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Report by **Timothy Crow**, 2019 Churchill Fellow

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Signed: Timothy Crow

Date: 12 December 2024

Acknowledgements

I would like to thank The Winston Churchill Memorial Trust for awarding me this Churchill Fellowship and providing the opportunity to undertake this life-changing experience.

A special thank you to the Ron Badman Family who sponsor Fellowships every four years for projects relating to an aspect of agriculture, focusing on seed production, pasture development and irrigation.

Ron Badman was a Churchill Fellow in 1967, and made major contributions to Australian agriculture, and on the back of his success, he decided to fund future Churchill Fellowships - an aspiration achievement.

I'd also like to thank my beautiful partner, Ash, who travelled with me throughout the Fellowship, documenting our journey across seven countries and 40 cities, and supported and assisted me in the production of this report.

Keywords

Hemp, Cultivation, Food, Fibre, Plant, Therapeutic, Science

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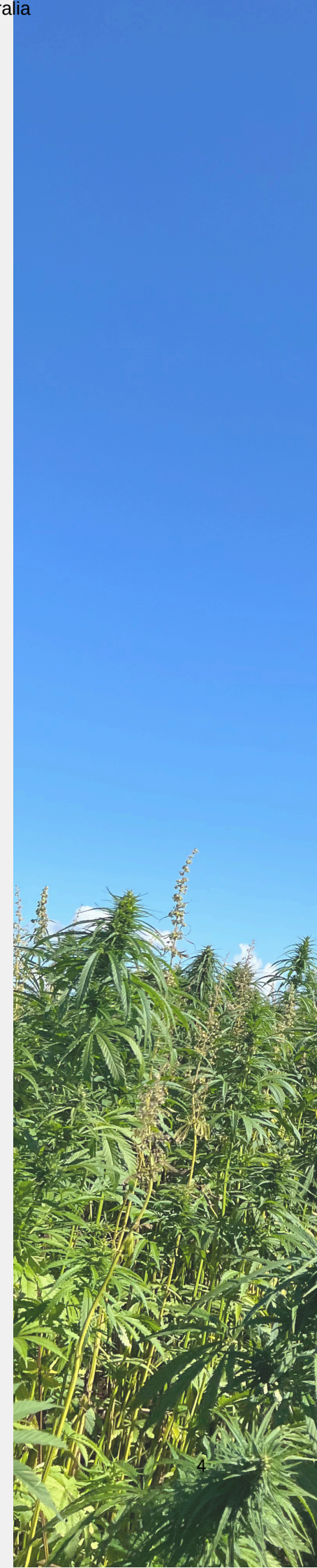


Introduction

The global hemp industry is experiencing rapid growth, with expanding applications across food, fibre, and therapeutic products. To gain deeper insights into this evolving sector, I travelled through seven countries, exploring the challenges that hinder its progress—many of which stem from misconceptions tied to its botanical name and the lingering stigma surrounding the plant.

Numerous entrepreneurs are building ethical businesses to overcome barriers and bring this highly versatile and beneficial plant into the mainstream. For Australian producers and processors, this presents a significant opportunity to not only capitalise on the industry's growth but also to contribute to meaningful and positive environmental outcomes. The industry needs more investment in research, education, product development, genetics, and processing technology to help the industry to scale.

Executive Summary

This Churchill Fellowship titled 'To further develop expertise in the cultivation, manufacturing, science, and policy of hemp' facilitates research into the burgeoning hemp industry to understand the potential for hemp products as sustainable alternatives to conventional commodities, and the factors limiting the industry from reaching scale and achieving the potential transformative impact.

The hemp market has experienced a remarkable global revival in recent years, driven in part by the increasing societal acceptance of medical cannabis. Groundbreaking research has unveiled the plant's vast therapeutic potential, eroding long-standing stigmas surrounding cannabis and, by extension, hemp. As a result, hemp has emerged from the shadows, gaining recognition for its versatility, sustainability, and numerous applications, ranging from textiles and construction materials to food and pharmaceuticals. This resurgence is expected to continue, with the global hemp market projected to grow significantly in the coming years.

After travelling through seven countries and observing the role of hemp in the old and new world, it was clear there are several challenges hindering the growth of the industry, however there are numerous people working to overcome these challenges to enable the industry to scale and establish hemp as a staple commodity in global supply chains.

For governments serious about addressing today's environmental challenges, supporting the development of hemp is both important and makes practical sense. Hemp offers a significant opportunity with minimal need for additional research and development to realise its potential in comparison to other speculative solutions.

Recommendations set out in this report focus on what the industry, along with other stakeholder groups need to do to enhance the sector, such as fostering awareness among policy makers about the economic, environmental, and social benefits of industrial hemp to drive legislative support and reduce regulatory barriers.

What is Industrial Hemp?

Industrial Hemp is the nomenclature used to describe non-drug varieties from the species, Cannabis Sativa L. The legal distinction between drug type cannabis and industrial hemp (non-drug type) varieties is based on maximum concentrations of delta-9-Tetrahydrocannabinol (THC), the compound largely responsible for the intoxicating effect of drug-type cannabis. Maximum concentrations for industrial hemp (low-THC cannabis) differ slightly depending on jurisdictions, however, mostly fall below either 0.3% or 1% total THC.

Historical Relevance of Hemp

For thousands of years, humans have grown Cannabis sativa for various purposes such as fibre, food, oilseed, medicine, and ceremonial practices. Archaeologists and historians have substantiated the utilisation of hemp for fibre and food by ancient societies, such as the discovery of seeds in Japan dated back to 8000 BCE[1] and pottery containing hemp fibre in China around 4000 BCE[2]. The utility of hemp made the seeds an important commodity to be traded and transported across continents. Central Asia is thought to be where Cannabis sativa originated from, however, given the frequent trading of seeds in early human civilization, and the subsequent dispersion across the planet, the origin of the plant is still largely undetermined.

Hemp fibre played a crucial role in tasks like food procurement, fishing, animal domestication, and other significant advancements pivotal to the progression of civilization. The success of major civilisations throughout history was commonly due to the strength of their armadas; to discover new lands, conduct commerce, and conquer enemies. These fleets consisted of sails, rigging, oakum (waterproofing of ships), and uniforms for the soldiers - all made of hemp. Therefore, a secure supply of quality hemp was critical to the establishment and rule of empires[3]. Furthermore, cannabis extracts were widely integrated into herbal remedies for a multitude of ailments, forming an integral part of pharmacopoeias on every continent for millennia, and the seeds have been used in culinary applications dating back to hemp’s introduction into civilization[4].

Cannabis and hemp have had a very colourful and problematic relationship with human society in recent history. Amidst concerns over drug abuse, particularly associated with intoxicating strains of cannabis, hemp became collateral damage in the push for prohibition. Lobbying efforts from industries threatened by hemp's versatility, such as paper, textiles, and petrochemicals, fuelled fear-mongering propaganda linking hemp with its psychoactive counterpart. This led to the enactment of the Marihuana Tax Act of 1937 effectively criminalising all cannabis varieties, including hemp, despite its non-intoxicating properties. This legislation, coupled with subsequent demonisation campaigns has resulted in hemp being strongly stigmatised with negative connotations, hindering its industrial potential for decades.

However, recent research has sparked a revival in the hemp industry, prompting a shift away from its negative drug connotations. Instead, there's a newfound emphasis on the diverse utility of the crop and its potential significance as an important commodity in the future. Given the historical importance of cannabis (hemp) and the potential impact of the crop in the future, I believe that the recent approximately 70 years of prohibition will be merely a blip on the historical human-cannabis timeline. In hindsight, we'll look back in disbelief, as we do at alcohol prohibition in the 1920's.

Modern resurgence of the hemp industry

Hemp was a valuable commodity before prohibition, and with its many sustainable qualities, it holds significant potential for meeting our 2050 sustainability targets. Globally, regulations focusing on the recreational / illicit use of drug-type cannabis varieties have long restricted the growth of the industrial hemp industry. However, the increasing body of research highlighting both the medicinal use of cannabis and hemp's beneficial properties has altered public perception and driven a strong resurgence of this historically important crop. Governments around the world are recognising hemp's economic and environmental value, with over 40 countries now engaged in industrial hemp production in some capacity.
A recent United Nations report stated "..industrial hemp value chains have the potential to be carbon negative and ecologically sustainable and can therefore effectively supplement strategies for sustainable development and the transition to clean energy"[5].

As the global population continues to grow the strain on natural resources will intensify, posing a range of environmental risks. The current rate of resource consumption is unsustainable, with the world using the equivalent of 1.75 planets' worth of resources annually[6]. To address this critical issue, world governments are recognising the urgent need to prioritise sustainability, driving efforts to transition to renewable energy, reduce waste, and promote eco-friendly products and practices. The adoption of Sustainable Development Goals and international agreements like the Paris Agreement demonstrate a growing commitment to a more sustainable future, where economic growth and environmental stewardship go hand-in-hand. By prioritising sustainability, governments and industries can ensure a liveable planet for future generations and mitigate the unknown consequences of unchecked resource depletion and environmental degradation.

Agriculture (the way we produce) is at the heart of the problem and also the solution. For agriculture to move towards sustainable production, farmers need to begin integrating regenerative agriculture techniques that improve soil quality, store carbon, and reduce pest pressures naturally, whilst minimising the need for chemical fertilisers, herbicides and pesticides. Rotational cropping is crucial to sustaining healthy soil ecology, and also diversifies revenues on farms, minimising economic risk.

Hemp offers an alternative cash crop for farmers, improves soil structure, and can boost yields of subsequent crops in rotation[7]. Hemp has remarkable carbon capture potential, with some studies suggesting it can sequester up to 22 tons of CO2 per hectare per year[8] which is then stored in a stable form in the buildings and products manufactured out of the stalk. The implementation of carbon taxes and credits will also provide farmers with an additional revenue stream and incentive to include hemp in their cropping rotations in the future. Thanks to the genetic plasticity of hemp, the crop can be grown successfully from temperate latitudes to the tropics, meaning it can be integrated into most farming systems - maximising the potential impact.

As regulations on industrial hemp production have relaxed, entrepreneurs and investors are seizing opportunities across diverse industries that hemp products have the potential to disrupt. In countries like China, France and the Netherlands, where hemp has been a longstanding part of the agricultural landscape, established players are now leveraging their early start as global markets expand. Meanwhile, recent regulatory changes in North America and Europe have spurred a surge of new ventures, with businesses racing to build the infrastructure needed to supply this burgeoning market.

