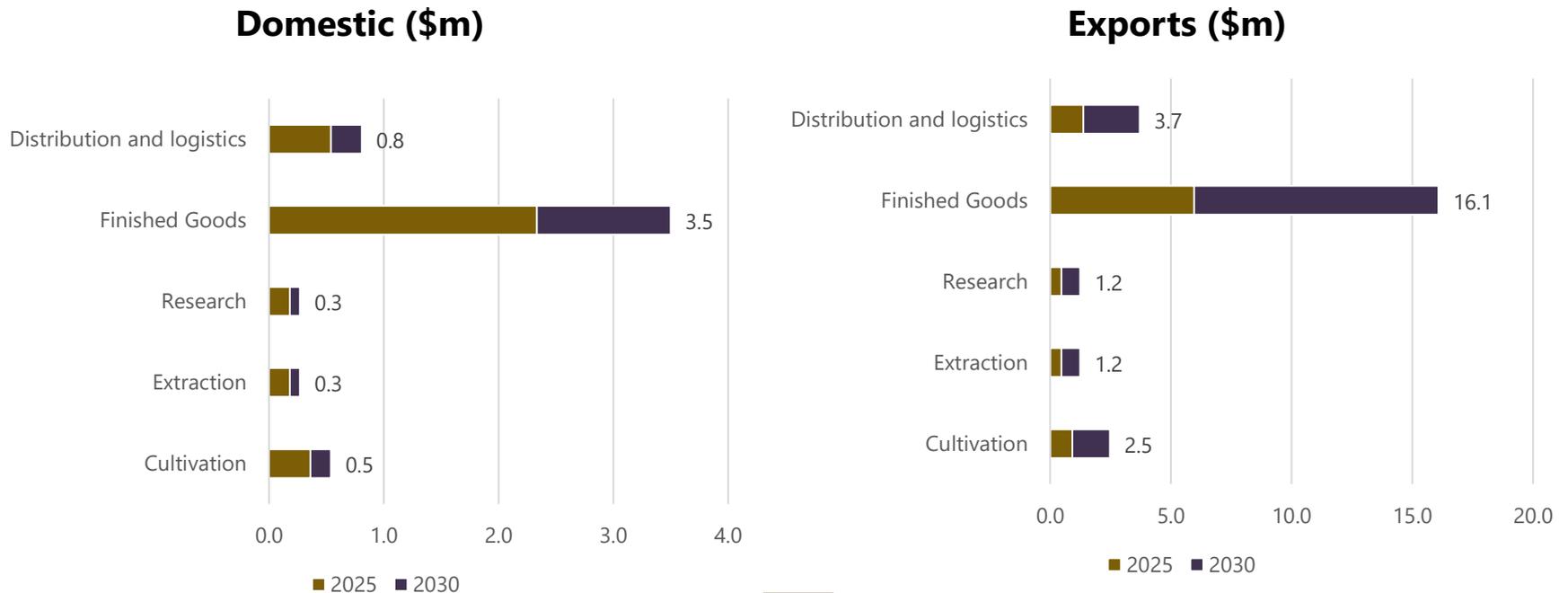
Extraction: Activities relating to the extraction of industrial hemp extracts/oils

Cultivation: Activities relating to the growing, cultivation and harvesting of industrial hemp crops.

For New Zealand, the majority of revenue and value captured lies in the finished goods part of the value chain, where New Zealand value-added manufacturers and processors can produce and sell finished products containing industrial hemp, particularly for export.

Value chain analysis – Scenario 2

Based on NZ capturing 0.1% of global market share and 22.0% CAGR (Scenario 2)

