Yorkshire Hemp Supply Chain Map

Promar International response to:

The Supply Chain Network

GROW YORKSHIRE
CULTIVATING ENTERPRISE

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The Supply Chain Network and Grow Yorkshire

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Section 1. Abbreviations

B2B – Business to business

BHA – British Hemp Alliance

EIHA – European Industrial Hemp Association

FAO Stat – Food and Agricultural Organisation of the United Nations Statistics

CBD – Cannabidiol

R&D – Research and development

RoI – Return on Investment

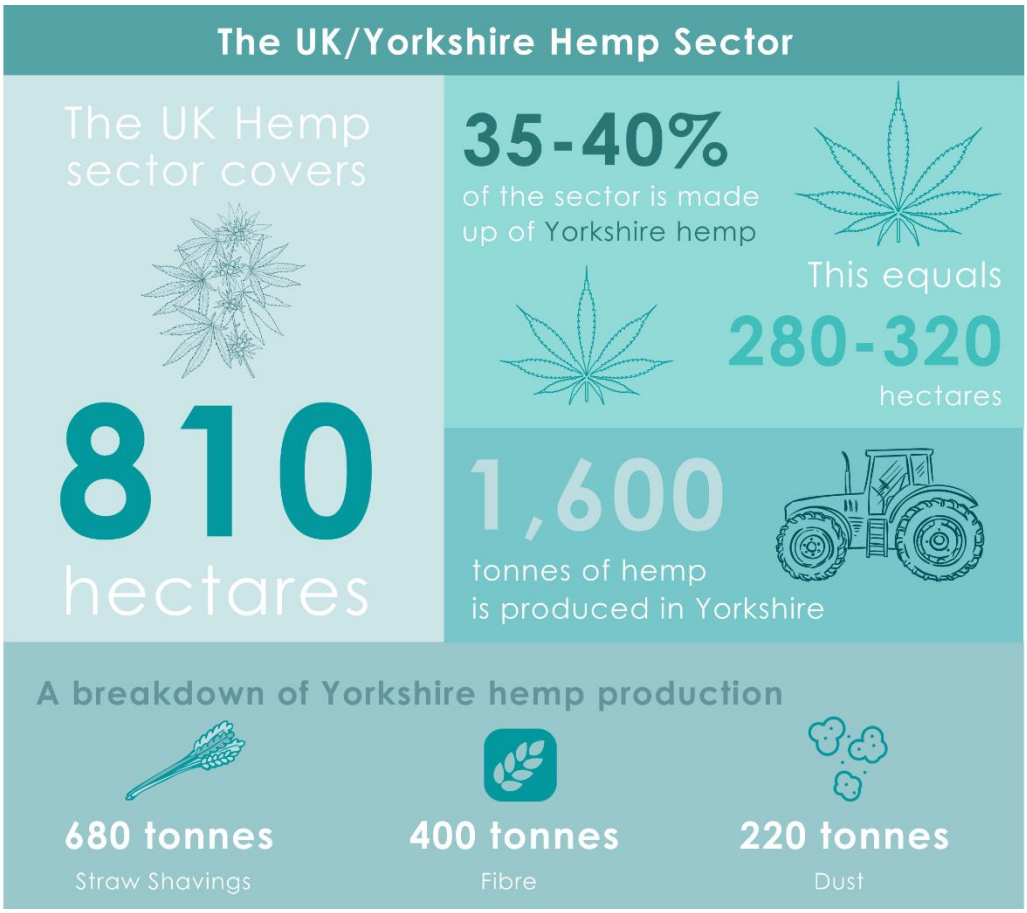
SWOT – Strengths, Weaknesses, Opportunities, Threats

THC – Tetrahydrocannabinol

UNCT – United Nations Comtrade

USP – Unique Selling Point

Section 2. Executive Summary



2.1 Global Overview

The global industrial hemp[1] industry is growing but remains a niche category. As such limited data is available on the sector. The global industrial hemp market was estimated to be worth the equivalent of £3.37 billion in 2019, with this value set to grow at a CAGR of 15.8% to 2027, according to data from Grand View Research.

Eurostat estimates that in 2019 c. 35,000 hectares of hemp were planted in the EU. Of this total, France accounts for the highest volume of planted hectares at 42%, the equivalent of 14,550 hectares.

In 2019, 3.8 million tonnes of hemp and its products, (including hemp flower, oil, seed cake/meal, CBD extract and fibre raw/processed) were exported globally, the equivalent of £4.5 billion. The main exporter currently is India, who account for c. 1 million tonnes of exports per year.

Within the UK, hemp production is much lower than the EU area at c. 810 hectares. In 2019 UNCT, details that the UK imported 100,000 tonnes of hemp and hemp products, at the equivalent of £150 million. In the same year the UK exported c. 17,500 tonnes of hemp and products. Hemp export data from the UNCT is significantly higher than the volume of hemp

[1] Throughout this report, industrial hemp is referred to as hemp

that the BHA believes is currently produced in the UK. This indicates that potentially some of the UK's exports could have been imported from another country prior to export (re-exporting).

2.2 UK and Yorkshire Hemp Overview

The UK's position within the global hemp sector is limited with just 810 hectares of land planted with hemp in 2020 according to data from the British Hemp Alliance (BHA), accounting for just 2% of Europe's total.

Of this total Yorkshire accounts for c. 35-40% of the UK's planted industrial hemp, the equivalent of 280 – 320 hectares. With average yields around 4 tonnes per hectare it is estimated that Yorkshire produces 1,600 tonnes of hemp per annum.

Hemp demand is on the rise due in part to the significant environmental benefits the plant has to offer, the most noted being:

- It has an efficient carbon sequestration structure resulting in its ability to successfully capture and store atmospheric carbon dioxide, with the ability to store up to 22 tonnes of carbon per hectare
- Improves soil health and can be grown in a wide range of soil types and conditions
- It has low input requirements in relation to herbicides, pesticides and fertilisers

2.3 Supply Chain Map

Desk research and in-depth business to business (B2B) interviews indicate that within the Yorkshire hemp sector there are two main growers of hemp who together account for 97% of the regions total hemp production, these being East Yorkshire Hemp and Harrison Spinks. The remainder of the region's hemp crop is grown by small scale farmers, typically using it as a rotational crop, although some are actively looking to increase their planted land.

Both growers have their own processing equipment in order to efficiently separate the hemp plant into its main components: fibre and straw shavings/shiv.

The most valuable part of the hemp crop (presently) is the fibre. Of the 1,600 tonnes of hemp being produced in Yorkshire: 400 tonnes hemp fibre, 680 tonnes shiv and 220 tonnes dust. The remaining volume is typically lost during the processing stage, due to the removal of impurities and drying to the ideal moisture level.

Currently, fibre is most notably used as a mattress filler and on a smaller scale for non-woven items such as vehicle seat coverings and interiors. New opportunities for fibre include use within the construction industry as an insulation material, or within the horticultural industry as a basket liner for plants.

The shiv part of hemp has less monetary value associated to it but can be found utilised in a variety of different products at present in Yorkshire including most notably, hempcrete a bio organic building material. Other uses for shiv include animal bedding and biofuel briquettes.

During the hemp separation process dust is created which if collected can be harnessed to produce products such as hemp plaster or biofuel briquettes.

Overall, the hemp supply chain in Yorkshire operates well despite its small scale. However, gaps in the chain in regard to collaboration and technical manufacturing facilities means that there are areas of improvement that can be to made to further strengthen the sector.

2.4 SWOT Analysis

The detailed SWOT analysis identifies a number of key areas where the sector presents gaps and weaknesses, as well as details on how the sector can work together to strengthen their position within the UK hemp sector, whilst also benefiting the local economy.

Strengths

- Yorkshire holds a strong farming tradition
- Hemp is adaptable and grows on a wide range of land types
- The region hosts a number of recognised research institutes working on hemp-based projects
- The supply chain contains stakeholders with relative expertise in working with hemp within both textiles and construction
- There is a consistent demand for hemp within the local area

Weaknesses

- Hemp farming remains relatively small scale
- There is a lack of viable processing facilities – particularly in terms of textiles
- There is an overarching lack of government support towards the hemp industry
- Areas of the supply chain are relatively dis-jointed with varying degrees of collaboration

Opportunities

- There is a growing demand for hemp globally
- Hemp has a wide range of environmental benefits which fits in with current sustainability trends
- There are opportunities to develop more varieties of hemp
- By products from the hemp processing sector can be utilised and sold on as products in their own right
- Yorkshire is renowned for its agricultural and textile heritage
- Work is beginning on developing Yorkshire based processing/manufacturing facilities for hemp

Threats

- The Yorkshire and UK hemp sector lags behind the wider global market
- There is no scale of production
- UK legislation means that growers are unable to access the most lucrative part of the hemp crop – its flowers and leaves
- With a lack of data and no clear return on investment (RoI) the sector is perceived as being a risky venture

2.5 Supply Chain Action Plan

The results of the desk research and B2B interviews indicated a number of clear opportunities and next steps for the Yorkshire hemp sector, these being:

- Developing a collaborative working cluster across the whole supply chain
- Encourage new grower entrants into the sector
- Providing a proactive approach to altering UK hemp legislation surrounding the use of hemp flowers and leaves
- Strengthening and developing the existing processing/manufacturing facilities for both the construction and textile industry
- Developing opportunities for by product sales
- Continue new varietal development research

Section 3. Overview

Promar International has produced this report for The Supply Chain Network and Grow Yorkshire.

The report provides valuable insight into the hemp industry and the development of a supply chain map focused on the Yorkshire hemp sector.

The report utilises two different research elements: desk research and B2B research.

3.1 Desk Research

Desk research was undertaken to provide an understanding and knowledge of how the global hemp sector operates and where the UK fits within this sector. In addition, information was sought on countries that were offering best practice scenarios in relation to hemp and the key environmental benefits that the crop offers.

3.2 B2B Research

The field element of our research involved conducting 20 interviews via the telephone and Microsoft Teams with research institutes, growers, processors, consultants and manufacturers across the Yorkshire region during January to February 2021.