However, this enthusiasm hasn't been without setbacks. In the United States, for instance, the 2018 Farm Bill legalized hemp production, triggering a "Green Rush" that flooded the market with new products and brands utilising therapeutic extracts. Expectations of exponential market growth and a "get rich quick" mentality fuelled high levels of investment. However as supply quickly outpaced demand, the market became oversaturated, leading to a severe price collapse in 2019. This abrupt downturn dashed the hopes of many farmers, processors, and businesses that had invested heavily in the industry, revealing the volatility and challenges within the emerging hemp market.

There is a renewed interest in the more industrial applications of hemp, as a food and fibre. While optimism remains high for these commodities, the market is being built by businesses that are prioritising sustainable scaling and long-term growth. This approach contrasts with the previous hype surrounding hemp therapeutics, which was often perceived as a quasi-legalization of cannabis. This misconception fuelled unrealistic expectations and led to inefficient allocation of capital by short-term focused investors and operators. There are now processors, manufacturers and researchers investing heavily into developing the necessary technologies required to scale the industry and make hemp alternatives easily substituted as feedstock to a wide range of industrial processes and applications.

Growing concerns about climate change and our environmental footprint have positioned hemp as a vital component in our transition to a more sustainable economy. This was evident in the aspirations of the individuals and companies I encountered during my Churchill Fellowship.

While profit is a motivator, it's clear that many in the industry are driven by a deeper sense of purpose and altruism, aiming to harness hemp's potential to create a better future for all. This underlying mission to make a positive impact on the planet resonated in a world where capitalism has a bad reputation. It seems the hemp industry as a collective, intends to use business to create positive change in the world.

Hemp Biology

Hemp is a rapidly growing annual plant. The development of the plant is predominantly influenced by short-day photoperiodism, meaning that the onset of reproductive development and flowering is mostly determined by the duration of nighttime darkness. Flowering initiates with lengthening nights (typically exceeding 10–11 hours) or shortening days. Recently, the development of 'auto-flowering' or day-neutral varieties have become more common, of which reproductive maturity is determined by age, not photoperiod. Hemp is naturally dioecious, featuring distinct male and female specimens, however, humans have been selecting and crossbreeding for thousands of years, and monoecious instances, with both male and female flowers on a single plant, are now common.

As the maturation cycle progresses, male hemp plants begin to develop pollen sacs, often reaching maturity before their female counterparts. Upon reaching full maturity, male plants release substantial amounts of pollen. At this point, female plants enter an early stage of maturity characterised by the formation of flowering sites. These sites undergo fertilisation through open pollination, facilitating the reproductive process. Once the pollen is released, the male plants die off and the female flowers mature, with the formation of oil rich seeds in the fertilised plants.

Image Source: Royal Queen Seeds

Hemp is a very sustainable crop to grow. The rapidly growing nature of the plant reduces weed pressure and the high concentration of bioactive compounds in the plant act as a natural defence from pests, thus significantly reducing the need for chemical applications. Additionally, the deep tap root and large root mass improves the soil structure and promotes soil biology. Successful cultivation for various purposes - such as fibre, oil, seed, and therapeutics - requires appropriate selection of genetic traits and suitability to the climatic and latitudinal conditions. Additionally, agronomic practices need to be considered.

There are many nuances to the agronomy in growing hemp for each specific use. When growing hemp for therapeutic purposes, it is common to grow hemp in a horticultural production system, with plants spacing at approximately 1 plant per m2. This is very different to broad-acre production of hemp, as seed production crops usually have about 60-120 plants per m2 and fibre crops have 200-250 plants per m2. Plant density causes the morphology of the plant to change significantly, with therapeutic crops looking like large shrubs with lots of branching, fibre crops are much more uniform for longer thinner stalks for better productivity of fibre, and seed crops are similar to fibre with minimal branching, with more space for flowering heads to develop.

Unlike fibre and seed production, when producing hemp for therapeutics it is standard practice to remove males from the production process. The therapeutic compounds are concentrated in the female flowers, and pollination reduces the production of secondary metabolites in female flowers by 56%[9], caused by female plants altering their relative investment in producing phytochemicals by reducing the production of secondary metabolites like cannabinoids, flavonoids, and terpenoids.

There are many nuances like this involved in the production of a plant with such a vast array of uses. For more detailed information on the best management practices please see: AgriFutures - Best Management Practice Manual.

Food	Fibre	Extracts
		

Anatomy

The hemp plant is composed of two main parts: the inflorescence (flowering head) and the stem (stalk) see image. Its morphology can vary greatly depending on the variety, production objectives, and agronomic conditions. Some hemp varieties, grown specifically for fibre, resemble bamboo with tall, slender stalks reaching heights of over four meters. Others are short-statured, dense, and auto-flowering, ideal for producing seeds and bioactive compounds. Between these extremes lies a broad spectrum of varieties, each suited to different uses and environments.

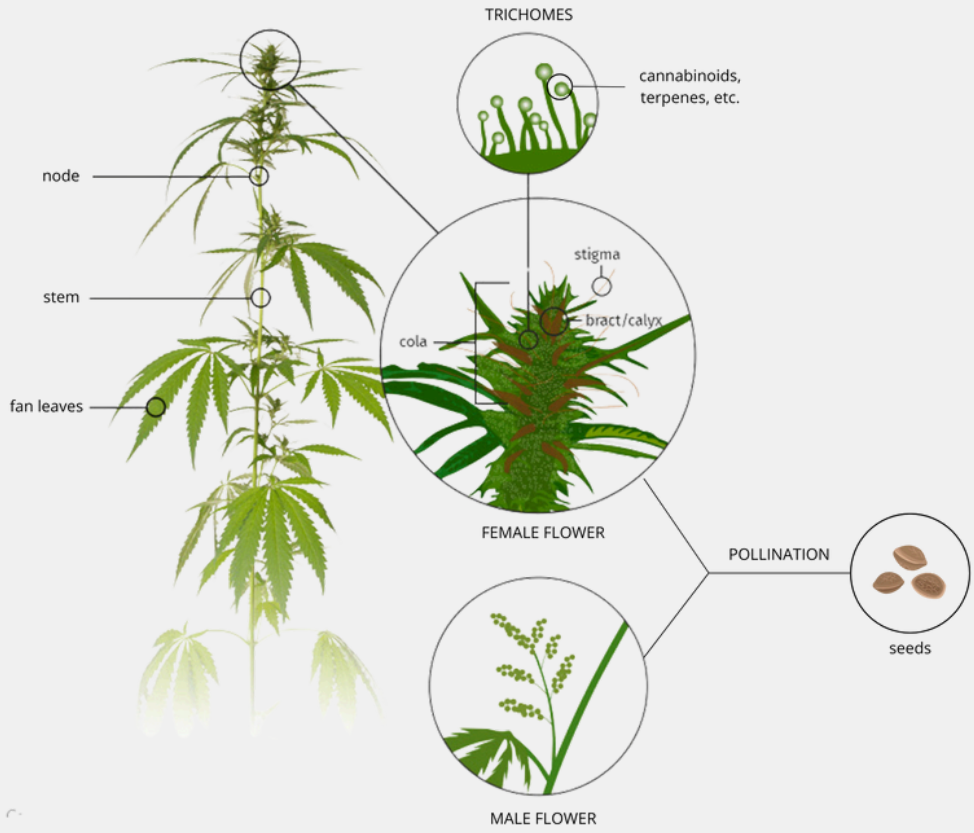


Image Source: Utah State University

Flowering head

Contains the highly nutritious seeds, as well as the glandular trichomes. Glandular trichomes are the resinous glands that almost look like crystals under light and are the pharmaceutical biofactory of the plant, where the bioactive compounds are produced.

Hemp Seeds

The seeds of the hemp plant (see image) are one of the most nutritionally abundant food sources on the planet. They contain over 25% protein, and 30% fat - enriched with omegas 3,6 & 9 in the ideal ratio for human functioning, dietary fibre, vitamins, minerals, as well as anti-inflammatory compounds. The protein in hemp is the type found in blood plasma, and contains all 20 amino acids, making it a complete protein and therefore highly digestible and bioavailable. The polyunsaturated fatty acid content is approx. 90% of the fat content, which is incredibly rare for a plant-based oil [10]. The seeds can be processed through a series of steps to achieve certain product types. Hulled seeds are produced through a de-hulling process which removes the shells through either impact or frictional forces. The oil from the seeds can be extracted through either mechanical forces or the use of solvents, which also results in a by-product of press cake. This press cake is then milled and refined to create high protein or high fibre flours. These products are used as ingredients across a range of industries including functional foods, nutraceuticals and cosmetics.

Cross-section of a hemp seed, and hulled hemp seeds
Image Source: T.H. Seeds, Canva

Glandular Trichomes

The glandular trichomes are the resin production glands found on the leaves and flowers of the cannabis plant, where most secondary metabolites are found. Although hemp has less than 1% THC - the compound responsible for the high, it is one of more than 545 compounds found in the plant - all with varied levels of therapeutic potential. These compounds are produced as a natural defence mechanism against pests and environmental damage. There are approximately 60 Cannabinoids, including THC (less than 1%), Cannabidiol (CBD), Cannabigerol (CBG), Cannabinol (CBN), Cannabichromene (CBC), delta-9-tetrahydrocannabivarin (THCV). These compounds interact with an ancient biological system found in all mammals, including humans, called the endocannabinoid system (ECS) which has receptors throughout the brain and periphery, and explains the plant's effectiveness as a wide-ranging therapeutic. Cannabis-based medicine is currently used to treat disease or alleviate symptoms including, but not limited to, Nausea and Vomiting Due to Chemotherapy, Appetite Stimulation in HIV/AIDS Infection, Chronic Pain, Spasticity Due to MS or Paraplegia, Epilepsy, Depression, Anxiety Disorder, Sleep Disorder, Psychosis, Glaucoma, Movement Disorders Due to Tourette Syndrome, among others. Hemp is also rich in terpenes, which are the aromatic component of essential oils. These have mild therapeutic effects and industrial uses in food, cosmetics and domestic products. There are also a number of other bioactive compounds including phenols, stilbenoids, and lignans, all of which have shown pharmacological activity.

Image: Glandular Trichomes. Source: Canva

Hemp Stalk

The stalk of the hemp plant provides two key materials: bast fibre and hurd. Bast fibre, located in the outer layer of the stalk, is strong and flexible, while hurd, the woody core, is found at the centre. Separating these components involves a process known as decortication, where mechanical forces break down the stalk. The material is then processed through multiple separation stages to isolate and purify the bast fibres and hurd, resulting in the raw materials for various applications.

