

New Zealand's Industrial Hemp Industry

Motivations, constraints, and moving forward

Polly Brownlee

A dissertation submitted in partial fulfilment of the requirements for the degree of

Master of Arts in Geography

at the University of Otago, Dunedin, New Zealand.

2018

Abstract

Industrial hemp (*Cannabis sativa* L.) is one of the oldest food, fibre, and medicinal plants known to humankind. Research demonstrates that industrial hemp could facilitate New Zealand's transition toward more sustainable agriculture because of its capabilities for carbon sequestration, environmental regeneration, phytoremediation, and the development of sustainable products. But despite this potential, New Zealand's industrial hemp industry is currently small, fragmented, and constrained. This dissertation critically analyses the constraints to industry development and the ways the industry can move forward. The topic of this dissertation is three-fold: 1) to understand people's motivations to be involved within the hemp industry; 2) to evaluate the constraints on the industry; and 3) to understand how the industry can best move forward.

Key informant interviews with diverse stakeholders within the industry informed the discussions and conclusions. This research project produced a number of key findings for each research question. Firstly, the majority of people involved in New Zealand's hemp industry are intrinsically and individually motivated due to personal passions for sustainability. Secondly, several major constraints to the industry exist including: stigma and corresponding regulations, lack of funding, physical infrastructure and governmental support; and lack of clarity within the industry regarding accessing information and the industry's niche and scale. Thirdly, moving forward several factors were discussed: it is suggested that the stigma is dismantled through political and social mechanisms; the industry decide on its niche and operational scale; and that an overarching social infrastructure is developed to provide clarity, collaboration and international competitiveness for the industry. Overall, an overarching social infrastructure could advance the New Zealand's hemp industry and the industry could harness existing passions for sustainability, creativity, and innovation at the core of its internationally competitive identity.

This is the first qualitative research study on New Zealand's industrial hemp industry. Ultimately, this dissertation hopes to emphasize the potential of the industrial hemp industry for the future sustainability of New Zealand, and to provide clarity regarding the constraints and future directions for the industry.

Acknowledgements

I wish to express my sincere gratitude to my Supervisor, Sean Connelly. Without your assistance, insight, and feedback, this would not have been possible.

To my partner, Louis Foot. For your unwavering support, humour, and encouragement, and for helping me see the wider importance when I was lost in the hempseeds. Thanks for providing the coffee, chocolate, and pics peanut butter!

To my flatmate, Surrey Collett, for your endless support and positivity, and to all the laughter we share together.

To my family, and parents especially, who have always encouraged me and have been my lifeline at times. Without my childhood on the farm this may never have happened.

Gratitude goes to all the awesome postgrads in the Geography Map Library community – having you all there for laughter and banter has been a blast.

I would like to thank the hemp community and the organisers of New Zealand's first iHemp Summit in July 2018.

Lastly, I would like to thank the University of Otago for providing me an opportunity to pursue this Master's degree with the help of the Coursework Master's Scholarship.

Table of Contents

Abstract	ii
Acknowledgements	iii
List of Figures and Tables	vi
Glossary	vii
1 INTRODUCTION.....	1
1.1 The scope of the report	5
2 LITERATURE REVIEW	8
2.1.1 The need for realism	8
2.2 HEMP FOR SUSTAINABLE AGRICULTURE	9
2.2.1 Emissions reductions	9
2.2.2 Hemp as a sustainable crop rotation	11
2.2.3 Hemp for phytoremediation.....	13
2.2.4 Economic returns	14
2.2.5 Sustainable products	14
2.2.6 Summary.....	15
2.3 CONSTRAINTS TO NZ’S HEMP INDUSTRY.....	18
2.3.1 Mismatch between predictions and reality	18
2.3.2 The war on Cannabis: Hemp’s marijuana stigma.....	20
2.3.3 Technological and funding constraints	22
2.3.4 Section Two Summary	24
2.4 FACTORS FOR AGRICULTURAL INDUSTRY SUCCESS.....	25
2.4.1 Innovation and collaboration	25
2.4.2 Niche marketing	29
2.4.3 Overarching social infrastructure	30
2.4.4 Section 3 Summary.....	32
2.5 Chapter 2 Summary	33
3 METHODS	34
3.1 Chapter overview.....	34
3.2 Research Questions.....	34
3.3 Methodology.....	34
3.3.1 Methodological approach: Post-structuralism	34
3.3.2 Constructivist framework	35
3.3.3 Multiplicity of voices.....	35
3.3.4 Positionality, ontology, and epistemology	36
3.4 Methods	37
3.4.1 Attending the iHemp Summit.....	37
3.4.2 Interviews	37
3.4.3 Analysing Data	40
3.4.4 Ethics	40

3.5	Chapter 3 Summary	40
4	RESEARCH RESULTS AND DISCUSSION	41
4.1	Chapter Overview	41
4.2	MOTIVATIONS.....	42
4.2.1	Intrinsic motivation.....	42
4.2.2	Passion for sustainability	44
4.2.3	Farmers: Hemp as a sustainable rotational crop for existing farms	45
4.2.4	Entrepreneurs: sustainability	48
4.2.5	Human health.....	51
4.2.6	Summary.....	52
4.3	CONSTRAINTS	53
4.3.1	Stigma: A major constraint.....	53
4.3.2	Lack of clarity within the industry	57
4.3.4	Summary.....	63
4.4	MOVING FORWARD.....	63
4.4.1	Stigma: Moving forward	64
4.4.2	Political mechanisms: Changes to Misuse of Drugs Act 1975 needed	64
4.4.3	Social mechanisms: More product innovations needed	66
4.4.4	Lack of clarity: Niche and scale	68
4.4.5	Develop an overarching social infrastructure	69
4.4.6	Venturing one step further: sustainability, creativity, and innovation	71
4.4.7	Summary.....	72
4.5	Chapter 4 Summary	72
5	CONCLUSION	73
5.1	Major Research Findings.....	74
5.1.1	Research Question 1: Motivations.....	74
5.1.2	Research Question 2: Constraints.....	75
5.1.3	Research Question 3: Moving forward.....	76
5.2	Limitations.....	77
5.3	Recommendations for future research.....	77
5.4	Recommendations for New Zealand's industrial hemp industry	77
5.5	Concluding comments	78
	REFERENCES	79
	APPENDIX A: Ethics Approval Letter.....	93
	APPENDIX B: Information Sheet for Participants.....	94
	APPENDIX C: Interview Questions Sample.....	96
	APPENDIX D: Consent Forms	97

List of Figures and Tables

Figure 1: International Marketing Campaign for “100% Pure” New Zealand.....	4
Figure 2: The structure of the dissertation.....	7
Figure 3: Average gross carbon sequestration by urban/forest trees and hemp plants.....	11
Figure 4: Hemp grown in Canterbury, 2004.....	12
Figure 5: Hemp value chain.....	16
Figure 6: The Shely Fibre Breaker, 1892.....	23
Figure 7: A German industrial hemp fibre processing plant.....	24
Figure 8: Key informant representations.....	41
Figure 9: Breakdown of the motivation orientations of participants.....	43
Figure 10: Most intrinsically motivated participants connected their motivations to sustainability.....	44
Figure 11: Perspectives of interviewed farmers on hemp’s potential for New Zealand.....	48
Figure 12: Hemp’s stigma prevents funding and governmental support, resulting in a lack of physical infrastructure and slow pace of industry development.....	55
Figure 13: Different perspectives on the New Zealand industrial hemp industry’s niche.....	60
Table 1: Hemp’s potential as a sustainable agricultural industry and/or as a sustainable rotational crop.....	17
Table 2: Roles of research participants.....	39
Table 3: Proposed Changes under the Misuse of Drugs (Industrial Hemp) Regulations 2006 and regulations under the Food Act 2014.....	66

Glossary

Bast – the long, strong outer hemp fibres that surround the woody core

Cannabis – A genus of flowering plant in the family *Cannabaceae*. There are three separate species recognised: *Cannabis sativa*, *Cannabis indica*, and *Cannabis ruderalis*.

Cultivar – the basic grouping for cultivated hemp varieties. NZ has 12 approved cultivars under the Misuse of Drugs (Industrial Hemp) Regulations 2006.

Decortification – the mechanical process of removing the long (bast) and short (hurd) fibres from the stem.

Decorticator – hemp fibre extraction machine

delta-9-tetrahydrocannabinol (THC) – the psychoactive ingredient that makes some Cannabis varieties a valued drug

Hempseeds – The female hemp plant produces nutritious seed after fertilisation with the pollen from the male plant. (Also called ‘hemp grain’ and ‘hemp nut’)

Hemp meal – the flour-like product from ground hempseed

Hempcrete – a lightweight, carbon negative bio-composite building material made from wet-mixing hemp hurd with a lime-based binder

Hurd – also known as hemp core, shives or wood, are a product from the inner woody cellulose core of the hemp stalk (bast). Comprises about 60% of the mass (Serecon Management Consulting, 2012: 9)

Industrial Hemp – a term to refer to *Cannabis sativa* plants (and subsequent products) that have low levels of THC. In NZ, industrial hemp is legally required to have no more than 0.5% THC.

Marijuana – a slang word for specific cultivars of Cannabis which have high levels of THC (5-20%+)

Retting – the process of separating the outer bast fibre from the woody core (hurd) using the microaction of micro-organisms and moisture to decompose or rot the cellular tissues surrounding the bast-fibre bundles

Adapted from O’Callaghan et al. (2018a 8).

1 INTRODUCTION

Industrial hemp (*Cannabis sativa* L.) is a plant which has been cultivated and used since 8000 B.C (Lash, 2003). If developed to its potential, New Zealand's industrial hemp industry could assist the country to transition toward sustainable agriculture and/or function as a sustainable rotational crop to complement other farming systems (Venture Taranaki, 2014). This assumption is a reflection of hemp's researched abilities to sequester large amounts of carbon dioxide (Zampori et al., 2013; Kenneth & Miller, 2012), rehabilitate soils (Cherney & Small, 2016), undertake phytoremediation (Linger et al., 2002), and generate environmentally-friendly food and fibre products (O'Callaghan et al., 2018).¹

Traditionally a sustainable fibre, food and medicinal source, hemp fibre and oilseed is also used to produce environmentally sustainable alternatives to existing products. *Hemp fibre* has been used historically to manufacture a huge variety of products including ropes, textiles, building material, paper, and, more recently, biodegradable alternatives to plastic (Parello, Karimi, & Fagan, 2013; Ministry of Health, 2006; Gibson, 2008). *Hemp oilseed* is a source of valuable and nutritious oil for human consumption and can be used as a renewable alternative to petroleum and fossil fuels, as exemplified by Henry Ford's early Ford cars which were built with hemp fibre and powered by highly unsaturated hemp oil (Conrad, 1997; Ministry of Health, 2006; Murphy, 2011). Furthermore, research has documented hemp's capabilities for environmental regeneration of land, phytoremediation, and carbon sequestration. From herein, 'industrial hemp' will be mostly referred to as 'hemp', and Cannabis plants grown for psychoactive properties will be collectively referred to as 'marijuana'.²

But despite the researched potential of hemp's capabilities to contribute to sustainable agriculture in New Zealand, the hemp industry remains small and fragmented and has been described as still 'in the infant stage' (Venture Taranaki, 2014: 50), and no primary research has

¹ Chapter 2 will expand more in depth on hemp's potential as a sustainable agricultural industry for New Zealand.

² Industrial hemp belongs to the family Cannabinaceae (genus *Cannabis* species *sativa*). Under the Misuse of Drugs Act (Industrial Hemp) Regulations (2006: 4) 'industrial hemp' refers to hemp which has THC content not above 0.5%. This legal requirement ensures that industrial hemp is too low to be an intoxicant (Swanson, 2015). Authorities may require the destruction of a hemp grower's entire crop if hemp plants are tested above 0.5% (Ministry of Health, 2006; 2010). New Zealand's differentiation between 'hemp' and 'industrial hemp' is crucial, as it is also the legal difference between marijuana and industrial hemp, respectively.

examined why. The purpose of this research is to address this research gap by understanding people's motivations for working within the hemp industry, the major constraints to the industry, and the ways the industry can move forward to contribute to more sustainable agriculture in New Zealand.

1.1 Sustainable agriculture

Global critiques of conventional agriculture and its detrimental effects on the natural environment has led to a call for agriculture to become less exploitative and more 'sustainable'. Different schools of thought have varying definitions of what constitutes the 'sustainability' of agriculture, and various labels are used such as integrated agriculture, holistic agriculture, organic agriculture, ecological agriculture, biological agriculture, and permaculture (Leeuwis, & van den Ban, 2004). This dissertation follows the Food and Agriculture Organization (FAO) of the United Nation's definition of sustainable agriculture (FAO, 1988; 2014; 2018). The FAO defines sustainable agriculture as:

'...the management and conservation of the natural resource base, and the orientation of technological change in such a manner as to ensure the attainment of continued satisfaction of human needs for present and future generations. Sustainable agriculture conserves land, water, and plant and animal genetic resources, and is environmentally non-degrading, technically appropriate, economically viable and socially acceptable'

(FAO, 1988: 12)

Why is sustainable agriculture needed in New Zealand? New Zealand's *Our Land Report* demonstrated that intensification of agriculture has deteriorated soil and water quality, noting that 'the state of our biodiversity and ecosystems and our soil resources is continuing to decline' (MFE & Stats NZ, 2018: 7; 42). Water quality has declined in regions where dairy farming has expanded, resulting from increased nitrogen concentrations in waterways from fertiliser, urine and faecal matter, irrigation, and erosion (MFE & Stats NZ, 2017; PCE, 2015). Indeed, the Environmental Ministry has revealed six of New Zealand's waterways have toxic nitrate levels (Clayton, 2014).

The 2018 IPCC (2018)³ *Special Report on Global Warming* warned that countries have a maximum of 12 years to meet and exceed their Nationally Determined Contributions (NDCs) for emissions reductions under the Paris Climate Change Agreement in order to limit global warming to a maximum of 1.5degrees warmer than pre-industrial levels. The report showed that half a degree of warming will significantly worsen the risks of extreme heath, drought, ice melt, floods, biodiversity loss, and poverty. Carbon dioxide emissions are rising in New Zealand alongside the expansion of intensive agriculture, despite the country's NDC to reduce greenhouse gas emissions to 30% below 2005 levels by 2030. Agriculture currently accounts for 49% of the country's gross emissions (MFEa, 2017; NZ Government, 2016). Indeed, the OECD's (2017) third *Environmental Performance Review* concluded that decreasing greenhouse gas (GHG) emissions from agriculture, particularly dairy farming, needs to remain a priority if New Zealand is to meet the 2030 climate mitigation target. In a report from the Parliamentary Commissioner for the Environment, Suzi Kerr argued:

'New Zealand will struggle to meet its Intended Nationally Determined Contribution of lowering total emissions by 30% relative to 2005 levels by 2030 through domestic mitigation without significant mitigation of agricultural emissions or afforestation'

(Kerr, 2015: 11)

Farming has always been central to New Zealand culture, identity, and economy, and arguably always will be (Carter & Perry, 1987). From an economic perspective, intensive dairy farming threatens to tarnish New Zealand's 'clean and green' '100% Pure' image which is fundamental to tourism, multiple export industries, the economy, and the country's international identity (Foote et al., 2014). Economically, the health of the land is critical: land underpins tourism and primary production, New Zealand's top two export earners (MFE & Stats NZ, 2018). But beyond the significance of preserving the 'clean and green' image, New Zealand's environment needs to be preserved for its intrinsic value and cultural significance.

³ The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science on climate change.



Figure 1: International Marketing Campaign for “100% Pure” New Zealand

As the people of Aotearoa New Zealand, we are tightly connected to our iconic land and biodiversity. Land is important for humanity, it is ‘where we define culture, express spirituality, and anchor memory and identity’ (MFE & Stats NZ, 2018: 7). In te ao Māori, people are kaitiaki (guardians) of the land (Harmsworth & Awatere, 2013):

Ko au te whenua,

ko te whenua, ko au

The land defines my quality of life,

I am the whenua, the whenua is me.

Toitū te whenua,

Ka ora ai te tangata

The well-being of the land provides,

for the well-being of the people.

(MFE & Stats NZ, 2018: 24; 35, emphasis added)

Sustainable agriculture could allow people to be kaitiaki for the land and for biodiversity. Instead of being viewed as detrimental to the environment, farming could be instead viewed as an *opportunity* for New Zealand. Indeed, sustainable agriculture helps to provide healthier ecosystems which benefit agriculture by optimising land-use, production and profitability (FAO, 2014; 2018; Anastasiadis et al., 2014). The FAO (2018: 6) asserted that agricultural sectors together account for the largest terrestrial freshwater and marine areas on Earth, and if managed sustainably, agriculture can contribute to critical ecosystem functions including water quality, soil rehabilitation, carbon sequestration, nutrient cycling, resilience, and biodiversity.

Industrial hemp could play a role in New Zealand's transition toward sustainable agriculture. An industrial hemp industry could provide a way for New Zealand to celebrate its farming culture while assisting with protecting, conserving, and enhancing the country's environment, sequestering emissions, and generating environmentally-friendly food and fibre products. But despite the hemp's researched potential for sustainability, the industry remains small, fragmented, and constrained. The purpose of this research is therefore to understand the reasons why people are motivated to work within the hemp industry, what factors are containing the industry from developing, and the ways the industry can move forward. The following research questions for this dissertation are:

1. *Why are people motivated to participate in the hemp industry?*
2. *What is constraining the industry?*
3. *How can the industry move forward beyond constraints?*

1.2 The scope of the report

As *Figure 2* shows, this dissertation is organised into five chapters. Chapter 1 provided a background for the report. Chapter 2 presents a review of previous literature in three sections: 1) the environmental potential of hemp to assist with sustainable agriculture in New Zealand; 2) existing literature on the constraints to the hemp industry; and 3) the factors that contribute to the success of agricultural industries. This chapter provides the knowledge background needed for later discussion on how the hemp industry can move forward as a sustainable agricultural industry for New Zealand. Chapter 3 discusses the methods and methodologies of

this study. Approaching this study from a human geographical and post-structural research perspective, this dissertation is concerned with hemp as a sustainable crop and agricultural industry for New Zealand, firstly by reviewing previous academic research and literature and then undertaking primary qualitative research. The aim is to give voice to farmers, entrepreneurs, researchers and others involved in the hemp industry to understand their motivations for involvement in the hemp industry, their perspectives on the major constraints on the industry, and their views on the ways the industry can move forward. Chapter 4 presents and analyses research results in three sections, a section to address and answer each research question. Conclusions are drawn with respect to people's motivations for involvement in the industry, the constraints on New Zealand's current hemp industry and the ways the industry can move forward. Final conclusions and recommendations are presented in Chapter 5.

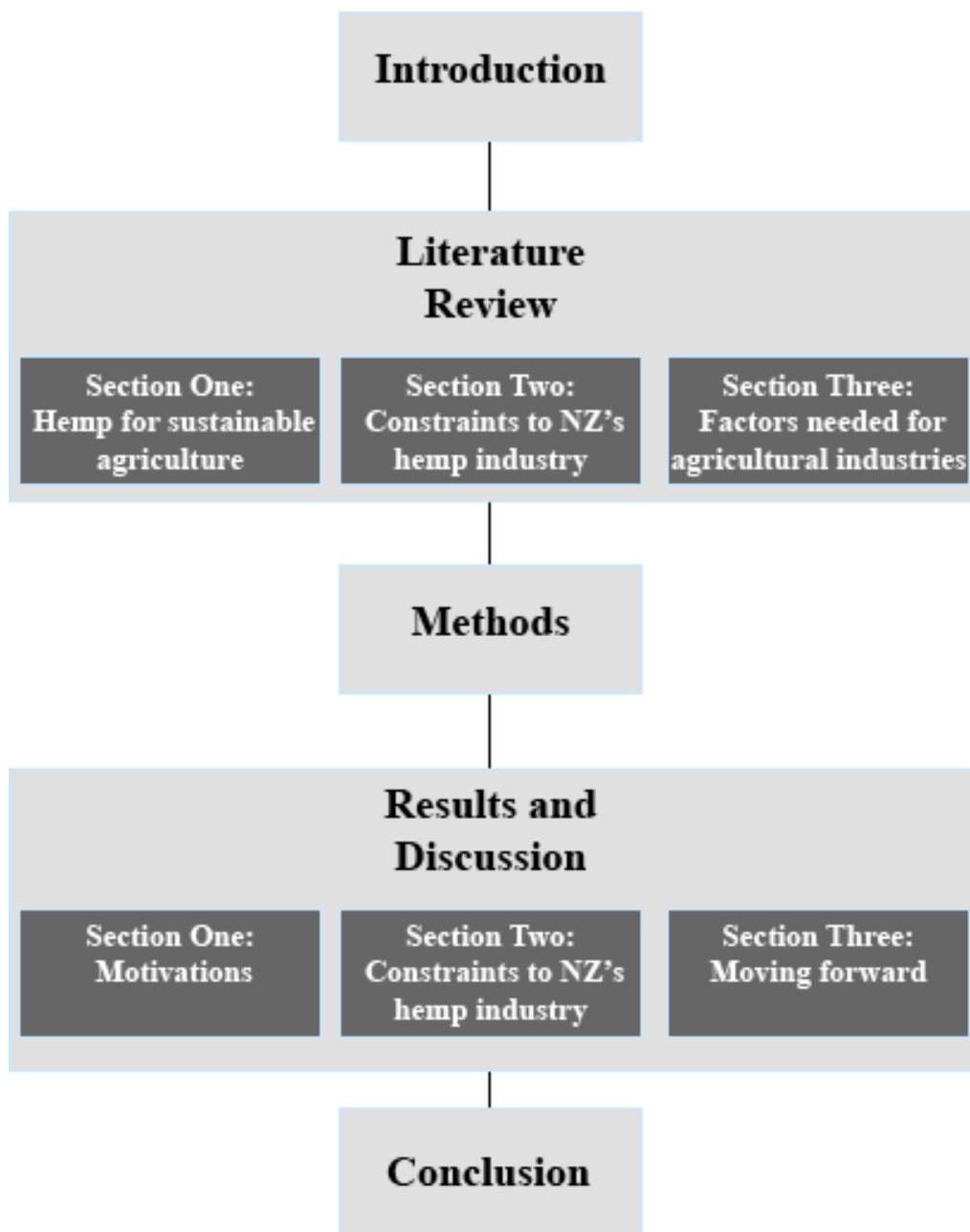


Figure 2: The structure of the dissertation

2 LITERATURE REVIEW

This chapter is structured in three sections to provide the groundwork needed prior to undertaking primary research. Section 2.2 reviews literature on the potential of industrial hemp to contribute to New Zealand's transition to sustainable agriculture. Secondly, Section 2.3 reviews literature on the constraints to New Zealand's industrial hemp industry. This section provides direction for the research by uncovering a large local research gap – no qualitative primary research has been undertaken on NZ's hemp industry, and all studies have either been empirical, literature reviews, or personal opinion. Further research is needed to determine the constraints on the industry. Thirdly, Section 2.4 reviews literature on the factors that contribute to the success of agricultural industries and organizations. The third research question of this dissertation, *'how can New Zealand's industrial hemp industry move forward beyond constraints'*, can only be answered with prior knowledge of what enables an agricultural industry to be successful, therefore this section provides the knowledge needed to assist with answering this research question.

2.1.1 *The need for realism*

Before beginning this chapter, it is important to note that the beginning of the “hemp revolution” involved overly-optimistic, exaggerated claims of hemp's potential to “save the world”. These claims have been criticised for being ‘at best supremely optimistic and at worst amazingly naïve’ (Dvorak, 2004: 60). In 1938, for example, hemp was referred to by Popular Mechanics as ‘the new billion-dollar crop’ who claimed that it could produce over 25,000 products (Swanson, 2015). This figure has been over-cited since, despite the fact that no research supports the claim. Meanwhile, government is sceptical of unfounded data, and farmers are often as sceptical as the government and conservative in the adoption of new crops (Merfield, 1999). Hemp research and literature needs to be credible, concise, and backed up by scientific evidence, therefore the following sections take care to review literature critically.