Interviews were delivered using a semi structured topic guide which can be found in Appendix 1 of this report.

The companies spoken to are: Biorenewable Development Centre, Bio York, British Hemp Alliance, Cultiva Kingdom, Fera Science, Future Fashion Factory, Haenep London, Harrison Spinks, Independent Hemp Farmer, Kuilderd Consulting, Leeds University, Native Chartered Architects, Omnia, Quantech Solutions, Sustainable Environmental Friendly Fibre, Tatham, The Carbon Farm, Valley Northern, Yorkshire Hemp and UK Hempcrete.

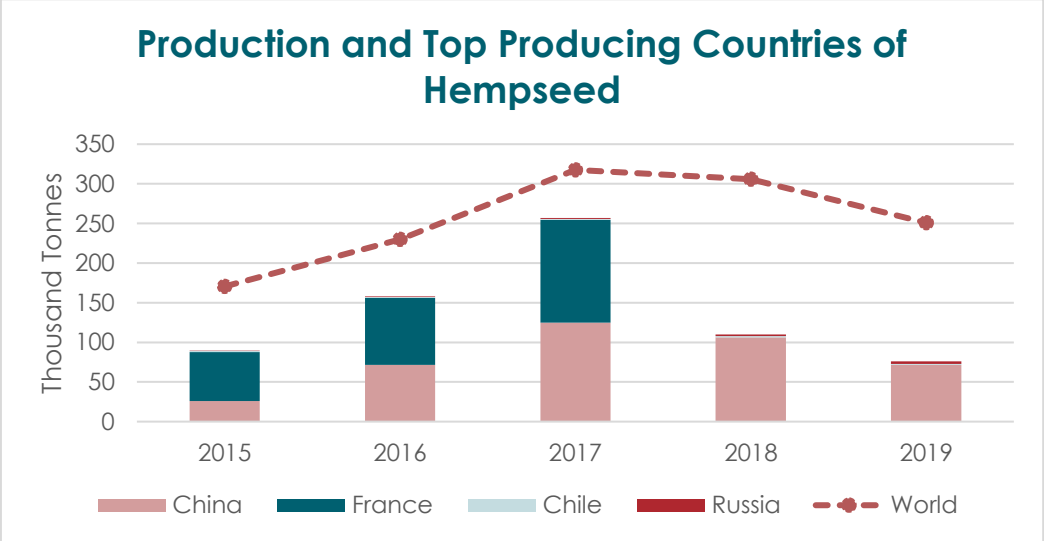
Section 4. Global Hemp Industry

4.1 Global Overview

Industrial hemp (Cannabis sativa L.) production has recently been the subject of increasing interest around the world. Hemp is a crop that has great versatility in its uses, among which it has the ability to supplement or replace fibre or paper, it has an abundance of environmental benefits and is a potentially profitable crop that fits well into sustainable farming systems. Hemp is one of the world's oldest cultivated plants that was developed from wild Cannabis plants that originated most probably in Central Asia over 3000 years ago.

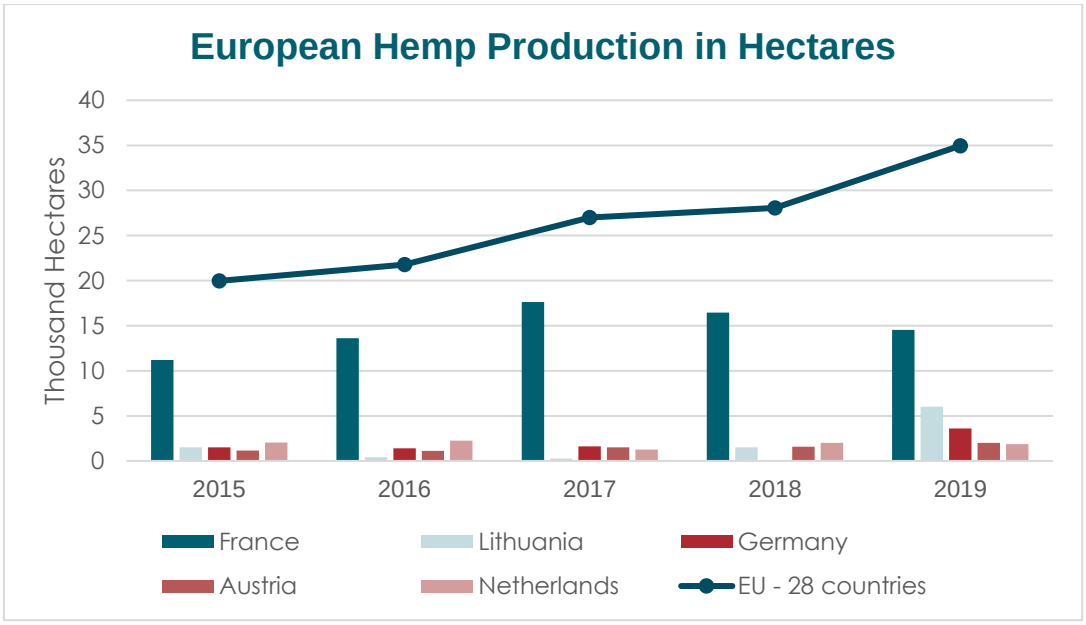
4.2 Production

Data on production of hemp is inconsistent, however, Food and Agricultural Organisation (FAO) details that in 2019 the global production of hempseed was 250,700 tonnes a decrease from 317,500 tonnes in 2017 when peak seed production was reached. Despite the decrease in the production of hempseed in the last two years, the data from FAO indicates that the hempseed market grew by around 32% in a period of 5 years. The main producing countries of hempseed are China and France that provided 31% and 22% respectively of the world's total production over this period. There are other important countries like Chile and Russia, but the volumes produced are around 1% of the world's production. Since 2018 there has been no French volume data in relation to hempseed production.



Source: FAO Stat

Within the EU-28, in 2019 approximately 35,000 thousand hectares were under hemp production, according to Eurostat. This is an increase of 15,000 hectares since 2015. France, Germany, Lithuania, Austria and the Netherlands accounted for 80% of the total amount of hectares under hemp production in EU-28 over this period. France is the country with the largest amount of land for hemp production accounting for 42% of the total in 2019. Behind this Lithuania accounted for 17% of the total.

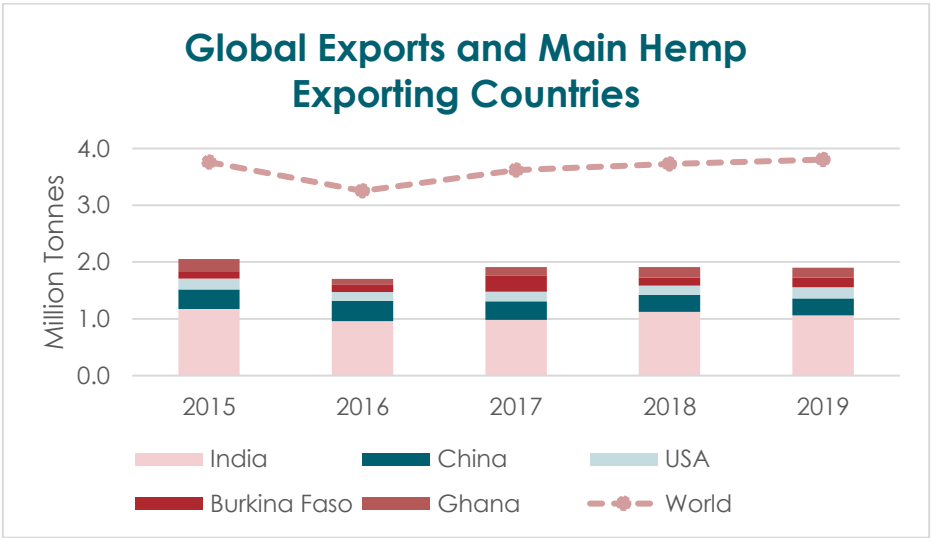


Source: EuroStat

4.3 International Trade

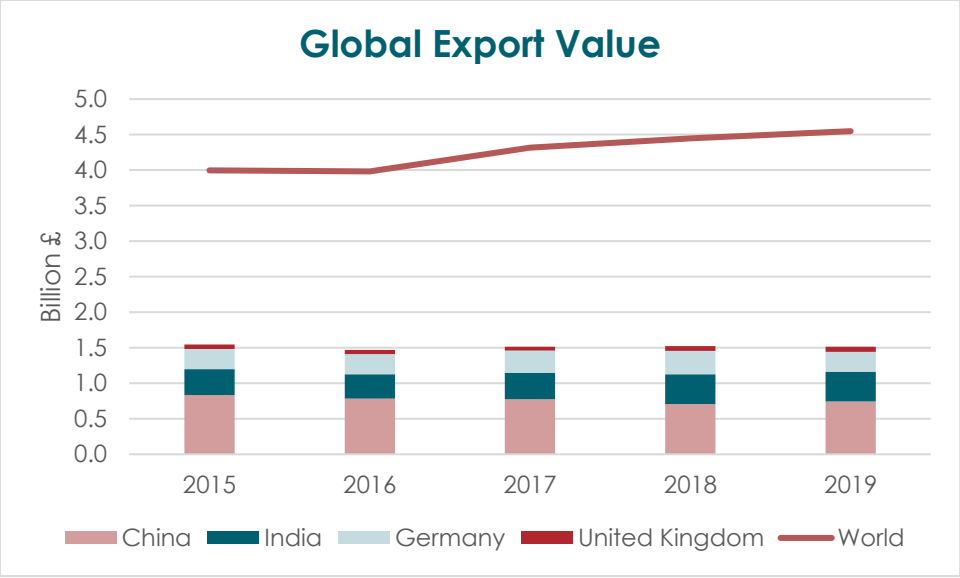
According to United Nations Comtrade (UNCT), over 3.8 million tonnes of raw hemp and hemp products (including hemp flower, oil, seed cake/meal, CBD extract and fibre raw/processed) were exported globally in 2019, this volume of exports is the highest since 2015.