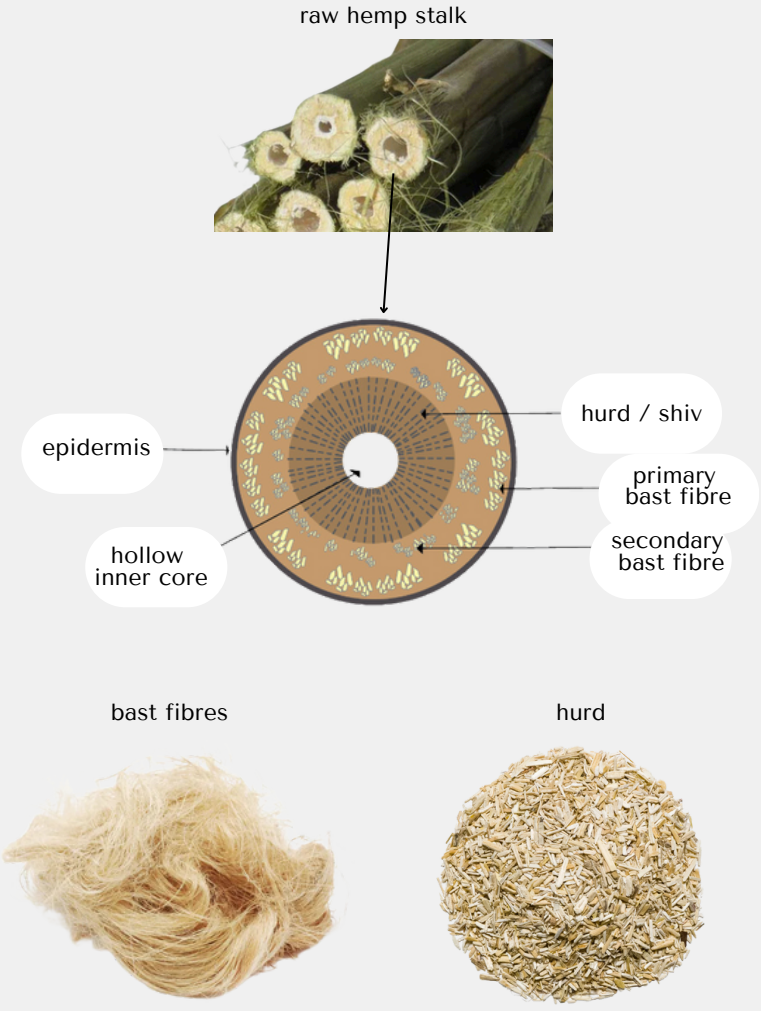
Bast Fibre

The bast fibre found in the stalk of the hemp plant is one of the strongest and most durable natural fibres. While it may not surpass spider silk in strength, the scalability of hemp production makes it far more applicable to commercial use.

It is incredibly versatile and has applications in a wide array of industrial applications. From textiles to paper production, from replacing fibreglass to serving as a sustainable binder and aggregate in composite materials

Hemp Hurd

The hurd is another highly versatile product that can be used in construction materials such as particle board, structural panels and hempcrete. Hempcrete presents a host of advantageous qualities, including fire retardancy, resistance to termites, excellent thermal and acoustic performance, biodegradability, and the capacity to store stable carbon once installed. Hemp hurd is also highly absorbent and has antimicrobial properties, so it works well in animal bedding applications, oil spill clean-ups, garden mulch, and a range of other commercial applications.



Purpose of my Churchill Fellowship

Goals

- Study the global hemp industry and understand the factors that are limiting scale.
- Determine the most effective way to produce and process hemp commodities at scale.
- Discover what research is currently being conducted, and what further research is needed to advance the industry.
- Understand how Australia is best positioned to capitalise on the future growth of the industry.

Trip Overview

Hemp has been grown in Australia since 1995, however, regulations to remove the red tape associated with commercialising production did not occur until the Federal government enacted the 2016 Narcotic Drugs Amendment Bill. This enabled each state to regulate hemp production and cultivation within their respective jurisdictions. Although the first crops were grown in the late 90's, hemp is still a very nascent crop for Australian farmers, as the majority of commercial production only began when the seeds were legalised for food consumption in November 2017.

The fibre and therapeutic markets are still mostly underdeveloped, and although food has been commercially produced and sold for seven years, production is still insignificant in size compared to other commodities grown in Australia. This being said, Australia is still one of the global leaders when it comes to hemp production, especially in the production of hemp foods. However, Australia still lags behind a lot of the world when it comes to fibre and therapeutic uses.

There has been a recent acceleration in the deregulation of industrial hemp globally, which has resulted in a significant investment into new market opportunities, rapidly expanding the hemp market. Additionally, there are some established markets where the production of hemp was never, or only briefly, prohibited such as France, China, Canada and the Netherlands.

Trip Overview

By visiting both established and emerging hemp markets my plan was to draw lessons from the successes and failures of each and develop an understanding of where Australian producers and manufacturers are uniquely positioned to play a role in the future of the global industry, and production methods to effectively scale the industry.

I visited seven countries across Europe, Africa, Asia and North America, and after 12 weeks of travel, I still feel like I've still only scratched the surface on all things happening within the global industry. This is expected, though, given the versatility, and wide-ranging potential applications of hemp are almost endless.

Since hemp agronomy is quite well understood in Australia, I focused my study on understanding how improvements in the rest of the value chain can drive efficiency gains to make hemp cost competitive with other commodities. In doing so, it will enable the many favourable characteristics of hemp to be integrated into everyday items, and to serve as feedstock into next-generation products in the future.

To do so, I met with individuals and businesses across the industrial hemp supply chain including equipment manufacturers, seed breeders, researchers, processors, and consumer facing brands.

Why scaling the hemp industry is so important

The unsustainable nature of building materials, textiles, food production and transportation has significant environmental consequences, contributing to emissions, deforestation, and water pollution[11] [12]. In contrast, hemp offers a promising solution as a sustainable crop with a plethora of uses. Industrial hemp has a remarkable ability to capture carbon, absorbing between 8 to 15 tonnes of CO_2 per hectare annually, making it one of the most efficient crops for carbon sequestration. This capacity significantly exceeds that of forests, which typically capture around 2 to 6 tonnes of CO_2 per hectare each year, depending on factors like tree age, species, and climate conditions[13]. Hemp's fast growth cycle, reaching maturity in as little as 100 days, allows it to convert CO_2 into biomass more rapidly than many other plants, enhancing its environmental benefits. Additionally, hemp is biodegradable, non-toxic, and can be grown with minimal water and without the intensive use of herbicides or pesticides, making it an attractive alternative to resource-intensive materials. Its versatility allows it to be used in a variety of applications, including sustainable building materials, textiles, an alternative protein source, animal feeds, and even as feedstock in sustainable biofuels, offering a promising path towards reducing our environmental footprint.

There is a global push towards creating a more sustainable economy for the future. The urgent need to address our impact on the climate and environment has become increasingly concerning to many researchers, and this is likely to worsen and affect a growing number of people as resource consumption continues to increase. Unfortunately, we can’t rely on the world to stop consuming, so to mitigate our impact on the planet, we need sustainable alternatives.

The versatility of applications for hemp is why it has such huge potential to make a positive transformation on the environmental impact of our production systems. At the height of the industrial hemp industry, prior to prohibition, hemp was considered to have over 25,000 uses. This is only truer today, with new research uncovering the many functional characteristics that make hemp an important input material in a range of future products. Hemp fibre is high in cellulose, one of the characteristics needed to replace several timber-based products and concrete in some instances. Hemp fibres are the strongest natural fibres available, opening applications from clothing to industrial matting. The seeds are high in protein and healthy fats, ideal for human and animal nutrition. Some hemp varieties can grow up to 18 tonnes of biomass per hectare in ~120 days, which is significantly higher than any other known crop, serving as a potential feed into biofuels. The therapeutic applications of the compounds found in the crop are only starting to be discovered, there is promising research associated with the treatment of pain, inflammation, insomnia, and anxiety, among others.

The relatively high production costs and extensive regulatory requirements associated with hemp cultivation, compared to traditional commodities, are currently hindering its integration into global supply chains. By drawing lessons from established commodities, garnering government support, and leveraging modern technologies, there is a real opportunity for hemp to scale quickly and make an impact in global supply chains.

Regions Visited

France – Sept. 2022	• The only western country that never prohibited hemp production • Majority of production is for hemp fibre • Products sold into building, automotive, textile, livestock, and paper industries
Italy – Sept. 2022	• Hemp cultivation was legalised in 2017 • Majority of cultivation is for therapeutics • Hemp fibre processing currently used to make textiles
Netherlands – Oct. 2022	• Hemp cultivation was legalised in 1999 • Predominantly producing hemp for the fibre market • CBD production still not legal in Netherlands
Morocco – Oct. 2022	• Hemp cultivation legalised in 2021 • Mostly grown for therapeutic purposes • Legalised in parallel to medical cannabis legalisation to legitimise the extensive illicit production
India – Oct. 2022	• Legalised production of hemp in 2018 • Legal to produce for therapeutics and industrial uses • Grows wild throughout India
USA – July 2023	• Hemp cultivation legalised in 2018 • Majority of production is for therapeutics • Production is now mostly for seeds and fibre • Large scale manufacturing being set up • Global leader in investment
Canada – July 2023	• Hemp cultivation legalised in 1998 • The second largest production area globally (after China) • Largest exporter of hemp seeds / hemp foods globally • Benefited from supplying US food market before US cultivation was legalised

Experiences

My Fellowship was full of life-changing experiences, along with many important lessons and interesting perspectives. These are a couple of my most memorable that I think give a sense of how transformative this organisation can have on the lives of those fortunate enough to be awarded a Churchill Fellowship.

France

My journey began with a landing in France, on my way to visit La Chanvrière—the world's largest and oldest hemp cooperative and Europe's foremost hemp fibre processor. This impressive facility processes 80,000 tonnes of hemp annually, sourced from 12,000 hectares of dedicated farmland. Along the way, we took a detour through the Champagne region (see image). While this may seem like an unusual stop on a hemp-focused trip, hemp and alcohol share notable similarities. Both are high-value agricultural products with recreational uses, and each has a rich history of human use. Champagne is renowned as the premier region for high-quality production, and by visiting some of its famed houses, I gained insight into the rigorous practices required to achieve excellence at scale.