2.2 THE POTENTIAL OF INDUSTRIAL HEMP FOR SUSTAINABLE AGRICULTURE

As discussed in Chapter 1, sustainable agriculture is critical for New Zealand. Could the country's existing industrial hemp industry fit within the FAO's definitions of sustainable agriculture, and contribute to New Zealand's transition to sustainable agriculture?

According to the FAO (1988; 2014; 2018), to be sustainable, agriculture needs to meet the needs of present and future generations, conserve land, water and ecosystems, and ensure social and economic equity, and environmental health. This section discusses the potential for industrial hemp to assist with sustainability and/or to function as a sustainable crop rotation for existing farms, with a particular focus on the potential of hemp for emissions reductions, environmental regeneration, phytoremediation, and sustainable product innovations.

'...the management and conservation of the natural resource base, and the orientation of technological change in such a manner as to ensure the attainment of continued satisfaction of human needs for present and future generations. Sustainable agriculture conserves land, water, and plant and animal genetic resources, and is environmentally non-degrading, technically appropriate, economically viable and socially acceptable'

(FAO, 1988: 12)

2.2.1 Emissions reductions

Carbon sequestration is a critical function of sustainable agriculture (FAO, 2018), and a developed industrial hemp industry could assist New Zealand with emissions reductions. As discussed in the previous chapter, current agriculture accounts for 49% of New Zealand's gross emissions (NZ Government, 2016) and a report from the Parliamentary Commissioner for the Environment on agricultural emissions reductions argued that New Zealand will struggle to meet its NDCs without significant mitigation of agricultural emissions. Kerr advocated for four options to reduce emissions:

‘New Zealanders can reduce agricultural emissions in four ways: reduce emissions per unit output; shift food production to lower-emission products; reduce demand for high-emission products; and help improve the emissions efficiency of international food producers’

(Kerr, 2016: 18)

A developed industrial hemp industry could be an opportunity to reduce agricultural emissions reductions ‘by reducing emissions per unit output’ through carbon sequestration during plant growth, carbon storage of durable products (Kerr, 2016), and the ‘carbon negative’ sequestering potential of hempcrete building materials.

Firstly, hemp has a high greenhouse gas (GRG) sequestration potential during plant growth, and secondly, durable hemp products have a high carbon storage potential. For example, a research comparison between hemp grown for bioenergy with dominant energy crops reveals that hemp has a greenhouse gas (GRG) sequestration potential of 11 tonnes of CO₂ per hectare annually, which is 140% and 540% greater than rape oilseed and sugar beet chains, respectively (Finnan & Styles, 2013: 152). As seen in *Figure 3*, ‘Hemp1’ demonstrates that one annual crop of hemp has a carbon storage potential greater than a 25-year-old spruce (‘Forest 1’) and pine (‘Forest 2’) plantations, if hemp turned into a durable product. Hemp has great potential to act as a sustainable carbon ‘sink’ for atmospheric carbon dioxide. ‘Hemp2’ shows a lower carbon storage potential, as this represents hemp converted into less durable products such as mulch and animal bedding (*Figure 3*; Pervaiz & Sain, 2003: 325).

And indeed, two independent research studies of hemp buildings confirmed that the hempcrete product is ‘carbon negative’ – carbon sequestration by hemp overcomes the total fossil-CO₂ emissions during cultivation and processing for building construction (Zampori et al., 2013; Kenneth & Miller, 2012). Hempcrete is a hemp-lime concrete made from a mixture of lime-based binder and hemp hurds. From a building perspective, hemp and other natural fibres are lightweight, have a high insulating potential, a high strength to weight ratio, can be economically viable, and are more recyclable than conventional materials (Cherney & Small, 2016: 16).

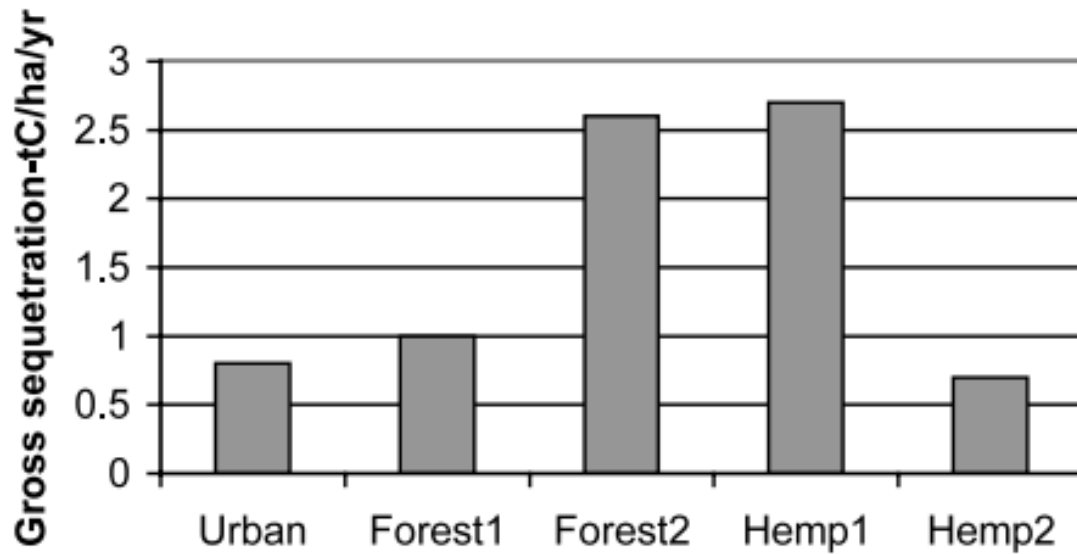


Figure 3: Average gross carbon sequestration by urban/forest trees and hemp plants (Pervaiz & Sain, 2003: 333).

Because hempcrete is carbon negative (Zampori et al., 2013; Kenneth & Miller, 2012; Cherney & Small, 2016) growing hemp and building with the resulting hempcrete would reduce emissions and could help New Zealand to meet its NDC target to reduce greenhouse gas emissions to 30% below 2005 levels by 2030. Using renewable materials and natural fibres like hemp presents an opportunity to limit energy resources and provide an alternative to cement which is GHG intensive, hence ‘making buildings healthier and more environmentally sustainable throughout their lifecycles’ (Ingrao et al., 2015: 29).

2.2.2 Hemp as a sustainable crop rotation

Literature often exaggerates the environmental benefits of hemp with claims that hemp can easily grow without fertiliser or irrigation. These claims are contradicted by other articles which show hemp has relatively high water requirements and nitrogen (N), phosphorus (P), and potassium (K) requirements (Dwyer, 1997; Cherney & Small, 2016). However hemp does have environmental benefit, particularly when compared to the production of other sources of fibres like cotton and wool. In general, hemp uses less water, less chemicals, smaller areas of land, has a shorter growing period, and has great fibre strength (O’Callaghan et al., 2018a).



Figure 4: Hemp grown in Canterbury, 2004 (Fyers, 2017)

As a rotational crop, industrial hemp could assist existing farms with sustainability and soil fertilisation, alongside its aforementioned carbon sequestration capabilities. Hemp has a deep tap root system that rapidly decays and provides both soil aeration and fertilisation (Cherney & Small, 2016), and the nitrogen-rich leaves add organic matter to the topsoil when shed throughout the season (Conrad, 1997; Parello, Karimi & Fagon, 2013). Australian and New Zealand researchers verified that that through biomass sequestration hemp is capable of sequestering ‘extremely high uptake rates’ of nitrogen (239kgN/ha when irrigated with 8mm/day), the majority of which is stored in the leaves (Davison et al., 2006: 219). But the study concluded that ‘their short growing season makes them unsuitable for year round effluent reuse’. However, there may be the opportunity that hemp could be grown annually as a rotational crop for intensive dairy farming to uptake nitrogen and increase soil quality – if hemp is properly retted, it can raise total nitrogen in soils for subsequent crops. Indeed, evidence demonstrates hemp can be rotated with existing fodder and vegetable crops to raise the yield of subsequent plants afterward (Parello, Karimi & Fagan, 2013). A report on the potential for horticultural development in the Taranaki considered industrial hemp as a viable option, especially as a rotational crop, arguing that establishing an industrial hemp industry in the region has been met with ‘considerable public interest’. The report states:

‘the growing conditions in Taranaki are excellent for hemp, which is generally grown as a rotational crop with soil-depleting crops, and could be grown in rotation with maize for dairy support in the Taranaki.’

(Venture Taranaki, 2014: 44)

Evidence also shows that as a rotational crop hemp can assist with weed and pest reduction, because it has broad leaves, is closely planted, and is fast growing – factors which typically trump competing weeds (Conrad, 1997; Smith-Heisters, 2008). Hemp has also been reportedly used in Canada in rotation with soybeans to reduce a parasitic pest; in China to combat insect pests from vegetable crops; and in The Netherlands in rotation with potatoes to diminish nematodes (Smith-Heisters, 2008). Research of hemp fibre production in New Zealand also showed that weeds posed no problems in crops (McPartland, Cutler & McIntosh, 2004).

2.2.3 Hemp for phytoremediation

There is also evidence to suggest that hemp could be a good rotational crop for phytoremediation. A process within bioremediation, phytoremediation is the use of plants as a sustainable environmental clean-up technique of heavy-metal polluted soils and is gaining momentum as a way to uptake heavy metals, restore productivity and fertility to soils, and to re-establish ecological cycles. The main advantage of phytoremediation is reducing costs of remediation when compared to conventional techniques such as dredging (Mani & Kumar, 2014)⁴.

A large body of empirical evidence demonstrates that certain hemp cultivars are exceptional at phytoremediation by uptaking heavy metals in soil (such as cadmium, copper, chromium, nickel, strontium and zinc) because of its branched, deep taproot and high biomass.⁵ Much of this uptake can be returned when properly retted back into the soil post-harvest, if need (McPartland, Cutler & McIntosh, 2004). In particular, industrial hemp could be helpful for uptaking cadmium in soils, which is the main ingredient in phosphate fertiliser used in New

⁴ There are many mechanisms involved in phytoremediation such as phytoextraction, phytodegradation, phytovolatilization which are not within the scope of this report (see Mani & Kumar, 2014).

⁵ For example: Parello, Karimi & Fagan, 2013; Shi et al., 2012; Khan et al., 2008; Linger et al., 2002; Irshad et al., 2015; Hoseini et al., 2012; Citterio et al., 2003; Ahmad et al., 2016.

Zealand agriculture, and is considered toxic to humans at high intakes (Stafford et al., 2014; MFE & Stats NZ, 2018). For example, scientific hemp cultivations undertaken in Germany found all parts of the hemp plant absorbs heavy metals (cadmium, nickel, and lead) from polluted ground without fibre damage. The researchers concluded hemp is an excellent profit yielding and renewable crop when used for phytoremediation purposes to decontaminate heavy metal polluted soils, noting that hemp has a ‘somewhat hyper-accumulator-like potential’⁶ for uptaking cadmium in its roots (more than 100mg kg⁻¹ Cd) (Linger et al., 2002: 572). If grown as a rotational crop for phytoremediation purposes, hemp could assist with the clean-up of heavy metals from soils. The contaminated hempseeds and leaves would not be able to be used in food or clothing production, but the contaminated fibre and hurd could be used in combine material or for energy production in thermal power stations (Linger et al., 2002: 40).

2.2.4 Economic returns

FAO definitions of sustainable agriculture state that agriculture needs to ensure economic equity and profitability. New Zealand’s media has claimed that hemp has potential to function as a “cash-crop” (Piddock, 2016; Fyers, 2017), but limited empirical research has been undertaken in the country to back these claims. However, Eerons (2003) demonstrated that hemp offers greater economic returns than ryegrass in the Taupo region, and a report from Taranaki claimed that the returns from hemp are ‘approximately twice those of maize grass (more than \$6000 per hectare)’. Venture Taranaki recommended hemp as a rotational crop for existing dairy farms in the region, asserting:

‘If successful, the industrial hemp industry in Taranaki will provide a high-returning sustainable diversification option for Taranaki growers, as well as green employment in the processing sector.’

(Venture Taranaki, 2014: 44)

2.2.5 Sustainable products

Perhaps one of the greatest sustainability contributions a developed industrial hemp industry could deliver for New Zealand is the manufacturing of environmentally-friendly end

⁶ ‘Hyperaccumulators’ are especially tolerant to uptaking large quantities of heavy metals (Mani & Kumar, 2014; Linger et al., 2002)

products, including carbon-sequestering bioplastics and concrete substitutes (Cherney & Small, 2016; O’Callaghan et al., 2018a). As mentioned in the introduction, hemp fibre and oilseed has been used to manufacture a large variety of products including nutritious foods, medicinal products, sustainable textiles, ropes, building materials, paper, bioplastics, as well as renewable alternatives to petroleum (Parello, Karimi, & Fagan, 2013; Ministry of Health, 2006; Gibson, 2008). *Figure 5* below demonstrates the miscellaneous hemp value chain and end-use product potential.

2.2.6 Summary

In sum, industrial hemp fits within the FAO’s (1988; 2014; 2018) definitions of sustainable agriculture: the plant could assist with emissions reductions, soil rehabilitation, bioremediation, and environmental health, and generate environmentally-friendly food and fibre products, and there is evidence to suggest that it could be profitable. Evidence and research to back up hemp’s potential as a sustainable agricultural industry and/or as a sustainable crop rotation is summarised below in Table 1. Moreover, a developed hemp industry could enhance the resilience of ecosystems, farmers and communities. In a period where the current intensive dairying model is contributing to rising GHG emissions (NZ Government, 2016; MFEb, 2017), decreasing water quality, and reducing biodiversity (MFE & Stats NZ, 2017; PCE, 2015), industrial hemp could be a timely sustainable agricultural industry for New Zealand, and a potential rotational crop for existing intensive dairy farms to assist with heavy metal uptake and carbon sequestration.

Given hemp’s potential to assist with sustainable agriculture in New Zealand, the questions now become: what has constrained Aotearoa’s industrial hemp industry, and what do people within the industry think the industry needs most to move forward? What role might industrial hemp play in contributing to the transformation of New Zealand’s agricultural sector toward more sustainable agriculture? To dissect this puzzle first requires reviewing existing literature on the constraints to New Zealand’s hemp industry. The end of this chapter will review literature on factors that enable an agricultural industry to be successful.

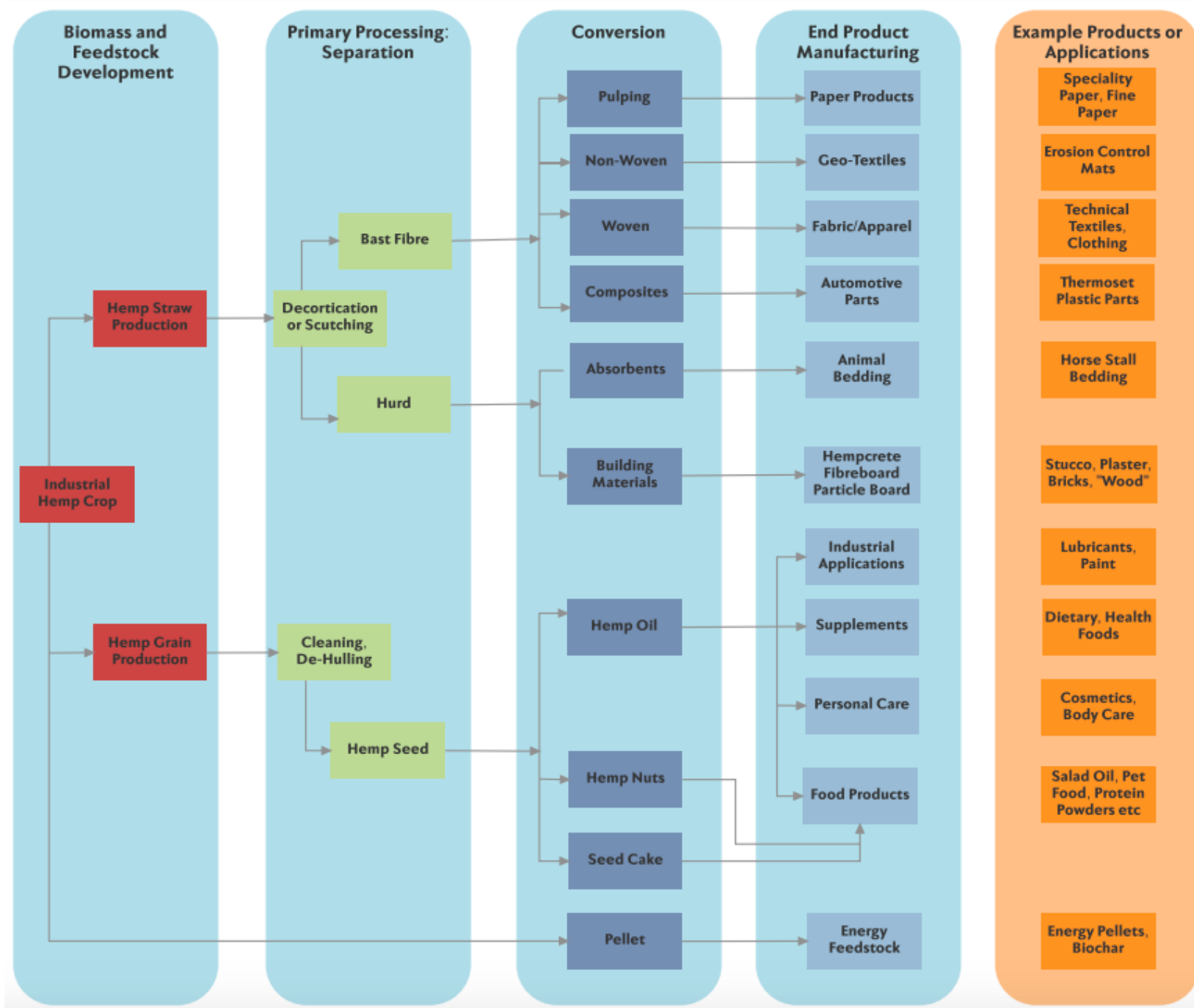


Figure 5: Hemp Value Chain
(Source: O'Callaghan et al., 2018: 8).

Table 1: Hemp’s potential as a sustainable agricultural industry and/or as a sustainable rotational crop

	Uses	Post-uses	Evidence	Notes	References
Phytoremediation	Uptaking heavy metals in soils like cadmium, nickel and lead	Contaminated fibre and hurd used for combine material or thermal energy production	Scientific hemp cultivations in Germany	Uptake can be returned to soil post-harvest.	Linger et al., 2002; McPartland, Cutler & McIntosh, 2004
Environmental health	Soil health: deep tap root system, nitrogen-rich leaves	Farmer choice	Raising yields of subsequent fodder and vegetable crops	Secondary research	Cherney & Small, 2016; Parello, Karimi & Fagan, 2013.
Weed and pest management	Reducing weeds and pests	Farmer choice	In rotation with crops in Canada, China, Netherlands	Secondary research	Smith-Heisters, 2008
Carbon sequestration	Assisting with on-farm emissions reductions	Farmer choice	During crop growth: 11t/C02/ha/yr; 239kg/N/ha/yr	Primary research	Finnan & Styles, 2013; Pervaiz & Sain, 2003;
Carbon sequestration	‘Carbon negative’ hempcrete	Building materials, emissions reductions	LCA of hemp cultivation and hempcrete	Primary research	Zampori et al., 2013; Kenneth & Miller, 2012
Sustainable products	Providing sustainable food and fibre products		Textiles, paper, bioplastics, hempcrete, etc	Secondary research	O’Callaghan et al., 2018; <i>Figure 4</i>
Economic potential			Greater returns than ryegrass in Taupo and maize in Taranaki; ‘more than \$6000 per/ha’	More research is needed	Eerons, 2003; Venture Tarnaki, 2014: 44

2.3 CONSTRAINTS TO NEW ZEALAND'S HEMP INDUSTRY

New Zealand academics emphasised the ‘vibrant future’ of hemp for Aotearoa, yet nearly two decades on and these claims have not come to fruition (Merfield, 1999; McPartland, Cutler & McIntosh, 2004). New Zealand’s industrial hemp industry has been a small, cottage-sized industry since the 1990’s. The media recently reported only a small hemp industry currently exists – roughly 40 licensed farmers grow around 200 hectares of the plant (Fyers, 2017), and a report from Venture Taranaki (2014: 50) described the industrial hemp industry as still ‘in the infant stage’. Factors are clearly constraining the growth and potential the hemp industry, and these constraints need to be explored. This section primarily reviews existing literature on hemp and its constraints in New Zealand discussing stigma, underdeveloped technologies, and the lack of funding as primary constraints. International research is incorporated.

2.3.1 Context

A ‘local myth’ states that hemp has long grown in New Zealand, with anecdotal reports on *Cannabis sativa* hemp permeating New Zealand’s history (McPartland, Cutler & McIntosh, 2004; McIntosh, 1997). However, no solid evidence of hemp cultivation exists prior to World War II except for reports of wild *Cannabis sativa* found around towns and cities, usually grown from discarded bird seed (Allan et al., 1961). Most of the claims of New Zealand hemp cultivation in the 1900 are based on a publication by Holmes (1900) or an article from Critchfield (1951) but the “NZ Hemp” described in the publications was native flax (*Phormium tenax*), not *Cannabis sativa* (McPartland, Cutler & McIntosh, 2004).

Hemp’s ‘newness’ to Aotearoa is surprising considering the country was colonized by Britain in 1840 and hemp production was encouraged throughout the British Empire (McPartland, Cutler & McIntosh, 2004). Further, hemp ‘thrives’ in New Zealand’s soils (McPartland, Cutler & McIntosh, 2004: 114), and some zonal soils are ‘excellent’ for hemp cultivation (Gibbs, 1980). Hemp also fits into the country’s crop rotational scheme (barley, wheat, maize, oats) as it does in Europe (van der Werf, 2002), and can be rotated with existing fodder crops and vegetable crops (McPartland, Cutler & McIntosh, 2004: 108), as discussed in Section 2.2.2.

2.3.2 *Mismatch between predictions and reality*

The slowness of New Zealand's hemp industry growth does not match up with the predictions of scholars at the turn of the century. Nearly twenty years ago, a report by New Zealand author Charles Merfield (1999: 4) declared that hemp 'is undergoing a sudden and rapid return to popularity'. He stated that 'there is now a strong international grass root movement pushing for the reintroduction and expansion of industrial hemp and its associated products'. This optimistic view was paralleled by New Zealand academics (McPartland, Cutler & McIntosh, 2004: 14), who wrote about the 'vibrant future' of hemp farming for New Zealand in the cottage industry by small landholders, and in the ecotourism sector, and in large-scale cultivation.

The slow pace and optimism of New Zealand's hemp industry reflects a global trend, with hemp poised to take off since the 1980s. Boston 'Hempologist' John Dvorak (2004: 65) advocated for patience and optimism in regards to the 'slowness' and 'invisible' nature of the global hemp industry, and to 'keep in mind that we are in this for the long haul', and that it will take several more years to 'firmly establish hemp as a leader in the food, paper, textile, building material and energy industries'. As Dvorak wrote:

'An inexorable force has been created that will continue to move forward, challenging the status quo and providing examples of hemp's myriad uses. Like its potent seed, chock-full of fibre and natural goodness, the hemp industry stands poised to explode past the seedling stage into a towering, sturdy juggernaut that reaches towards the sun with relentless determination. As we reach toward the future, keep in mind our humble beginnings and our humongous plans.'

(Dvorak, 2004a: 65-66)

Perhaps Dvorak underestimated the amount of years it would take for hemp to 'explode past the seedling stage' – fourteen years on and the industrial hemp industry is yet to be firmly established as a leader among industries or into a 'towering, sturdy juggernaut'. Likewise, the 'vibrant future' and 'rapid return to popularity' which New Zealand scholars discussed nearly two decades ago still has not come to fruition (McPartland, Cutler & McIntosh, 2004; Merfield,

1999). Hemp's marijuana stigma, corresponding regulations, and undeveloped technologies are discussed below as primary reasons why this may be the case.