Global exports of hemp have remained relatively stable in the period studied ranging between 3.2 to 3.8 million tonnes per year. India is the main exporter of hemp, on average over this period, with the country providing 29% of total global exports, the equivalent of over 1 million tonnes per year. China is the second largest exporter of hemp accounting for 9% of the global exports, with annual exports between 300,000 to 350,000 from 2015 to 2019. USA, Burkina Faso and Ghana are important exporter countries and the volumes of hemp exports of each country represents between 4% and 5% of the global hemp exports in the studied period.



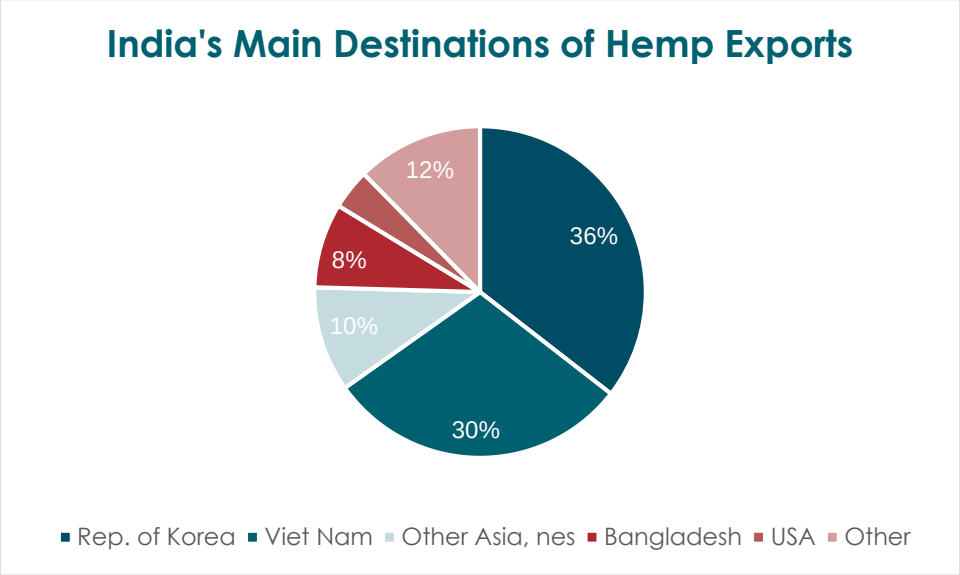
Source: UNCT

The world export market value of hemp in 2019 was estimated by UNCT at £4.5 billion, this is the peak hemp value export in the 5-year period. Since 2015, the annual export market value of hemp fluctuated between £4 to £4.5 billion per year. From 2015 to 2019 the global hemp export value increased by approximately £0.6 billion.



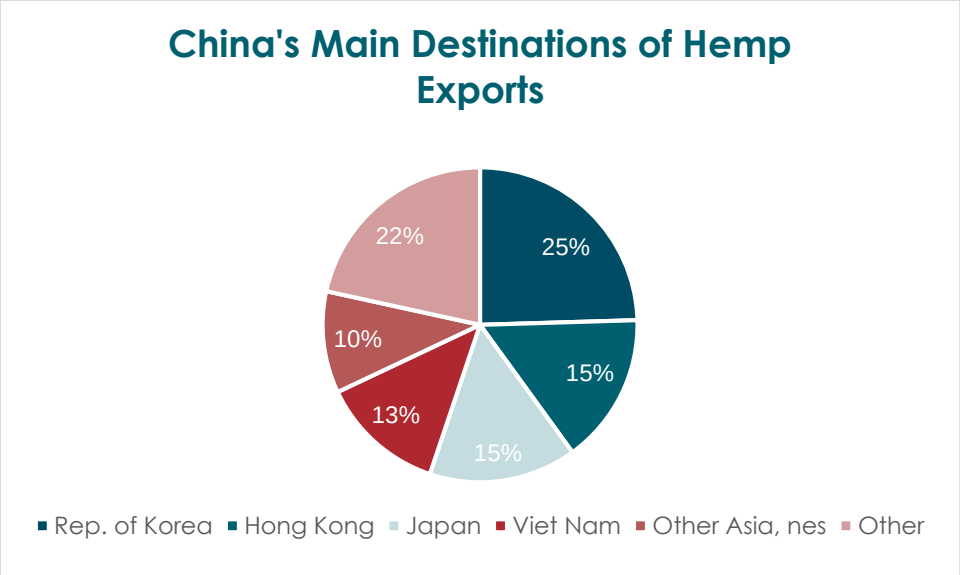
Source: UNCT

In volume terms, India is the largest hemp exporter, accounting for 29% of the global export volume. The main export destinations for Indian hemp are the Republic of Korea and Vietnam representing 36% and 30% of the total respectively. Other Asian countries, Bangladesh and USA are important countries for the Indian hemp exports with a share between 4% to 10%.



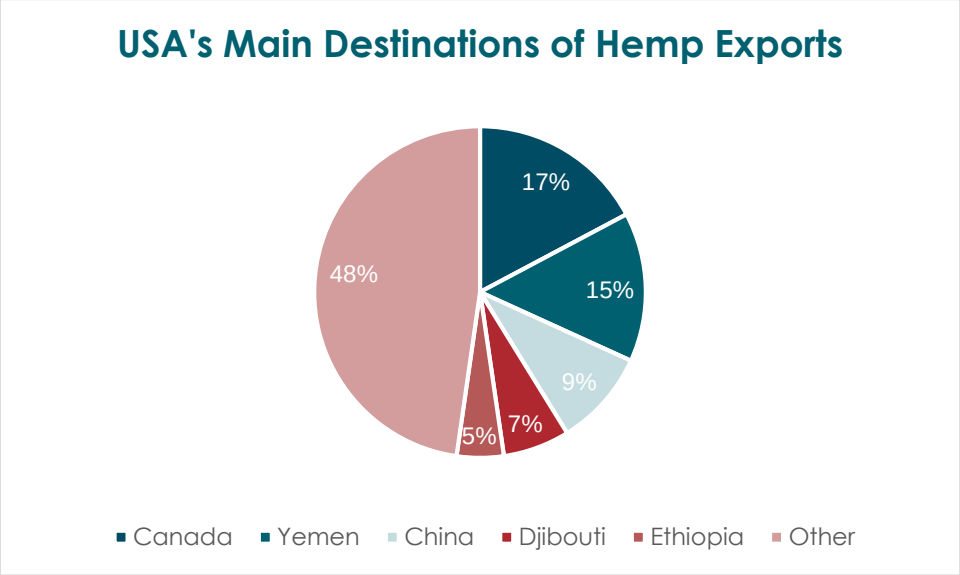
Source: UNCT

The second largest market of the global hemp sector is China with 9% of the volume of the global exports. China's main hemp market export is the Republic of Korea representing 25% of the Chinese export market. Hong Kong, Japan and Vietnam are all destinations for Chinese hemp exports each country accounting for 13% to 15%.



Source: UNCT

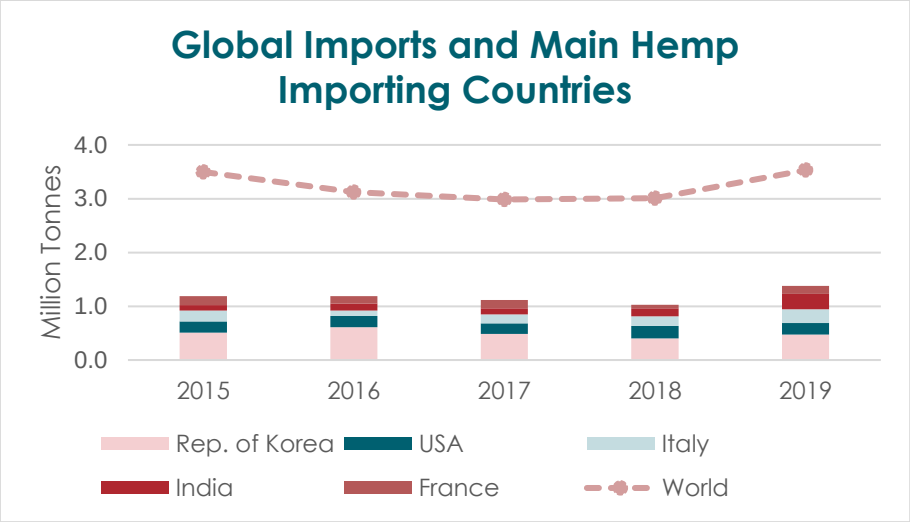
According to UNCT 17% of the USA hemp exports have Canada as a destination. This is the most important market for hemp exports followed by Yemen, accounting for 15% of total hemp exports. China, Djibouti and Ethiopia are important markets for USA hemp exports each country representing 5% to 9% of the USA total hemp exports.



Source: UNCT

The main global importing country of hemp is the Republic of Korea with volumes varying from 400,000 to 600,000 tonnes per year accounting for 15% of global hemp imports from 2015 to 2019. The USA is the second largest hemp importing market, imports per year range between

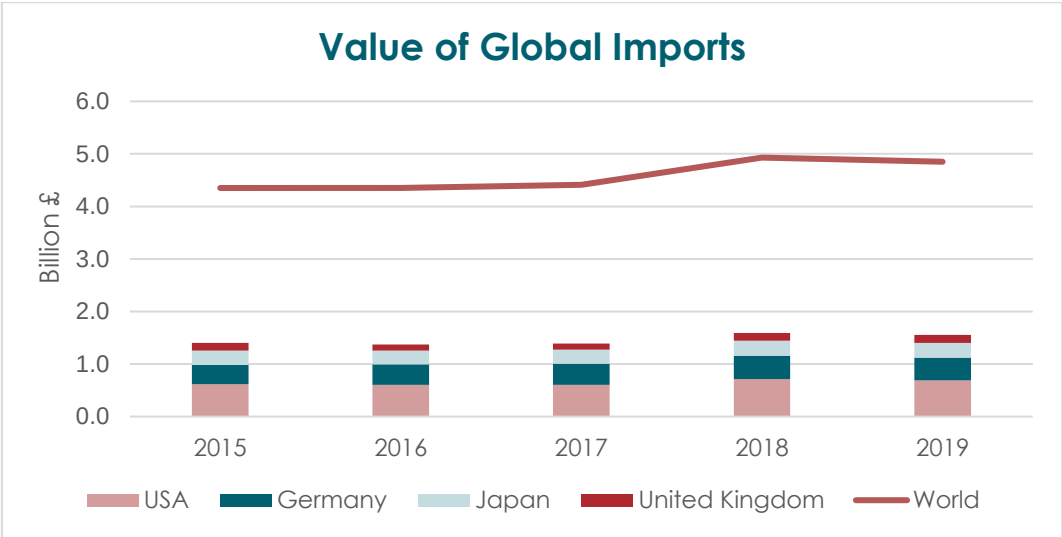
200,000 to 230,000 tonnes accounting for c. 7% of the world's total imports in the analysed period.