It all comes down to strict guidelines and standardized practices throughout the production chain. The process begins with highly porous limestone soils, minimal chemical intervention, and hand-harvesting to maintain grape quality. From there, a meticulous manual process is applied to age and develop the product, resulting in the superior sparkling wine Champagne is known for. This approach offered a glimpse into practices that could shape the future of hemp extracts and flower consumption, where quality and consistency are key.

Image: One of the many farms producing grapes for G.H. Mumm

Pascal, the CEO of La Chanvrière, generously provided a brief tour of their facility—a rare opportunity, as tours are generally restricted due to concerns around intellectual property. He emphasized the importance of finding markets for byproducts, setting standards for building applications, and collaborating with customers to meet specific needs. The scale and efficiency of this operation, alongside the strength of a network of incentivized farmers, illustrated a potential future in which hemp could emerge as a sustainable alternative to cotton in Australia.

Image: Manufacturing Facility of La Chanvrière

Italy

We met Gianpaolo Grassi (see image) at his research facility in Monselice, Italy, where he had on display the many projects he has been involved in and developed over the course of his 40 years researching hemp. He has seen all the ups and downs of the industry, and the challenges with government regulations, and has been involved with countless research and development projects to enable the industry to grow. He has developed varieties with no cannabinoids (i.e. THC, CBD, etc.) to be compliant in any location and be used similarly to herbal teas. He has developed a line of hemp genetics that are skewed to have less than 10% of the less productive male plants, which usually account for 50% of the crop, and has a keen interest in the less explored, non-cannabinoid compounds found in the plant such as terpenes and flavonoids.

Jacopo from Enecta gave insight into the many challenges of running a hemp extracts business in Europe and the impractical legislative environment in which he operates. His company operates in all facets of the supply chain, from genetics to production, processing, and retailing.

This complete oversight of the supply chain enables the company to produce the highest quality products with the most effective therapeutic effects. It also exposes him to the many convoluted and nonsensical regulations that restrict business operations, of which he has creatively operated within compliantly.

Images: Gianpaolo Grassi at his research facility, Canvasalus

Netherlands

Dun Agro is one of the original hemp fibre companies in the Western Hemisphere. Founded by Albert Dun in 1999, his son Kees now oversees and operates the business, which is based 2.5 hours outside of Amsterdam. We timed our visit to observe their novel harvesting method, which is heavily reliant on the horsepower of their tractors to do the bulk of the processing of their hemp stalk. This preprocessing step in the field significantly reduces the footprint and power requirements of their facility, as it eliminates the need to break the stalk, and is purely for the separation of the three fractions - hurd, bast fibre, and dust. Additionally, the company produces prefab homes in their factory, where their hemp hurd is turned into hempcrete and used to fill the wall cavity and create a naturally insulated wall. As well as a small lab on site, where the extracts produced from the flower and leaf material from hemp fibre production are formulated into therapeutic oils and creams.

Image: Processed hemp fibre at Dun Agro, with Kees Dun

HempFlax is only a few minutes drive from Dun Agro and is another one of Europe's leading hemp fibre processors, Hemp Flax. As the name suggests, HempFlax was initially focused on the production of flax fibres, and in 1993 began producing hemp for fibre.

Although so close to Dun Agro, the company has very different production techniques. HempFlax cuts and bales their hemp stalks in the field, then breaks down and processes whole bales through their facility, as opposed to the infield processing method of Dun Agro. The product range is sold into a wide range of industries including automotive, animal bedding, textiles, therapeutic markets, and more.

Image: In-field processing by Dun Agro

Behind the production of the many varieties of cannabis retailed in these coffee shops are several globally renowned seed genetic companies, based out of Amsterdam. These companies acted as the backbone of the global cannabis genetics (both legal and illegal) and were able to operate legal enterprises as the seeds do not contain any cannabinoids, so are not considered a scheduled product. Dutch Passion and Greenhouse Seeds have dominated the market since their establishment in the late 80's. Although their focus was on non-hemp, high THC varieties of cannabis, it was these two companies that largely popularised the first non-intoxicating varieties of cannabis specifically for medical patients, which contained little to no psychoactive THC, but an array of other therapeutic compounds such as CBD, CBG, etc. These formed the foundations of the hemp-based extracts industry. I was fortunate enough to be invited to the flagship store of Greenhouse Seeds (see image) to experience the consumption culture in the Netherlands and the diversity of people who consume cannabis in its variety of forms - the walls were littered with countless celebrities who have visited their establishments.

The Netherlands has long been considered the most liberal jurisdiction when it comes to cannabis legislation. Since 1976, the Coffee Shops have been a legal place of cannabis consumption and commerce and have been a draw card for tourists from around the globe.

Interestingly, the consumption and sale of cannabis through the coffee shops has always been a criminal offence, however, it is considered tolerated by local law enforcement and not prosecuted.

Although the sale and possession of small amounts (up to five grams per person) is tolerated, the production and supply to coffee shops is not tolerated and is illegal. Apart from the obvious confusion as to how the product is meant to magically appear in the coffee shops, this legislation also highlights one of the troubling facts of prohibition. Without regulations, there are no standards to meet in production, which causes fluctuations in quality and a lack of product testing which ensures consumers that what they are consuming is safe.

Image: Outside Greenhouse Seeds' coffeshop


Image: With Mahmoud from Dutch Passion

Morocco

Morocco has a rich history with the cannabis plant. The plant has been produced and consumed in the region for hundreds of years and has been quasi-legal in certain districts even after the global prohibition of the 1960's. This is especially true in the Rif Mountains (see image), which is a region in the central north of the country, where Chefchaouen is the largest city. Although predominantly grown for the illicit market, this production has recently been legalised by King Mohammed VI to open a potentially lucrative opportunity for the farmers of the region to enter global medical markets. There are also initiatives to process the stalk and turn it into building materials and textiles for local producers.

This was one of the most culturally rich and eye-opening experiences of the trip. Chefchaouen is known as 'the blue city', with all the streets covered in blue paint, and surrounding the city are fields of cannabis crops. The visit was during the harvest season, and we saw the entire community of families coming together to harvest and prepare the crop for drying. We also had first-hand experience on the production of cannabis resin which is used for medical and recreational use. It was an incredible experience to see how this product is such an integral part of their community and the key source of revenue in terrain where options are very limited.

Images: Harvested plants drying in the sun. Dry plant material being processed into hashish

India

India and its surroundings are widely considered to be the origin of the cannabis species. When you visit the area, you see cannabis plants growing wild on the side of roads and green spaces across the country - something hard to comprehend in Australia where this would be immediately eradicated. India has a strong history of cannabis use for therapeutic purposes, and the plant is common in Ayurvedic medicine and has been consumed for a range of ailments for thousands of years. The most famous region in India for the cannabis culture and history is the Parvati Valley. This region backs onto the Indian Himalayas and is one of the most scenic places I have ever been (see image below). The backdrop of snowy mountain peaks, lush green forest, and crystal-clear rivers, is home to the world renowned Charas - otherwise known as live-resin hash.

Image: A crop at 10,000ft elevation in the Indian Himalayas

Although the production and consumption of this product is mostly illegal, the region continues to produce large volumes of the product for domestic and international consumption. The pressure from law enforcement, however, has forced the production deep into the mountain regions, which is where I went. When hiking deep into the mountains, I was fortunate enough to meet a local who could speak enough English to guide me to where the fields were located which were at nearly 10,000 ft elevation. Here I was able to view the locals processing the Charas by hand, which entails cutting each individual plant and rubbing the flowering heads between their hands to remove the sticky, compound rich resin. This technique produces a product known as 'live' resin, as the flowers are still alive and therefore the trichomes are still fresh and full of moisture, unlike when dried flowers are used. This process encapsulates all the trichomes and volatile compounds within the extract, which makes a more aromatic outcome with a full spectrum of therapeutic compounds. Each home produces approximately 4-7kg of charas, which fetches approximately AU$1,000 / kg and is enough for a family to subsist on for a year. All from approximately three months of hard labour.

The mountainous terrain is not well suited to standard agriculture, and the only other real alternative for income is highly dangerous mountain logging, so cannabis is the lifeblood of the community. The seeds from harvest are collected to be used to propagate future crops and also as a valuable nutrition source throughout the year.

Image: Removing therapeutic-containing resin by manually rubbing live plants

USA

Colorado was the first state in the US to legalise recreational cannabis consumption, and in turn became a leader in the production of industrial hemp for the extract markets. Thanks to market dynamics, the focus has moved from hemp for extracts, to now producing hemp for the food and fibre markets. To that end, I travelled from Denver to meet with Rich from New West Genetics (NWG) (see image), and visited their first gender-skewed crop, where they have produced a 100% female line of seeds, which can be crossed with another line to create stable, hybridised genetics. Thus, reaping the known gains from hybrid vigour found in other crops. It was great to discuss their non-GMO approach to modern breeding and get insight into the potential agronomic gains and creation of novel nutritional characteristics that are possible in the future.

I then travelled deep into the Colorado desert to Alamosa to meet with Randy and the team at Formation Ag (see image), who have been making innovations in equipment for harvesting and processing all forms of hemp. Their innovative harvesting equipment enables the scaled harvesting of extract hemp, however, due to the downturn of the hemp extract market, they have focused on hemp fibres.

Their decortication system innovates on an old Schlichten patent for hemp processing from the early 20th century which can process 1.5-2T / hour of stalks, and they have even built a mobile processing plant that fits on a semi-trailer. In the early years of the company, they worked on a project with Patagonia to get locally grown hemp for their products. Although the project was not successful, yet, it highlighted the importance of long fibres for clothing and is something that the company is focusing on. We also discussed the potential of hemp plastics that biodegrade completely, a project with the University of Nebraska where they have developed a material stronger than concrete, using only hemp and natural materials.

Image: Decortication equipment, Formation Ag

Randy also discussed the importance of consistent infeed of material into their decorticator to achieve desired quality and throughput outcomes, and additionally how certain input material has performed significantly better than others, which highlighted how much more research and development is needed to optimise production and processing.


Image: Large-scale solventless extraction, Sweetwater Hemp

Nebraska is a sea of green. During a seven hour round trip, all there was, was corn and soybean fields from the edge of the road to as far as the eye could see. Brett from Sweetwater Hemp was kind enough to give a tour of his large-scale solventless hemp extraction operation where he uses only ice and water to physically separate the therapeutic-containing trichomes from the biomass. It's a simple process, which has been modernised and can produce 65 kg per run and achieve 10-20% yields, depending on the quality of the starting material. Brett has seen the rise and fall of the CBD market and has innovated and adapted his business to the changing market dynamics in hemp extracts. He is highly focused on developing new products that incorporate hemp to drive adoption of hemp extracts in the market.