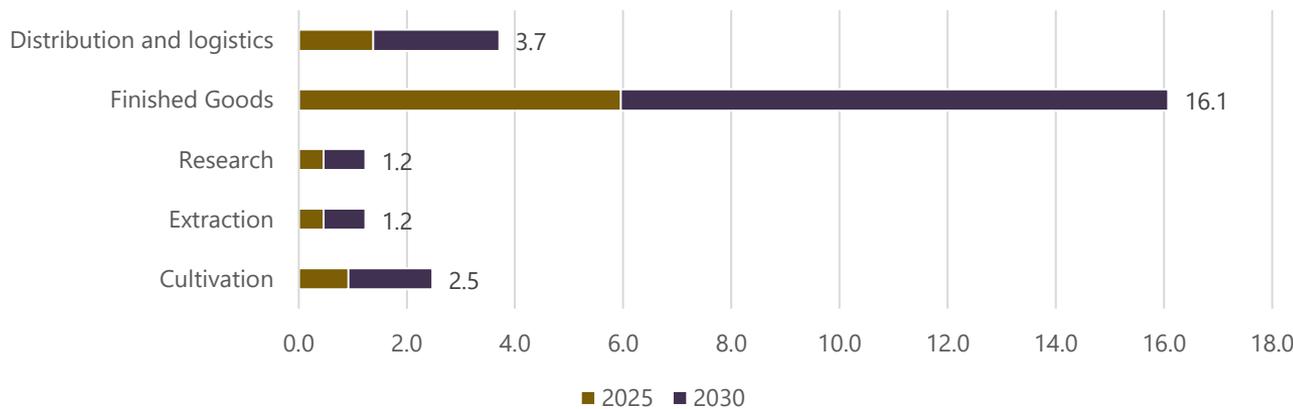


Estimated NZ revenue
2019: \$3-5 million
2025: \$12.8 million
2030: \$30.1 million

Value chain analysis - export scenarios

If future growth in the global market for industrial hemp is driven by fibre, then there would be less potential revenue for New Zealand to capture, as it is less likely to have a comparative advantage in fibre products

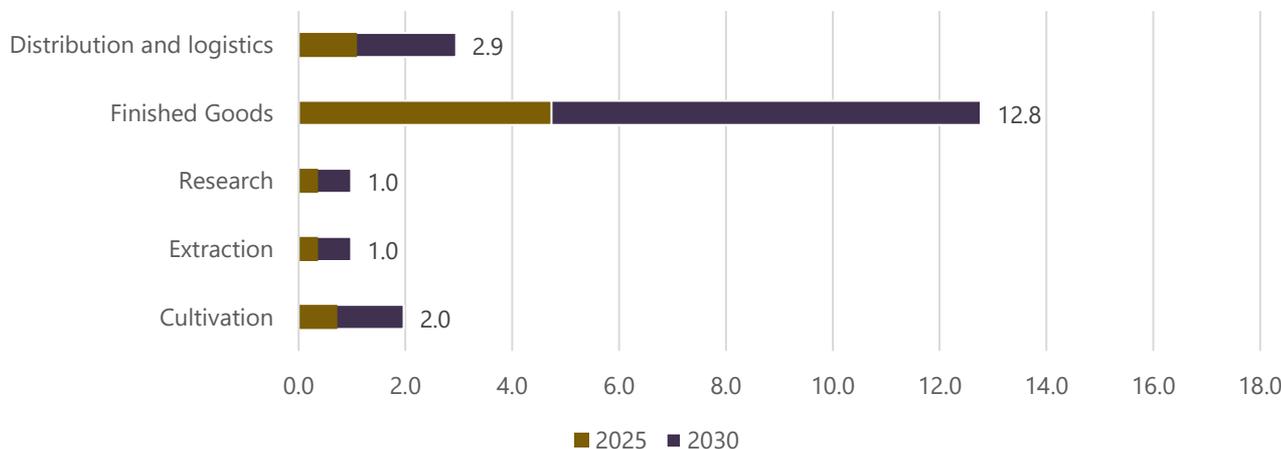
Driver of growth is food (\$m)



NZ total revenue in 2030 (\$USD)

➔ \$30.1m

Driver of growth is fibre (\$m)



➔ \$25.0m

Other modelling assumptions

Assumptions

Domestic

- Estimates of domestic impact based on expected per capita spend on hemp-based products in USA in 2025 (from New Frontier Data):
 - \$0.41 per capita spent on food products
 - \$0.24 per capita on fibre products
- These figures are multiplied by the expected NZ population by 2025 = 5.51 million (from Stats NZ)
- Value chain as a % of revenue is based on estimate of value chain for cannabis health products: Cultivation 10%, Production 5%, R&D and extension 5%, Finished Goods 65%, Distribution & Logistics 15% (based on previous Sapere analysis).