Source: UNCT

Import data indicates that Italy, India and France accounted for 6%, 5% and 4% respectively of the global hemp imports from 2015 to 2019, the volumes imported for each country varies between 65,000 to 290,000 tonnes per year.

Global hemp imports value in 2019 was estimated by UNCT at £4.8 billion a decrease from 2018 when peak imports where achieved at £4.9 billion in the studied period. From 2015 to 2019 the value of hemp imports increased £0.5 billion. Since 2015 the global hemp imports value range between £4.3 to £4.9 billion.

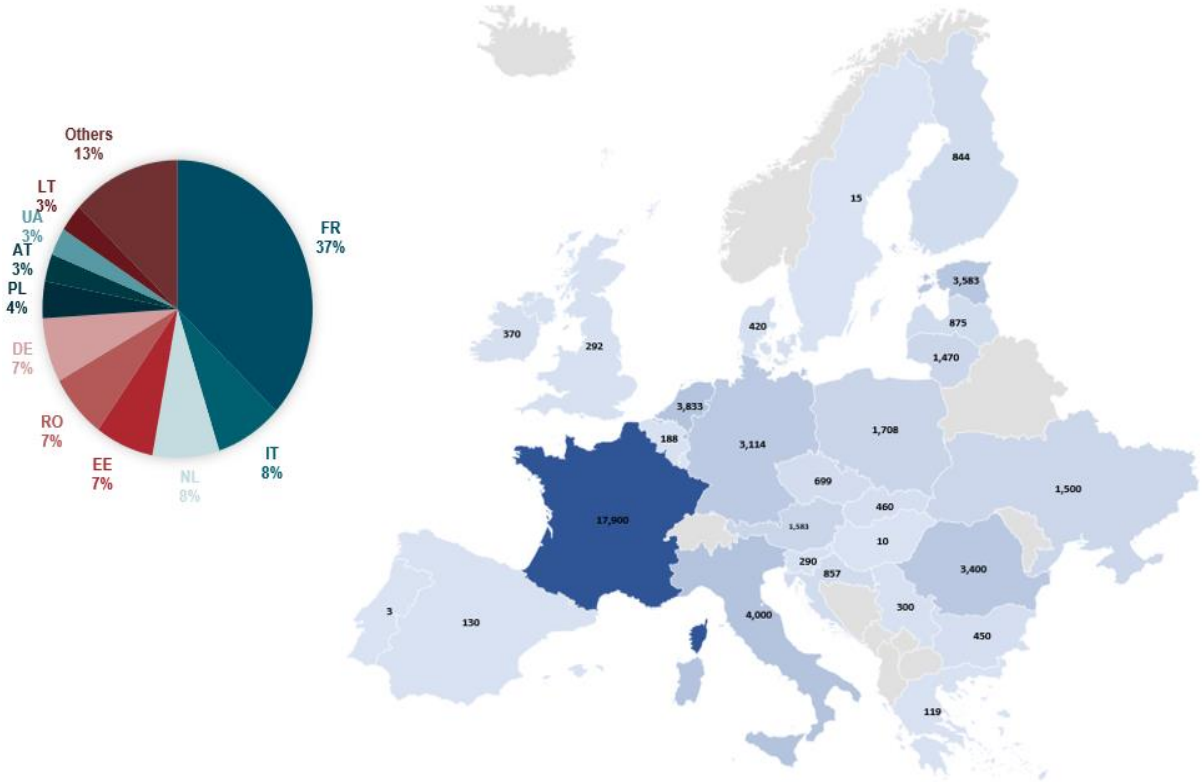


Source: UNCT

UK Position

Data on production of hemp in the UK is limited and contradictive. Data from the European Industrial Hemp Association (EIHA) estimates total UK hemp production at 292 hectares, the equivalent of 1% of the EU total (approximately 48,420 hectares) in 2018.

Europe Land Surface Use for Hemp Production in 2018 (Hectares)

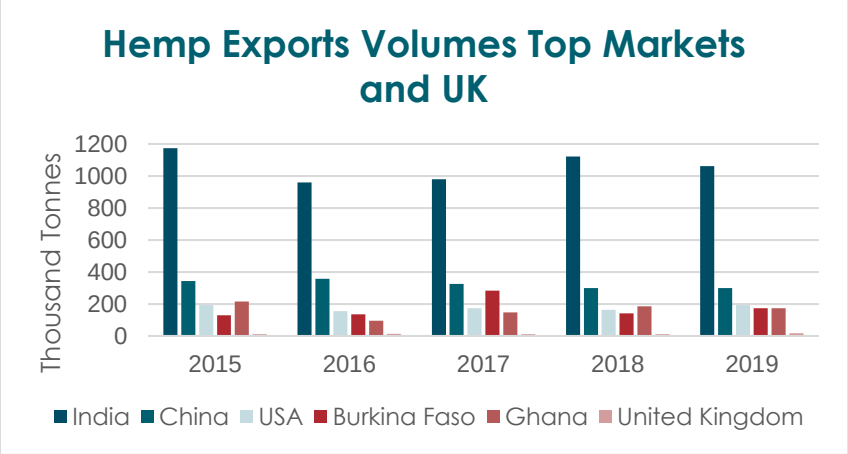


Source: European Industrial Hemp Association (EIHA)

However, B2B interviews indicated that there was a significantly larger area of land dedicated to hemp production in the UK currently. Data from the British Hemp Alliance (BHA) indicated that UK hemp production was higher at c. around 2,000 acres (810 Hectares) in 2020. The BHA estimates that the average production of hemp in the UK is around 6,075 tonnes per year. If data from the EIHA is accurate, it indicates that in the UK hemp land has increased by 518 hectares in 2 years.

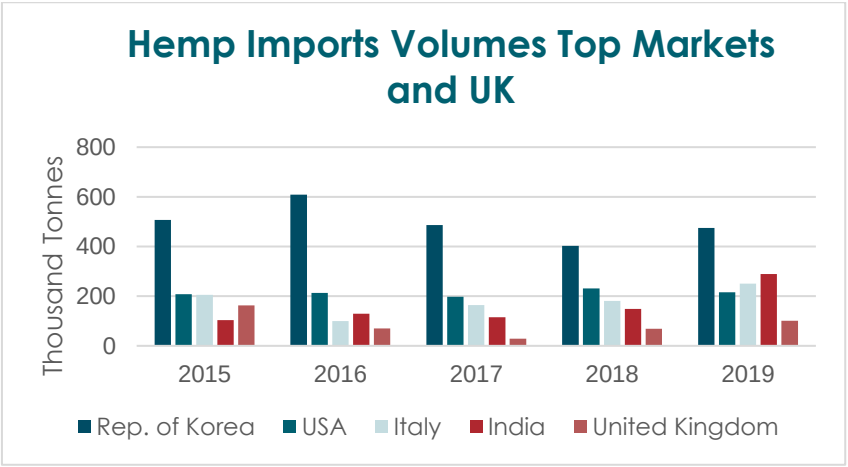
Data from the BHA and from B2B interviews indicate that Yorkshire accounts for c. 35 – 40% of the UK's total hemp production, the equivalent of 750 acres (320 hectares).

The exports of hemp products from the UK reached 17,234 tonnes according to UNCT in 2019, this was the country's highest export volume since 2015. This figure is higher than the total volume of UK production and indicates that re-exports may have a part to play in the numbers. The UK hemp market exports for 2019 were estimated at £151 million. India is the largest hemp exporting market, in Europe countries like Spain, Denmark and Germany are the biggest exporters, each market accounted for 3% to 4% percent of the total global exports since 2015. The UK is far from these markets accounting for 0.4% of the total hemp exports in the studied period.



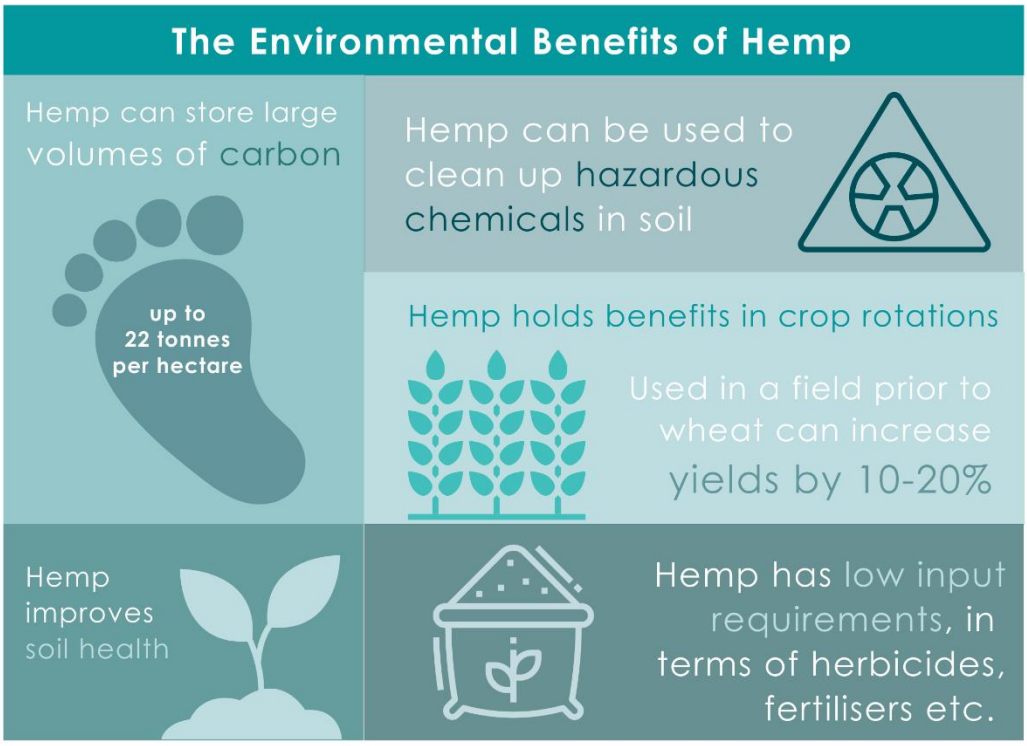
Source: UNCT

The imports of hemp in 2019 to the UK were above 100,000 tonnes a decrease by approx. 60,000 tonnes from 2015 when peak import was reached at 163,389 tonnes. The import market in the UK in 2019 was estimated at around £150 million. Since 2017, an increase in hemp imports in the UK is noted with volumes increasing by 33,000 to 40,000 tonnes annually. The UK accounted for 3% of the world's hemp imports from 2015 to 2019. Far from the main importer country, the Republic of Korea, accounting for 15% of the total hemp imports.