2.3.3 The war on Cannabis: Hemp's marijuana stigma

Erving Goffman's book (1963: 3) *Stigma: Notes on the Management of Spoiled Identity* defined stigma as 'an attribute that is deeply discrediting', that reduces the person 'from a whole and usual person to a tainted, discounted one'. The resulting attitudes and stereotypes of what he termed 'the normals' is to create distance between themselves and the other person's 'undesired differentness' (p. 5). Almost forty years after Goffman's seminal essay, Link and Phelan's (2001: 363; 371) renowned article *Conceptualising Stigma* argued that literature has defined stigma in a too individualistic sense. The authors redefined stigma more broadly 'as the co-occurrence of its components-labelling, stereotyping, separation, status loss, and discrimination' (p. 363), and further indicate that for stigmatization to occur, *power must be exercised*. Goffman's (1963) and Link and Phelan's (2001) conceptualisations of stigma are useful to understanding the stigmatisation of hemp in the context of New Zealand.

A large body of international literature has acknowledged the stigmatisation industrial hemp, which is 'probably the world's most recognizable, notorious and controversial plant' (Small, 2015: 190). International scholars widely agree that general public misunderstandings of the difference between industrial hemp and marijuana have helped to stunt the popularity, potential, and reputation of the plant (Conrad, 1997; Small, 2015; Cherney & Small, 2016; Vantreese, 1998; Herer, 1985; Dvorak, 2004; Wirtshafter, 2004). The production of hemp in most western countries was banned in the 1920s and 1930s because of Cannabis strains high in Δ^9 -tetrahydrocannabinol (THC), the principal intoxicant cannabinoid (Cherney & Small, 2016). As argued in a University of Kentucky paper:

'Industrial hemp is repeatedly praised for its never-ending array of uses, for its harmony with the environment, as a production alternative for small farmers, and as a value-added enterprise for local businesses. Meanwhile, its twin cousin continues to muddy the water, as industrial hemp is seen as a stepping stone to the legalization of marijuana and an impediment to the war on drugs'

Through the eyes of Goffman (1963) and Link and Phelan (2001), industrial hemp's history of prohibition and regulation in New Zealand signals that power has been exercised and may have contributed to the labelling and stereotyping of hemp's 'drug' stigma. New Zealand's Dangerous Drugs and Poisons Act prohibited all Cannabis cultivation in 1927. The New Zealand Hemp Industries Association (NZHIA) began in 1996 to petition the government to allow for low THC hemp cultivation. As of 2005, growing certain approved low-THC cultivars of industrial hemp (no more than 0.5% THC) is allowed with a permit under the Ministry of Health (MOH) (McPartland & Rhode, 2005). But the legacy of the prohibition continues: industrial hemp is listed in Schedule 3 Part 1 of the Misuse of Drugs Act 1975, classified as a Class B and Class C controlled 'drug' that poses 'high' or 'moderate risk of harm' (Misuse of Drugs Act, 1975: 8). The Misuse of Drugs Act 1975 (2018: 68; 43) states that 'any part of the genus Cannabis' is prohibited, and 'plant material means the whole or any part of the leaf, flower, or stalk of any plant (of whatever species)'. Because of hemp's legal classification as a drug, anyone seeking to cultivate, process, or possess industrial hemp is legally required to obtain a license from the Ministry of Health, a process which requires applications, police vetting checks, and strict growing and THC-testing regimes (Misuse of Drugs (Industrial Hemp) Regulations, 2006).

Furthermore, hemp's connection with drug legislation meant that selling hempseed as a food for human consumption was prohibited until recent approved changes to the Australia New Zealand Food Standards Code in 2017 (MPI, 2018)⁷. Prior to this law change, New Zealand producers could only sell hemp oil for human consumption. The co-product hempseed meal (which is 75% of the entire seed) was restricted for animal food only. This legal limitation has certainly constrained hemp industry innovation and development in the food sector.

But industrial hemp is not a 'drug': industrial hemp can legally contain no more than 0.5% THC in its leaves and flowering heads; a THC concentration of 1% is the minimum concentration necessary for Cannabis intoxication (Swanson, 2015; Ministry of Health, 2006; 2010). Classifying industrial hemp as a 'drug' is to ensure 'that other forms of Cannabis are

⁷ These regulatory changes came into force on 12 November 2018.

not cultivated and distributed under the guise of industrial hemp’, a classification which justifies a tight licensing regime (Misuse of Drugs (Industrial Hemp) Regulations, 2006: 4). The irony of this fear is the opposite reality: industrial hemp’s high CBD content counteracts the effects of THC’s psychoactivity and cross-pollination of hemp and marijuana plants severely reduces the THC content of their offspring, effectively rendering it useless to smokers (Parello, Karimi, & Fagan, 2013).

New Zealand’s aforementioned history of prohibition and hemp’s continuing legal classification as a drug suggests that a stigma exists, but no primary research provides evidence for its existence. Central to Link and Phelan’s (2001: 375) conceptualisation of stigma is the notion that stigma is ‘entirely dependent’ on power – it takes social, political, or economic power to stigmatize. Has New Zealand’s legal classification of hemp as a ‘drug’ created a stigma around the hemp plant, and is it constraining industry development? Could the stigma be reduced if hemp was no longer classified as a ‘drug’? These are questions that will be asked in this research project.

2.3.4 Technological and funding constraints

A lack of developed technology and funding may have constrained the hemp industry’s growth. In a literature review, a New Zealand scholar argued that hemp’s connection with marijuana is the key issue restricting the resurgence of hemp and forestalled the development of technologies capable of harvesting hemp efficiently (Merfield, 1990). However, no New Zealand literature has explored this constraint in depth. International research argues that hemp did not undergo the same rapid technological harvesting and processing advancements like the steam engine, cotton gin, and wood paper processing. These competitive large-scale industries significantly hindered the market for hemp (Dvorak, 2004). While hemp technologies have advanced since the times of the Shely Fiber Breaker from 1892 which required up to nine people to assist with hemp fibre processing (Dvorak, 2004; *Figure 6*), scholars argue that significant improvements of hemp products and broader end-use applications are still needed for the global hemp industry to reach its full potential (Amaducci & Gusovius, 2010).

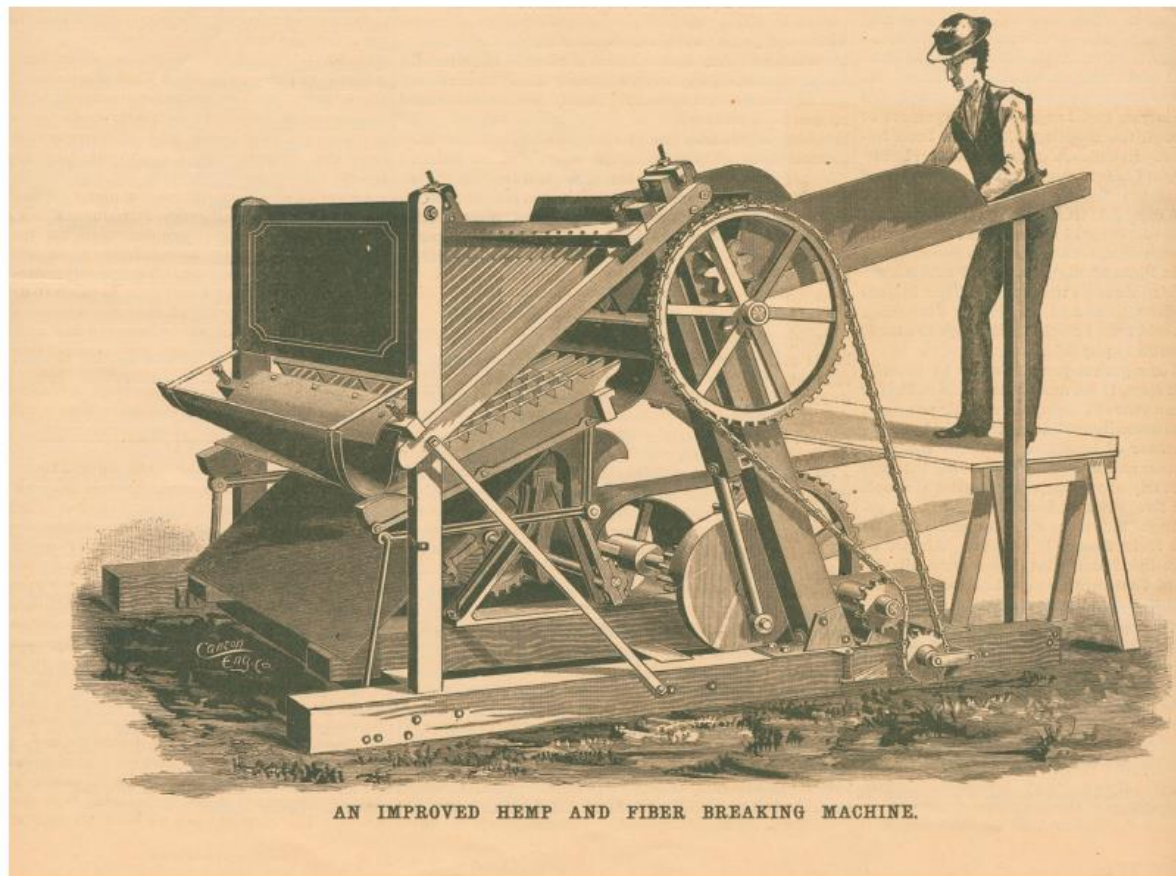


Figure 6: *The Shely Fiber Breaker*, 1892 (Source: Dvorak, 2004: 62)

Furthermore, modern hemp technologies and processing facilities are expensive. One study on the development of the hemp industry in the Manjimup area, Western Australia (WA) estimated that hemp fibre processing facilities could cost \$10million AUD, and noted that processing hemp for fibre is ‘technically complex and requires significant investment in infrastructure’ (O’Callaghan et al., 2018a: 20). The fibre processing model seen in *Figure 7* below was based on a recent German innovation and is the same model which also being developed at WA (O’Callaghan et al., 2018a; Pecenka et al., 2012). Given international research suggests that the development of hemp technologies and physical infrastructure is complex and expensive, does New Zealand’s hemp industry have the physical infrastructure needed to develop its industry and compete internationally?

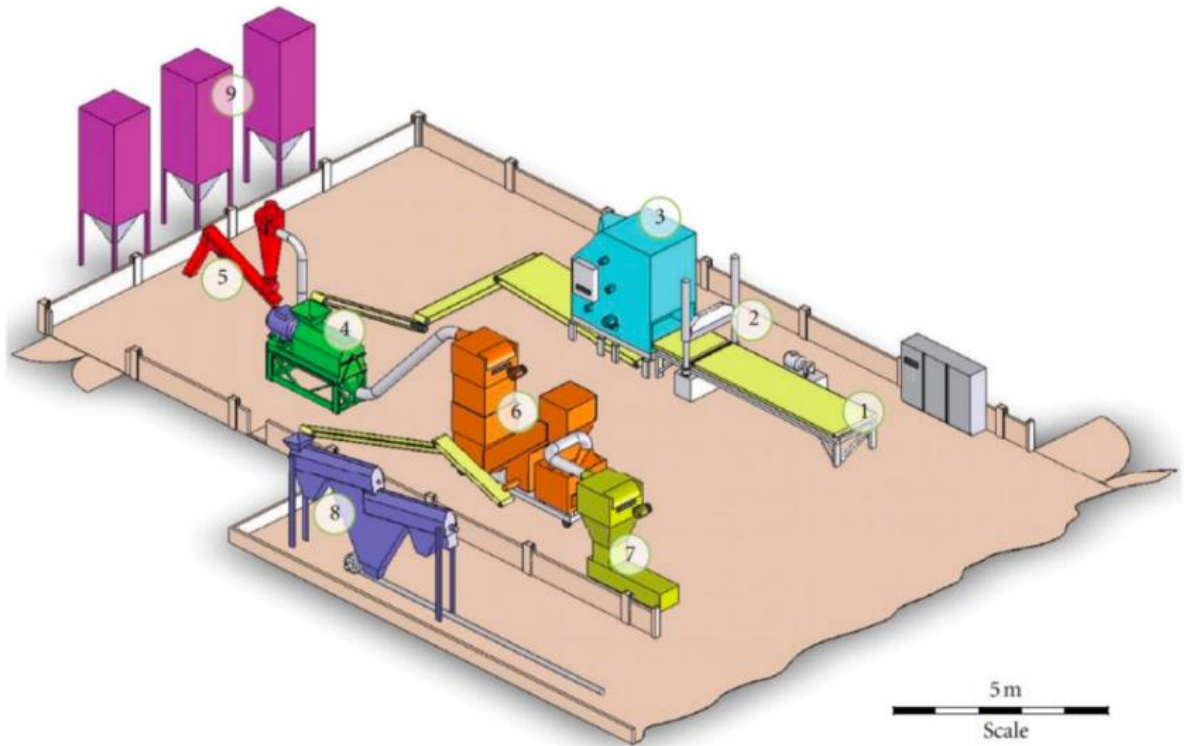


Figure 7: A German Industrial Hemp Fibre Processing Plant

(1) Bale feeder (2) Bale/straw cutter (3) Straw opener (4) Decortication (5) Dust separation (6) Fibre cleaning (7) Fibre bale (8) Hurd/shive cleaning (9) Air cleaning (Pecenka et al., 2012: 2)

2.3.5 Summary

This section has reviewed literature regarding the prominent constraints to New Zealand's industrial hemp industry. Optimistic predictions of industrial hemp's 'vibrant future' for New Zealand are met with the reality of an under developed agricultural industry. The agricultural and environmental potential reported in international research and national literature has not come to fruition in New Zealand. The aforementioned national and international literature suggests New Zealand's hemp industry has been historically constrained by its marijuana-stigma, legal regulations and prohibition, and a lack of technological advancements (McPartland, Cutler & McIntosh, 2004; Merfield, 1999; Conrad, 1997; Small, 2015; Cherney & Small, 2016; Vantreese, 1998).

However, no primary qualitative research exists within New Zealand regarding what has constrained and is constraining the hemp industry. International research and literature was drawn on to assist with understandings, but the local situation may be different. While empirical

research in New Zealand has assessed hemp's potential as a sustainable material and reinforcement in biocomposites qualitative research is yet to begin (eg. Islam, Pickering & Foreman, 2010; Efendy & Pickering, 2014).

Furthermore, no research has been done regarding how the industry can move forward and what this future might entail. Thus, the following section reviews literature on the factors that contribute to the success of agricultural industries. This understanding will assist with conducting research and with the discussions and conclusions regarding how New Zealand's hemp industry can best move forward.

2.4 WHAT CONTRIBUTES TO THE SUCCESS OF AGRICULTURAL INDUSTRIES?

This section draws on articles that are the most cited in agricultural industry literature and focusses on the factors that continually arise including: innovation and collaboration, which includes creativity and intrinsic motivation; entrepreneurs; niche marketing; and overarching social infrastructure. This understanding will assist with later discussions and conclusions on the constraints to New Zealand's hemp industry and the ways the industry can move forward, analysed in Chapters 4 and 5.

The importance of innovation and collaboration are discussed first because this is a central theme in industry literature. The dairy industry is briefly drawn on to illustrate the importance of innovation and collaboration, as a highly successful New Zealand agricultural industry. The factors that are core to the dairy industry's success could be applied in Chapter 4 regarding how the hemp industry can develop and move forward. Creativity and intrinsic motivation are mentioned, followed by a brief discussion of the importance of entrepreneurs, niche marketing, and overarching social infrastructure.

2.4.1 Innovation and collaboration

Perhaps the biggest theme in agricultural industry literature is the belief that innovation is critical for the success and competitive advantage of industries and organisations (Woodman et al., 1993; Huenks, 1998). Innovation of any kind – product innovation, process innovation,

and social innovation – fosters growth, especially for small firms. Indeed, the chances of a small firm surviving is actually dependent on innovation (Huenks, 1998). Innovation can be thought of as a ‘one of the engines of growth’ driving productivity, and therefore ultimately income growth (Evans and Meade, 2007: 7).

Evans and Meade (2007: 43) argued that the pressure for New Zealand’s agricultural sector to continue making innovations and productivity gains is greater than ever, especially with increasing challenges such as discerning global consumers, greater competition from low-cost producers, demographic changes (declining rural populations in New Zealand), and increasing buyer power. In the report, the authors argued that New Zealand producers are facing pressures to improve their farming sustainability, pay increasing attention to biosecurity, and ensure product traceability from farm to plate. Meanwhile, one report argued that ‘innovation has become the promising concept’ to enhance agricultural performance and overcome challenges (Vogl et al., 2015: 5). A comprehensive review of horticultural industry development in Taranaki demonstrated the importance of innovation and collaboration:

‘The competitive advantage of an industry will depend on the level of innovation and cooperation that exists across the whole supply chain including producers, processors, marketers [and] scientists’

(Venture Taranaki, 2014: 21)

For, innovation involves more than technology; it increasingly relates to strategy, marketing, management, organisation, plurality of actors, and design. Innovation is, therefore, closely linked to collaboration through information flows, social interaction, changing patterns of interaction between people, natural resources, and tools. Innovation is a ‘process’ that are viewed as the outcome of collaborative hybrid networks, and greatly influenced by farmers’ and rural entrepreneurs’ values, knowledge and motivations. Farmers and rural actors play a crucial role in the process of restructuring and innovation that occurs in rural areas (Knickel et al. (2009: 134).

New Zealand’s dairy industry, innovation and collaboration

New Zealand’s dairy sector has had an explicit focus on innovation and collaboration. It is widely recognised that the New Zealand dairy sector is extremely successful: New Zealand

is the world's largest exporter of dairy products, and dairy farming earned \$NZ13.4 billion in export revenue in 2016-2017 (Venture Taranaki, 2014; NZIER, 2017). The dairy industry's innovation networks involve a diverse group of actors relevant to a specific problem, and are particularly useful in agriculture because of the complexities of a problem. Innovation networks needs the 'continuous innovation and generation of ideas' through collaborative efforts 'across the full spectrum of technologies', requires a sense of urgency, a willingness to work together, a common vision, and a variety of relevant actors (Rijswijk & Brazendale, 2017: 148; 257-258). DairyNZ's innovation network, the Pasture Improvement Leadership Group (PILG), is a prime example of the industry's focus on collaboration and innovation. In order to innovate the way services were provided to farmers, PILG is a successful collaborative effort involving a variety of people such as researchers, seed breeders, seed retailers, contractors and farmers (Rijswijk & Brazendale, 2017: 246). Overall, the dairy industry has undergone extensive infrastructural development, fostered competitive advantage through innovation in production, processing, packing, distribution and logistics (Nesbit, 2011).

A second example of the dairy industry's focus on collaboration and innovation was emphasised within DairyNZ's 2009 publication of their second strategy for the future of dairy farming in New Zealand (Trafford & Tipples, 2011: 46). The main intended outcomes of the strategy included: the recruitment talented and skilled people; the enhancement of the industry's reputation locally and globally; and the shared goals through the partnership between industry and government and wider community. Innovation and collaboration are at the heart of the dairy industry's success – in fact, innovation is becoming “more about collaboration” according to managing director of Fonterra Australia John Doumani (Glenys, 2007). Fonterra moved toward an open innovation model where they entered commercial partnerships with suppliers, biotech companies, university, industry associations and experts to collaboratively work together to create new and innovative products driven primarily by real consumer demand (Glenys, 2007).

Creativity

According to scholars, creativity is pivotal for all innovations, and is the building block of organisational innovation (Vogl et al., 2015). A widely accepted distinction between innovation and creativity argued that creativity is 'the production of novel and useful ideas by an individual or small group of individuals working together', whereas innovation 'is built on

creative ideas as the basic elements’ (Amabile, 1988: 126). Innovation is turning creative ideas into physical and economic reality. Therefore, creativity functions at the individual level and innovation at the organisational level (Oldham & Cumming, 1996). One study argued that ‘the task of an entrepreneur’ is to recognize the opportunity in a creative idea and translate that it into an economic reality (Heunks, 1998: 263). Organisational innovation then, is ‘the successful implementation of creative ideas within an organisation (Amabile, 1988: 126).

Intrinsic motivation

If creativity creates innovation, what influences creativity? Amabile’s (1997) theory of creativity is one of the most renowned studies on the factors that influence creativity and innovation, and stipulated that intrinsic motivation has enormous positive effects on individual creativity. In general, to be motivated is to be moved to do something (Ryan & Deci, 2000), but scholars have differentiated between intrinsic motivation and extrinsic motivation, arguing that intrinsic motivation is a more effective contributor to creativity. Intrinsic motivation arises from a positive reaction and intrinsic value of the project by the individual; it includes a belief, passion and commitment to the idea, and a sense of excitement (Amabile, 1993). Empirical studies have proven that intrinsically motivated employees display a more creative performance than those extrinsically motivated (e.g., Tierney et al., 1999; Jaussi and Dionne, 2003). Further, intrinsic motivation creates the resilience needed in hard times to persevere and generate creative solutions (Shalley et al., 2000). In sum, intrinsic motivation appears to be vital to organisations and industries, because it feeds into greater creativity, resilience, and innovation, qualities which assist with industries and organisations.

Entrepreneurs

The definition of an entrepreneur can be described as ‘the founder of a firm nearly by definition is an entrepreneur and innovator’ (Heunks, 1998: 263). At the community level, entrepreneurs create jobs, increase wealth and local incomes, and can connect the community to the global economy. Entrepreneurs are recognised as vital sources of economic growth to communities, agricultural businesses and industries (Henderson, 2002; Mostafanezhad & Suryanata, 2018). Amabile (1997: 18) described entrepreneurial creativity as ‘the generation and implementation of novel, appropriate ideas to establish a new venture’. More specifically, definitions of ‘environmental entrepreneurs’ vary from people who intend to gain financial benefit from market opportunities, to people who are passionate about their environmental

values and intend to change the rules in their business environment to better align with their philosophies (Zahraie et al., 2016). The former group are extrinsically motivated. The latter group are intrinsically motivated, and are sometimes also described as ‘grassroots’ entrepreneurs because they generate ‘novel bottom-up solutions’ in response to unmet social needs and a commitment to alternative ideologies (Seyfang & Smith, 2007: 585). The latter group may seek to question fundamental assumptions underlying current societal and economic systems and seek to alternate mainstream norms with others that are more aligned with sustainability (Isaak, 1998; O’Neill, Hershauer, & Golden, 2006 – in Zahraie et al., 2016). In sum, entrepreneurs can provide ‘grassroots’ alternative solutions to local problems, disrupt normative ways of thinking, and can contribute economic growth in communities, agricultural businesses, and industries. In terms of the entrepreneurs and hemp industries, Wirtshafter (2004) argued that the efforts of entrepreneurs and activists has helped to revive the global hemp industry, and encouraged hemp entrepreneurs to continue to develop new and innovative products.

2.4.2 *Niche marketing*

Niche marketing demonstrates the importance of industries collaboratively functioning together as a unit on a broad collective level. The Oxford Dictionary Online gives the origin of niche from the Latin *nidus* or nest and defines niche as: ‘a specialized but profitable corner of the market’. Mitchelson (1988) asserted that the first rule of niche marketing is offering the customer a clearly differentiated, premium product that fills a need – the niche has to be real, and the product has to satisfy. Likewise, Shani and Chalasani (1992) defined niche marketing as the process of carving out a small space in the market where needs are not fulfilled.

The importance of an internationally recognised market niche for New Zealand’s hemp industry is seen in the niche markets of Canadian, European and Chinese hemp industries. These countries have internationally recognized niche markets for their hemp industries – hemp production in the European Union has traditionally focused on fibre (Cherney & Small, 2016), China is recognised for hemp fibre production for textiles and related products (Johnson, 2018), and Canadian hemp production is internationally recognised for hempseed production for the food and nutraceutical market, and hempseeds represent the largest percentage of the Canadian hemp industry’s export total (Johnson, 2018; Serecon Management Consulting, 2012). While a small, dedicated niche market for hemp fibre will likely exist in Canada, the

fibre market in Canada has limited potential compared to oilseed (Cherney & Small, 2016); annual retail sales of Canadian hempseed products are estimated between \$20 million to \$40 million (Johnson, 2018). A crucial element of the success of international hemp industries is their clearly defined and internationally recognised niche markets.

2.4.3 Overarching social infrastructure

On a broader level, overarching social infrastructure is critical to agricultural industries to facilitate an environment which allows the aforementioned qualities of innovation, collaboration, creativity, and entrepreneurship to flourish and to assist with niche marketing. A renowned paper by Flora and Flora (1993: 51) pointed out that key entrepreneurs in one community were ‘totally ineffective’ in another seemingly similar community when attempting to facilitate change. They argued that it takes more than individual entrepreneurs and key actors to facilitate change in a community, and that an entrepreneurial social infrastructure (ESI) is a necessary ingredient for community development in rural communities. Overarching social infrastructure provides a large representative body and co-operative to connect individual organisations and people involved within the industry to provide direction, structure, identity, and international competitiveness for the industry (McGiven, 2016).