The next stop was at Hemp Harvest Works (see image), which is a subsidiary of Bish Enterprises - owned and operated by Andrew Bish and his family. Bish Enterprises has been making specialised agricultural equipment since 1976, and recently made a foray into the hemp industry with the development of a range of harvesting infrastructure, initially geared towards harvesting hemp for extracts at scale. However, after the implosion of the demand after 2019 for extracts, they are now building equipment designed for scaled harvesting of hemp for fibre production. Andrew is a major advocate for the amendment to legislation prohibiting the use of hemp seeds as animal feeds, and is part of the Hemp Food Coalition, pushing for changes.

Image: Fibre harvesting equipment, Hemp Harvest Works

He believes that hemp produced for fibre and grain needs to be legislated separately from hemp for extracts as the confusion and association with recreational cannabis is causing unnecessary red tape and delays to legislation that could allow the industrial hemp industry to reach its full potential. This component of the trip also involved a discussion with FarmMax who developed a system to catch the tailings from a combine harvester to collect the biomass for extract production. However, this was discontinued as the industry production areas plummeted in the crash of 2019.

Hempitecture, based in Jerome, Idaho, is innovating further up the supply chain, turning hemp fibres into a range of sustainable building materials including thermal and acoustic insulation and flooring solutions. These provide crucially important sustainable alternatives to the current unsustainable materials currently dominating the industry. Deshawn (see image on next page), their Operations Manager, gave a tour and insight into the trials and tribulations of developing a new product and scaling commercial production. The products have been tested to ensure their performance is on par with what is currently available and require further testing to be able to be incorporated into the US building codes. The equipment is not purpose-built for hemp and instead has been modified for the purpose, which has caused a multitude of challenges, however, this has also driven innovation, and mistakes have actually resulted in extensions to their range.

Image: With Deshawn from Hempitecture

Image: Final stage of production for hemp insulation batts

IND Hemp is based in Fort Benton, Montana and has both large-scale hemp fibre processing and hemp food processing. Each year, the company puts on a hemp summit to discuss the latest research and development in the industry, which doubles as a great networking event for all those involved in the industry. The event gave insight into the work that is being done by the Hemp Feed Coalition to enable the byproducts of hemp food production to be fed to livestock and in turn make hemp more competitive with other plant-based ingredients. The conference also gave insight into the depth of research currently being undertaken by universities across the US to develop higher-yielding genetics, optimise processing technologies, and validate products for commercial use. Hemp fibre is currently receiving a lot of attention and investment across the industry as the potential applications continue to grow, and many companies are working to bring hemp fibres into global textile markets. IND Hemp also gave tours of both facilities, and it was impressive to see the scale of the facilities were on par with those in Europe.

Image: Large-scale fibre processing equipment at IND Hemp, Montana

Based in Monterey, California is Cryomass (see image), a company that has designed a solventless extraction system to separate the therapeutic-containing trichomes using purely mechanical forces. The equipment uses liquid nitrogen to bring the temperature of the material below freezing, causing the trichomes to become brittle and snap, releasing them from the biomass. These are then subjected to several different sized sieves which determines the grade of the material and concentration of cannabinoids. The system works well for large-scale hemp biomass as well as for high-THC production for the recreational markets. The process has taken an ancient technique of hash production, as used in places such as Morocco and Lebanon, and optimised it through modern technology.

Image: Large-scale solventless extraction, Cryomass

Western Fibres was one of the most interesting stops on the Churchill Fellowship (see image). They're based in Riverdale, CA, and have converted an old cotton gin into a functional hemp fibre decortication system. The cotton industry has been declining in the region over the recent decade and Tom and the team at Western Fibres believe that hemp could become an important future commodity in the region. We were given a tour of their facility, which was built in the 1970s and looks like a Hollywood movie set.


Image: A cotton gin converted for hemp processing

Tom also gave a demonstration of the production process, where they took the stalk remaining from hemp extract production and processed it into quality hemp hurd. They have made some modifications to their gin to allow it to process hemp straw, and considering how un-uniform hemp straw is from crops grown for biomass and extract production, the quality of the resulting fibre was impressive. It gave insight into what the future of the industry could look like, as the capital requirements to establish scaled hemp decortication facilities are significant, and this may provide a solution to enable the industry to reach scale without the need for significant investment.

Canada

Manitoba Harvest (see image) is the largest hemp food manufacturer in the Western Hemisphere and has been a pioneer in the industry since the company was established in 1998 when hemp foods were legalised in Canada. Clarence Shwaluk, the senior Director of Operations, provided us with a tour of their facility and gave insight into what is required to process over 12,000 tons of hemp seeds annually, and the highs and lows of industry growth over the past 25 years.

Image: Storage for hemp seeds before processing, Manitoba

They have consolidated most of the market in Canada after merging several competing businesses, and now dominate both the Canadian and US market for hemp foods, with over US$50M in annual revenue. Regulatory challenges still persist in what would be considered a mature market, as hemp is still classed under cannabis legislation, hindering its acceptance as an agricultural commodity. A major component of their production is from dryland farmers, which significantly reduces their cost of production, something currently missing from Australian production. Clarence also stressed the importance of sustainable farm-gate pricing to ensure stable supply chains, as well as the need for improved genetics and product innovation to drive growth in this still niche but maturing industry.

Bluesky Hemp is based in Saskatoon, Saskatchewan in the middle of Canadian prairie country. They have both hemp foods and cannabis extraction on the same site, which has come with its own set of challenges. Spencer gave a tour of the facility which included one section as a world-class hemp food facility, where they currently produce hemp ingredients for their global customers. In a separate area, they are producing high-quality, high-volume extracts from both hemp and high-THC biomass for the regulated markets in Canada. The company is focusing on 'whole-plant utilisation' and finding markets for seeds, fibres and extracts.


Image: Hemp seed processing equipment, Saskatchewan

There were some interesting challenges this presented, for example, varieties with high concentrations of cannabinoids also have high concentrations of terpenes which were found to negatively affect the flavour profile of hemp seeds. Similarly to Manitoba Harvest, Bluesky also has part of their production from dryland farmers which reduces the cost of production. They are continually innovating their product offering and have developed an almost translucent hemp seed oil, which significantly increases the shelf life and smoke point, opening up a wide range of new applications. They are also undertaking a project with support from Protein Industries Canada to develop a high-concentration hemp protein. The company is also producing cannabinoid isolates from hemp extracts which are sold into the regulated cannabis market locally and formulated into a range of different product formats.

Hempalta (see image) is a hemp fibre processing company based in Calgary. Brittany gave a tour of their facility where they have utilised the 'Hemp Train' technology to produce hemp hurd and bast fibres. They have a unique business model, where they focus on marketing their own branded lines of hemp commodities, and have developed a range of interesting product formats including cat litter, fresco packs - to extend the shelf life of fruit and vegetables, soil additives, along with the usual hemp hurd and bast fibre products. Hempalta is also developing a hemp carbon standard to promote industrial hemp cultivation and offering reliable, quantifiable carbon credits on a global basis.

Image: Hemp fibre processing equipment, Hempalta

Image: Animal bedding made from hemp hurd

Findings

Before undertaking my Churchill Fellowship, the perspective I had was that the Australian industry was significantly trailing behind the rest of the world in regard to production, legislation and general industry maturity. However, after visiting these regions it was clear that although some regions are more established in certain aspects of the hemp supply chain, each jurisdiction has its own unique challenges and many challenges were universal across all markets. Australia has a lot to learn from the rest of the world, however, I believe our industry can also contribute significant knowledge and value to the rest of the world in many areas of the hemp supply chain.

The hemp industry has a wide variety of production techniques, products, manufacturing requirements and applications, so rather than focusing on one particular aspect, I decided to take a broader approach to understand the overarching factors currently limiting the potential growth of the industry and finding potential solutions.

The following are the key findings observed and what I believe are having the most impact on the progression of the industry and where if we get these aspects correct, will prove to be a major driving force behind future growth.

1) Policy

Policy is driven by public perception; however, it always has a lag time. Unfortunately, due to the propagandised campaigns of the 1960s for the prohibition of cannabis, not only did hemp get wrapped up in the policy changes, but it also implanted a very strong, negative attitude towards the plant in the mind of the public. This stigma has been the strongest obstacle for the industry to overcome, as this filters down to everything from government regulations, investment appetite, consumer acceptance of products, banking restrictions, and even the ability to advertise online - just to name a few. Thanks to the internet and our unfettered access to information, this stigma has started to erode. However, this historical interpretation of hemp is still impacting the industry today as many policy makers are unaware of the difference between hemp, medical cannabis and illicit forms. All involved in the industry believe that educating the public and policy makers is critical to removing the unnecessary red tape that is hindering industry growth and the industry from reaching its potential in the future.

1.1 Conflation of Therapeutic and Industrial Uses

While there is growing acceptance of regulated cannabis consumption for both medicinal and recreational purposes, this shift in perception hasn't entirely benefited the hemp industry.

Findings

The legislation governing medical and recreational cannabis is often conflated with that of industrial hemp, creating unnecessary complexity for hemp farmers and processors seeking approval for their products and activities.

The lack of nuanced understanding of hemp often causes confusion among regulators, who frequently conflate hemp-related products with the therapeutic use of cannabis. This misperception leads regulators to treat even benign hemp requests - such as using hemp seed waste containing less than five parts per million of cannabinoids in animal feed - similarly to handling medical cannabis. As a result, unnecessary red tape and regulatory hurdles are imposed.

One of the most prominent examples is the strict regulation of hemp food byproducts for animal feed. Although hemp seeds are approved as food in every jurisdiction visited during the Fellowship, the sale of hemp byproducts for animal feed remains tightly regulated in most markets, as if they were veterinary medicines rather than nutritional ingredients. This is despite hemp's long history of safe use in animal diets without any documented welfare concerns.
In most agricultural sectors, byproducts are routinely used as animal feed, reducing waste and increasing profit margins for producers. These secondary markets create economies of scale, lowering production costs. Unfortunately, in the case of hemp, concerns about compounds found in cannabis have resulted in hemp byproducts being treated differently from typical food crops. Instead of benefiting from existing agricultural practices, hemp producers are required to conduct costly clinical trials to prove the safety of these byproducts for animals, adding unnecessary burdens to the industry. The Hemp Feed Coalition is actively working with regulators to address the misconceptions and open animal feed markets for the hemp industry.

The confusion around hemp has also made online advertising nearly impossible for hemp companies. Major social media platforms ban ads involving hemp, misclassifying it as related to narcotic drugs. This outdated perception severely limits marketing options, especially as digital advertising accounts for 70% of all global advertisement spending, and nearly 30% of all business activity is conducted online. So it is essential for reaching and educating new customers.