Exports

- Estimated value of current NZ industrial hemp market is based on an estimate of 1,200 hectares in 2019-20 * \$3,000-\$4,500 per hectare (from NZHIA)
- Estimate of global market size for industrial hemp is based on average of CAGR from publicly available market research estimates = **22.0% CAGR**
- Median value of market share in 2020 = **\$USD5.3 billion**
- Estimates of exports are based on the proportion of the global market share that NZ exports are expected to account for
- Value chain as a % of revenue is based on estimate of value chain for cannabis health products: Cultivation 10%, Production 5%, R&D and extension 5%, Finished Goods 65%, Distribution & Logistics 15% (based on previous Sapere analysis)
- Market shares are based on NZ's current market share of global seafood (0.2%), vegetable products (0.5%) and wine markets (1.0%)
- Export scenarios assume NZ can produce 75% of personal care products and 25% of textile and biomaterial products available in 2030.

Modelling assumptions - scenarios

We consider two potential scenarios for the future trajectory of the global industrial hemp market that will have implications for the New Zealand industrial hemp industry. As there are many different types of products and applications using industrial hemp that could emerge, the major drivers of value in the global market could differ significantly between the present distribution and 2030, with different product classes making up a larger proportion of the market. We consider two such scenarios:

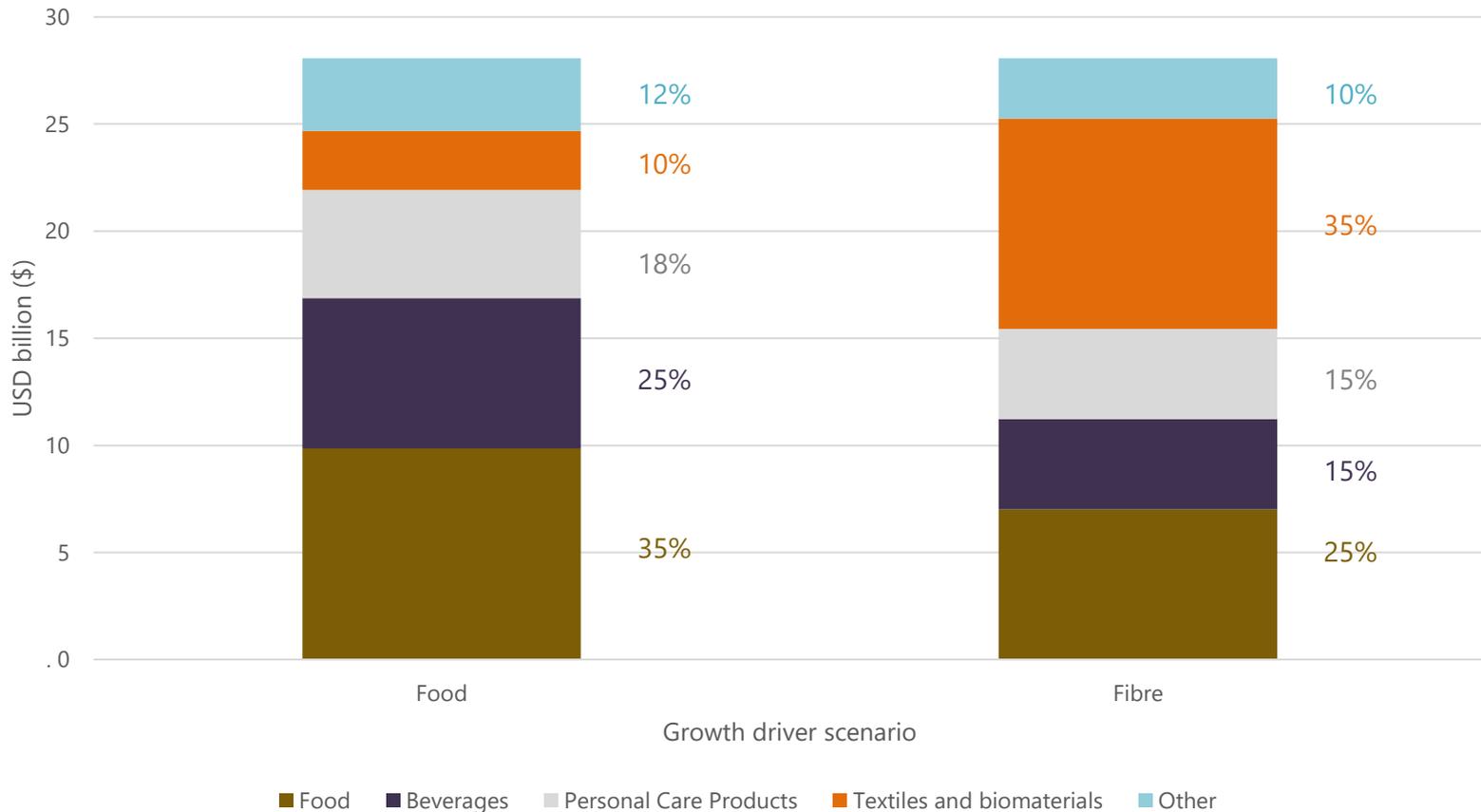
- **Food applications drive future growth (baseline):** In this scenario, food and beverage remain the product class with the largest market share of the industrial hemp industry in 2030.
- **Fibre applications drive future growth:** In this scenario, fibre applications have the largest market share amongst products to 2030, resulting in a smaller potential market opportunity for New Zealand's industrial hemp sector.