Source: UNCT

Environmental Benefits



Hemp has significant potential as a multi-purpose crop with not only economic but also environmental benefits through carbon sequestration (the process of capturing and storing atmospheric carbon dioxide); improved soil health; and phytoremediation (the ability of living plants to clean up soil, air, and water contaminated with hazardous contaminants).

Carbon Sequestration Potential

Hemp's fast growth and development makes it an efficient carbon dioxide to biomass converter. As a high biomass crop grown for fibre, hemp can sequester large volumes of carbon by photosynthesis and then store it in the plant's body and roots, with most carbon stored in the harvested hemp stem and less in the roots and leaves. Hemp production, depending on final usage, can sequester up to 22 tonnes of carbon dioxide per hectare, - more than other commercial crops or even woodland (Adensina *et al.,* 2020)[2]. Alternatively, it is estimated that 1.63 tonnes of CO2 is sequestered, for every tonne of hemp grown.

The carbon sequestration potential of hemp production is significant across a range of end products. Hemp is receiving increased appeal for its ability to capture large volumes of carbon and to form part of circular systems, particularly in industrial usage. Such cyclical systems aim to eliminate waste and continuously reuse and recycle resources. Depending on the final use

[2] Adesina, I., Bhowmik, A., Sharma, H. and Shahbazi, A., 2020. A review on the current state of knowledge of growing conditions, agronomic soil health practices and utilities of hemp in the United States. *Agriculture*, *10*(4), p.129.

of the hemp plant, this carbon can potentially be stored indefinitely. Such uses include Hempcrete, a bio-composite building material, a mixture of a lime-based binder and hemp.

Hempcrete is recognised for its ability to both offset a carbon-intensive building material and simultaneously provide a long-term carbon store. The potential of hemp as a sustainable building material is illustrated when comparing emissions versus raw materials with similar properties. 198kg of CO2 is emitted to make one tonne of reinforced concrete. Its equivalent, 1m2 of timber framed, hemp-lime wall (weighing 120kg), stores 35.5kg of CO2 after allowing for the energy cost of transporting and assembling the materials.

Another upcoming use of hemp biomass is the production of biochar for soil applications. These applications can improve soil carbon sequestration and reduce agricultural greenhouse gas emissions.

Improved soil health

Hemp offers a viable alternative to other break crops such as oilseed rape and sugar beet. Break crops are used by farmers to improve disease and weed control, as well as to improve soil structure. Hemp grows in a diverse range of soil types and conditions. Optimum growth is reached within well-structured, loam soils with a pH of 6 - 7.5. The physiology of hemp improves soil structure while also protecting and binding soil. Hemp's large taproot, reaching up to 150cm long helps remediate compacted soils. This extensive rooting system also enables the plant to recover nutrients ordinarily outside of the reach of most plants. These nutrients may otherwise be lost from the field, leaching away into groundwater.

Hemp produces high quantities of below-ground organic matter, which is returned to the soil and decomposes, feeding nutrients back into the ground. This process builds soil organic matter, further supporting carbon sequestration. As a result, this makes hemp a unique alternative within a crop rotation with winter cereals, which require high-quality, healthy soils.

Hemp also offers good potential for use as a phytoremediator – it can be utilised in cleaning up hazardous chemicals and heavy metals from soil and water.

Low input requirements

There are several agronomic and environmental benefits of cultivating hemp in rotation with other crops, with one of the greatest being its low-input requirement. Hemp therefore fits in well with strategies for minimising inputs into farming systems.

Hemp grows at a high density and rapidly accumulates biomass, enabling the crop to smother weeds successfully and therefore reduces reliance upon herbicides when in-situ. Hemp responds best to fertilisation prior to seeding, therefore once sown the plant requires little fertilisation. As a result, fertiliser inputs are relatively low as application rates beyond 120 kgN/ha hemp, shows that hemp has little response to additional nitrogen.

The low-input characteristics of hemp production also extends to the following crop within a rotation. This makes hemp an excellent predecessor in a crop rotation, particularly before winter cereals such as wheat. Hemp cover can suppress weed populations efficiently for the following crop thereby reducing the need for herbicide inputs and enhancing soil health. Studies have also illustrated that how the allelopathic effects of hemp can be beneficial within a rotation. This is the function of chemical inhibition through release of substances into the environment of certain other species – acting germination or growth inhibitors. This has been

demonstrated by hemp serving as a nematicide (reducing pest nematode populations) for crops that are susceptible to nematode infestation such as potato and maize.

The beneficial effects of hemp to following crop yields have been quantified and the inclusion of hemp in a crop rotation has been proven to enhance the yields of wheat in temperate climates by 10-20%. The physiological characteristics of hemp supports its ability to be grown for several years in conventional monoculture without experiencing yield declines.

4.4 Best Practice Case Studies

Canada

Canada became the first G7 nation to legalise recreational cannabis use in 2018. According to the Canadian government in 2019 37,435 hectares were under cultivation of industrial hemp in the country. Since 2018 innovation and investors have flowed into the market. Canada's hemp sector today is growing to provide secure supplies of hemp seed and raw fibre materials for domestic and international markets, as well as processed and value-added products like cosmetics, hemp oils and hemp protein powder.

The federal regulations in Canada helps to create quality safety and accountability, as well as ensuring that essential research continues. Hemp can be successfully grown under any traditional Canadian production system, as it fits with typical rotation systems and can be sewn into previous years stubble.

Hemps rapid growth rate means it can also be an excellent crop to grow under organic production. Some producers, with shorter varieties will seed alfalfa and grass seed along with the hemp in the Spring. The forage crop established in the shaded microclimate under the hemp can be harvested without effect in the Spring when the hemp crops loses its leaves and is flattened.

The Canadian Hemp Trade Alliance undertake a wide range of research for its members on topics such as innovation in the production system, information on seed rates, cultivation techniques, variety selection, insect, pest and disease control. This knowledge investment in the sector is why Canada is often referred to as a leading innovator in the sector.

China

China grows nearly half the world's legal hemp, with sales in 2018 totalling £0.86 billion. Unlike in the UK, leaves and flowers may be processed for CBD leading to a wider market potential.

China allows hemp growing in just 2 regions (Yunnan Province and Heilongjiang Province). Universities in these growing regions in China have completed research into designing new hemp varieties, that are more versatile and efficient with harvesting equipment, as well as new technologies to generate fine hemp fibres.

The hemp textiles industry is large in China, as they have been producing the plant for fibre production for many years. Once prohibition was lifted in 2010, the industry exploded and expanded to include production of the seed too. An important market in China is hemp seed products such as hemp oil and protein. These are hugely valuable and are rich in polyunsaturated fats and the perfect ratio of Omega 6 and 3. China also has a long history in the medicinal use of hemp products (over 5000 years). In China, the main drivers for a renewed interest in hemp is its traditional uses.

China is a huge player in the production and use of hemp in infrastructure and new technologies, however due to the government's strict limitations, North America outpaces China in overall CBD production. Hemp cultivars in the North of China are mainly introduced from Ukraine, and the large flat farms here enable mechanisation of production. In the South the cultivars are largely home bred, and the mountainous land owes to more hand labour.

France

France in 2019 had 14,500 hectares under hemp production and is one of the largest world producers of hemp, although very strictly controlled by European legislation. The plant can only be commercially exploited if it contains less than 0.2% THC (the psychoactive substance). It must also be a variety authorised by the French government. French hemp is intended for industrial purposes with each part of the plant having a specific use. The hempseed is also utilised in the food industry, when pressed obtaining an oil widely used in cooking and cosmetic products.

France was traditionally an industrial producer of hemp, turning it into linen, rope, natural oil and fabric. The market for industrial hemp in Europe accounted for a revenue share of 22.2% in 2019 on account of its use in automotive parts, construction materials, textiles, and fabrics in the form of fibres.

In addition, growing demand for hemp products in the food and supplements, cosmetics, and personal care markets is expected to drive the market growth over the next few years.

Italy

The entry into force in January 2017 of Italy's law No. 242/2016 (promoting hemp cultivation to preserve biodiversity and reduce the environmental impact of agriculture) promoted hemp cultivation. Its industrial uses led to a sector revival, with more than 800 farms cultivating 4,000 ha in 2018 as an alternative to durum wheat, mainly in the regions of Toscana, Piemonte, Veneto, Sicilia, Puglia, Emilia Romagna, Basilicata, Abruzzo, and Sardegna.

According to the latest industry estimates, hemp yields a profit of approximately £517/ha, while durum wheat generates net earnings of nearly £258/ha. Approximately 80% of the Italian hemp production is destined to the food industry. The remaining 20% goes to the green building, cosmetics, and nutraceutical sectors. The Italian Ministry of Health does not require any authorisation to cultivate hemp plants containing a maximum THC content ranging from 0.2 to 0.6%.