Australia’s Industrial Hemp Alliance (AIHA), for example, is the overarching collective body for the national hemp industry which represents all people and organisations involved in industrial hemp nationally. AIHA is a non-for-profit association formed in 2015 with the primary aim to expand Australia’s hemp industry. As stated on their website:

‘The Purpose of the Alliance is to represent all people and organisations interested in any aspects of industrial hemp and associated products at a national level in Australia, in order to develop and grow all aspects of the industry’⁸

Likewise, the Canadian Hemp Trade Alliance (CHTA, est. 2003) is a national organisation that promotes Canadian hemp and hemp product globally, and which represents

⁸ ⁸ More information about AIHA is available from: <http://hempalliance.org.au>

those involved in Canada's hemp industry including farmers, processors, manufacturers, researchers, entrepreneurs, and marketers:

*'The key functions of the Alliance are to disseminate information, promote the use of nutritional and industrial hemp and coordinate research'*⁹

New Zealand's dairy industry success is arguably a result of the overarching Fonterra Co-operative Group Ltd, owned by New Zealand farmers (Bain & Dandachi, 2015). Fonterra was established in 2001 as a merger between New Zealand Dairy Group (NZDG), Kiwi Dairy Co-operative and the New Zealand Dairy Board (NZDB) (McGiven, 2016). In 2018 the Fonterra Co-operative Group Ltd (FCG) was the world's largest dairy-export firm with a total revenue of \$12.3billion and 21,300 employees¹⁰ (Collins, 2017). Underneath Fonterra's overarching Co-operative, innovation networks exist and dairy farmers can farm in diverse ways but are connected under the wider framework and common narrative. An article from the University of Waikato argued that Fonterra's dominant cooperative structure and marketing is critical to international competitiveness, and the fragmentation or removal of this overarching structure would be detrimental, resulting in farmers acting individually and making short-term decisions for themselves rather than for the industry as an entity and for the long-term (McGiven, 2016: 18).

Given the aforementioned importance of an overarching social infrastructure for agricultural industries and international success, does New Zealand's hemp industry have a cohesive overarching social infrastructure reminiscent of AIHA's, CHTA's and Fonterra's? Are hemp farmers and organisations acting individually or are they operating collectively? Is there representation of people and organisations involved, direction for the industry, distribution of information, and collaboration within the industry? These questions will be explored in this research.

⁹ More information about CHTA is available from: <http://www.hemptrade.ca/>

¹⁰ Gale Business Insights Online Collection

2.4.4 Section 3 Summary

This section has provided the groundwork to ensure that the final research questions can be accurately researched and answered, regarding constraints on New Zealand's industrial hemp industry and how the industry can move forward. This section demonstrates that innovation and collaboration are vital for the success of organisations and industries, and are a core focus to New Zealand's dairy sector. Innovation is complex and multifaceted, increasingly relating to strategy, marketing, collaboration, and information flows. Synthesised, the literature in Section 2.4.1 shows that innovation is bred from creativity, and creativity is produced from intrinsically motivated individuals. Intrinsic motivation is vital for industries because people are at their most innovative and creative when they are intrinsically motivated, qualities which are vital to industries and organisations (Ryan & Deci, 2000; Evans & Meade, 2007; Woodman et al., 1993; Huenks, 1998). Moreover, entrepreneurs are vital to industries, and intrinsically motivated entrepreneurs may seek to alternate mainstream norms with creative, sustainable and novel solutions. It is important, therefore, to understand the motivations of people within the hemp industry to identify whether creativity is rife within the industry, whether new, innovative products are being created, and to understand peoples' motivations for working collaboratively within the industry. Given the importance of intrinsic motivation to industries, why are people involved in New Zealand's industrial hemp industry motivated to work within New Zealand's industrial hemp industry? And if so, are these individuals demonstrating the related qualities of creativity, innovation, and resilience?

But further than individual elements within an industry, niche marketing and an overarching social infrastructure are crucial elements for industry success, enabling the industry to function collaboratively together on a broad collective level. This was exemplified by the success of Fonterra and the existing Alliances of international hemp industries such as the Australian hemp industry and the Canadian hemp industry. An overarching infrastructure can nurture the aforementioned qualities that are critical to agricultural industries, such as innovation, group collaboration, creativity, entrepreneurs, as well as providing direction and international competitiveness.

2.5 Chapter 2 Summary

This chapter provides the foundations for further research regarding New Zealand's industrial hemp industry. Section 2.2 reviewed literature on hemp's environmental potential to contribute to New Zealand's transition toward sustainable agriculture. Section 2.3 showed that stigma, legal regulations and the lack of technological advancements could be constraining factors to the hemp industry, but emphasised that no primary research has been undertaken for New Zealand's industrial hemp industry specifically. Section 2.4 reviewed literature on the factors that assist with the success of agricultural industries, and emphasised the importance of innovation and collaboration (which includes creativity and intrinsic motivation, entrepreneurs), niche marketing, and perhaps most importantly, overarching social infrastructure.

The last wave of New Zealand literature was written over a decade ago in overly-optimistic ink, and claims of hemp's 'vibrant future' for New Zealand and its 'sudden and rapid return to popularity' have not come to fruition (McPartland, Cutler & McIntosh, 2004: 14; Merfield, 1999: 4). Over a decade on, where is hemp's 'vibrant future'? Why has New Zealand's industrial hemp industry marinated in the depths of stagnation for so long? Given hemp's potential to contribute to sustainable agriculture in New Zealand and/or function as a crop rotation for existing farms (discussed in Section 2.2.2), the questions still prevail: what factors are constraining New Zealand's hemp industry, and how can the industry move forward?

This research aims to fill these gaps in research by undertaking qualitative research to provide new insights about the constraints to New Zealand's contemporary hemp industry and to discuss the ways that the industry can move forward, in order to understand how to maximise the environmental potential of this multifaceted crop.

Therefore, this dissertation's research questions are:

1. *Why are people motivated to participate in the hemp industry?*
2. *What is constraining the industry?*
3. *How can the industry move forward beyond constraints?*

3 METHODS

3.1 Chapter overview

This chapter sets out my methodology and approach to research, followed by a discussion of the methods, and concluding with ethics. My research is firmly rooted in a post-structuralist approach, drawing on qualitative, constructivist, and interpretivist methods.

3.2 Research Questions

- 1) *Why are people motivated to participate in the hemp industry?*
- 2) *What is constraining the industry?*
- 3) *How can the industry move forward beyond constraints?*

3.3 Methodology

3.3.1 *Methodological approach: Post-structuralism*

This dissertation is firmly rooted within a post-structuralist approach. Post-structural geographies have been classified by Kitchin and Tate (2000) as schools of thought that are ‘critical science’. Post-structuralism ‘describes social and cultural systems that are open and dynamic, constantly in the process of ‘becoming’’ (Murdoch, 2006: 18). Post-structural geographies retain the structuralist concern for ‘systems’ and ‘structures’ rather than just individuals, but focus on ‘depth’ as opposed to ‘breadth’ (Murdoch, 2006: 17). Structures that geographers analyse can be social, cultural, economic, political, or environmental (Hay, 2000: 4). Embedded, ingrained and normalized structures like capitalism, the patriarchy and racism have cast long and enduring shadows over human experiences and opportunities, constrain individuals, and advocate for certain hegemonic behaviours (Panelli, 2004). This post-structuralist approach can assist in unpacking structural constraints on New Zealand’s hemp industry.

The post-structural approach enables the expression of multiple narratives within the hemp industry and a diverse range of voices were included to ensure that different viewpoints

were heard that otherwise might have been silenced or excluded (Hay, 2016). Post-structuralist geographers are concerned for the multiplicity of meaning and the production of agency, and any efforts to establish foundational truths ‘are doomed a failure’ – forcing one simple narrative onto multiple perspectives is considered ‘problematic’, even ‘illegitimate’ (Murdoch, 2006: 16). Rather than condensing multiple perspectives into one simplified narrative, the post-structural approach enables this dissertation to give voice to diverse perspectives and experiences within the hemp industry in order to gain a complex understanding of people’s unique motivations for involvement in the industry as well as their perspectives on the constraints and future of the industry.

3.3.2 Constructivist framework

This project was constructed and interpreted using a constructivist framework. A constructivist framework is qualitative social science method that assumes knowledge to be socially constructed and the world knowable only by how it is perceived (Panelli, 2004; Hay, 2016). This epistemology assumes the world is unknown and seeks to explain phenomena and ways of knowing through interpretation (Panelli, 2004). Constructivists advocate for qualitative research methods that seek to interpret and explain social experiences through non-numerical methods with an emphasis on quality, authenticity, and validity (Tashakkorie & Teddlie, 1998). Qualitative methods are becoming increasingly chosen by human geographers to explain and elucidate complex social processes, individual experiences, and human environments (Winchester & Rofo, 2016: 3). Qualitative methods were chosen in this project to elucidate diverse perspectives and individual experiences of participants within the industrial hemp industry, as well as highlighting shared social experiences, understandings, and socio-political structures.

3.3.3 Multiplicity of voices

Qualitative researchers often struggle with disentangling a dualism between ‘either’ social structures ‘or’ individual experiences (Murdoch, 2006). But as Hay (2016: 6) wrote: ‘qualitative geographers must be aware that an overemphasis on structures and processes rather than individuals could lead to a dehumanized human geography’. The post-structural paradigm allows this research qualitatively engages with both a concern for individual experiences and structural constraints. The sound of individual voices are interwoven throughout my

dissertation to provide context, clarity, and deeper insights into the perceived structural constraints to New Zealand's hemp industry and the ways the industry can move forward.

3.3.4 Positionality, ontology, and epistemology

Researchers have unique ontological and epistemological understandings. The twin terms of methodology, 'ontology' and 'epistemology', are understood as the study of 'knowing' and 'being', respectively (Clough & Nutbrown, 2002: 30). An ontology is a person's theory of what exists and how it exists, and includes their beliefs about the world; an epistemology is the unique ways the person came to knowing the world (Clough & Nutbrown, 2002). The researcher's own personal values inform their ethical and moral responses to research challenges as well as their research methodologies (Clough & Nutbrown, 2002). Geographers create contrasting works because all social research is 'positional' (Clough and Nutbrown, 2002: 10) and is written from 'somewhere' (Panelli, 2004: 8); knowledge is always 'situated' within specific terrains of power (Haraway, 1988).

Like all researchers, I have personal beliefs, values, ontologies and epistemologies, which mean that this dissertation is 'positional'. Raised on a sheep and beef farm on the Canterbury Plains, my family spent our time tramping, camping, and being outdoors. I have a close affinity and love for wildlife and nature which is embedded throughout my dissertation, and which fuelled my interest in sustainable agriculture and industrial hemp specifically. This research dissertation is a solutions-based response to local environmental issues and a reflection of the personal belief that farming can, and should, be sustainable. Sustainable agriculture could create a new narrative of farming in New Zealand, and allow farmers to reclaim pride in their livelihood and land.

Qualitative methods involve social interactions, therefore research gives emphasis to personal subjectivity (Dowling, 2016). As Winchester and Rofe (2016: 25) argued, 'the voices of the researched [...] are mediated through the researcher's experiences and values'. Critical reflexivity is the self-conscious scrutiny of yourself, positionality, and research (Dowling, 2016); and radical listening involves defining your own positionality, and being honest with yourself in what you want to listen to, what you want to hear, and what you believe 'counts' as a voice (Clough & Nutbrown, 2002: 24). Critical reflexivity and radical listening helped me to

be conscious of my positionality which, in turn, helped to reduce the personal mediation of interviewee's voices and assisted in giving careful attention to numerous perspectives within the research topic.

3.4 Methods

3.4.1 *Attending the iHemp Summit*

New Zealand's first 'industrial hemp summit' was held in Wellington on the 5th and 6th of July 2018. I attended the Summit as a 'participant-as-observer', seeking to understand the hemp industry in a new light (Kearns, 2016: 319). The iHemp Summit was focused on 'building the networks we need to grow the NZ hemp economy', with the aim to 'provide NZ companies, farmers, scientists, funders and regulators with the information they need to collaboratively develop the NZ industrial hemp economy'. According to the website, the Summit's purpose was:

*'to share local and international knowledge on hemp, identify the local and export opportunities available to companies entering the industry, highlight the barriers to success within the market and develop strategies and relationships that will help the industry to overcome them'*¹¹

The Summit involved 34 speakers with specific topics falling under either hemp for food, fibre, or medicine. With knowledge and consent, eight speeches were recorded and transcribed, and five speakers were subsequently interviewed. These speeches and interviews provided my research with initial foundations of the potential, constraints and future of hemp for New Zealand, as well as more detailed understanding about the plant and the industry.

3.4.2 *Interviews*

Interviews collect a diversity of meaning, experiences, and opinion, and can also reveal consensus on particular issues (Dunn, 2016). Qualitative, semi-structured interviews were

¹¹ More information about the NZ iHemp Summit is available on the website: <https://hempsummit.nz/>

chosen as the research method because they allow for flexibility and for natural conversational flow, encouraging participants to engage (Hay, 2010; Eyles & Smith; 1988; see Appendix B). As seen in Table 2 below, 21 participants engaged in this research project. The interviews were between 15-30 minutes long, and 15 were interviewed at the iHemp Summit. Six telephone interviews were undertaken with prior organising: three after the Summit to follow up on themes and to gain deeper understandings; and an additional three with a farmer, an entrepreneur, and a researcher involved in the hemp industry, to broaden understandings and to hear diverse perspectives. A ‘snowball’ effect took place during this research, whereby interviewees recommended me to speak with further key informants (Stratford & Bradshaw, 2016).

The general grouped categories of key informants are: farmers; researchers; and entrepreneurs. In some cases these categories overlap because some participants have more than one role, for example, they may be both a researcher and a farmer. These participants cannot be individualised into one role because their unique perspectives (as a researcher, farmer, or entrepreneur) give valuable depth to discussions later in the findings chapter. This will be re-emphasised at the outset of these occurrences.

Interviewing a range of people from farming, researching, and entrepreneurial backgrounds was critical to this post-structural research project in order to hear a multiplicity of meaning and narratives within the industry (Murdoch, 2006; Hay, 2016). It was essential for this project to hear from a range of perspectives in order to gain an accurate representation of the diversities and commonalities in people’s motivations for being involved in the hemp industry, the perspectives on the constraints to the industry, and the understandings on how the industry can move forward (see Table 2). The questions asked in interviews were grouped into three categories for each research question. In regards to the first research question, people were initially asked what their motivations are for being involved in the hemp industry, and how they see industrial hemp fitting in within current farming systems in the country, as well as the economic and environmental potential. For the second research question people were asked questions surrounding what they see as the greatest constraints to the industry. For the final research question, participants were asked what they think is needed most for the industry to move forward, including what support is needed, what the industry’s ‘niche’ should be, and where they see the industry operating at in the future (see Appendix C for interview questions).

Table 2: Roles of research participants

	Farmer	Researcher	Entrepreneur	Speaker	Interviewed at the iHemp Summit	Speech Transcribed	Telephone interviewed
KI1		X			X		
KI2			X		X		
KI3				X		X	
KI4	X		X		X		X
KI5	X		X		X		X
KI6			X	X	X	X	
KI7	X		X		X		
KI8			X		X		
KI9		X	X	X	X	X	
KI10		X			X		
KI11		X			X		X
KI12			X		X		
KI13	X		X		X		
KI14	X				X		
KI15			X	X		X	
KI16				X	X	X	
KI17				X		X	
KI18	X			X	X	X	
KI19	X						X
KI20	X		X	X		X	X
KI21			X				X
Total	8	4	12	8	15	8	6

3.4.3 *Analysing Data*

Recorded interviews were transcribed and all data was compiled on a personal document. The data was analysed through a post-structural lense to enable the expression of multiple narratives, rather than condensing diverse perspectives into one simplified narrative (Murdoch, 2006). All quotes were coded with key informant numbers under both broad and specific headings such as ‘constraints’, ‘stigma’, ‘niche’, etcetera. This technique elucidated similarities in perspectives, themes, and common viewpoints among participants, as well as revealing multiple narratives and contradicting perspectives.

3.4.4 *Ethics*

Ethics B Approval (see Appendix A) was obtained from the Ethics Committee of the University of Otago prior to conducting research. The ethics application included: detail regarding the targeted research participants; standardised research questions; matters of confidentiality; and a description of how information would be collected and securely stored. All participants of this research study were given an information sheet with the aims of the research and how the supplied information will be used (see Appendix B). After reading this, participants signed a consent form to acknowledge that they understand the purpose of the research, what will be done with the research findings, and show that they understand the optional nature of confidentiality in this research project (see Appendix C). The majority of ‘key informants’ (KI’s) are kept anonymous but some key stakeholders are named with their consent.

3.5 Chapter 3 Summary

This chapter discussed the methods and methodologies for this research project, and exposed my personal ontological and epistemological assumptions within my field of inquiry. I have justified post-structuralism as the appropriate rationale for my research and qualitative, constructivist methods to analyse the data. The post-structural concern for depth and multiplicity narratives enables the research aims of this project to be met through ‘giving voice’ to a diverse range of people, perspectives, and experiences (Murdoch, 2006; Hay, 2016). The post-structural paradigm allows this research to qualitatively engage with a concern for both individual experiences and structural constraints.

4 RESEARCH RESULTS AND DISCUSSION

4.1 Chapter Overview

This chapter is set out in a way which logically addresses and discusses each research question in a similar way to the order the questions were asked in interviews (see Appendix C). Section 4.2 discusses the results to the first research question regarding participant's motivations for being involved in the hemp industry. It is important to discuss people's motivations within the hemp industry first, in order to later discuss industry constraints and futures. This section compiles responses to critical questions regarding the prospects of hemp for in New Zealand and its potential to fit within existing farming systems. With participant's motivations for working with hemp and their beliefs on the potential of the industry in mind, Section 4.3 proceeds to discuss the results to the second research question regarding the greatest constraints to New Zealand's hemp industry. Finally, Section 4.4 addresses the third research question regarding the ways the industry can progress, and involves compiling informants' understandings regarding what is needed for the industry to overcome constraints, and the industry's future scale and international niche market (see Appendix C).

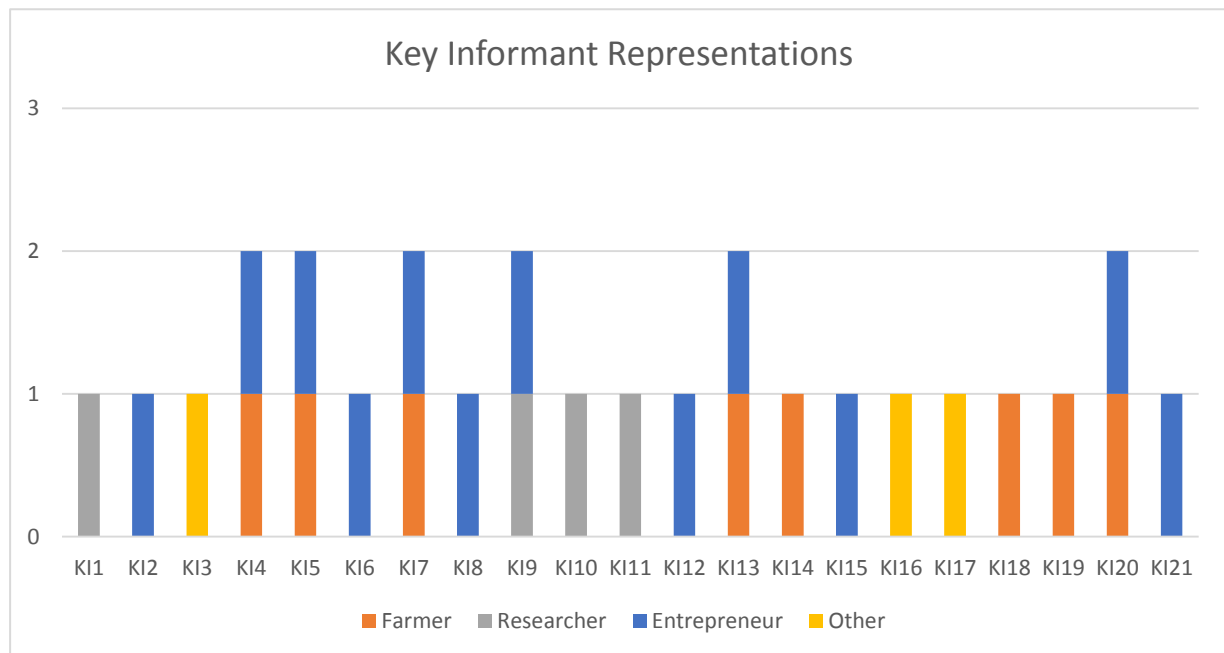


Figure 8: Key informant representations: Some participants have more than one role.¹²

¹² Some key informants are represented in graphs in this chapter twice because some are both farmers and entrepreneurs. These participants cannot be individualized into either farmers or entrepreneurs, because they have both unique farming perspectives and entrepreneurial perspectives.

4.2 MOTIVATIONS

To recap from Chapter 2, individuals are *intrinsically* motivated when they seek joy, interest, self-expression, or passion in their work. In contrast, people are *extrinsically* motivated when they engage in their work to obtain an external goal, such as income (Amabile, 1996). It is important to understand why people are motivated to work within the hemp industry because intrinsic motivation has links to creative, innovative, and resilience qualities (Amabile, 1996; Shalley et al., 2000), traits which are vital to the success of an industry and organisation (Evans and Meade, 2007; Woodman et al., 1993; Huenks, 1998; Knickel et al., 2009; Amabile, 1988). These concepts were applied to the interview analysis: economic incentives to partake in the industry were categorized as extrinsic motivations; and joy, interest, a passion for industrial hemp, and environmental reasons for working within the industry were categorized as intrinsic motivations.

This section discusses the research findings in relation to the motivations of participants, in relation to the first research question of this study: *why are people motivated to participate in the hemp industry?* The majority of participants are intrinsically motivated (Section 4.2.1). Of this number, most connected their motivations to sustainability, particularly farmers and entrepreneurs (Section 4.2.2). Farmers are motivated to work with hemp initially for intrinsic motivations (primarily hemp's capability as a sustainable crop rotation) but also extrinsically (as a "*cash-crop*" (Section 4.2.3). Entrepreneurs view hemp's potential for sustainability in a different light: they expressed their intrinsic motivation to work with hemp because of the potential for a more sustainable and healthier culture and to create environmental product innovations to replace existing unsustainable products (Section 4.2.4). Entrepreneurs are also demonstrating creativity, innovation, and resilience, arguably linked to their intrinsic motivation. Finally, some intrinsically motivated participants are driven because of personal passions for human health (Section 4.2.5).

4.2.1 *Intrinsic motivation*

This research suggests that New Zealand's hemp industry largely consists of intrinsically motivated individuals. Overall, when interviewed regarding a variety of questions about their motivations and reasons for being involved in the hemp industry, the majority of participants spoke were intrinsically motivated (19/21). Of this number, 14 participants spoke

only of intrinsic motivation to partake in the hemp industry, five were both intrinsically and extrinsically motivated, and only one was solely extrinsically motivated. These findings are displayed in *Figure 9* below.