Which trajectory occurs is important for New Zealand, as our analysis suggests it would be more difficult for New Zealand to develop and grow an industry that cultivates and manufactures products that utilise industrial hemp fibre. This is due to the complexity of processing fibre and a greater difficulty in achieving economies of scale and less experience in industrial manufacturing when compared to other competitors such as China and France. We also expect that there are some types of major fibre products (and potentially, extract products) which New Zealand would be unable to manufacture.

Modelling assumptions - scenarios

These scenarios describe the breakdown of the 2030 global industrial hemp market under the two global growth scenarios

Breakdown of global industrial hemp market in 2030 – by product class



Priority actions to support industry development

Overall assessment- grain

- There is potential for New Zealand to support the growth of industrial hemp for seed, but it will be dependent on the presence of local processors who can turn those seeds into value-add products
- There are regions which may have economic potential for growing hemp for seed and grain based on climate and access to irrigation (e.g., Canterbury, Hawkes Bay and Horowhenua). However, the extent to which the crop can be successful will depend on the relativity between potential gross margin returns per hectare from hemp grown for different uses and alternative land uses
- New Zealand's experience and strong reputation in produce and food could be leveraged by companies manufacturing hemp seed products
- Government could support these businesses by supporting opportunities for them to grow through co-funding, connecting them to buyers and helping overcome barriers to trade and exporting.

Overall assessment - fibre

- The broadacre nature, need for nearby processing and lack of equipment and knowledge needed to process hemp for fibre create a greater barrier to entry for New Zealand into the hemp fibre market in a major capacity
- It is unlikely that New Zealand hemp, grown for fibre, would be able to compete as a viable export crop with larger producers such as China and France who enjoy economies of scale and industrial fibre processing expertise
- There is potential for the application of hemp fibre products, which have appealing sustainability benefits, into sectors such as construction. This could potentially support small scale industrial fibre growing in New Zealand – however, it is possible that this could emerge organically without government support, and it might be more efficient to import this type of product (or parts of this product) rather than producing it domestically.

Overall assessment- oils

- The use of hemp seed extracts such as oils in the use of personal care products, nutraceuticals and food has significant potential based on the current and forecast value of CBD and CBD products
- New Zealand has a strong record in plant research that could use these extracts to produce valuable products
- However, this would need significant investment into skills, infrastructure, manufacturing practices and market presence that it is not clear that New Zealand presently possesses at scale
- A broader development of skills and manufacturing practices that can extract value and develop products from these oils would create opportunities to use not just hemp extracts but also extracts from other plants (e.g. olive, manuka).

Priority actions

- Support opportunities to help businesses develop new products using industrial hemp or processing practices that could enable more efficient processing and extraction, particularly (but not exclusively) in food or personal care products
- Work with industry to develop trials of different strains of hemp that are best suited to New Zealand's unique conditions and their highest value applications
- Establish an industrial hemp advisory committee bringing together key industry and government stakeholders to advise on policy, industry and regulatory issues
- Undertake more detailed analysis of the economics of the post-farm gate processing of different hemp products and the competitiveness of New Zealand production options
- Identify gaps in and develop the skillset of workers, services and manufacturing practices to utilise hemp seed (and other) oils in nutraceuticals and personal care products.