According to law No. 242/2016, the Italian Ministry of Agricultural, Food, and Forestry Policies shall allocate a maximum amount of €603,000 per year to finance research and development projects related to hemp cultivation and processing.

Uruguay

Uruguay was the first country in the world to regulate the production of cannabis, both for adult recreational, medical and industrial use, approved by Parliament on December 10, 2013, which also created the Institute for Regulation and Control of Cannabis (IRCCA), responsible for implementing the regulation and controls related to the plant. The use of medical, recreational or textile cannabis under certain circumstances was already in force in countries such as Israel, Holland and some Eastern Europe. But Uruguay was the first to establish a regulatory framework for all the plant's functionalities. The law and the granting of licenses to

produce cannabis generated local and global expectations, allowing the development of events such as Expo Cannabis and the arrival of numerous companies interested in investing in Uruguay.

The business is very attractive for Uruguay, both because of the prices and the strong growth in demand. Also, many countries authorize the importation of medical cannabis but not its production. It can be said that this is the highest possible value-added chain of Uruguayan agriculture. These possibilities, which go beyond the production of flowers, grains and seeds, will burst in, once a volume of biomass is generated from what can be considered by-products: leaves and stems and even roots.

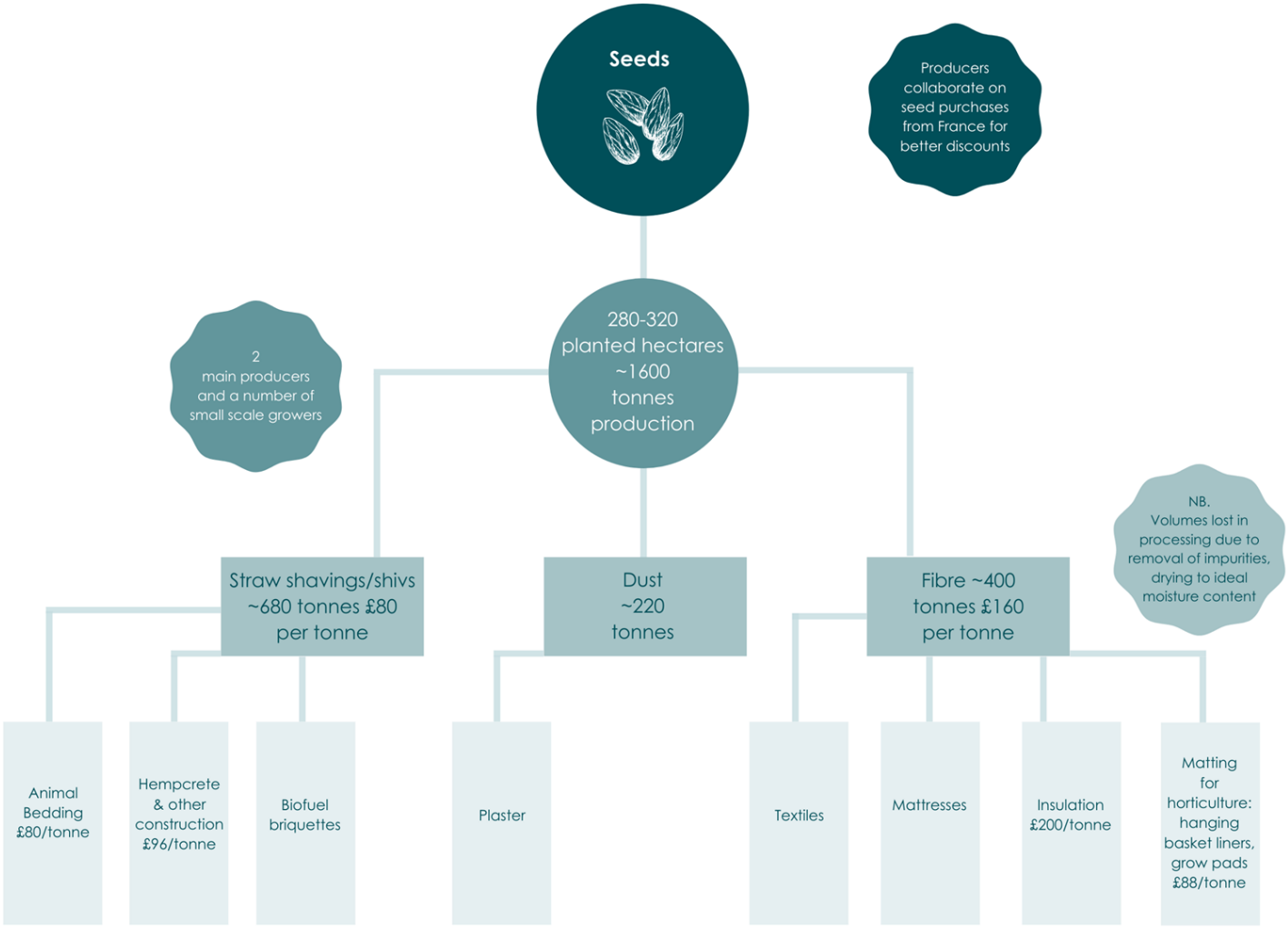
All options require the availability of abundant raw material at an accessible price, which must emerge as a by-product of the main products in value. Because of the early regulation of cannabis for recreational and industrial use Uruguay developed structural competitive advantages in areas like products regulation, development and good functioning of the industry, high value exports for land-based products and traceability systems already implemented to name some.

Section 5. Supply Chain Map

Utilising desk research and in-depth B2B interviews with stakeholders, a supply chain map has been developed which outlines the structure of the Yorkshire hemp supply chain.

Appendix 2 and 3 details the individual stakeholders spoken to in order to develop the map, as well as the assumptions behind the map.

Yorkshire Hemp Supply Chain Map



Source: Promar International

5.1 Production

The Yorkshire climate does not necessarily lend itself to dual hemp production (whereby the hemp crop is also grown for its seeds). For hemp to be grown for seed it must be harvested in September/October and the weather at this time in the UK is not ideal for harvesting. As such, the leading growers in Yorkshire (East Yorkshire Hemp and Harrison Spinks) work collaboratively to purchase hemp seeds from the South of France. They have been doing this for a number of years and expect to continue to do so going forward. Working collaboratively means they can gain economies of scale and purchase seeds at a better price.

Data from the BHA and information gathered from B2B interviews indicates that there is between 280 and 320 hectares of hemp currently planted in Yorkshire. This is c. 35 – 40% of the UK's total plantings.

There are two main growers of hemp in Yorkshire, who together account for 56% and 41% of the total hemp planted area in the region. The remaining 3% is made up of growers with much smaller areas of land – typically not growing it as their main crop, but on rotation or on contract. Although some growers are actively looking to increase their plantings and focus solely on hemp.

Average crop yields vary by grower and those with more experience are typically seeing higher growth yields of c. 4 – 5 tonnes per hectare. This is a typical yield rate when compared to other European countries. It is estimated that Yorkshire is currently producing 1,600 tonnes of hemp per annum.

Although there is no quantifiable data to support, information gathered from B2B interviews indicates that both of the major hemp growers in Yorkshire have increased their planted area year on year over the last 3/5 years due to increased demand from the supply chain. In addition, both growers indicated that they would like to double their current planted area over the next five years as they forecast that demand from relevant channels will continue to grow and evolve.

In order to develop the sector further, new growers should be encouraged to enter the market. Currently a lack of knowledge on the growers' side, in regards to what to do with hemp as a final crop is the main barrier to entry.

5.2 Processing

Utilising data from the French hemp growers' association Inter Chanvre, alongside the B2B interviews and desk research, it is estimated that of the 1,600 tonnes of hemp produced 680 tonnes is converted into straw shavings/shiv; 400 tonnes becomes fibre; and 220 tonnes is dust. The remaining volume is typically lost during the processing stage due to the removal of impurities and drying to the ideal moisture level.

This stage of the supply chain has been identified as being the weakest due to inadequate facilities and a lack of investment. Processing facilities at the moment, meet current hemp supply levels, however if growers increased production volume and greater demand came from further down the supply chain the sector would struggle to fulfil all processing requirements within Yorkshire.

Once hemp is harvested it goes through a process known as decortication whereby the crops shiv is separated from the fibre. Currently both large-scale hemp growers have their own

decortication machines on site to undertake this stage. These are large pieces of equipment and costly in terms of investment, again a barrier to new entrants.

The B2B interviews indicated that there was a Yorkshire based decortication machine manufacturer, Tatham Ltd. Currently they have two decortication facilities being utilised in Yorkshire and one in Leicestershire. In addition, they are seeing growing demands in exports to New Zealand and Canada. Tatham's machine capacity is for input of retted hemp stalks of up to 2,000 kg or 4,000 kg per hour. The capital investment required for the decortication and cleaning equipment is significant at between £1 - £1.6 million. Small scale decortication is not economic.

5.3 Channels

After the hemp has been separated through the decortication process it is ready for use within a variety of different channels. Both the shiv and the fibre have a monetary value. Typically, the fibre has a greater value due to its end usage channel having a greater value attached.

5.3.1 Fibre

Fibre is (currently) the most profitable part of the hemp plant in the UK. It can be used within a variety of different end products ranging from woven and unwoven textiles, through to mattress stuffing, insulation ad horticulture matting[3].

The Yorkshire area is historically well known for its textile industry – it used to be very much a UK hub for the industry with an abundance of processing facilities and the necessary skills amongst workers. However, in terms of utilising hemp as a woven fibre within Yorkshire there remain some key gaps, these being lack of processing facilities and lack of technical expertise.

"Hemp textile technology in the UK is five years behind those companies operating in Europe"

"A lot of investment is needed in order to develop the correct technology to produce hemp fibres for textiles"

As a result, hemp fibre is more frequently used in an unwoven capacity for things such as seat covers in public transport, or within a car's interior (dashboard, door panel, boot lining etc). Situations where a more robust and sturdy fabric is required.