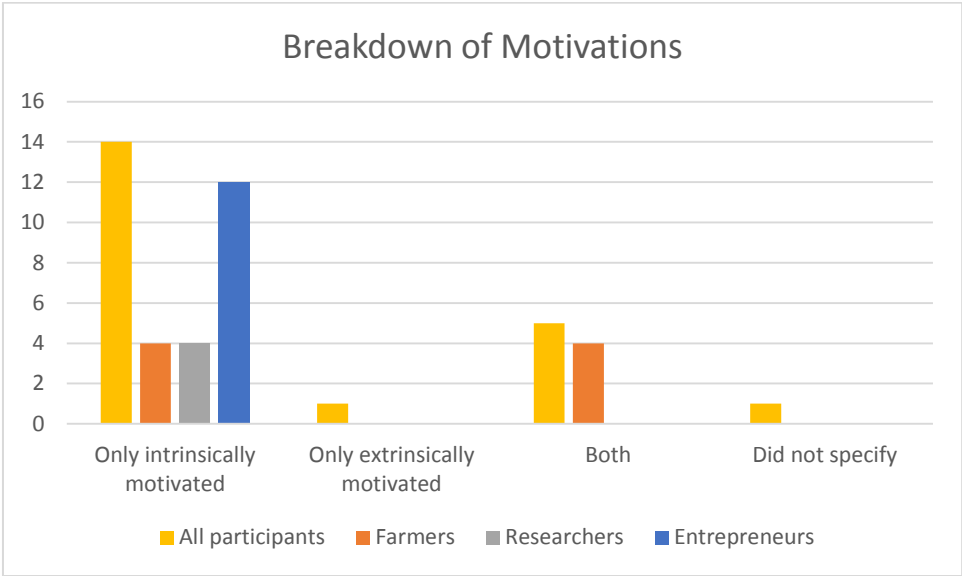


Figure 9: Breakdown of the motivation orientations of participants¹³

As seen in the graph above, all entrepreneurs and researchers are intrinsically motivated to work within the hemp industry, and farmers are both intrinsically and extrinsically motivated. The importance of intrinsic motivation for participants within New Zealand’s hemp industry is exemplified by the following quotes from two entrepreneurs within the hemp industry. As one stated:

“I think in any business or activity you need some form of passion. That passion might be in terms of the outcome (for example money, award, or achievement) or it might be more about a bigger cause around social, environmental, or family, etcetera. I think my passion lies in the opportunity of the plant for integration into normal day to day lives of everyday people [...] to get the word out and products into the hands of people, to use in whatever way they need or desire, whether that’s in medicine, food, cosmetics, clothes, etc. Lots of passion and commitment is definitely needed.”

KI5

¹³ Some participants have more than one role.

As a co-founder and managing director of a Cannabis group stated:

“It’s not about individually doing really well out of hemp, it’s about lifting communities across all of Aotearoa, together”

KI15

The joy and passion for learning about hemp (KI1; KI7; KI9) is exemplified in the following quote: *“once you start learning about the hemp train, you never get off”* (KI9).

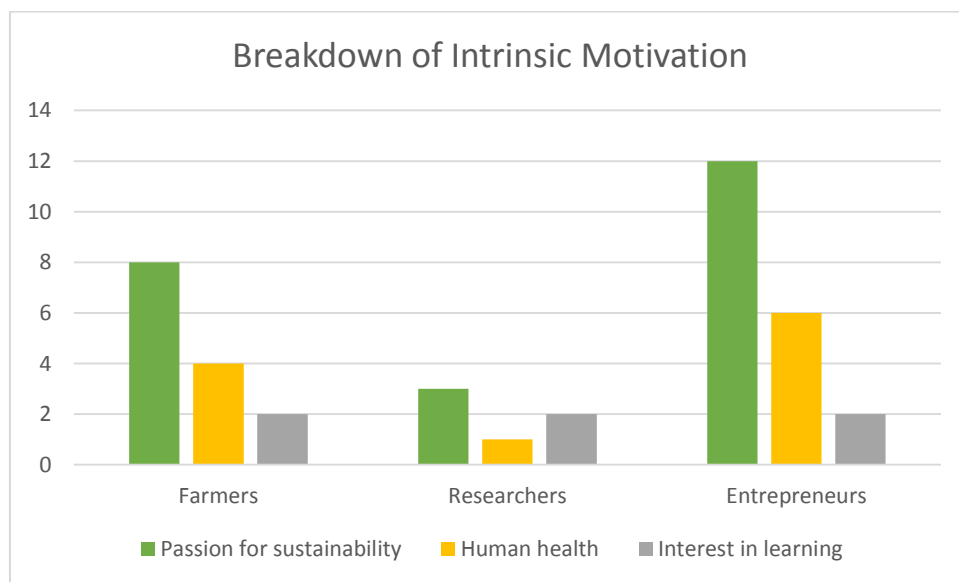


Figure 10: Most intrinsically motivated participants connected their motivations to sustainability.¹⁴

4.2.2 *Passion for sustainability*

A key theme is that the majority of intrinsically motivated participants connected their motivations to partake in the hemp industry to an intrinsic passion for sustainability (18 participants, *Figure 10*). For example, as a hemp farmer and entrepreneur asserted:

“For me the motivation lies in the opportunity for sustainability. Hemp is a great product and is such a great resource that it unutilized for food, fibre,

¹⁴ Some participants have more than one role.

medicine... just using hemp for everything. You don't really 'do' hemp for the money."

KI4

Likewise, an entrepreneur stated:

"[People involved in the hemp industry are] conscious, open-minded, [and] want a better planet... they care for sustainability and the future of this world"

KI2

4.2.3 Farmers: Hemp as a sustainable rotational crop for existing farms

Could industrial hemp could be incorporated as a rotational crop to complement other existing farming systems? All eight interviewed hemp and dairy farmers believe so, connecting their motivations to grow hemp with hemp's capacity for bioremediation, environmental regeneration, and sustainability, and visualise hemp fitting in within current farming systems. One dairy farmer is looking to hemp as a potential crop to diversify her dairy farm and to help with nutrient losses:

"Every farming system should have diversity, it's just that dairying doesn't... hemp is potentially a way for dairy to diversify"

KI14

As a researcher asserted:

"The first opportunity for hemp in New Zealand is in the bioremediation space. Hemp is a really good soak crop, nothing in the world soaks up nitrogen more than hemp. Every single dairy farmer in New Zealand should have to grow hemp as a rotational crop."

KI11

Furthermore, two dairy farmers agreed that *"hemp fits in well within the dairy farming system"* because it can be sown in October, harvested in February or March in time for the

dairying winter grass rotation, before being sown back into hemp the following October (KI14; KI19; Piddock, 2016). An entrepreneur who sources hempseed from hemp farms in the South Island spoke of the possibility that seed crops could fit within existing physical infrastructure of dairy farms, although this requires research outside the scope of this study. As the participant stated:

“I think hemp should be able to work within the current intensive farming system, without having too much of an impact. Hemp, especially if grown for seed, should fit under existing centre pivots. The other thing is that the infrastructure that is in place is highly suited to start giving farmers the ability to – in 5 – 10 years-time or so – I mean, the irrigation system is there, the dairy shed is there, it’s covered up, it’s got electricity and water... in my mind, those physical utilities could be used for a different purpose, they could be used for hemp.”

KI21

Interviewed hemp and dairy farmers are both extrinsically and intrinsically motivated to grow hemp, stressing the economic potential of hemp as a “cash-crop” or “piggy-back” crop for dairy farmers as well as its environmental potential for phytoremediation, environmental regeneration, and diversification.

Economically, four farmers spoke of their extrinsic motivation to grow hemp for the plant’s potential as a “cash crop” (KI14; KI18; KI19; KI20). Hemp has the potential to be “an incredibly profitable crop, if we’re able to utilize all parts of the plant” (KI21). One dairy farmer is looking to grow hemp for diversification, to incorporate a new income revenue, and increase farming resilience. She is considering annually rotationally growing seed cultivars as a “piggyback crop” for dairy farming and looking into creating hemp milk alongside cow milk. She views hemp as a way to regenerate intensively farmed land whilst supplementing incomes, viewing the plant as “an amazing marketing opportunity” (KI14).

Environmentally, interviewed farmers believe hemp has the capacity to fit within the dairy farming systems and possibly physical infrastructure. As an entrepreneur who sources hempseed from South Island hemp farmers summarised:

“If farmers are going to be able to meet their nitrate limits, which are serious reductions in their ability to grow grass, reductions in milk, and reductions in cash ... there’s really no other option for them not to consider something else too. In my opinion, there’s a far greater purpose in hemp than it just being another crop [...] I’m not just talking about the benefits of nitrate uptake and emissions reductions, but also about including hemp as a cash crop specifically, because we think it is as economically viable.”

KI21

In sum, interviewed farmers believe industrial hemp could be an economical and environmental rotational crop for dairy farmers: assisting with nitrate uptake and emissions reductions, as well as functioning as a “cash-crop” specifically. These findings relate to the literature reviewed in Chapter 2, which discussed the potential of industrial hemp as a rotational crop (Venture Taranaki, 2014) because of its potential to uptake heavy metals through phytoremediation (Linger et al., 2002), to assist with soil health and weed reduction (Parello, Karimi & Fagan, 2013; Cherney & Small, 2016; Smith-Heisters, 2008), and to assist with on-farm emissions reductions via biomass carbon sequestration (Finnan & Styles, 2013; Davison et al., 2006).

However, further research is needed in New Zealand to assess the economic potential of hemp as a rotational crop. The economic potential has also been reported in the media but limited research has been undertaken in New Zealand to verify this, particularly as an economical crop rotation. A study by Eerons (2003) presented a case where hemp offered more attractive economic returns than ryegrass in the Taupo region, and a report from Taranaki claimed that hemp can generate approximately twice the returns of maize per hectare (Venture Taranaki, 2014), but more research is needed to confirm the economic viability of growing hemp as a rotational crop for dairy farms.

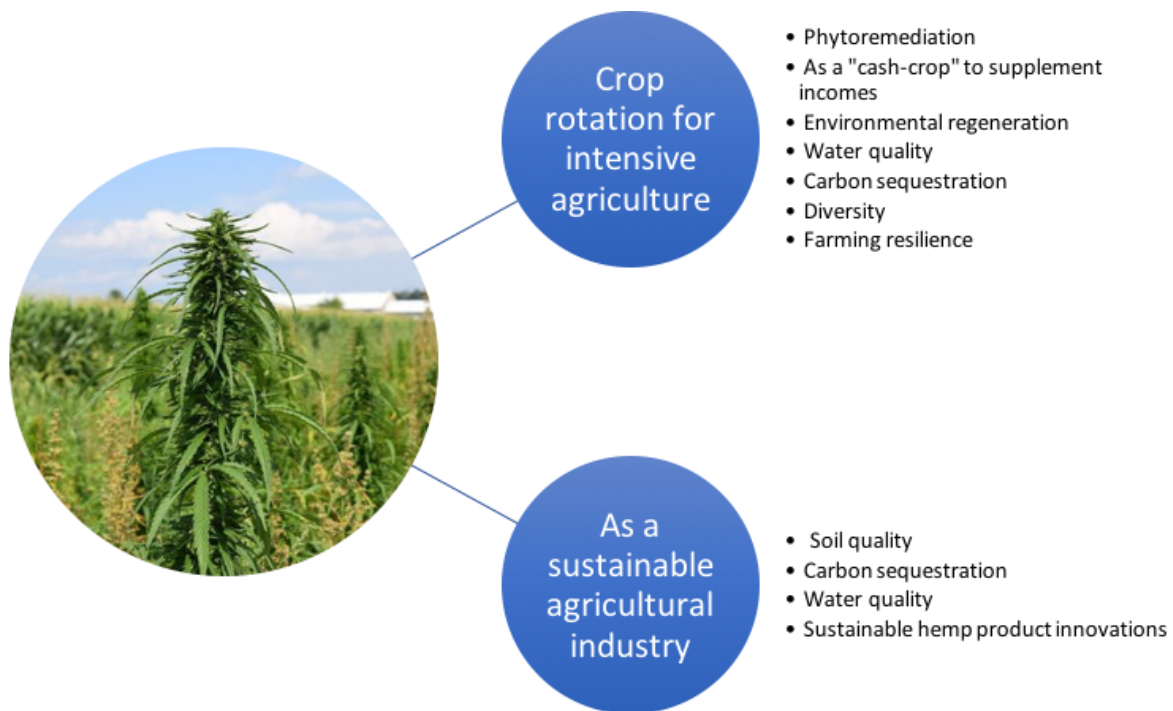


Figure 11: Perspectives of interviewed farmers on hemp's potential for New Zealand

4.2.4 Entrepreneurs: sustainability

To recap from Section 2.4.1 of Chapter 2, entrepreneurs are key to spurring innovation within organisations and industries and critical for the success of agricultural industries. The definition of an entrepreneur can be described simply as ‘the founder of a firm’, and entrepreneurial activity as the creative generation and implementation of novel, appropriate ideas’ (Heunks, 1998: 263; Amabile, 1997: 18). But the interviewed entrepreneurs in this study can be described further as examples of ‘grassroots environmental entrepreneurs’, because they are ‘generating novel bottom-up solutions for sustainable development’ in response to both unmet social needs and a commitment to alternative ideologies (Seyfang & Smith, 2007: 585). All 12 interviewed ‘grassroots’ entrepreneurs in this study are intrinsically driven to work with hemp in response to personal values, social need and ideological motivations regarding sustainability, which puts them within the definitions of ‘grassroots environmental entrepreneurs’, as discussed in Chapter 2 (Zahraie et al., 2016; Seyfang & Smith, 2007). For example, one founder of a new hemp food business explained that his drive to be involved in hemp is linked to a broader sustainability vision:

“With hemp, we are dealing with something that can have a fundamental impact on a multitude of sustainability issues we’re talking about – it’s not just

nutritional... it's the social and cultural issues, it's human health, it's the pollution issues... it's agriculture, and the way we're farming, it's sustainable farming...it's the need to reconnect the rural and urban populations...."

KI21

Another entrepreneur explained that their motivations to work with hemp are connected with sustainability:

"...replacing petroleum based things with more environmentally friendly solutions, and also around the medical side... opportunities around plant-based medicines, for vegetarians and vegans, for healthism... for physical or mental health. There are so many opportunities."

KI5

Creativity, product innovations, and resilience

Entrepreneurs spoke about hemp's potential for sustainability differently than farmers. While farmers spoke about hemp's potential as an environmental crop rotation, entrepreneurs spoke about sustainability in terms of creating environmental product innovations. Indeed, all interviewed entrepreneurs within the hemp industry are intrinsically motivated and the majority (10/12) mentioned that they are creating novel sustainable product innovations (KI2; KI4; KI5; KI6; KI7; KI8; KI9; KI15; KI20; KI21).

The aforementioned finding suggests that people's sustainable product innovations could be connected to intrinsic motivations for sustainability. This also provides further suggestion that there is a linkage between intrinsic motivation with creativity and innovation as discussed in Section 2.4.1 of Chapter 2 (Amabile, 1996). Many people explained that they are motivated in hemp because hemp can help with environmental regeneration, sustainable agriculture, sustainable product creation, and with creating a healthier, plant-based culture. These entrepreneurs are translating their intrinsic passion into innovative and sustainable new product creations. One entrepreneur has poured her intrinsic passion for sustainability into creativity, creating and innovating sustainable hemp clothing:

"Clothing is another media; it is a platform to express thoughts. You want to make the buyer ask a question to themselves, to put an image out there. It's like art – they can take what they want from it and choose to wear the clothes and

advocate for the message.”

KI2

The above quote shows that the clothing brand is an expressive and creative platform to advocate for hemp and sustainability. Likewise, another CEO views their hemp food business a platform to turn creative ideas into innovative and sustainable products, stating that *“we are looking for sustainable solutions for everyday life”* (KI4). As another entrepreneur who is innovating hemp food products stated:

“Food is a connector of the hearts, and once people are deeply motivated, then they’ll be the best advocates for hemp.”

KI8

Furthermore, some entrepreneurs stated that their personal passion for hemp generates resilience. This finding parallels previous literature which showed that intrinsic motivation creates the resilience needed to overcome hardship and to generate creative solutions (Shalley et al., 2000). As one participant said about growing hemp: *“it’s not all roses and its pretty bloody hard”* (KI16). Eva Cambourn, business director and co-owner of environmentally aware hemp clothing brand *GrumpySuns* believes her passion for sustainability has led to greater resilience:

“I think being passionate about hemp helps with resilience... because you know no matter what happens, you know it’s actually the right thing to do. The reasons aren’t selfish, so you don’t feel guilty about that being your ultimate goal, as you might for money.”

Eva Cambourn

As discussed in Chapter 2, creativity, innovation, and resilience are attributes which are vital for the success of agricultural industries (Amabile, 1996; Shalley et al., 2000; Evans & Meade, 2007; Woodman et al., 1993; Heunks, 1998; Vogl et al., 2015), and more specifically, hemp industries (Wirtshafter, 2004). The research findings above suggest that creativity, innovation and resilience within the hemp industry is connected with grassroots intrinsic motivations and passions for sustainability.

4.2.5 Human health

Within those who connected their motivations to work within the hemp industry to a passion for sustainability, some participants are intrinsically motivated to work with hemp because they see hemp as a nutritious and sustainable food, as an opportunity to enhance the human health and nutrition of New Zealanders (KI4; KI5; KI6; KI8; KI11; KI16; KI20; KI21). For example, Cameron Sims, who has also been referred to by the media as “*New Zealand’s King of Cannabis Cuisine*”, is the founder of start-up Plant Culture, New Zealand’s first premium hemp food company. He connected his motivation to work with hemp to human health, which he believes is a prerequisite to sustainability:

“For a more sustainable, harmonious culture, we have to eat healthy first... that’s why I’ve chosen hemp for food. I think hemp is a resource that can help to bring this culture back.”

Cameron Sims

Cameron explained his motivation to work with hemp because he believes health and sustainability starts from the inside – for an environmentally sustainable planet and a plant-based economy, “*people have to eat healthy first*”. Like other entrepreneurs, Cameron spoke of hemp’s potential to shift New Zealand’s consumerist, fast-paced, and unsustainable economy and culture towards a more environmentally proactive culture. Another participant mirrored Cameron’s perspectives – through hemp, the informant is on a mission to enhance human health and the environment:

“My first mission is to help kiwis become the healthiest and most energized people on the planet. The second is to give kiwi farms products they can grow that can regenerate, rather than degenerate, our land and waterways.”

KI6

He also spoke of hemp's potential to reform the food system:

“The fundamental problems on our planet today are profit-driven multinational corporations, marketing us their over processed, over sugared, over packaged food. It is poisoning us and our planet. Simply put, they put their profits before people and planet, and profit then flows to their already financially wealthy shareholders – poisoning us and our planet. It’s wrong, it’s time for a revolution, and I would love to see hemp play a leading role in the reformation of the food system.”

KI6

In summary, many people are intrinsically motivated to work with hemp because they regard hemp as an environmentally sustainable “*superfood*” which can help to reform both the food system and to amplify the health of New Zealanders. Some participants argue that good personal health is a fundamental prerequisite to an environmentally sustainable culture, and view hemp food as a critical tool in cultural change (KI6; KI8). This again confirms the key finding that many people are intrinsically and individually driven to work within New Zealand’s hemp industry in response to personal passions and commitments to sustainability, culture, and unmet social and environmental needs.

4.2.6 Summary

This section presented the results regarding the first research question: *why are people motivated to participate in the hemp industry?* The first major research finding is that people’s motivations for being involved in the hemp industry begin from an intrinsic motivation – participants are motivated for more than just profit, they are seeking passion, joy, and interest in their work (Amabile, 1996). Furthermore, the majority of participants linked their intrinsic motivation to a passion for environmental sustainability, and some for human health too. Entrepreneurs in particular expressed their motivation to work with hemp because of the plant’s potential to create a sustainable and healthy culture and the correlated opportunities to create sustainable and/or nutritious product innovations. Farmers are both intrinsically and extrinsically motivated to grow hemp because of hemp’s potential as a regenerative, sustainable

crop rotation for intensively farmed land, and for its economic potential as a “*cash-crop*”, respectively.

Within the hemp industry, intrinsic motivation appears to be the roots for creativity, product innovation, and resilience. As a result of personal passion for sustainability all entrepreneurs in this study are utilising hemp for food or fibre to produce environmentally sustainable product innovations. These creative product innovations provide further suggestion for the link between intrinsic motivation with creativity, innovation and resilience (Amabile, 1996; Shalley et al., 2000).

Overall, many people are intrinsically and individually motivated to work within the hemp industry because of a personal passion for sustainability. Entrepreneurs regard hemp as a sustainable food, fibre, and medicinal resource, and as a mechanism to foster a more sustainable culture and future. Farmers are motivated to grow hemp because they perceive hemp as a sustainable agricultural industry and a sustainable crop rotation for dairy farms, as a way to diversify farms and to increase farming resilience and profitability.

4.3 CONSTRAINTS

The second research question for this dissertation was: *what is constraining the industry?* The results to this research question is presented and discussed in this section. The first major constraint discussed is hemp’s stigma, which is perceived flow into other constraints including a lack of funding, governmental support, and physical infrastructure. The second major constraint to New Zealand’s hemp industry development is the lack of clarity within the industry, stemming from a lack of information and differing views regarding the industry’s future, scale, and niche.

4.3.1 Stigma: A major constraint

The first major constraint to New Zealand’s hemp industry raised by 13 participants is hemp’s drug-connection stigma. One participant stated that people involved in hemp are often perceived as “*a bunch of radical hippies*” (KI1). Another stressed the effects of the stigma, arguing that the stigma is one of the greatest challenges to New Zealand’s hemp industry:

“One of the biggest challenges we [New Zealand’s hemp industry] have is the marijuana connection stigma... we need a way to dissolve this manufactured lie held by the conditioned masses”

KI6

Some participants mentioned that hemp’s stigma is detrimental to public engagement with their hemp products (KI2; KI6; KI8; KI19). For example, one entrepreneur stated that her hemp clothing products often get confused with marijuana:

“People ask me questions like: ‘isn’t that marijuana?’; ‘if I wear hemp clothes will I get high?’; and ‘what if I smoke the clothes?’ [laughs] Man, it’s pretty frustrating.”

KI2

Interviewed participants’ perspectives generally coalesce regarding the idea that the stigmatization of hemp flows into many other factors including the regulations, discouraging people from considering hemp as an agricultural crop or a market product, and limiting funding and governmental support required for physical infrastructure and industry development (KI1; KI2; KI3; KI4; KI5; KI6; KI8; KI9; KI10; KI11; KI16; KI20; KI21).

Lack of physical infrastructure and funding

Many participants stated that New Zealand’s hemp industry is lacking in physical infrastructure and some believe this is a flow-on effect from the stigma and the correlated lack of funding and governmental support (*Figure 12*; KI3; KI10; KI11; KI21). This finding provides evidence to back up a previous New Zealand scholar who claimed that hemp’s connection with marijuana is restricting the revival of hemp and has forestalled technological advancements in harvesting and processing (Merfield, 1999), as discussed in Section 2.3.3 of Chapter 2. To answer the question posed in Section 2.3.3: it appears that New Zealand’s industrial hemp industry does not currently have the physical infrastructure needed to compete on the international stage. Meanwhile, New Zealand’s physical infrastructure for seed and fibre crops is “no-where near the scale it needs to be”:

“The real limitation that’s really going to become prominent is the lack of physical infrastructure moving forward. There’s about three to four times increase in hemp being grown [in the last year]... and that’s without the law change, and without the physical infrastructure in place.”

KI21

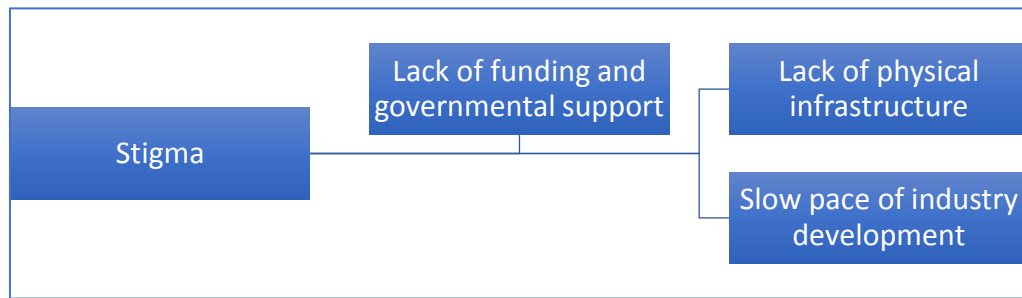


Figure 12: Hemp's stigma prevents funding and governmental support, resulting in a lack of physical infrastructure and slow pace of industry development (KI3; KI10; KI11; KI21).

The above quote demonstrates that there is a risk of oversupplying hemp in New Zealand if the physical infrastructure is not in place for processing (KI11¹⁵). A report from Canada for example, showed that the legalisation of commercial hemp production in 1998 led to optimistic and excited hemp industry participants to oversupply (Serecon Management Consulting, 2012). The report argued that long term growth depends on 'the development of a well-established primary and secondary processing capacity' (Serecon Management Consulting, 2012:4).