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Stats NZ (2020) Yearly datasets of imports and exports from 2000 onward, available at: <https://www.stats.govt.nz/large-datasets/csv-files-for-download/overseas-merchandise-trade-datasets#yearly-datasets-of>

University of Kentucky College of Agriculture, Food and Environment (2019) Economic & Policy Update, February 2019, available at: <https://agecon.ca.uky.edu/files/extbluesheetfeb2019.pdf>

Overview of international jurisdictions – references

| Government support | Examples of relevant jurisdiction | Reference |
|---|--|---|
| Industrial hemp strategies in collaboration with industry | Colorado: Colorado Hemp Advancement and Management Plan (CHAMP) | https://ag.colorado.gov/plants/industrial-hemp/champ-initiative |
| Investment into hemp seed trials | Australia: AgriFutures National Industrial Hemp Variety Trial | https://agrifutures.com.au/product/fact-sheet-national-industrial-hemp-variety-trial/ |
| | Western Australia | https://www.agric.wa.gov.au/news/media-releases/hemp-seed-trials-take |
| | Tasmania | https://www.utas.edu.au/tia/news-events/news-items/industrial-hemp-trials |
| | Kentucky | https://hemp.ca.uky.edu/sites/hemp.ca.uky.edu/files/2018_uk_industrial_hemp_variety_trials.pdf |
| Grants for commercial R&D and investment into hemp businesses | Canada: Government investment into hemp processing facilities and new innovations using hemp <ul style="list-style-type: none"> • Funding for hemp fibre processing facility | https://core.ac.uk/download/pdf/144232258.pdf https://www2.gnb.ca/content/dam/gnb/Departments/10/pdf/Agriculture/IndustrialHemp-ChanvreIndustriel/Hemp-Consultants-Report.pdf https://www.woodworkingnetwork.com/wood-market-trends/woodworking-industry-trends-press-releases/Investments-in-Forest-Industry-Transformation-Program-242091971.html |
| | New York: Industrial Hemp Agricultural Research Pilot Program | https://esd.ny.gov/industrial-hemp |

Overview of international jurisdictions – references

| Government support | Examples of relevant jurisdiction | Reference |
|---|--|--|
| Development of investigative taskforces or advisory committees to advise on the hemp industry | Victoria: Victorian Industrial hemp Taskforce | https://agriculture.vic.gov.au/crops-and-horticulture/cannabis-in-victoria/industrial-hemp-taskforce |
| | Queensland: Industrial Hemp Advisory Committee | https://www.legislation.qld.gov.au/view/html/bill.first.exp/bill-2002-884 |
| | Colorado: Hemp Advisory Committee | https://ag.colorado.gov/press-release/ag-department-appoints-six-new-hemp-advisory-committee-members |
| | Kentucky: Industrial Hemp Advisory Board | https://kyhempassociation.org/advisory-board/ |
| | United Kingdom: Taskforce on Innovation, Growth and Regulatory Reform | https://www.gov.uk/government/publications/taskforce-on-innovation-growth-and-regulatory-reform#:~:text=The%20new%20Taskforce%20on%20Innovation,cutting%2Dedge%20technologies%2C%20and%20support |
| Tax incentives and subsidies for hemp growers | Netherlands: Historic and current subsidies for hemp farmers and processors | https://ufdc.ufl.edu/UFE0046379/00001 https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=An%20Overview%20of%20the%20Dutch%20Hemp%20Market_The%20Hague_Netherlands_05-08-2020 |
| | Montana: Tax exemption for equipment used to process hemp | https://leg.mt.gov/bills/2021/LcHtml/LC2874.htm |

Overview of international jurisdictions – references

| Government support | Examples of relevant jurisdiction | Reference |
|--|---|--|
| Investment into standards to support the hemp industry demonstrate quality of crops. | Canada: Investment into industry wide-grading standards to provide assurance of high quality of Canadian hemp products | https://www.newswire.ca/news-releases/growing-the-canadian-hemp-sector-through-investment-and-cannabis-legislation-692421531.html |
| Establishment of an innovation centre to undertake R&D into hemp applications | Canada: The Alberta Biomaterials Development Centre | https://www1.agric.gov.ab.ca/\$Department/dept_docs.nsf/all/bt16406/\$FILE/ABDC.pdf https://nadc.ca/media/1350/final-education-toolkit-print.pdf |

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