B2B interviews indicate that one major hemp grower in Yorkshire utilises their own hemp production predominantly to develop fibre for use within mattresses. It provides the business with a natural material for mattress stuffing, in comparison with other companies that utilise manmade fibres for this process. As well as the environmental benefits in terms of carbon capture, it provides added benefits to the user, as hemp is 10 x more absorbent than cotton

[3] It is important to note that the versatility of hemp means that there is an abundance of different end channel options for the crop. However, the supply chain map and this report have focused on those areas that were highlighted within the B2B interviews as providing viable opportunities for the Yorkshire hemp sector currently and in the near future.

so works well in drawing moisture away whilst sleeping, effectively keeping you cool in summer and warm in winter.

Other channels for hemp fibre that are currently being developed in Yorkshire include use within the construction industry as a form of insulation, or within the horticultural industry as a basket liner to grow plants from.

5.3.2 Shiv

The 'wood' part of hemp, commonly referred to as straw shavings or shiv is less financially appealing than fibre and can frequently be described as a by-product. However, it too has viable uses through a range of channels.

Shiv can be effectively used as a green building material known as hempcrete by combining it with a lime-based binder and water. Hempcrete is not as strong as concrete and as such builders must have the necessary skills required to utilise it, using timber posts for strength. However, hempcrete does provide a number of benefits as it is a good form of insulation, helps improve carbon capture and works well in areas that suffer from earthquakes.

The use of hempcrete as a viable building tool has increased in popularity over recent years. B2B interviews with specialised Yorkshire construction that use hempcrete, indicate that they had seen their usage of the product more than double over the last five years.

"10 years ago we might have developed one building a year using hempcrete, but over the last five years this has increased to around two to four projects a year."

These respondents also indicated that they expect to more than double their use of hempcrete over the next five years. Either through upcoming projects or expected rising demand forecasts.

"There is more focus on environmental and sustainability now. Hemp as a crop has a lot of environmental benefits – particularly in terms of the construction trade. As such demand can only rise."

Shiv is also currently used to a lesser degree for animal bedding and for creating biofuel briquettes. Biofuel briquettes are typically made from shiv, with a combination of waste hemp fibres and hemp dust from processing lines. These elements are also compressed together using a specialised machine to form the briquette. Typically, they are used in wood burning stoves and offer average burn times of c. 90 minutes per briquette

5.3.3 Dust

During the decortication stage one additional by-product is hemp dust. Some stakeholders are taking this by-product and utilising it within construction materials previously explored within this section, in the form of plaster or biofuel briquettes.

In order to utilise the dust a separate piece of equipment is needed in the form of a centralised dust plant which brings all the dust together for further processing. This is a good way of adding value to hemp by utilising what would otherwise be a waste product. In addition, it adds to the overall environmentally friendly focus of the industry by ensuring that all parts of the hemp plant can be utilised and re purposed.

Section 6. SWOT Analysis

In-depth B2B interviews provided a wealth of insight and knowledge to determine the strengths, weaknesses, opportunities and threats (SWOT) encapsulating the Yorkshire hemp sector. These are provided below in further detail:

6.1 Strengths

Yorkshire is well renowned for its long-standing farming background and traditions. It is often perceived as being an agricultural hub within the UK. Although not specific to Yorkshire, the adaptability and robustness of hemp means that it can be grown across a wide number of areas that other crops will struggle. It grows well in the uplands area of Yorkshire, providing a viable commercial use for this agricultural land.

Across Yorkshire there are several globally recognised academic research institutes that have teams and facilities focused on hemp research and development (R&D) throughout the supply chain. This is a key strength for the sector as the R&D helps to form a basis for the future progress of the industry and provides a backing/evidence base for future potential investors.

Research institutes of note include:

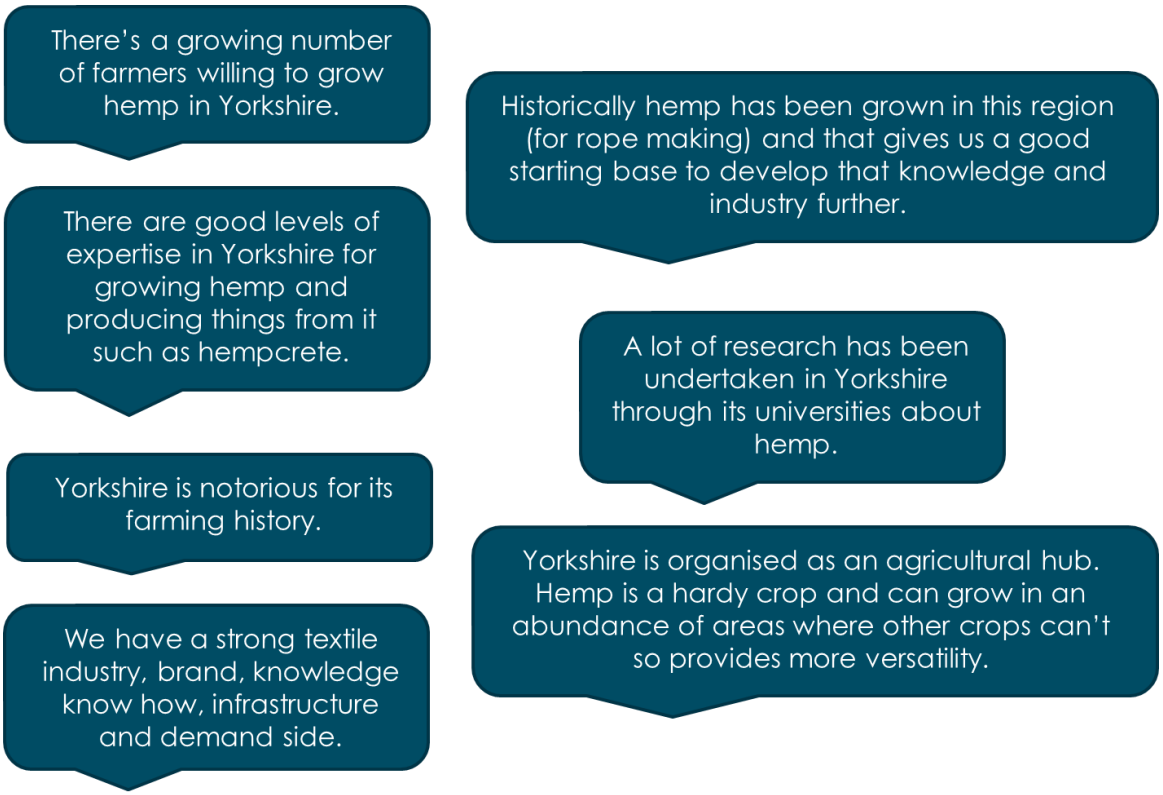
- Leeds University – researching into developing hemp into a fibre suitable for use within a commercial textile industry
- Leeds University – Future Fashion Factory – a government funded organisation set up to support the UK Fashion and textile industry, with particular focus on businesses in the Yorkshire and Humber area.
- York University – Bio York– developing new varieties of hemp seed for the global market

Coupled with this is the fact that Yorkshire harnesses a wealth of expertise in terms of both the textiles and construction industries. The Yorkshire region is renowned for its historic textile

industry, which is something that research institutes are keen to bring back into the spotlight again by nurturing more young talent.

Skills and technology exist within in the region in regard to processing hemp into a woven cotton like fibre but not on a commercially mass market size scale at present. Yorkshire also has a strong foundation in terms of being able to process hemp into building materials such as hempcrete, having architects who understand how to design building using the material, and construction companies available who have the requisite skills to work with the material. However, as with textiles this knowledge base is small and is yet to be proven on a wider scale.

It is clear from the B2B research that within the existing Yorkshire hemp supply chain there is a fairly balanced level of supply and demand due to the niche and small scale of the sector. The components exist, in terms of growers, processors, manufacturers, research institutes, but further work is needed to strengthen the links between stakeholders and to develop and grow the sector further.



6.2 Weaknesses

Although Yorkshire is a key area for growing hemp in the UK, its weakness remains that acreage is small in comparison to the UK as a whole and on a wider scale in Europe. At present it is estimated that Yorkshire accounts for c. 35 - 40% of total UK hemp production. This means that in order to develop new opportunities and channels for hemp there needs to be larger scale production to meet demand. One respondent estimated that in order to fully develop the opportunities in the textile industry for hemp on a commercial scale a viable pilot would need c. 1,000 tonnes of hemp – this equates to over 60% of the regions current production.

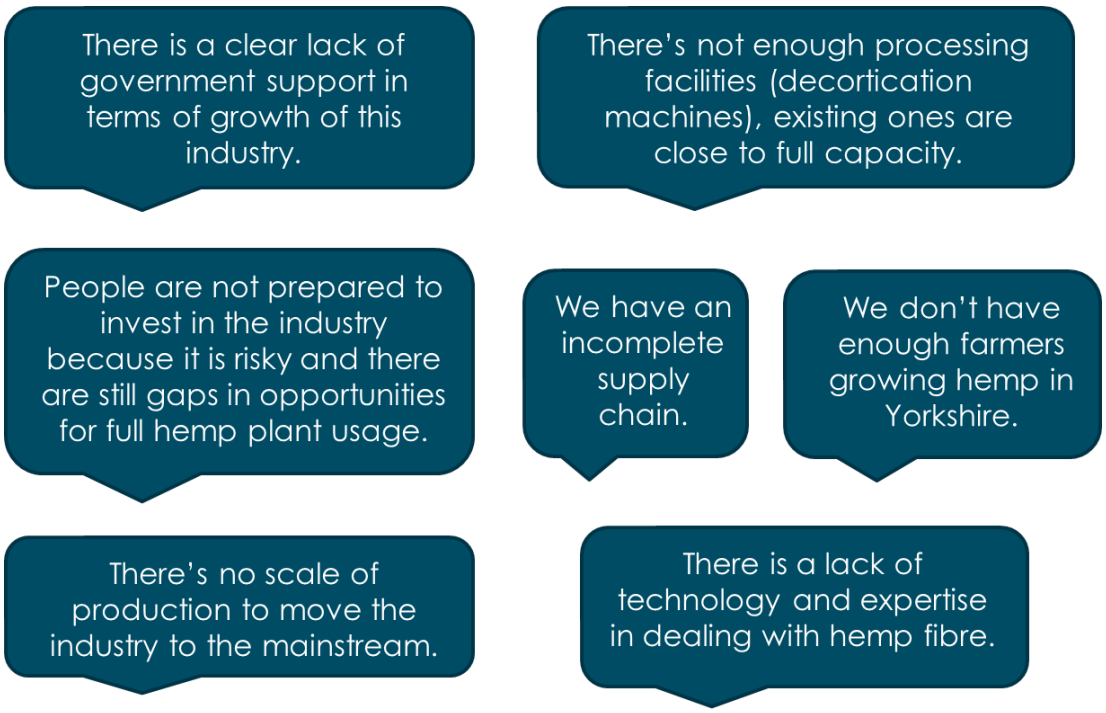
There are a handful of stakeholders in the Yorkshire supply chain that are successfully processing hemp for the construction, automobile, textile, and mattress industries. However as with production, scale remains small resulting in costly processes that are more difficult to

transfer to a larger scale commercially viable proposition. Data from the B2B survey indicates that stakeholders feel that the basis is there to develop these supply channels but there is no clear strategy on how they can take it from the small-scale level to a mass market output. In terms of construction in particular there needs to be further education along the supply chain to ensure that there are adequate businesses who have the correct skills to work with hempcrete.