These platforms are essential to reaching and educating new customers, so without access to platforms like Facebook, TikTok, and Google Ads, hemp businesses face significant challenges in building awareness and competing in the market. This is particularly damaging given the growing interest in hemp's health, wellness, and sustainability benefits. Many companies are forced to rely on resource-intensive alternatives like influencer marketing and email campaigns. To support the hemp industry, regulatory clarity and fair advertising policies are crucial.

These changes would not only help businesses thrive but also break down misconceptions and promote an industry focused on health and sustainability.

1.2 Lack of Consistency in Definitions and Regulations

The lack of a clear and unified definition of hemp, along with inconsistencies in permitted activities, has resulted in convoluted regulations across different regions. This regulatory patchwork has added significant complexity and confusion for industry operators striving to maintain compliance. A key issue is the variation in allowable THC concentrations—the defining factor that distinguishes hemp from marijuana. THC limits vary widely, from 0.2% in Europe, to 0.3% in North America, and up to 1% in Australia. This disparity places Europe at a distinct disadvantage compared to regions like Australia, as the more restrictive THC threshold severely limits the range of compliant hemp varieties available for cultivation. As a result, breeding programs in Europe must prioritise reducing THC levels, often at the expense of improving other important agronomic traits, such as yield potential. This focus on THC reduction diverts valuable resources that could otherwise enhance the overall productivity and profitability of the hemp industry. Genetics used in production must also be registered on the EU's Common Catalogue of Varieties of Agricultural Plant Species, which requires years of data, further restricting access for producers.

Additionally, the classification of legal hemp products varies significantly across jurisdictions. While hemp foods are legal in all regions, legislation surrounding products made from hemp flowers and biomass differs widely. In North America, any product containing less than 0.3% THC is classified as a hemp product. This has led to the proliferation of diverse offerings, including CBD oils, gummies, capsules, smokable flowers, beverages, balms, and even suppositories—the only limit is imagination. The sale of these products in Europe is also very common and sold in vending machines and many retail stores. However, the European Union lacks consistency in its regulations, particularly due to varying interpretations of United Nations guidelines and differences in laws across member states for production and manufacturing. This inconsistency complicates operations and hinders cross-border trade. For example, the company Enecta must grow hemp in Italy, extract and bottle their products in Germany, and then distribute products from the Netherlands to avoid seizures or disruptions in fulfilling customer orders.

Meanwhile, Australia has taken a much stricter stance, effectively banning hemp extracts unless produced under Medical Cannabis Licences issued by the Office of Drug Control with stringent security measures in place, and only available with a prescription.

The restrictive legislation surrounding hemp over the past 50 years has also stifled research, particularly on its therapeutic uses. Until recently, it was nearly impossible for researchers to access material for studies and get access to government funding, further impeding our understanding of the plant, and hindering innovation and the potential growth of the industry. Some countries have reaped the benefits of more relaxed regulations. For instance, France has allowed hemp production for over 50 years, and La Chanvrière, a French hemp cooperative, has been producing hemp fibre for decades. Today, it is the largest hemp fibre producer in Europe, supplying fibre to the European automotive market where it is used in car door panels as a sustainable alternative to fibreglass.

1.3 Therapeutic Hemp Restricting the Growth of Hemp for Food and Fibre

The regulatory ambiguity surrounding non-medical, therapeutic hemp products is significantly hindering progress in the food and fibre sectors. The confusion among policymakers about the complex distinctions between CBD and THC extracts, as well as the similarities in plant types and production processes, makes it nearly impossible to advance policy discussions. This conflation is obstructing the growth of the food and fibre markets.

The therapeutic use of the entire cannabis plant should be legalised through a common-sense approach to adult use. However, in the meantime, it's essential to clearly differentiate industrial hemp applications for food and fibre from therapeutic uses. Although this may be an unpopular stance, I believe that therapeutic hemp products should be regulated similarly to other therapeutic products, requiring stringent manufacturing standards such as GMP certification, and claims to be validated by third parties - in alignment with complementary medicines. Industrial hemp grown for food and fibre, on the other hand, should have regulations completely removed - similar to flax, soy and other crops - without licensing requirements or stringent testing of certified seeds. Certified seed approval should only require two years of test data showing THC levels consistently below the legal threshold, ensuring reliable compliance for growers.

While this regulatory delay may initially slow the growth of non-therapeutic hemp extracts, the immediate potential of these products for growers and processors is minimal compared to the vast opportunities within the food and fibre markets, and I believe the extract market will ultimately achieve legitimacy as wide-spread adult use markets come online.

1.4 Slow Progress Increases the Potential for Harm

By slowing legislative progress and continuing to prohibit hemp products, governments are causing more harm than good.

When there is sufficient consumer demand for a product, there will always be someone willing to supply it. The key decision for governments is whether that supply comes through legal, regulated channels or illegal, unregulated ones. This is true for all cannabis legislation. Bootleg hemp extracts are common in markets with no legal frameworks for production, which results in untested products being sold to the public. They are also sold as cosmetics, or animal products, even though they are almost all sold to be consumed orally. With no standards to conform to, or regulatory bodies to enforce them, it results in consumers not knowing the purity, potency, and safety of the products they are purchasing.

The slow progress in regulating high-THC cannabis markets also impacts the safety and credibility of the hemp industry, as some operators exploit regulatory loopholes. In North America, for example, certain producers use creative chemistry to modify hemp products, mimicking the effects of high-THC cannabis while remaining within the legal framework for hemp. A notable case involves cannabidiol (CBD), a non-intoxicating hemp-derived compound, which can be synthetically converted into analogs like delta-8-tetrahydrocannabinol (Delta-8). Delta-8 produces intoxicating effects similar to the more tightly regulated delta-9-THC. However, Delta-8 is poorly researched, and its potential risks remain largely unknown.

This practice is particularly prevalent in states lacking legal recreational cannabis markets, where it serves as a workaround to meet the demand for cannabis products through legal ambiguities. This not only undermines consumer safety but also perpetuates unregulated and potentially hazardous products. To safeguard public health and eradicate illicit markets, it is essential to legitimize medical and/or recreational cannabis markets. This would enable responsible adults to access safe, regulated products, ensuring quality control, consumer protection, and the reduction of risks associated with unregulated cannabis use.

2) Genetics

The selection of hemp genetics is largely based on some key aspects. Firstly, what is the goal commodity being produced – i.e. seed, fibre, or therapeutics. Next is what latitude you are growing in, as this affects daylight hours, which is the most common trigger for hemp to reach maturity. There are daylight-neutral (auto-flowering) varieties that are not influenced by daylight hours; however, these are not as common. Therefore, selecting genetics from similar latitudes is key to success, as late-flowering or late-maturing crops may face adverse seasonal weather or become too tall for standard harvesting equipment, limiting production efficiency in many regions. Other key factors to consider for the success of any genetics are similar climatic conditions, soil types, nutrition, pest and disease pressures, and access to irrigation.

Findings

Local hemp yields have more than doubled over the past five years[1], however, much of this progress has stemmed from enhanced agronomic practices, including optimised sowing dates, seeding depths, nutrition, and irrigation strategies. Genetic improvements have largely remained stagnant; however, they are now advancing rapidly as seasoned experts from other crop industries bring their experience to modernise the hemp sector. These professionals are applying breeding techniques common and proven in other crops but not yet widely implemented in hemp, offering significant opportunities for improving key traits.

2.1 Hybridisation

One of the goals of leading breeders in hemp genetics is to introduce hybridisation. This process generates a well-known concept in agriculture called hybrid vigour. This results in faster growth rates and larger overall size compared to parent strains. Hybrid vigour occurs when the offspring (hybrids) inherit the best traits from both parents, such as disease resistance, climate tolerance, and improved yield. Consequently, hybrid plants are stronger and healthier, with enhanced resistance to pests and diseases and better adaptability to environmental stresses. This technique is widely employed across agriculture to develop high-yielding crop varieties, thereby improving food security and sustainability. University trials of these varieties have shown yield increases of more than double compared to standard varieties.

2.2 Dryland Agriculture

To expand the hemp industry sustainably, developing genetics suited to perform well in dryland agriculture is crucial. Currently, hemp production is concentrated in irrigated systems, where it competes with high-value crops like vegetables, raising production costs and limiting accessibility. With over 90% of Australian farmland lacking irrigation, drought-resistant hemp varieties are needed to thrive in low-water conditions.

Canada offers a useful example: approximately 50% of its hemp is grown in dryland systems, benefiting from natural snowmelt to establish crops without heavy irrigation. This environmental advantage allows Canadian producers to achieve seed costs roughly 40% lower than in Australia. By focusing on breeding hemp varieties tailored to Australia's unique dryland environment, hemp can become a scalable, cost-effective cash crop that supports sustainable agriculture even in arid regions.

2.3 Multipurpose Use

Hemp is a unique crop, in that the multiple fractions of the plant (seeds, stalk, and extractable biomass), are of high value. However, currently, varieties are designed for either high seed yield, high stalk yield, or high-yielding biomass for extraction. There are a few varieties designed with characteristics suitable for multi-purpose harvesting. If farmers can derive high value from all the byproducts of production, it will bring down the cost of all, as the farmer can achieve a desired gross margin without heavy reliance on a single hemp commodity. Genetics are needed that can be utilised for all three fractions; however, this is not without its challenges. It was found that varieties with high levels of secondary metabolites in the biomass for extraction also have high terpene profiles, which in turn taints the flavour of the seeds. Additionally, when growing for fibre, the crop exceeds the standard of combine harvesters to collect the grain. This also creates a further challenge, as for most multi-purpose crops, specialised harvesting equipment is usually required to cost-effectively harvest the crop.

2.4 Breeding for Uniqueness

The genetic diversity within cannabis allows for targeted development toward various outcomes. While the primary focus has been on enhancing yields of key commodities like seed, fibre, and cannabinoids, research is now exploring more specialized traits. For example, New West Genetics has developed a hemp variety with elevated Stearidonic Acid (SDA), an omega-fatty acid precursor to DHA, which holds promise for fish feed by improving health benefits and reducing reliance on unsustainable fish meal.

Innovators like Gianpaolo Grassi are advancing genetics to highlight minor compounds like rare cannabinoids and flavonoids. Additionally, to navigate regulatory constraints around THC and CBD, he has developed a cannabinoid-free hemp variety, ideal for tea due to its aromatic and flavourful profile. fibre varieties could also be bred with higher cellulose content, improving efficiency for bioplastics.