Funding and governmental support are critical for the physical infrastructure required for the development New Zealand's hemp industry, because physical infrastructure for hemp processing is expensive (KI1; KI2; KI4; KI5; KI9; KI10). Estimates within the industry on the price of the physical infrastructure needed ranged between 9 – 11 million dollars (KI10; KI13; KI21). As discussed in Chapter 2, the recent German hemp fibre processing model which is also being utilised in Western Australia could cost \$10million AUD and is 'technically complex and required significant investment in infrastructure' (O'Callaghan et al., 2018a: 20). But interviewed farmers believe the government is "*resisting hemp's comeback*" (KI4; KI5; KI19). One dairy farmer who has diversified his farm with hemp emphasised the influence the government could have to enable the hemp industry to move forward:

"The government has got the ability [to assist and fund the hemp industry to progress], if they have the want"

¹⁵ Research is needed to determine the quantity of licenses which are for hemp fibre crops versus seed crops to provide a better understanding of what physical infrastructure is needed for industry development.

A hemp entrepreneur agreed:

“There are government incentives to produce dairy... government incentives to produce hemp would be great”

KI2

Another key informant stated:

“The government needs to get on board. The government is resisting hemp’s comeback. If the government was on board about hemp.... Phew.”

KI5

The same participants who believe the government is resisting “hemp’s comeback” also argue that funding would contribute to hemp industry development, be crucial in dismantling the stigma, and help with the implementation of physical infrastructure (KI2; KI4; KI5; KI12; KI19). Indeed, New Zealand’s agricultural land use changes are intricately connected with Government schemes and subsidies, as highlighted by the quote below (Taylor et al., 1997):

“Agricultural pressures on the land are driven largely by economics and have fluctuated with export prices and past government subsidies. High market prices caused farmers to convert forest to pasture during the 1950’s wool boom, and government subsidies for pastoral farming had the same effect in the 1970’s and early 1980’s. Since the incentives ended in the mid-1980’s, sheep numbers have declined and several thousand hectares of pasture has been converted to exotic pine forests.”

(State of the Environment Report, 1997)

If New Zealand’s industrial hemp industry had governmental support and funding (or was subsidised), industry development and expansion could be much more likely. Indeed, a research study on New Zealand’s wine industry found that government funding in support of organic production helped enormously with opportunities by providing financial support and formality to the industry, eventually resulting in greater knowledge generation and sharing

(Zahraie et al., 2017). The Fonterra Co-operative Group Ltd (FCG) had a total revenue of \$12,397,560,000¹⁶ in 2018, and is the world's largest dairy-export firm (Collins, 2017) – if Fonterra invested in New Zealand's industrial hemp industry and subsidised industrial hemp as a crop rotation for existing dairy farms, the potential could be endless (KI11). But overall, perhaps if hemp's stigma were dismantled and hemp viewed as *“just another agricultural crop”*, governmental funding and collaborative support might be possible (KI19). Therefore, how can hemp's stigma be dismantled to encourage governmental funding, and to ensure the industry is not perceived as *“a bunch of radical hippies”* (KI1)? This will be discussed later in the chapter.

4.3.2 Lack of clarity within the industry

Several other limitations to industry development raised by participants are rooted within a wider major constraint: the lack of clarity in the industry. In particular, there is a lack of clarity regarding how to access critical information, a lack of clarity and inconsistency in views in regards to what the scale of the hemp industry should be, and a lack of clarity and differing views on what the industry's niche should be. This theme may be related to the diverse motivations of participants, discussed in Section 4.2 of this chapter: the majority of people interviewed within the hemp industry are intrinsically motivated, and perhaps a drawback of this is that intrinsic, personal motivations could be connected to the different perspectives of participants regarding what the industry's niche should be and contradicting opinions regarding what scale the industry should be operating at.

4.3.2.1 Lack of information

When asked about industry constraints, many participants mentioned the confusion regarding accessing information about hemp licensing, growing, importing, and selling, as well as who to talk to, where to get information, and ambiguities regarding industry leadership (KI1; KI12; KI6; KI14; KI15). As a dairy farmer reported:

“There's no information, no support for farmers. Finding people with information and advice is hard [...] it's not promoted as an industry and as a farmer, you can tell.”

¹⁶ Gale Business Insights Online Collection

Farmers in particular spoke of a lack of information regarding how to grow hemp, and pointed out that farmers are highly unlikely to invest in or grow the crop if there is uncertainty regarding crop agronomics, harvesting procedures, licensing and regulatory processes. The lack of clarity around how to get involved in the industry and where to seek critical information regarding involvement and growing hemp is a major constraint to industry development. The industry needs to provide easily accessible information to supply farmers and people with the knowledge and expertise they need, and to encourage a new population of followers and potential investors.

4.3.2.2 *Differing views on scale*

An article from the FAO (Loconto, 2018: 55) wrote about ‘scaling-out’ as a more common approach for sustainable agroecology initiatives. Rather than ‘scaling-up’, which typically means organisations vertically growing to reach an economy of scale, ‘scaling-out’ refers to the horizontal expansion by communities, in order to reach widespread coverage. They concluded that agroecology initiatives require some vertical growth, but mainly horizontal growth.

Participants of this study disagreed on the future scale that the hemp industry should operate at. Some argued that the industry needs to ‘scale-up’ and operate at a broad acre commercial scale. These people argued that the only way the industry can compete on the international stage is through operating at a large-scale and decreasing competition within the industry. In this view, *“it doesn’t need to be a competition”* (KI14); competition hinders industry growth New Zealand’s small-sized hemp industry needs to collaborate and function as a *“unit”* to compete on the international stage (KI9; KI14; KI17; KI18). One speaker warned against having too many individual brands within the industry and emphasised the importance of collaboration:

“Do we want a 1000 brands out there competing in the marketplace? If that’s what we want, then we just live with the consequences. Just remember, you make yourself easier to be picked off [...] I think it’s really becoming an art of collaboration.”

In contrast, others see the hemp industry operating at a much smaller scale and ‘scaling out’ rather than ‘up’, to benefit communities primarily. For example, some participants envision the future of hemp in New Zealand consisting of a multitude of small-scale quality farms and reject the idea of a large-scale monoculture, arguing that more diversity is needed (KI4; KI5; KI11; KI15). As one participant argued:

“If you’re growing hemp for communities you’re also becoming the backbone for regional economies. We are looking for ways to making farming and land use more sustainable, and hemp looks like a great option.”

KI11

“I think if we are going to compete, we’re only really going to be competing in the domestic market. There’s no scale to compete at international market.”

KI14

Participants who advocate for ‘scaling out’ believe that competition is beneficial for the industry because it produces more creativity, innovation, and growth, as one participant stated:

“If you see someone doing something and you think you can do it better, then I think you should have a crack at it! Competition does spur innovation in a way.”

KI14

The aforementioned quotes suggest a disparity of opinions: people who advocate for the industry to ‘scale-up’ view competition as detrimental to the industry’s potential to expand and compete on the international scale; meanwhile, people who advocate for a ‘scaling-out’ regard competition as beneficial for generating creativity, innovation, and growth. Other participants, particularly farmers, see industrial hemp fitting in as a seasonal crop rotation for dairying (KI4; KI5; KI11; KI19; KI20; KI21). The different perspectives regarding scale principally suggest that there is a lack of clarity within the industry regarding what the industry’s future should be.

4.3.2.3 Differing views on the niche

An internationally recognised market niche is critical to New Zealand's industrial hemp industry, as seen Canadian, Australian, European and Chinese hemp industries (discussed in Chapter 2). But participants of this study disagree on what the New Zealand hemp industry's niche should be, whether that be food, fibre, bioremediation, research, cosmetics, high-end products, or biocomposites. When asked questions like '*what do you believe New Zealand's hemp industry's niche should be*', and '*how do you see New Zealand competing on the international stage*' many differing perspectives arose (see Appendix C). Some believe the industry could have multiple niches. However, the majority of participants believe that bioremediation (11 participants) and/or food (9 participants) could be the hemp industry's focus and niche. This disparity in opinions are presented in *Figure 13* below.

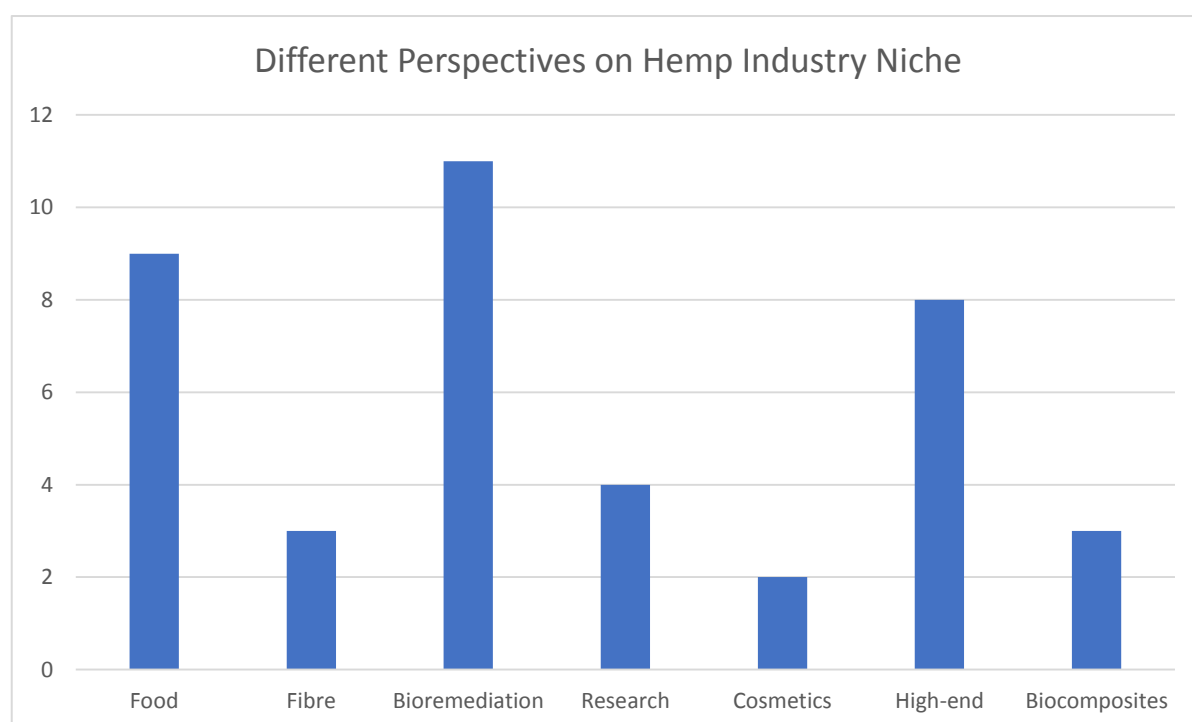


Figure 13: Different perspectives on the New Zealand industrial hemp industry's niche¹⁷

4.3.2.4 Food – the niche?

The potential of hemp for bioremediation was discussed earlier in Section 2.2.2 and in Section 4.2.3 of this chapter, whereby all eight interviewed farmers connected their motivations

¹⁷ Note: this graph accounts for the fact that some participants believe the hemp industry can have more than one niche.

to grow hemp with hemp's potential for environmental regeneration, sustainability, and bioremediation. Therefore, this section will focus on the potential of hemp for food as the industry's niche.

Nine participants agreed that food could be the hemp industry's niche. This relates back to Section 4.2.5 of this chapter which demonstrated that many people are intrinsically motivated to work with hemp because they view hemp as an opportunity to enhance human health of New Zealanders by providing nutritious and sustainable hemp food products (KI4; KI5; KI6; KI8; KI11; KI16; KI20; KI21). Some also argued that hemp for food taps into new and growing market demands for sustainable, plant-based products (KI6; KI8; KI20; KI21; KI14). As one informant stated:

“There is a trendy, kind of hipster movement happening at the moment, and hemp could fit within it very well!”

KI4

Another informant agreed:

“For me the niche food, because we're a food based nation and already have this reputation internationally [...] I think the way things are going in the world, toward plant-based nutrition and sustainability, it really has the ability to change rapidly. They're talking about hemp sales forecasted to double by 2020, that's a phenomenal rate of growth... there's been no other industry where we can see that level of growth... we're an agricultural nation, an export based economy, and we've got to meet that changing consumer demand. If the public don't want animal protein anymore, we've got to meet the changing demand.”

KI21

The above quotes indicate that hemp food product could fit within a growing niche for sustainable, plant-based foods. As discussed in Chapter 2, the first rule of niche marketing is offering customers a clearly differentiated product that fills a need: the niche has to fulfill a real and unfulfilled market need (Mitchelson, 1988; Shani & Chalasani, 1992). Indeed, research from the Mintel Group Ltd. (2018) shows the demand for sustainable, plant-based products is

steadily increasing internationally, and the dairy milk market is declining in the U.S. According to a New Zealand health food company *Sanitarium*¹⁸, more than 463,000 New Zealanders report they are “always” or “mostly” vegetarian, a 27 percent increase in vegetarians in the last four years. Hempseed and its products is a good source of nutrition for human consumption and plant-based diets; among other properties, hempseed contains substantial amounts of protein (200-250g/kg), minerals (56-80g/kg) and insoluble fibre (100-150g/kg), and is rich in essential amino acids (Hofmanova, Svec & Hruskov, 2014; Callaway, 2004; Teh & Birch, 2013).

Furthermore, a characteristic of an attractive niche is the willingness of customers to pay premium price to the firm for the products (Kotler, 2003), and as reported in Australian news, there is a ‘very high demand’ for hemp milk with producers charging premium prices (Bell, 2018). Considering the consumption of nut milks grew 24 percent in New Zealand in 2018¹⁹, and given the 2018 law changes to allow for the human consumption of hemp (Misuse of Drugs (Industrial Hemp) Regulations 2006; Food Act 2014), it can be assumed that the demand for hemp milk will soon be high in New Zealand and customers may be willing to pay premium price like our Australian counterparts. In sum, quality hemp food products could help to fulfil a growing niche for sustainable, plant-based, nutritious food products in New Zealand, and could these ‘speciality food products’²⁰ could command premium prices. But whether or not food should be the New Zealand hemp industry’s niche is not for this report to comment on – that is an industry decision.

4.3.3 Summary: lack of clarity

In sum, there is a lack of clarity in the industry primarily regarding accessing information, whether the industry should ‘scale-up’ or ‘out’, and what the hemp industry’s international market niche should be. This lack of clarity is undoubtedly limiting the industry’s development, for how can the industry expect to develop if there is confusion regarding fundamental elements like the industry’s niche, scale, and accessing critical information?

¹⁸ sanitarium.co.nz

¹⁹ Ibid.

²⁰ According to Ilbery and Kneafsey (1999), speciality food products are recognised as quality products. They are differentiated from standard products and are therefore able to command premium prices.

4.3.4 Summary

In sum, participants of this study discussed many constraints to New Zealand's industrial hemp industry, several of which contradicted one another. The first major constraint which many participants coalesced on was hemp's marijuana-connection stigma, which is perceived to flow into regulations and the lack of physical infrastructure, funding, and governmental support. Several other constraints raised by participants are rooted within the wider major constraint: the lack of clarity within the industry. These constraints include a lack of clarity regarding accessing information, what scale the industry should operate at, and what the industry's niche should be. Participants had different beliefs concerning the scale and niche. It was suggested that the lack of clarity in the industry could be linked to the intrinsic motivation orientation of the majority of participants (discussed in Section 4.2): perhaps it makes sense that people disagree on many fundamental elements of the industry considering these grassroots people are individually motivated to partake in the industry and are operating "*without a sense of industry*" (KI3). Therefore, the final research question is: *how can the industry move forward beyond constraints?*

4.4 MOVING FORWARD

The third and final research question of this dissertation is: *how can the industry move forward beyond constraints?*

This section will discuss ways the industry can move forward beyond the major constraints discussed in the previous section. This section incorporates the perspectives of research participants, research findings from Sections 4.2 and 4.3, and drawing on literature discussed in Chapter 2. Political and social mechanisms are suggested to overcome hemp's marijuana-connection stigma. It is suggested that the lack of clarity be addressed by the industry deciding on its niche and scale, as well as developing an overarching social infrastructure to provide clarity, collaboration, and direction for the industry and for people within. Finally, this section suggests that the hemp industry could venture one step further than other international hemp industries by incorporating creativity, innovation, and sustainability within its identity and within its overarching social infrastructure. This competitive advantage would both utilise and emphasise New Zealand's 'clean and green' image, as well as fostering kiwi ingenuity and other existing qualities that are rife within the industry.

4.4.1 *Stigma: Moving forward*

Through the eyes of the renowned Italian Marxist Antonio Gramsci, hemp's stigma can be viewed as a product of social construction and cultural hegemony. Gramsci argued that beliefs, values, and perceptions of those in society are manipulated and dominated by a particular group in that society – the beliefs of those in power become the 'normal' and 'natural' beliefs of everyone else in society (Glassman, 2009). In this way, and in the context of hemp in New Zealand, the 'common sense' understandings that people have about hemp – the negative perceptions, attitudes and 'drug' stigma – is a product of cultural hegemony: the negative beliefs and false perceptions that hemp is a 'drug', produced in legislation by those in power, has trickled down into the minds of the masses. The combination of hemp's classification as a 'drug' under the Misuse of Drugs Act 1975 with the attitudes held by those in power towards the plant has created a common sense understanding that 'hemp is marijuana'. Through the eyes of Gramsci hemp's stigma is politically and socially constructed, but it can also be deconstructed through political and social mechanisms.

Political mechanisms: Changes to Misuse of Drugs Act 1975 needed

As discussed in Section 4.3.1, hemp's marijuana-connection stigma is perceived as one the largest constraints to New Zealand's hemp industry, hindering funding, governmental support, and the development of required physical infrastructure. Eight participants believe that hemp's marijuana-connection stigma is tightly connected with industrial hemp's definition as a Class C Controlled Drug under Schedule 3 in the Misuse of Drugs Act 1975 (p. 68; KI6; KI8; KI12). And as discussed in Section 2.3.2 of Chapter 2, industrial hemp is a variety of *Cannabis sativa* which legally can not contain any 0.5% THC, which is too low to be an intoxicant (Swanson, 2015; Ministry of Health, 2006; 2010). Regardless, under the Misuse of Drugs Act 1975 industrial hemp is classified as a 'drug' that 'poses a moderate risk of harm' (p. 8) and is treated as a 'prohibited plant' (p. 5). Therefore, anyone seeking to cultivate, process, or possess industrial hemp is legally required to obtain a license by the Ministry of Health, critiqued as a "confusing" process which requires corresponding regulations and a "complicated" and "difficult" licensing regime, perceived as one of the greatest barriers to the hemp industry growth because "it puts people off" (KI; KI2; KI3; KI4; KI5; KI8; KI10; KI14; (Misuse of Drugs (Industrial Hemp) Regulations, 2006). As one participant stated:

"The whole licensing system is very complicated and difficult for people, it puts people off."

The recently proposed changes to the Misuse of Drugs (Industrial Hemp) Regulations 2006 and regulations under the Food Act 2014 (see Table 3; MPI, 2018) did not propose amending industrial hemp's definition as a 'drug'.²¹ Continuing industrial hemp's classification as a 'drug' validates the crop's association with marijuana, whereby continuing to justify the stigma and misinformation regarding hemp's psychoactive effects (KI8; KI9; KI3; KI21). Many participants of this study agreed that public and mainstream market need to receive a clear message from government that industrial hemp and marijuana are different and have distinctive differences in agronomic, psychoactive, nutritional, and medicinal properties. Steward Jessamine, Director Protection, Regulation and Assurance from the Ministry of Health, confirmed this perspective when he spoke at the iHemp Summit:

"I can see that this substance is a medicine, but the Misuse of Drugs Act sits at the very top – so if it sees hemp as a drug, and then it automatically wins.[...] It's time, and it's appropriate for us, to take this opportunity to go back and look at some of those things [...] our door is open to have those conversations, this is a good time to have these conversations [...] We need to re-look at the Misuse of Drugs Act and see whether it really needs to be thought of as a drug."

Steward Jessamine

And, as one key informant stated:

"Once the prohibitive legislation is abandoned, the stigma will dry away."

KI8

The aforementioned quotes demonstrate the utmost importance of reconsidering the assumption that hemp needs to be legally classified as a 'drug'. As argued in Chapter 2, Link and Phelan (2001: 375) argued that stigma is 'entirely dependent' on power, and that it takes political, social, or economic power to stigmatise. The suggestion here is that New Zealand's legal classification of industrial hemp as a prohibited and dangerous 'drug' continues to

²¹ Note: this law change occurred in the final month of this dissertation. Further research is needed to assess the implications of the law changes for industry development, as well as ongoing limitations within the regulations (hempseed is legal for human consumption but hemp flowers and leaves remain illegal. Furthermore, the leaves and stalks are not permitted as animal feed.)

reinforce a stigma which is stunting the potential of the industry (KI6; KI8; KI12). Therefore, moving forward, industrial hemp needs to be removed from the Misuse of Drugs Act 1975. Removing hemp’s definition as a ‘drug’ from the Misuse of Drugs Act 1975 would certainly help to remove the stigma (KI2; KI6; KI8; KI9; KI21), simplify the complicated licensing system that “*puts people off*” (KI4; KI5; KI14), and perhaps enable funding and governmental support which is perceived as “*crucial*” to the industry and the development of physical infrastructure (KI1; KI2; KI4; KI5; KI12; KI19).

Table 3: Proposed changes under the Misuse of Drugs (Industrial Hemp) Regulations 2006 and regulations under the Food Act 2014 (MPI, 2018: 9).

Object	Amend to reflect hemp seed as food
Cannabis means <i>Cannabis sativa</i>	Note that only <i>Cannabis sativa</i> seeds are permitted to be used as food
Director-General means the Director-General of Health	Amend to enable administration of the Industrial Hemp Regulations to move to another Ministry in the future
Hemp means cannabis plant, seed, or fruit	Remove and include it in the industrial hemp definition (technical drafting)
Industrial hemp	Amend to include the hemp definition (technical drafting)
Hemp food product (new)	Adding a definition that is consistent with the Food Standards Code.
Hemp product means a product of a kind that is derived, in whole or in part, from industrial hemp	To make a clear distinction between industrial hemp products and products made from hemp for a therapeutic use
Hulled hemp seed (new)	Hulled seeds means seeds from which the outer coat or hull of seeds has been removed and are non-viable (will not require a licence)
Whole hemp seed (new)	Whole seeds means seeds from which the outer coat or hull of seeds has not been removed and includes seeds that are able to germinate (will still require a licence)
THC means tetrahydrocannabinol	Total THC means the amount of delta 9-tetrahydrocannabinol and delta 9-tetrahydrocannabinolic acid

Social mechanisms: More product innovations needed

As advocated previously, the first part of eradicating hemp’s stigma is political – removing hemp as a ‘drug’ from the Misuse of Drugs Act 1975 – but many participants believe the other part of dismantling hemp’s stigma is social, engaging the public with hemp through

product innovation, events, and media publicity. As a hemp farmer and speaker at the summit stated in an interview:

“We need more events like this [the iHemp Summit] for knowledge sharing, for creating social networks within the industry, for sharing information and collaborating, and for learning from other peoples’ mistakes and experiences”

KI18

One informant believes that the hemp industry will see momentum if hemp were taken off the Misuse of Drugs Act as a ‘drug’, *“but only if hemp is also heavily media-ised”*. As outlined in Section 4.2.4, many entrepreneurs have been developing new and sustainable product innovations that are being showcased in the news limelight (KI2; KI6; KI8; KI21). Creating product innovations could, therefore, help to dismantle hemp’s stigma by normalising, popularising, and *“media-ising”* hemp (KI2; KI4; KI5; Dvorak, 2004b; Wirtshafter, 2004). The importance of media attention and innovative new hemp products links with a previous article by Boston self-proclaimed ‘hempologist’ John Dvorak (2004: 83):

‘Getting hemp goods into the hands of the masses is one of our industry’s biggest challenges. While great advances have recently been made in its cultivation, harvesting and processing, it is innovative new products that will catch the public’s attention and bring hemp into the much-deserved limelight.’

(Dvorak, 2004b: 83-84)

Similarly, an article by Wirtshafter (2004: 9) advocated for people within hemp industries to develop new high-quality products:

‘I therefore encourage entrepreneurs to come up with new, unique products to sell rather than imitate products already on the market. [...] We also have to keep the quality of our goods high so as not to turn off consumers with inferior merchandise that falls apart.’

(Wirtshafter, 2004: 14)

Summary

In sum, hemp's stigma is a major constraint to the development of New Zealand's hemp industry. Hemp's marijuana-connection stigma is perceived by participants of this study to be detrimental to the progression of the hemp industry because it affects public engagement with hemp products, discourages new farmers from considering hemp as an agricultural crop, and has prevented funding and governmental support needed for industry development and physical infrastructure. This section has argued that dismantling hemp's socially constructed stigma requires removing hemp from the Misuse of Drugs Act 1975 and continuing to attract media attention through the development of creative product innovations within the industry.

4.4.2 Lack of clarity: Niche and scale

It was suggested earlier that the lack of clarity within New Zealand's hemp industry is a major constraint to industry development, particularly regarding accessing critical information, and the industry's future scale and niche market. Moving forward, it is suggested that the industry decides on its scale and niche market(s) in order to compete on the international stage. As discussed in Chapter 2, Canada, Australia, Europe, and China have internationally recognised hemp industry niche markets. As one participant stated:

"We need to find a niche in order to compete with the international hemp industries"

K110

But the purpose here is not to condense key informant's diverse understandings on what the hemp industry's niche should be – that is for the industry to decide. And as discussed in the Chapter 3, forcing multiple narratives into one simple perspective is considered 'problematic' or even 'illegitimate' by post-structural geographers (Murdoch, 2006: 16). The suggestion here is that in order for the industry decide on its niche and scale, it needs to be functioning more collectively. Currently it appears the hemp industry is small and fragmented, consisting of numerous 'grassroots' innovations, organisations and entrepreneurs who are largely intrinsically motivated and are therefore operating as individuals. The downside of this reality is that these people are not connected by an overarching social infrastructure or wider organisational umbrella but are acting individually, separated from a sense of collective industry vision or purpose. Participants largely agreed that more collaboration, social networking, and information flows are needed. An overarching social infrastructure could facilitate this environment.

4.4.3 Develop an overarching social infrastructure

In light of the lack of clarity within the industry, and perhaps most critically, New Zealand's industrial hemp industry needs an overarching social infrastructure – an industry body with a common vision, purpose and strategy. This social infrastructure could provide a mechanism to connect intrinsically motivated grassroots individuals and organisations within the hemp industry to provide clarity and direction for the industry's future, especially regarding the niche and scale. Overarching social infrastructure is critical for connecting people and organisations and for providing clarity, direction, structure, and international competitiveness for the industry, as discussed in Section 2.4.3 of Chapter 2 (McGiven, 2016; Flora & Flora, 1993). To recap, Australia's Industrial Hemp Alliance (AIHA) is Australia's overarching hemp industry body with the primary aim to expand their national hemp industry:

*'The purpose of the Alliance is to represent all people and organisations interested in any aspects of industrial hemp and associated products at a national level in Australia, in order to develop and grow all aspects of the industry'*²²

Moving forward, New Zealand could develop a similar 'Alliance' to represent all people and organisations involved in the country's hemp industry. The New Zealand Hemp Industries Association (NZHIA) is the industry's main organizational body, but the NZHIA was critiqued by nine participants for several reasons including a lack of direction, leadership, collaboration, and clarity regarding New Zealand's hemp narrative moving forward (KI4; KI5; KI8; KI11; KI12; KI13; KI14; KI19; KI20). The NZHIA does not play the role that Australia's Alliance does in terms of representing and connecting all people and organisations within the industry at a national level. As one participant stated:

"The NZHIA has had a bit of a tackle at it, but somethings not quite right there... it still doesn't seem to have the muscle it needs, and I think that muscle comes from having a range of people who are in the business – farmers, that sort of thing."

KI20

Two participants have a slightly different angle – they believe that an overarching industry body is needed not only to flourish the hemp industry nationally, but also to facilitate

²² More information about AIHA is available from: <http://hempalliance.org.au>

an environment where competition, innovation, and unique brands can exist underneath this larger collective. As one stated:

“The hemp industry should team up as Team NZ or something, but with individual brands within [...] Fonterra has heaps of different brands underneath [...] If there’s no collaboration within the industry then we’re fighting over the peas rather than fighting over the pie.”

KI4

Dave Jordan, CEO of ‘HempFarm NZ’, agreed that one large collaborative is needed and that *“true collaboration is needed, also on a ministerial level”*. The HempFarm are key leaders within the hemp industry: they have developed harvesting and processing techniques, have focused on developing relationships with growers, processors, national and international markets, key stakeholders from MPI and MOH, and have been developing and providing industries and consumers with raw and processed hemp materials, cosmetics, and nutritional supplements since 2011. Dave’s perspectives on overarching social infrastructure:

“That Alliance, or whatever you want to call it, will come... We’re doing that work that an alliance would do, but we don’t have an Alliance yet. [...] Something will definitely come from us; whatever we’ve got will go towards that anyway, and whether [the Alliance] is led by us or somebody else, it doesn’t actually matter as long as it’s somebody that’s really got a bit of influence, a bit of push, and a bit of knowledge because there’s a lot of misunderstandings about this industry.”

Dave Jordan

An overarching Alliance could, therefore, assist with industry development. Fortunately, aspects of social infrastructure can be developed and changed (Flora & Flora, 1993). It is therefore suggested that New Zealand’s industrial hemp industry develop an overarching social infrastructure similar to Australia’s model (AIHA) to provide the industry with a common vision and direction, to create clarity within the industry particularly regarding scale and niche, and to generate international competitiveness. This Alliance could foster a social environment which facilitates collaboration, social networking, information sharing, and research and development (McGiven, 2016; Flora & Flora, 1993).

4.4.4 *Venturing one step further: sustainability, creativity, and innovation*

Moreover, New Zealand's overarching industry infrastructure could go one step further than the AIHA. New Zealand's hemp industry could utilize one of the main findings of this research project: that many people within the industry are intrinsically motivated because of passions for sustainability (Section 4.2.2), and that creativity and innovation is rife within the industry (Section 4.2.4). The research findings from Section 4.2 suggest that participants' differing views regarding the industry's niche share a common belief: that the niche will have sustainability, creativity, and innovation at its core. Regardless of what the niche is, participants assume that the industry's niche will fill a gap in market for sustainability and will utilize kiwi ingenuity. Whether the niche is food, fibre, or cosmetics, people expressed the belief that the associated hemp products will be creative, innovative, and sustainable. Likewise, if hemp's niche is as a crop rotation for dairy farmers, this is perceived as innovative way to farm sustainably.

New Zealand's point of difference could involve fostering the theme of sustainability, creativity, and innovation within the industry and incorporating this within the industry's wider purpose and vision. Indeed, fostering this could be our competitive difference to Australia's hemp industry – while the AIHA has a collective purpose and priorities as mentioned above and on their website, the AIHA does not express how their hemp industry is unique within the international hemp market. New Zealand's hemp industry needs a unique point of difference. New Zealand already benefits from an internationally recognised and highly profitable 'clean and green' image and New Zealanders pride themselves on their 'kiwi ingenuity'. Therefore, fostering and marketing the shared mindset for sustainability, creativity, and innovation would feed into existing reputations for a 'clean and green' country rife with 'kiwi ingenuity'. Indeed, the hemp industry could harness these qualities and provide authentic, hard evidence *for* these claims. It is therefore suggested that the current passion for sustainability and the existing creativity and innovation within the hemp industry could be further capitalized on: sustainability, creativity, and innovation could be the core components of the New Zealand hemp industry's niche. As an interviewed researcher asserted:

"It's important to get the narrative right so the hemp industry isn't seen as a bunch of radical hippies, but a coordinated, organized industry that actually knows what they want."

KII

Developing an overarching social infrastructure which fosters and markets the hemp industry's key components of sustainability, creativity and innovation could enhance New Zealand's hemp industry, provide international competitiveness and recognition, and facilitate an innovative, collaborative social environment with a shared vision.

4.4.5 Summary

This section has discussed the research findings concerning how New Zealand's industrial hemp industry can move forward beyond constraints. Political and social mechanisms were discussed as ways to move forward beyond hemp's constraining stigma, and it is recommended the industry address the lack of clarity (particularly information, niche and scale) through deciding on niche and scale and by developing an overarching social infrastructure to provide clarity, collaboration, and direction for the industry. It was also discussed that New Zealand's hemp industry could develop a sense of 'identity', a uniqueness and international competitiveness that could be found through harnessing the existing passion for sustainability, creativity, and innovation within the industry.

4.5 Chapter 4 Summary

This chapter has discussed the research findings to the three research questions of this dissertation. Section 4.2 discussed the motivations of interviewed people within New Zealand's industrial hemp industry, and presented key findings regarding intrinsic motivation, farmers' and entrepreneurs' motivations, passions for sustainability, and the existing creativity and innovation rife within the industry. Section 4.3 discussed the major constraints to the industry perceived by participants and argued that major constraints to the industry are the stigma, the lack of funding and governmental support, and the lack of clarity within the industry. Section 4.4 discussed the ways the industry can move forward, with a particular focus on the industry deciding on its niche and scale and developing an overarching social infrastructure. The subsequent chapter will conclude this dissertation.

5 CONCLUSION

Industrial hemp has the potential to revolutionise farming in Aotearoa. Farming is central to New Zealand's culture, identity, and economy, and arguably always will be (Carter & Perry, 1987; KI23), but mounting evidence is demonstrating the detrimental effects of intensive dairy farming on water quality and biodiversity and its contribution to rising greenhouse gas emissions (MFE & Stats NZ, 2017; PCE, 2015; NZ Government, 2016). Industrial hemp could be a timely sustainable agricultural industry for New Zealand, one which celebrates our farming nation and which contributes to the transition toward a more environmentally sustainable farming culture. As one participant advocated:

“Hemp is about us being able to tell the good farming story – it’s talking about sorting out our waters... taking nitrate out of soil, carbon out of air, about being able to sell healthy and sustainable food, fibre, medicine, stock feed.... It’s a new story that the agricultural sector needs to get the social license to farm back.”

KI21

If the hemp industry is developed to its full environmental and agronomic potential it could provide evidence and authentication for our internationally marketed ‘clean and green’ image. Hemp could assist with emissions reductions by sequestering carbon and nitrogen emissions during plant growth (Finnan & Styles, 2013; Davison et al., 2006), by developing durable carbon sequestering products (Pervaiz & Sain, 2003), and carbon negative ‘hempcrete’, building materials (Zampori et al., 2013; Kenneth & Miller, 2012). Hempseed and fibre can be utilised to develop environmental food and fibre alternatives to existing unsustainable products (Strategy Matrix, 2018), and pioneers within the hemp industry are demonstrating this reality. Overall, a developed industrial hemp industry could play a vital role in New Zealand's transition toward sustainable agriculture and toward sustainability.

Despite this potential, the industry is fragmented and constrained and previous research does not elucidate why. No primary qualitative research exists clarifying industry constraints or suggesting ways the industry can move forward. This dissertation seeks to fill this research

gap by understanding people's motivations for working with hemp, the major constraining factors to the hemp industry, and the ways the industry can move forward.

5.1 Major Research Findings

This section will summarise the findings to the three research questions from this project: *why are people motivated to participate in the hemp industry; what is constraining the industry; and how can the industry move forward beyond constraints?*

5.1.1 Research Question 1: Motivations

The majority of interviewed people are intrinsically motivated to work within the hemp industry, particularly because of a passion for environmental sustainability. A key finding is that many people are individually motivated to work within the hemp industry in response to intrinsic and individual passions for sustainability, culture, and unmet social and environmental needs, and are therefore operating as grassroots organisations and individuals as a result. Further, this research suggests that intrinsically motivated people are more likely to demonstrate creativity, innovation, and resilience, evident in the creative and sustainable product innovations of intrinsically motivated people within the industry. This proposal backs up previous literature that suggested an association between intrinsic motivation with creativity, innovation, and resilience (Amabile, 1996; Shalley et al., 2000).

Hemp and dairy farmers are both intrinsically and extrinsically motivated to grow hemp for sustainability and economic reasons, respectively. They agreed that *“hemp fits in well within the dairy farming system”* for five main reasons. Firstly, because it can be sown in October and harvested in time for the dairying winter grass rotation (KI14; KI19; Piddock, 2016). Secondly, because seed cultivars in particular have the potential to fit under existing irrigation infrastructure and subsequently save financially. Thirdly, because hemp has phytoremediation capacities and could be a good option to uptake heavy metals, although its potential to uptake nitrate needs to be researched. The uptake can be returned when properly retted back into the soil post-harvest, if need (McPartland, Cutler & McIntosh, 2004). Fourthly, because of hemp's economic potential as a *“cash-crop”*, although further research is needed to confirm this. And finally, because hemp could assist with on-farm emissions

reductions via biomass carbon and nitrogen sequestration during plant growth, which is proven by research (11 tonnes of CO₂/ha/yr; Finnan & Styles, 2013: 152; 239kgN/ha/yr; Davison et al., 2006: 219). Furthermore, hemp's researched capacities to assist with soil health, fertilisation, and weed and pest reduction could also be beneficial as a rotational crop (Parello, Karimi & Fagan, 2013; Cherney & Small, 2016), with evidence from Canada, China and the Netherlands (Smith-Heisters, 2008). In sum, industrial hemp could be an economically and environmentally viable rotational crop to complement existing farming systems.

5.1.2 Research Question 2: Constraints

In regards to the second research question, participants perceive the largest constraints to industry development to be hemp's drug-connection stigma and the lack of clarity particularly regarding information, scale, and market niche. The discussions suggested that the stigma largely derives from hemp's classification as a Class C 'drug' under the Misuse of Drugs Act 1975. This research provides support for earlier claims that hemp's stigma and the lack of physical infrastructure, funding, and governmental support are constraining the industry (McPartland, Cutler & McIntosh, 2004; Merfield, 1999). As discussed, a New Zealand scholar previously claimed that hemp's connection with marijuana is restricting the resurgence of hemp and has forestalled technological advances in harvesting and processing (Merfield, 1999). Nearly two decades on from these claims, hemp's stigma continues to prevail in New Zealand culture and the industry still lacks funding, governmental support, and physical infrastructure, arguably as an outcome.

Currently the physical infrastructure needed for seed and fibre processing and harvesting is "*nowhere near the scale it needs to be*", but physical infrastructure is expensive. Meanwhile, there is a risk of oversupplying hemp in New Zealand is the physical infrastructure is not developed for processing, as seen in the Canadian experience (KI3; KI10; KI11; KI21; Serecon Management Consulting, 2012). General consensus agreed that funding and governmental support are required for the physical infrastructure needed for industry development, particularly considering infrastructure could cost over \$10million NZD as seen in the Australian experience (Strategy Matrix, 2018a; KI1; KI2; KI4; KI5; KI9; KI10; KI13; KI20; KI21). It is suggested that with the marijuana-stigma dismantled industry funding may

be more likely. If Fonterra, who had a total revenue for of \$12.4billion²³ in 2018, recognised and financed hemp's potential as a sustainable, carbon-sequestering, and potentially economical rotational crop for dairy farms, the hemp industry may be able to develop the necessary processing and harvesting infrastructure.

5.1.3 Research Question 3: Moving forward

Moving forward, it is suggested that the stigma be dismantled through both political and social mechanisms. Politically, industrial hemp needs to be removed from the Misuse of Drugs Act 1975. Socially, the industry could continue to attract positive media attention and public engagement through hemp-related events and the continued development of creative and sustainable products. This could assist with normalising, popularising, and de-stigmatising the hemp plant in New Zealand. Perhaps most critically, it is advised that the lack of clarity be addressed through developing an overarching social infrastructure or 'Alliance', similar to Australia's AIHA or Canada's CHTA, to connect all organisations and grassroots people operating as individuals within the industry with a sense of a collective 'industry', a vision, a strategy, and an international point of difference. This organisational body could help the industry function collectively, and would help to address the lack of clarity by facilitating a social environment which fosters collaboration, social networking, and information flows. This body would need to converse regarding the future scale of the industry and what the industry's international market niche(s) might be.

Furthermore, it is also suggested that the industry could acknowledge the existing passions for sustainability, creativity and innovation within the industry and incorporate these qualities within its internationally recognised identity and market niche(s). Research proves that the industrial hemp can certainly be thought of as a sustainable agricultural industry (as discussed in Chapters 1 and 2) and it is suggested that the industry harnesses sustainability at the core of its internationally competitive difference and industry purpose. Unique brands and organisations could compete within this wider national organisational structure and be connected with the common purpose of developing sustainability, innovation and creativity within the industry and for New Zealand. This identity would feed and fuel New Zealand's

²³ Gale Business Insights Online Collection

‘clean and green’ image while helping to foster a new, more sustainable farming narrative for the country.

5.2 Limitations

The recent law change allowing hempseed for human consumption came into fruition in the final months of this dissertation. It was not possible to undertake further interviews regarding the positive effects of this law change on industry development, as well as several major limitations of the law change (hemp flowers, leaves, and stalks remain illegal for human and animal consumption).

5.3 Recommendations for future research

Further qualitative research could assess the impacts of the recent law change allowing hemp for human consumption on the hemp industry’s development, and to further engage with the ongoing legal and regulatory constraints to the hemp industry. Empirical research is needed to determine hemp’s capacity to assist with nitrate leaching in New Zealand and the viable options to use post-harvest. Further research is needed to determine the economic viability of hemp as a rotational crop for dairy farms.

5.4 Recommendations for New Zealand’s industrial hemp industry

- A process needs to exist to coalesce the diverse perspectives within the industry regarding the industry’s future, niche and scale, in order to develop an agreement and move forward
- Develop an overarching social infrastructure with a collective vision and strategy, a unique New Zealand identity, and industry leadership roles. It is suggested that sustainability, creativity and innovation (‘kiwi ingenuity’) play a core role in the industry’s national identity
- Invest in research and development so that innovative new products can be produced, to determine what the market is demanding, and to determine the economic viability of hemp as a rotational crop for dairy farms

-
- Work to reduce hemp's stigma through a) political mechanisms (lobbying to remove industrial hemp from the Misuse of Drugs Act 1975) and b) social mechanisms (including hemp events, knowledge sharing and collaborative hemp events, and the continued hemp product innovations to assist with media publicity and public engagement)
 - Communicate better with potential farmers and the public and provide them with relevant agronomic, processing, harvesting information and support

5.5 Concluding comments

The industrial hemp industry has the potential to revolutionise farming in New Zealand and to re-write the narrative of farming as we progress into the twenty-first century. Hemp could assist New Zealand's transition toward sustainable agriculture and towards a low-carbon economy, complement existing farms as an environmental crop rotation, and be developed as a stand-alone sustainable agricultural industry. Multiple factors are currently constraining the industry but dismantling hemp's stigma, deciding on the industry's internationally recognised niche(s) markets, and developing an overarching social infrastructure would assist the industry to progress.

A developed hemp industry could provide authentication for the country's 'clean and green' image which is crucial culturally, economically, and internationally. With hemp, New Zealand has the opportunity to develop a more sustainable agricultural industry, to transition toward a low-carbon economy, and to contribute to New Zealand's efforts and reputations as pioneers in the global movement toward sustainability.

REFERENCES

- Ahmad, R., Tehsin, Z., Malik, S., Asad, S., Shazad, M., Bilal, M., Shah, M. & Khan, S. (2016) Phytoremediation of hemp (*Cannabis sativa* L.): Identification and characterisation of heavy metals responsive genes. *Clean Soil Air Water*. 44(2), 107-218.
- Allan, H., Moore, L., Edgar, E., Healy, A., Webb, C., Skyes, W., Garnock-Jones, P., Goven, D., Conner, H. & Dawson, M. (1961) *Flora of New Zealand*. Wellington, New Zealand, Government Printer.
- Amabile, T. (1993) Motivational synergy: toward new conceptualisations of intrinsic and extrinsic motivation in the workplace. *Human Resource Management Review*. [Online] 3(3), 185-201.
- Amabile, T. (1997) Entrepreneurial creativity through motivational synergy. *The Journal of Creative Behaviour*. [Online] 31(1), 18-26.
- Amabile, T. (1988) A model of creativity and innovation in organisations. *Research in Organisational Behaviour*. [Online] 10(1), 123-167.
- Amaducci, S. & Gusovius, H. (2010) Hemp: Cultivation, extraction and processing. In: Müssig, J. (ed.) *Industrial Application of Natural Fibres*. Bremen, Germany, Wiley, pp. 109-134.
- Anastasiadis, S., Kerr, S., Zhang, W., Allan, C., & Power, W. (2014). 'Land use in rural New Zealand: Spatial land use, land use change, and model validation', *Motu Economic and Public Research Working Paper*, No. 14-07.
- Bell, L. (Oct 3, 2018) 'Hemp milk demand in Western Australia inspires East Coast expansion plan', *ABC News*, Oct 3, available from: <https://www.abc.net.au/news/rural/2018-09-19/wa-hemp-milk-producer-looks-to-expand/10257102> [accessed Oct 3 2018].

Bain, C. & Dandachi, T. (2015) “100% pure”? Private governance efforts to mitigate the effects of “dirty dairying” on New Zealand’s environment. In: Bonanno, A. & Busch, L. (eds.) *Handbook of the International Political Economy of Agriculture and Food*. Massachusetts, U.S.A, Edward Elgar Publishing Limited, pp. 40-58.

Callaway, J. (2004) Hempseed as a nutritional resource: An overview. *Euphytica*. [Online] 140(1-2), 65-72.

Cherney, J. & Small, E. (2016) Industrial hemp in North America: Production, politics and potential. *Agronomy*. [Online] 6(58), 1-24.

Citterio, S., Santagostino, A., Fumagalli, P., Prato, N., Ranalli, P. & Sgorbat, S. (2003) Heavy metal tolerance and accumulation of Cd, Cr and Ni by *Cannabis sativa* L. *Plant and Soil*. [Online] 256(2), 243-252.

Collins, B. (2017) ‘World news: Dairy fuels New Zealand pollution fears – environment damage from sector's growth threatens clean image projected to tourists’, *Wall Street Journal*, 15 Aug, available from: <https://global-factiva-com.ezproxy.otago.ac.nz/ga/default.aspx> [accessed 16 September 2018].

Conrad, C. (1997) *Hemp for Health: The Medical and Nutritional Uses of Cannabis sativa*. Vermont, U.S, Healing Arts Press.

Clayton, J. (2014) ‘Turning the tide on water pollution’, *Stuff*, 29 Jan, available from: <http://www.stuff.co.nz/dominion-post/capital-life/9661570/Turning-the-tide-on-water-pollution> [accessed 20th March 2018].

Clough, P. & Nutbrown, C. (2002) *A Student’s Guide to Methodology*. Sage Publications, New Dehli.

Critchfield, H. (1951) Phormium tenax – New Zealand's native hard fiber. *Economic Botony*. [Online] 5(2), 172-184.

Cuthbert, R. H. (2011) *Strategic Planning in Agricultural Niche Markets*. A PhD Submitted for the Doctor of Philosophy at the University of Otago, Dunedin, New Zealand. 1-244.

Davison, L., Pont, D., Bolton, K. & Headley, T. (2006) Dealing with nitrogen in subtropical Australia: seven case studies in the diffusion of ecotechnological innovation. *Ecological Engineering*. [Online] 28(3), 213-223.

Dowling, R. (2016) Power, subjectivity, and ethics in qualitative research. In: Hay, I. (2016) *Qualitative Research Methods in Human Geography*. Canada, Oxford University Press, pp. 29-44.

Dunn, K. (2016) Interviewing. In: Hay, I. (ed.) *Qualitative Methods in Human Geography*. Canada, Oxford University Press, pp. 149 – 188.

Dvorak, J. (2004) The invisible hemp industry? *Journal of Industrial Hemp*. [Online] 9(2), 59-66.

Dwyer, S. (1997) The hemp controversy: Can industrial hemp save Kentucky? *Kentucky Law Journal*. [Online] 86(4), 1143-1181.

Efendy, M. & Pickering, K. (2014) Comparison of harakeke with hemp fibre as a potential reinforcement in composites. *Composites Part A: Applied Science and Manufacturing*. [Online] 67, 259-267.