Hemp also contains therapeutic compounds at low concentrations, which are economically challenging to extract. Future varieties with increased levels of these compounds could boost adoption and meet demand for targeted health applications. As the industry evolves, unique genetic traits will differentiate products, expanding hemp's market potential across diverse applications.

3) Harvesting

A variety of harvesting techniques are currently used in hemp production, largely determined by the specific type of hemp commodity being produced and whether the crop is focused on a single purpose or multiple uses. Most harvesting techniques and equipment in hemp production - such as seed drills, combine harvesters, silage harvesters, windrowers, and balers - are adapted from standard equipment used in other crop types. Many businesses slightly modify this standard equipment to optimise it for hemp harvesting. These modifications often come after first-time harvesters harvest hemp as they would wheat and other crops, resulting in strong hemp fibres wrapping around driveshafts, causing tractors to seize. Some modifications are as simple as covering the driveshaft to protect it from fibre wrapping. However, in some areas, this equipment isn't readily available, so adaptable equipment is being produced by the likes of Bish Enterprises, which can easily be connected to a wide variety of tractor types to effectively harvest hemp.

Genetics, agronomy, and timing are critical to successfully harvest a hemp crop. Precise timing is essential to avoid yield losses: harvesting too early for seeds results in unripe, empty seeds, while harvesting too late can cause seed shattering, where overripe seeds fall from the plant before they can be collected. For crops harvested for flower or extractable biomass, harvesting too early limits secondary metabolite (ie. cannabinoids, etc.) production, while delayed harvesting often increases the proliferation of mould within the crop, drastically reducing its value.

Fibre crops present unique timing challenges. Harvest timing depends on crop height and weather forecasts, and proper retting is vital for decortication. After harvest, stalks are left in the field to undergo microbial and moisture-driven lignin breakdown, known as retting, which ensures the inner hurd can be easily separated from the outer bast. A manual "snap" test checks if the retting process is complete - if the stalk snaps easily and the bast fibre peels off cleanly, it's ready. The uronic acid content in stalks is a more scientific and reliable indicator: around 5% uronic acid signifies proper retting, above 5% indicates insufficient retting, and below 5% means the stalks are over-retted.

In all hemp commodities, moisture content at harvest is critical, as seeds, fibre, and biomass must be dry for further processing or sale. Therefore, drying becomes more complicated and costly the more moisture there is in the crop at harvest. Seeds and biomass must be exposed to aeration within hours of harvest to maintain the quality and integrity, and to minimise risk of mould and high microbial count. Since fibre isn't consumed, this is much less critical.

Findings

3.1 Multipurpose Harvesting

To leverage the novel characteristic of hemp, and extract the most value from the crop, harvesting strategies need to be geared towards extracting multiple commodities from the one crop. In an ideal universe, this would mean all three at once - seeds, fibre, and extracts - however, in reality, there are a number of complexities that make this challenging.

As aforementioned, genetics geared towards fibre exceed the height of standard combine harvesters, and it is critical when harvesting grain from the top of the crop that the excess stalk is minimised to prevent the fibre wrapping and seizing up drive shafts. Even specialised dual-harvesting combines, which have an elevated combine header sitting above a fibre cutting front are not suitable for fibre-focused varieties that can reach over four metres in height. Since seeds are produced at the end of plant maturity, you are unable to harvest these varieties prematurely to achieve a dual harvest. So instead, slightly shorter dual-cropping genetics are used, which can also be harvested for seed, however, there is a trade-off as it results in lower fibre yields.

Large-scale biomass capturing equipment has also been developed to allow for tri-crop harvesting, however, there are several roadblocks to adoption. Firstly, genetics for seed or fibre production are usually quite low in cannabinoids - usually 1-5% concentration, compared to up to 25% in hemp genetics specifically grown for extracts in horticultural production systems. This can cause downstream processing (i.e. drying and extraction) to be unviable or require significant capex to meet the necessary extraction scale. This can be solved by either increasing the concentration of cannabinoids through genetic improvements or adding a low-cost, large-scale concentration step - most likely a physical separation step to remove trichomes from the biomass (similar to hash production). As aforementioned, genetics with higher concentrations of cannabinoids, also have higher terpenes, which were found to negatively affect the flavour profile of the seeds in food - another challenge for multi-purpose harvesting for extracts. Another limitation of multi-purpose harvesting is the complexity of finding markets for multiple commodities in different markets.

3.2 In-field Processing

There has been a lot of focus on designing and engineering equipment to process hemp material in facilities. Standard practice in the industry is to rake and bale whole stalks of the crop, then break down the bale and process the whole stalks through heavy equipment in processing plants.

However, an alternate approach is to pre-process the stalk in the field.

An alternate, and I would argue, a more effective method is to utilise the horsepower of tractors and pre-processing the material in the field. Cutting the straw into shorter lengths speeds up the retting process and allows the material to be removed from the paddock earlier. Additionally, because the product is windrowed, it provides a uniform feed rate into the tractors. This is one of the challenges with many hemp fibre manufacturing facilities as the bales are not uniform, and therefore cause an inconsistent feed rate, which negatively affects the quality of the outfeed products.

Additionally, further processing the straw in the field through techniques such as Dun Agro, means that the factory is purely a refinement step. This results in less reliance on heavy equipment in the factory and reduces the need for floor space.

4) Processing and Manufacturing

Innovation in processing and manufacturing is advancing new hemp products and materials for global supply chains. Building this manufacturing capacity is essential to leverage hemp's natural benefits and achieve the scale and efficiency needed to make sustainable, hemp-based alternatives cost-competitive. Proper production and harvesting practices are crucial for delivering quality and consistency in manufacturing.

Currently, hemp stalks are decorticated through a method that usually involves first breaking down the stalk with either a hammer mill or rollers. This breaks the rigid inner hurd, and in most cases will separate a large proportion of the hurd from the fibres. The next steps used are for further refinement and usually involves the use of combs and aspiration to remove the remaining hurd from the bast fibre fraction, and the bast fibres from the hurd fraction.

The processing of hemp seeds depends on the desired ingredient outcome. Seeds are either dehulled to remove the fibrous outer shell to create hemp hearts, the shells are usually sold as a low-value product into agricultural markets. Oil is extracted from the seeds through several different methods whether it is mechanically or through some form of food-grade solvent. Oil production also results in a meal cake byproduct, which is usually milled into flour or protein powder.

Findings

4.1 Hemp as an Inclusion, Not the Total

Something common in the industry is the belief in hemp and a passion for all the amazing characteristics of the many facets of the plant. This, however, often leads to a narrow focus on using only hemp in consumer products, which although possible, is usually less superior than blending hemp with other ingredients. Hempitecture is a prime example of this. They originally set out to make insulation using 100% hemp fibres, however, they determined that blending hemp with other natural fibres produced a higher-performing product. Many clothing products also feature a higher-quality, hemp and cotton blend. This is also true for food products where hemp works well as an addition to recipes and formulations. Hemp has many unique and valuable characteristics as an inclusion in a range of consumer goods. The industry needs to step out of the mindset that 'hemp is the solution', and instead that 'hemp is part of the solution'.

4.2 Importance of Byproduct Utilisation

Hemp is unique in that it produces multiple commodities from a single crop, making byproduct utilisation crucial for eliminating waste, reducing costs and maximising margins for producers. This is the thesis for why multi-purpose production / harvesting is so important. However, this is also applicable to both seed and fibre processing. When producing hemp seed oil, over 70% of the output is hemp meal / protein, and hulled seeds produce over 50% hemp hulls. Similarly, the stalk is made up of hemp of approximately 20-30% bast fibre and 70-80% hurds, and processing also produces a component of dust and fines, depending on the quality of the processing equipment. To ensure hemp products are profitable and at reasonable prices for consumers, successful operators have developed or are developing markets for these byproducts. This sometimes involves purely marketing the raw ingredients and the potential benefits, or further processing the product into a more marketable format.

4.3 Leveraging Existing Infrastructure

The establishment of any new industry or business venture typically requires significant capital investment to build specialised equipment. However, this is not always necessary, yet ambitious founders and operators often rush into this without considering whether existing infrastructure could provide at least part of the solution.

There is specialised equipment currently used in every part of the hemp supply chain, whether it's planting equipment for extracts, harvesting equipment for fibres and multi-purpose cropping, or specialised processing equipment for fibre or seed. Although these may have higher quality or more efficient outcomes, sometimes a solution that achieves 80% of the ideal outcome is enough to satisfy market demands, and where existing infrastructure can be used. The use of standard silage harvesting equipment to pre-process hemp stalks is one example of this. Another is the use of a cotton gin to separate hurd and fibre from hemp stalks. Leveraging this infrastructure significantly reduces the initial capital required to establish new production regions, and in the early stages of the industry, the 'low-hanging fruit' of initial products usually doesn't require the highest quality of inputs.

4.4 Artisan Versus Mass Production

The hemp industry balances between artisanal craftsmanship and the need for large-scale production. Small batch, solventless extracts and cottage industry health foods highlight the benefits of artisan hemp products, valued for their purity, minimal processing, and quality. These products cater to niche markets that prioritize wellness, transparency, and a personal touch, providing a unique, carefully curated experience.

However, scaling the industry is essential to fully realise hemp's environmental potential. Large-scale production enables hemp to replace less sustainable materials and meet demand in textiles, construction, and biofuels, amplifying its positive environmental impact.

At the same time, there will always be a market for small-scale, high-quality, handmade hemp products. These cater to consumers who seek distinctive, premium offerings and support traditional, sustainable practices. By balancing artisanal and mass production, the hemp industry can achieve both environmental goals and meet diverse consumer demands, establishing hemp as a force in sustainable innovation.

4.5 Standardisation Of Hemp Commodities

For hemp to be successfully integrated into various industrial supply chains, achieving industry-wide standards for product characteristics is essential. This ensures that hemp products consistently meet the validated specifications and perform reliably across batches.

This will encompass standard practices across all aspects of the supply chain to achieve these standards, however, it will give manufacturers a guarantee that all hemp-derived products achieve uniform results, which will foster trust and reliability within the industry.

4.6 The Importance of Innovation and Marketing

To successfully integrate hemp into our daily lives, the industry must develop products that solve specific problems, as most consumers won't use hemp merely for its novelty. Identifying areas where hemp can add value and creating suitable products and delivery methods is crucial.

Dun Agro have developed prefab homes built with hempcrete as the insulative material, and panels are produced efficiently in their factory thereby bypassing the need to install hempcrete onsite which is an inefficient and labour-intensive process.

Canadian Greenfields has created a process to treat hemp fibres to produce a high-performance, sustainable concrete additive. Hempitecture continues to innovate with new sustainable building materials. Biodegradable hemp-based bioplastics are starting to enter the market of bio-based resins to replace unsustainable oil-derived products. A range of hempcrete bricks and panels are now available to eliminate the inefficient process of installing hempcrete.

Additionally, several companies are developing hemp food ingredients with enhanced functional characteristics, such as protein concentrates, de-coloured hemp seed oil with a higher smoke point and longer shelf life, and various product blends incorporating hemp for its functional benefits. Nepra Foods is transforming hemp proteins into egg replacements and textured proteins. Innovative products need to be coupled with effective branding and marketing strategies to educate consumers on the benefits to drive adoption and market growth.

5) Investments

5.1 The Curse of Overly Ambitious Growth Projections

The transformative potential of the hemp industry has attracted significant attention and investment, and in turn, ambitious growth projections. This hype is great as it brings well-needed investment to establish key infrastructure and educate the market, however, excessive hype can distort growth and misallocate capital.

Findings

Historically, the hemp market has faced multiple hype cycles, such as the 2016 Canadian hemp food market boom, which led to massive oversupply in the following year and had a significant financial impact on the industry. Similarly, the U.S. CBD market, spurred by the 2018 Farm Bill, saw rapid production expansion that outpaced demand, causing a market crash and a backlog of unsold biomass. Australia has recently had a similar experience in the hemp food market, where major overproduction caused several companies to cease operations. This burns invested capital, damages market perceptions for potential future investors, and worst of all, means farmers usually don't get paid, making it less likely they will grow hemp again. Although I'm hopeful it doesn't occur, the hemp fibre market looks to be following a similar trajectory, with many companies investing heavily to establish large-scale production capabilities without established markets to sell products into. Hopefully, the market develops as quickly as anticipated and the scaling of capacity is validated, so history doesn't repeat itself.

5.2 The Need for Investment into R&D

As aforementioned, to improve all facets of the hemp supply chain, investment in research and development is crucial. In a nascent industry such as hemp, the investment in capturing data, trialling new equipment and processes, and developing new products and technologies are all pushing the industry forward. We need to continue to understand the novel traits that make hemp unique and how the functional characteristics of the products are applicable to certain industries. It is essential that there is a continued investment in R&D programs to drive industry growth, and there is a significant amount of improvements through low-hanging fruit in the early stages of the industry which usually derive outsized returns on investment.

5.3 Funding Avenues

In the early stages of the hemp industry, securing funding from traditional sources such as banks and brokerage firms proved inherently challenging, with the stigma surrounding hemp often cited as a significant barrier. Consequently, startups frequently relied on venture capital investment or financial support from the founders' personal networks. Crowdfunding also emerged as an innovative and effective funding method, successfully leveraged by numerous startups to bridge financial gaps and accelerate growth.

In many regions, government funding has played a pivotal role in establishing the industry by enabling startups to build the infrastructure necessary to support the supply chain. Government initiatives aimed at transitioning to sustainable industries, fostering regional job creation, and promoting innovation have been instrumental in directing capital to hemp entrepreneurs.

A notable example of securing unconventional funding is HempWood in the US, which utilised soy-based adhesives in its hemp flooring product and cleverly obtained funding from the United Soybean Board (USB). This demonstrates the potential for hemp businesses to find investment opportunities from established industries outside of hemp. These industry groups, with significant capital allocated to research and development, may view hemp as a complementary commodity and facilitate necessary investments. By positioning hemp within the broader agricultural ecosystem and exploring synergies with other commodities to create functional, value-added products, hemp businesses could unlock resources and investment opportunities from large agricultural establishments and other well-funded industries. This cross-industry collaboration not only enhances the growth potential of hemp but also underscores its versatility and value in a sustainable future.

Future Opportunities

The number of potential applications for the numerous agricultural commodities produced by the hemp plant meant that there were many areas of the industry that I didn't have time to explore. However, after many discussions, there are several future opportunities currently being explored within the industry that show strong potential for growth. These include, but are not limited to:

Carbon Markets

Hemp's natural ability to sequester carbon offers significant promise within carbon credit markets. By participating in these markets, farmers can earn carbon credits, which they can sell to companies looking to offset their emissions. This adds an additional revenue stream for farmers while incentivizing the cultivation of hemp as a climate-friendly crop. As carbon credits help offset production costs, there is potential for reduced overall costs for hemp products, making them more accessible and competitive across industries.

Biofuels and Sustainable Aviation Fuels (SAF)

for reducing greenhouse gas emissions in the aviation industry. Hemp-based biofuels could provide a renewable, lower-emission alternative to traditional jet fuel, supporting the transition toward sustainable aviation.

Future Opportunities

Non-Cannabinoid Bio-Active Compounds

Beyond cannabinoids like CBD, hemp produces various bioactive compounds with potential therapeutic and nutraceutical applications. These non-cannabinoid compounds, such as flavonoids and terpenes, may offer health benefits and could serve as ingredients in supplements and functional foods, driving innovation in wellness products without the regulatory burdens imposed on cannabinoids.

Nano-Materials

Hemp fibres are being researched for applications in nanotechnology due to their strength, flexibility, and biodegradability. Electro-spun nano hemp fibres have potential uses in industries ranging from medical supplies to high-performance textiles. These nano-materials can enhance durability, conductivity, and other properties in products, while also offering a more sustainable alternative to synthetic materials commonly used in electronics, construction, and automotive industries.

Animal Feeds

Hemp seeds and other byproducts can be used as protein-rich animal feeds. This application not only creates a use for hemp byproducts but also provides a nutritious, sustainable option for livestock and aquaculture, supporting the demand for high-quality animal feed. Additionally, hemp-based feed could contribute to improved livestock health due to its high omega-3 and omega-6 fatty acid content.

Phytoremediation

Hemp's ability to absorb toxins from the soil makes it a valuable plant for phytoremediation, especially in contaminated areas like former mining sites. Planting hemp on these degraded lands can gradually extract heavy metals and other pollutants, restoring soil health and potentially revitalizing previously unusable land for agricultural or environmental purposes. This could provide an environmentally sustainable solution for mining companies seeking to remediate and repurpose their sites post-extraction. Each of these areas represents a significant opportunity for growth and innovation, positioning hemp as a versatile crop that can contribute to both economic development and environmental sustainability across industries.

Conclusions

The Churchill Fellowship provided me with an incredible opportunity to travel the world at a pivotal time in the development of the global hemp industry, where dreamers and ideals have been replaced by entrepreneurs focused on commercialising these ideas and establishing markets. By traversing the old and new world I was able to get insight into the importance of hemp in cultures throughout history, as well as the renewed optimism in markets where hemp is having a resurgence as an important tool to meet our new sustainability goals.

There's no question that hemp has the potential to add significant monetary and environmental benefits to global supply chains. If the Australian industry can scale effectively and produce hemp commodities efficiently and economically it will present a major economic opportunity for local farmers and manufacturers in the future. However, the industry needs to overcome a multitude of challenges, some typical to any new industry, however, these are magnified by problems unique to hemp and the stigma that seems to be omnipresent.

The industry needs more investment, and more people from outside the industry to bring expertise into the market to find solutions to the challenges facing the industry. We need to look past the botanical name and eliminate the stigma attached to hemp, as this is preventing governments and institutions from backing the industry and many professionals from considering it as a viable career. We need governments and regulators to allow the markets to develop without overburdening red tape. The public perception of the plant has completely evolved over the last 10 years, and it's now up to the regulator to catch up.

Hemp products are currently considered expensive commodities in the many applications they can be used. There is a niche market for consumers willing to pay more for things such as health foods, sustainable construction materials and natural therapeutics, however, for the industry to have the largest positive impact, hemp needs to become feasible to be adapted into mainstream markets.

It is clear from my travels that the hemp industry is going through a major period of commercialisation which will drive gains in efficiency and productivity. This could hit the critical mass required to drive hemp into global supply chains. This will only be possible by the industry working together to solve the universal challenges restricting the industry and grow the industry sustainably by making great products, educating the market on the benefits and establishing the infrastructure required to support the supply chain. Simple really...

Recommendations

Educate Policy Makers and Clarify Regulations

A united industry lobbying effort needs to be made to foster awareness among policy makers about the economic, environmental, and social benefits of industrial hemp to drive legislative support and reduce regulatory barriers. In doing so, separate regulations for hemp food and fibre markets from therapeutic uses to streamline regulations and foster industry growth.

Promote Public Awareness

Launch industry-led and funded campaigns to shift public perception of hemp from its association with narcotic drugs and educate the public on its sustainable and versatile industrial applications.

Expand R&D Investment

Develop pathways for funding from the private and public sectors to prioritise research into hemp's applications, genetics, and processing technologies to unlock new markets and improve crop yields. Including, but not limited to developing genetics and harvesting methods that enable efficient use of all parts of the hemp plant (fibre, seeds, and cannabinoids). Develop hemp varieties suited for dryland farming to make production more cost-effective and accessible to low-cost production regions. Leverage R&D to develop secondary markets for hemp byproducts to enhance profitability and minimise waste.

Leverage Existing Infrastructure

Work with large-scale producers and processors to utilise and adapt current agricultural and industrial equipment for hemp production to lower startup costs and integrate hemp into established supply chains.

Encourage Hemp Use in Sustainable Farming Systems

Work with industry groups and grower networks to promote regenerative agriculture techniques and the use of hemp as a benefitial rotational crop.

Recommendations

Overcome Marketing Barriers

Work in conjunction with governments to pressure social media companies to enable fair advertising policies for hemp businesses, addressing misclassifications and boosting market reach.

Promote Carbon Offset Incentives

As an industry body, advocate for carbon credits and other incentives for hemp's significant carbon sequestration potential to attract more farmers and investors. Develop a hemp carbon standard to validate the sequestration capacity of hemp crops.

Foster Collaboration

Encourage the industry to work together to share best practices in production and processing to accelerate the industry's growth and develop standards for raw materials.

Support Localised Value Chains

Convey the potential of the industry with state and local governments to encourage the development of regional processing facilities to reduce logistical challenges and create local economic opportunities.

Dissemination and Implementation

As an active member of the Tasmanian Hemp Association and the Australian Hemp Council, I look forward to freely sharing my learnings from the research with the wider industrial hemp industry.

I will also continue to educate outside the industry through presenting at conferences, doing media interviews, and undertaking educational campaigns through social media channels.

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