Evans, E. & Meade, R. (2007) *The effect of industry structure and institutional arrangements on growth and innovation in the New Zealand agricultural sector*, Wellington, New Zealand Institute for the Study of Competition and Regulation.

Eyles, J. & Smith, D.M. (1988) *Qualitative Methods in Human Geography*. Cambridge, Polity Press.

Finnan, J. & Styles, D. (2013) Hemp: A more sustainable annual energy crop for climate and energy policy. *Energy Policy*. [Online] 58, 152-162.

Food Act 2014. No.34/2018. Wellington, New Zealand Government.

Food and Agriculture Organisation of the United Nations (FAO). (1988) *Report of the Council of FAO*, CL 94/REP, Rome, Italy: FAO 94th Session.

Food and Agriculture Organisation of the United Nations (FAO). (2014) *Building a Common Vision for Sustainable Food and Agriculture: Principles and Approaches*, Rome, Italy.

Food and Agriculture Organisation of the United Nations (FAO). (2018) *Sustainable Agriculture for Biodiversity*. [Online] Rome, Italy.

Foote, K. & Joy, M. (2014) ‘The true cost of milk: Environmental deterioration vs. profit in the New Zealand dairy industry’, presented at *2014 NZARES Conference*, Tahuna Conference Centre, Nelson, New Zealand, 28-29 August.

Foote, K., Joy, M., & Death, R. (2015) New Zealand’s dairy farming: milking our environment for all its worth. *Environmental Management*. [Online] 56(3), 709-720.

Flora, C. & Flora, J. (1993) Entrepreneurial social infrastructure: A necessary ingredient. *The ANNALS of the American Academy*. [Online] 529, 48-58.

Fyers, A. (6 July, 2017) ‘Could our farmers cash in on legal cannabis?’, *Stuff*, 6 July, available from: <http://i.stuff.co.nz/business/farming/cropping/93226526/Could-our-farmers-cash-in-on-legal-cannabis> [accessed 3 May 2018].

Gibbs, H. (1980) *New Zealand Soils*. Wellington, New Zealand, Oxford University Press.

Gibson, K. (2008) The bag idea. *Journal of Industrial Hemp*. [Online] 13(1), 73-77.

Glenys, C. (2007) Ideas key to Australian success. *New Zealand Dairy Exporter*. [Online] 83(1), 148-149.

Glassman, J. (2009) Hegemony. In: Kitchen, R. & Thrift, N. (eds.) *International Encyclopedia of Human Geography*. Amsterdam, Netherlands, Elsevier, pp. 80-86.

Goffman, E. (1963) *Stigma: Notes on the Management of Spoiled Identity*. New York, USA., Simon and Schuster Inc.

Haraway, D. (1988) Situated knowledges: The science question in feminism and the privilege of partial perspective. *Feminist Studies*. [Online] 14(3), 575-599.

Harmsworth, G. (2004) The role of biodiversity in Māori advancement: A research framework. *He Pukenga Korero: A journal of Māori Studies*. [Online] 8(1), 9-16.

Harmsworth, G. & Awatere, S. (2013) *Indigenous Māori knowledge and perspectives on ecosystems. Ecosystem services in New Zealand – conditions and trends*. Lincoln, NZ, Manaaki Whenua Press.

Hay, I. (2016) *Qualitative Research Methods in Human Geography*. (4th ed.) Canada, Oxford University Press.

Henderson, J. (2002) Building the rural economy with high-growth entrepreneurs. *Economic Review*. [Online] 87(3), 45-70.

Herer, J. (1985) *The Emperor Wears No Clothes*. USA, Library of Congress.

Heunks, F. (1998) Innovation, creativity and success. *Small Business Economics*. [Online] 10(3), 263–273.

Hofmanova, T., Svec, I. & Hruskov, A. (2014). Nutritional properties of non- traditional seeds. *Journal of Life Medicine*. [Online] 2(1), 10-14.

Holmes, J. (1900) New Zealand Hemp. *New Zealand Yearbook*. [Online] 9(1), 477-479.

Hoseini, P., Poursafa, P., Moattar, F., Amin, M. & Rezaei, A. (2012) Ability of phytoremediation for absorption of strontium and cesium from soils using *Cannabis sativa*. *International Journal of Environmental Health Engineering*. [Online] 1(1), 17.

Ingrao, C. Giudice, A., Bacenetti, J., Tricase, C., Dotelli, G., Fiala, M., Siracusa, V. & Mbohwa, C. (2015) Energy and environmental assessment of industrial hemp for building applications: A review. *Renewable and Sustainable Energy Reviews*. [Online] 51, 29-42.

IPCC (2018) *Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments* [Press Release], 8 Oct, available from: <https://www.sciencemediacentre.co.nz/2018/10/08/ipcc-1-5c-special-report-expert-reaction/> [accessed 10 Oct 2018].

Irshad, M., Ahmad, S., Pervez, A. & Inoue, M. (2014) Phytoaccumulation of heavy metals in natural plants thriving on wastewater effluent at Hattar industrial estate, Pakistan. *International Journal of Phytoremediation*. [Online] 17(2), 154-158.

Isaak, R. (1998). *Green Logic: Ecopreneurship, Theory and Ethics*. Sheffield, UK, Greenleaf Publishing.

Islam, M., Pickering, K. & Foreman, N. (2010) Influence of accelerated ageing on the physico-mechanical properties of alkali-treated industrial hemp fibre reinforced poly(lactic acid) (PLA) composited. *Polymer Degradation and Stability*. [Online] 95(1), 59-65.

Jaussi, K. & Dionne, S. (2003) Leading for creativity: the role of unconventional leader behaviour. *Leadership Quarterly*. [Online] 14(4-5), 475–498.

Johnson, R. (2018). *Hemp as an agricultural commodity*. Congressional Research Service Report no: RL32725, USA.

Kearns, R. (2016) Placing observation in the research toolkit. In: Hay, I. (2016) *Qualitative Research Methods in Human Geography*. Ontario, Canada, Oxford University Press, pp. 313-333.

Kenneth, I. & Miller, A. (2012) Life cycle greenhouse gas emissions of hemp–lime wall constructions in the UK. *Resources, Conservation and Recycling*. [Online] 69, 1-9.

Kerr, S. (2016) ‘Agricultural emissions mitigation in New Zealand: Answers to questions from the Parliamentary Commissioner for the Environment’, Motu Economic and Public Policy Research Working Paper no: 16-16.

Khan, M., Ajid, A., Noor, S., Khattak, F., Akhter, S. & Rahman, I. (2008) Effect of soil contamination on some heavy metals content of *Cannabis sativa*. *Journal of the Chemical Society of Pakistan*. [Online] 30(6), 805-809.

Kitchin, R. & Tate, N. (2000) *Conducting Research in Human Geography: Theory, Methodology and Practice*. London, Longman.

Knickel, K., Brunori, G., Rand, S. & Proost, J. (2009) Towards a better conceptual framework for innovation processes in agricultural and rural development: from linear models to systemic approaches. *Journal of Agricultural Education and Extension*. [Online] 15(2), 131-146.

Lash, R. (2002) Industrial hemp: The crop for the seventh generation. *American Indian Law Review*. [Online] 27(1), 313-356.

Leeuwis, C. & van den Ban, A. (2004) *Communication for Rural Innovation: Rethinking Agricultural Extension*. Oxford, UK, Blackwell.

Linger, P., Mussig, J., Fischer, H. & Kobert, J. (2002) Industrial hemp (*Cannabis sativa* L.) growing on heavy metal contaminated soil: fibre quality and phytoremediation potential. *Industrial Crops and Products*. [Online] 16, 33-42.

Link, B. & Phelan, J. (2001) Conceptualising stigma. *Annual Review of Sociology*. [Online] 27, 363-385.

Mani, D. & Kumar, C. (2014) Biotechnological advances in bioremediation of heavy metals in contaminated ecosystems: an overview with special reference to phytoremediation. *International Journal of Environmental Science and Technology*. [Online] 11(3), 843-872.

McGiven, A. (2016) The future opportunities and challenges for one of the world's largest dairy export firms: Fonterra in New Zealand. *The Journal of Applied Business and Economics*. [Online] 18(3), 16-23.

McIntosh D.J. (1997) *A Brief History of Cannabis sativa L. (Hemp) in New Zealand*. Wellington, New Zealand, Wiley Publishing.

McPartland, J., Cutler, S. & McIntosh, D. (2004) Hemp production in Aotearoa. *Journal of Industrial Hemp*. [Online] 9(1), 105-115.

Merfield, C. (1999) *Industrial Hemp and its Potential for New Zealand*. A Report for the 1999 Kellogg Rural Leadership Course, Lincoln University, New Zealand.

Ministry for the Environment (MFEa). (2015) *New Zealand's Greenhouse Gas Inventory 1990-2013*. Report no: ME 1195, Wellington, New Zealand Government.

Ministry for the Environment (MfEb). (2017) *New Zealand's Greenhouse Gas Inventory 1990-2015*. Report no: INFO 798, Wellington, New Zealand Government.

Ministry for the Environment (MFE) & Stats NZ. (2017) *New Zealand's environmental reporting series: Our Fresh Water 2017*. Report number: ME 1305, Wellington, New Zealand Government.

Ministry for the Environment (MFE) & Stats NZ. (2018) *New Zealand's environmental reporting series: Our Land 2018*. Report number: ME 1350, Wellington, New Zealand Government.

Ministry for Primary Industries (MPI). (2018) Proposed changes to the Misuse of Drugs (industrial Hemp) Regulations 2006 under the Food Act 2014, no.2018/01, Ministry of Health and New Zealand Food Safety, Wellington, New Zealand.

Ministry of Health. (2006) *Guidelines for industrial hemp license applicants*, V1.4/2010, Wellington, New Zealand.

Ministry of Health. (2010) *Guidelines for the sampling of industrial hemp for testing*, V1.3/2010, Wellington, New Zealand.

Mintel Group Ltd. (2018). 'Dairy and non-dairy milk – U.S – September 2018'. Available from: <https://store.mintel.com/dairy-and-non-dairy-milk-us-september-2018> [accessed 3 Nov 2018].

Mitchelson, G. A. (1988). Niche marketing in the trenches. *Marketing Communications*, June, 19-24.

Misuse of Drugs (Industrial Hemp) Regulations 2006. No.163/2018. Wellington: New Zealand Government.

Misuse of Drugs Act 1975. No.116/2018. Wellington: New Zealand Government.

Mostafanezhad, M. & Suryanata, K. (2018) Is farming sexy? Agro-food initiatives and the contested value of agriculture in post-plantation Hawaii. *Geoforum*. [Online] 91, 227-234.

Ministry for Primary Industries (MPI) (2018) 'Hemp seeds can now be sold as food', Beehive, 6 Nov, available from: <https://www.beehive.govt.nz/release/hemp-seed-can-now-be-sold-food> [accessed 6 Nov 2018].

Murdoch, J. (2006) *Post-Structural Geography: A Guide to Relational Space*. London, Sage Publications.

Murphy, D. (2011) Oil crops as potential sources of biofuels. *Technological Innovations in Major World Oil Crops*. [Online] 2, 269-284.

Nesbit, S. (2011). *An updated look at New Zealand's comparative advantage*. Occasional Paper 13/02, New Zealand, Ministry of Business, Innovation and Employment.

New Zealand (NZ) Government. (2016) *New Zealand's action on climate change*, ME 1255, Wellington, Ministry for the Environment.

NZIER. (2017) New Zealand Dairy Statistics. Ministry for Primary Industries Statistics, New Zealand, DairyNZ Economics Group.

O'Callaghan, A., Gooch, M., Wallis, R., Pearce, K. & Shearing, G. (2018a) *Manjimup hemp milling pre-feasibility study*. Report no: 1, Manjimup, Australia, Strategy Matrix.

O'Callaghan, A., Gooch, M., Wallis, R., Pearce, K. & Shearing, G. (2018b) *Manjimup hemp milling pre-feasibility study: Stage two report, technical and financial modelling*. Report no: 2, Manjimup, Australia, Strategy Matrix.

OECD. (2017) *OECD Environmental Performance Reviews: New Zealand 2017*. OECD Publishing, Paris.

Oldham, G. & Cummings, A. (1996) Employee creativity: personal and contextual factors at work. *Academy of Management Journal*. [Online] 39(3), 607–34.

O'Neill, J., Hershauer, J. & Golden, J. (2006). The cultural context of sustainability entrepreneurship. *Greener Management International*. [Online] (55), 33–46.

-
- Oxford English Dictionary. (1989) New York, Clarendon Press.
- Panelli, R. (2004) *Social Geographies*. London, Sage Publications.
- Parello, N., Karimi, M. & Fagan, J. (2013) *Hemp nation bars – The gluten-free, high-protein, superior granola bar*. Student Research Project, Rutgers University.
- Parliamentary Commissioner for the Environment (PCE). (2015) *Update Report – Water Quality in New Zealand: Land Use and Nutrient Pollution*. [Online] Wellington, New Zealand Government, available from: <http://www.pce.parliament.nz/media/1008/update-report-water-quality-in-new-zealand-web.pdf> [accessed 05 Sep 2017].
- Pecenka, R., Lühr, C., & Gusovius, H. J. (2012). Design of competitive processing plants for hemp fibre production. *International Scholarly Research Network Agronomy*. 2012(1), 1-5.
- Pervaiz, M. & Sain, M. (2003) Carbon storage potential in natural fiber composites. *Resources, Conservation and Recycling*. [Online] 39, 325-340.
- Piddock, G. (2016) ‘Hemp poised to take off as New Zealand's next big industry’, Stuff, 23 Sep, available from: <https://i.stuff.co.nz/business/farming/84266734/Hemp-poised-to-take-off-as-New-Zealands-next-big-industry> [accessed 04 March 2018].
- Rijswijk, K. & Brazendale, R. (2017) Innovation networks stimulate public and private sector collaboration for advisory services innovation and coordination: the case of pasture performance issues in the New Zealand dairy industry. *Journal of Agricultural Education and Extension*. [Online] 23(3), 245-263.
- Ryan, R. & Deci E. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*. [Online] 55(1), 68–78.

Serecon Management Consulting. (2012) *Alberta hemp cost of production & market assessment*, Final report, Alberta Agriculture and Rural Development Economics and Competitiveness Division, USA.

Seyfang, G. & Smith, A. (2007) Grassroots innovations for sustainable development: towards a new research and policy agenda. *Environmental Politics*. [Online] 16(4), 584-603.

Shani, D. & Chalasani, S. (1992) Exploiting niches using relationship marketing. *The Journal of Consumer Marketing*. [Online] 9(3), 33-42.

Shalley, C. E., Gilson, L. L., & Blum, T. C. (2000). Matching creativity requirements and the work environment: Effects on satisfaction and intentions to leave. *Academy of Management Journal*. [Online] 43(2), 215–223.

Shi, G., Lui, C., Cui, M., Ma, Y. & Cai, Q. (2012) Cadmium tolerance and bioaccumulation of 18 hemp accessions. *Applied Biochemistry and Biotechnology*. [Online] 168(1), 163-173.

Small, E. (2015) Evolution and classification of *Cannabis sativa* (marijuana, hemp) in relation to human utilization. *The Botanical Review*. [Online] 81(3), 189-294.

Smith-Heisters, S. (2008) Environmental costs of hemp prohibition in the United States. *Journal of Industrial Hemp*. [Online] 13(2), 157-170.

Stafford, A., Cavanagh, J.A. & Roberts, A. (2014) Soil cadmium – review of recent data in relation to the tiered fertiliser management system. In: Currie, L. & Christensen, C. (eds.) *Nutrient Management for the Farm, Catchment and Community*. Palmerston North, NZ, Fertiliser and Lime Research Centre, p. 1-8.

Stratford, E. & Bradshaw, M. (2016) Qualitative research design and rigour. In: Hay, I. (2016) *Qualitative Research Methods in Human Geography*. Ontario, Canada, Oxford University Press, pp. 117-129.

Swanson, T. (2015) Controlled substances chaos: The Department of Justice's new policy position on marijuana and what it means for industrial hemp farming in North Dakota. *North Dakota Law Review*. [Online] 90(3), 599-612.

Taylor, R. & Smith, I. (1997) *The State of New Zealand's Environment*. Wellington, New Zealand, GP Publications.

Tashakkorie, A. & Teddlie, C. (1998) *Mixed Methodology: Combining Qualitative and Quantitative Approaches*. Thousand Oaks, California, Sage Publications.

Teh, S. & Birch, J. (2013). Physicochemical and quality characteristics of cold- pressed hemp, flax and canola seed oils. *Journal of Food Composition and Analysis*. [Online] 30(1), 26-31.

Tierney, P., Farmer, S. Graen, G. (1999) An examination of leadership and employee creativity: the relevance of traits and relationships. *Personnel Psychology*. [Online] 52(3), 591–620.

Trafford, S. & Tipples, R. (2011) Where will the milkers come from? A future employment conundrum for New Zealand's largest export industry. *Employment Relations Record*. [Online] 11(1), 43-61.

van der Werf, H. (2002) Hemp production in France. *Journal of Industrial Hemp*. [Online] 7(2), 105-109.

Vantreese, V. (1998) *Industrial hemp: Global operations, local implications*, University of Kentucky, Lexington, Kentucky, USA.

Venture Taranaki. (2014) *The potential for horticultural development in the Taranaki*. Agribusiness and Economics Research Unit (AERU), Lincoln University, New Zealand.

Vogl, C., Kummer, S., Leitgeb, F., Schunko, C. & Aigner, M. (2015) Keeping the actors in the organic system learning: The role of organic farmers' experiments. *Sustainable Agricultural Research*. [Online] 4(3), 140-148.

Winchester, H. & Rofo, M. (2016). Qualitative research and its place in Human Geography. In: Hay, I. (ed.) *Qualitative Research Methods in Human Geography* (4th ed.). Ontario, Canada, Oxford University Press, pp. 3-28.

Wirtshafter, D. (2004) Ten years of a modern hemp industry. *Journal of Industrial Hemp*. [Online] 9(1), 9-14.

Woodman, R., Sawyer J., Griffin R. (1993) Toward a theory of organizational creativity. *Academy of Management Review*. [Online] 18(2), 293–321.

Zahraie, B., Everett, A., Walton, S. & Kirkwood, J. (2016) Environmental entrepreneurs facilitating change toward sustainability: a case study of the wine industry of New Zealand. *Small Enterprise Research*. [Online] 23(1), 39-57.

Zampori, L., Dotelli, G. & Vernelli, V. (2013) Life cycle assessment of hemp cultivation and use of hemp-based thermal insulator materials in buildings. *Environmental Science & Technology*. [Online] 47(13), 7413-7420.

APPENDIX A: Ethics Approval Letter



D18/186

Academic Services
Manager, Academic Committees, Mr Gary Witte

8 June 2018

Dr S Connelly
Department of Geography
Division of Humanities

Dear Dr Connelly,

I am writing to confirm for you the status of your proposal entitled "**New Zealand's Industrial Hemp Industry**", which was originally received on May 30, 2018. The Human Ethics Committee's reference number for this proposal is **D18/186**.

The above application was Category B and had therefore been considered within the Department or School. The outcome was subsequently reviewed by the University of Otago Human Ethics Committee. The outcome of that consideration was that the proposal was approved.

Approval is for up to three years from the date of HOD approval. If this project has not been completed within three years of this date, re-approval must be requested. If the nature, consent, location, procedures or personnel of your approved application change, please advise me in writing.

Yours sincerely,

Mr Gary Witte
Manager, Academic Committees
Tel: 479 8256
Email: gary.witte@otago.ac.nz

APPENDIX B: Information Sheet for Participants



RESEARCH STUDY: NZ'S INDUSTRIAL HEMP INDUSTRY

INFORMATION SHEET FOR PARTICIPANTS

Thank you for showing an interest in this project. If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you and we thank you for considering our request.

What is the Aim of the Project?

The aim of the project is to address a gap in research through addressing the potential of the industrial hemp industry for New Zealand's future, the barriers and constraints to this potential, and what is believed to be needed for the future of the industry. This project is being undertaken as a part of the requirements for Polly Brownlee's Postgraduate Master of Arts degree in Human Geography.

What Types of Participants are being sought?

Participants sought are people who are involved in the hemp industry who are attending the iHemp Summit. Children (under 18 years) will not be consulted in this project.

What will Participants be asked to do?

Should you agree to take part in this project, you will be asked to participate in a semi-structured 15-20 minute interview about your perspectives on the prospects, challenges, constraints and opportunities for the NZ hemp industry. You will be asked for your permission to audio record the interview. In the event that the line of questioning does develop in such a way that you feel hesitant or uncomfortable, you are reminded of your right to decline to answer any particular question(s).

What Data or Information will be collected and what use will be made of it?

The interviews may be recorded and transcribed and the data collected will be incorporated into the final project. Access to the information can be made available to research participants if they choose to receive it. The results of the project may be published and available in the University of Otago Library (Dunedin, New Zealand), but every attempt will be made to preserve your anonymity if requested. Any personal information held on the participants will be destroyed at the completion of the research.

The information received will be incorporated within the final project and, if you agree on the Consent Form, in a creative blog that will be publicly available at www.plantculture.nz/blogs. The purpose of the blog is to share key findings and interesting themes of this research with the wider hemp community.

Can Participants change their mind and withdraw from the project?

You have the opportunity to correct or withdraw from the project or to withdraw information given in the interviews by contacting the researcher before 1 October 2018.

What if Participants have any Questions?

If you have any questions about our project, either now or in the future, please feel free to contact either:-

Polly Brownlee (Researcher)

Department of Geography

Phone: 0211642951

polly.brownlee.nz@gmail.com

Dr. Sean Connelly (Supervisor)

Department of Geography

Phone: 473-8535

sean.connelly@otago.ac.nz

This study has been approved by the Department stated above. However, if you have any concerns about the ethical conduct of the research you may contact the University of Otago Human Ethics Committee through the Human Ethics Committee Administrator (ph +643 479 8256 or email gary.witte@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

APPENDIX C: Interview Questions Sample

SAMPLE INTERVIEW QUESTIONS

Research Question 1: Participant motivations

- What were your motivations and reasons for being involved in the hemp industry?
- How do you see the industrial hemp industry fitting in within current agriculture in New Zealand?
- Do you see hemp fitting in within current farming systems like dairy farming? (if so, how?)
- What do you see as the opportunities and prospects for the hemp industry for New Zealand?
- Economic potential?
- Environmental potential?

Research Question 2: Industry constraints

- Why do you think the hemp industry has not taken off yet?
- What do you think the greatest constraints are to the development of the industry?
- What kind of support do farmers get, and is there accessible information about growing?
- What do you think are some of the main factors preventing people from getting involved in the industry, whether that be growing or investment?
- Collaboration within the industry and hemp organisations?
- Funding and governmental support?
- Physical infrastructure?
- Do you think hemp has a stigma? (If so, what is the stigma, and what are the effects?)

Research Question 3: Moving forward

- What is needed the *most* for the hemp industry to meet its potential, to move past the
- What support do people in the industry need the most?
- What do you think the industry's internationally marketed 'niche' should be / where do you see us competing on the international stage?
- What scale do you think the industry needs to operate at?
- In an ideal world, where would you see the industry operating at in 10 years time?
- What factors would need to prerequisite that reality?

APPENDIX D: Consent Forms



RESEARCH STUDY: NZ'S INDUSTRIAL HEMP INDUSTRY

CONSENT FORM FOR PARTICIPANTS

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage. I know that:-

1. My participation in the project is entirely voluntary;
2. I am free to contact the researcher to change or withdraw certain information without disadvantage before 1 October 2018;
3. Personal identifying information such as audiotapes will be destroyed at the conclusion of the project but any raw data on which the results of the project depend will be retained in secure storage for at least five years;
4. This project involves an open-questioning technique. In the event that the line of questioning develops in such a way that I feel hesitant or uncomfortable I may decline to answer any particular question(s) and/or may withdraw from the project without any disadvantage of any kind;
6. The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand), but every attempt will be made to preserve my anonymity if requested.

7. I, as the participant:
- a) agree to being named in the research ☐
 - b) agree to being included in a creative blog, ☐

OR;

- c) would rather remain anonymous. ☐

I agree to take part in this project.

.....
(Signature of participant)

.....
(Date)

.....
(Printed Name)