Coupled in with this is the perceived lack of government support for the industry, meaning there is no funding for the sector to undertake wider and extensive R&D which would help to provide a baseline understanding of potential opportunities for investors.

Legislation around growing hemp is cumbersome and perceived by interviewees as archaic, particularly when compared to other European and global countries. Presently industrial hemp can only be grown under licence for its fibre and seed under the Misuse of Drugs Act 1971. All varieties grown in the UK must also comply by containing no more than 0.2% of tetrahydrocannabinol (THC). In other European countries industrial hemp is typically classified as an agricultural crop.

Harrison Spinks, based in Leeds has successfully developed their own hemp vertical supply chain, meaning they have complete control from growing through to final usage. This works successfully for the business but is not replicated in the Yorkshire supply chain overall, particularly across different supply channels. Although some stakeholders are collaborating, others are meeting resistance and struggling to identify and develop relationships above and below them in the chain. A united and collaborative supply chain will help to strengthen the industry not just in Yorkshire but beyond.



6.3 Opportunities

Over the last five years hemp has seen its awareness and usage grow both in the UK and internationally. FAO data indicates that in 2015 19,970 hectares of hemp was grown, this figure increased by 75% to reach 34,960 hectares in 2019. This presents opportunities for growth and development not just in Yorkshire and the UK but also internationally. In the UK the demand for hemp has in part increased due to a greater awareness and focus on sustainability and the environmental impacts of products. The environmental credentials of hemp have helped push it forward across a number of channels with no signs of this focus shifting anytime soon.

Consumers are making more informed choices about their lifestyle from the clothes they wear, the food they eat, their carbon footprints and their energy efficient homes. These trends provide a wide range of opportunities for the utilisation of hemp in the future. Data from the B2B interviews indicated that the environmental benefits were helping to grow and create opportunities for hemp in the construction sector and as an inclusion within health foods.

Several research projects are currently being undertaken by the Biorenewable Development Centre Yorkshire at York University. Research is focused around the development of new seed varieties that would produce a hemp plant suitable for use within the food supply chain. The growing trend of veganism and plant-based diets in the UK means there is an ever-increasing demand for more plant based, nutrient rich food. Data from the Vegan Society shows that in the UK in 2019 there were 600,000 vegans, an increase of over 300% from 150,000 people in 2014. In addition, all of the major UK supermarkets now have dedicated own brand vegan ranges available.

As a crop, hemp has a somewhat unique aspect to it in terms of whole crop usage. At the processing stage there are by-products created when separating out the fibre from the plant such as the shiv and dust. These by-products still have a monetary value and can be used for alternative channels. For example, the shiv can be used for animal bedding, compost, building materials such as hempcrete; hemp dust can be used to produce plaster for use within the construction channel; and energy efficient briquettes can be produced to burn for heating purposes.

Several interviewees who processed their own hemp, indicated that these alternative by-product channels were just as important to them in terms of revenue. It was emphasised that further collaboration was needed in order to develop these revenue streams further, by being able to provide the by-product directly to another stakeholder in the supply chain. Particularly as production and processing volumes of hemp have increased year on year in Yorkshire in recent years and is set to continue over the next 3/5 years.

Yorkshire's strong agricultural heritage provides a baseline for future provenance development of the hemp supply chain. The developments that have already occurred within the Yorkshire hemp supply chain mean that it is seen to be perceived as a leader within the UK. This is an opportunity to continue to push forward and enable Yorkshire to become a best practice example for the rest of the country. This will then provide additional opportunities in terms of selling the supply chains knowledge/skills/technology to other areas of the UK and potentially beyond. Intrinsically linked with this is the potential to develop a 'Made in' brand to help further strengthen the proposition to the UK market.

Results from our B2B research indicate that 44% of respondents were positive that a Made in Yorkshire brand would help their business to grow and develop. The remaining 56% of

respondents however felt that there may be more benefit from utilising a made in Britain/UK brand – particularly when they sold products internationally.

The somewhat disjointed supply chain means that there are development opportunities to engage stakeholders and collaboratively strengthen levels. In particular, there is a need to develop the processing/manufacturing level of the supply chain. The textile industry in particular lags behind due to the lack of sufficient fibre processing technology to produce woven fabric commercially. Technology exists in Yorkshire to undertake this process, but monetary investment is a barrier to many smaller scale operations.

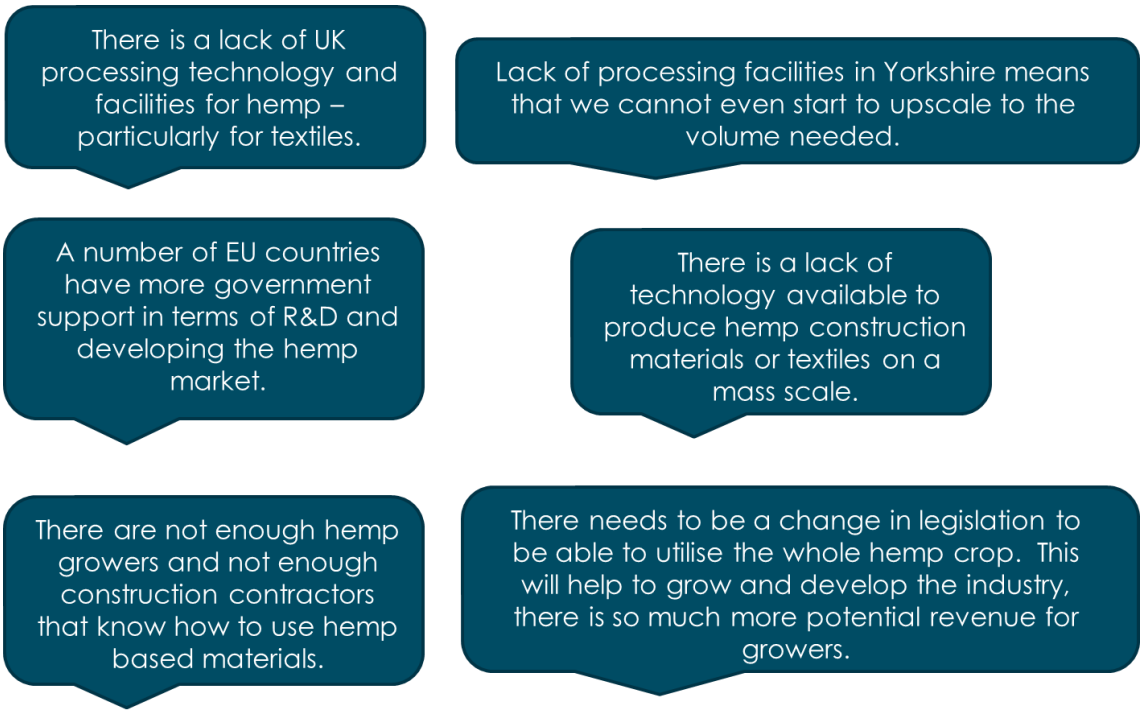
6.4 Threats

The small size of the Yorkshire hemp market (and in parts the UK supply chain as a whole), means that the industry itself lags behind other global hemp industries. This presents a very clear threat to the industry in the fact that it may get left behind on the global platform. An example of this is within the textile supply channel. In the UK, investment into developing hemp fibre into a workable woven textile clothing fabric has stagnated. Technology has been developed in the UK but is being licensed out to European countries as they have the right level of investment, in addition final usages of these textiles are being piloted by a UK based business but with collaborators in Europe that have the additional money and expertise. If the industry does not start to build its infrastructure soon and scale up its production, it risks being left behind and unable to appeal to the mass market.

Until the industry can prove itself as having the capacity to operate on a wider scale it risks losing out on potential investment opportunities. Return on investment for investors is unclear so less attractive. It's a catch-22 situation but a real threat to the industry as without investment it will be difficult to take the sector to the next level.

The enhanced legislation surrounding industrial hemp means that growers are unable to access the most lucrative part of the hemp crop – the flowers and leaves – which can be processed to produce cannabidiol (CBD) oil.

There is a growing demand for CBD in the UK as it is used in health supplements, food and drink items and body care products. It Is estimated that the UK CBD market is worth £300 million and is set to reach an estimated £1 billion by 2025. Despite the growing market, UK growers remain cut off from the market and instead rely on imports, predominantly from the US and Eastern Europe. Data from UNCT indicates that in 2015 the UK imported 550 tonnes of CBD oil with this increasing by a CAGR of 30% to 1,690 tonnes in 2019. A handful of growers in the UK have managed to obtain a specific medicinal cannabis licence in order to grow and extract CBD but they are in the minority. For example, in Norfolk, British Sugar currently grow medicinal cannabis for GW Pharmaceutical. The plants contain a high level of CBD but still very little THC meaning they have been approved for use in epilepsy drugs.



Section 7. Yorkshire Hemp Supply Chain Action Plan

The B2B interviews and SWOT analysis provide a number of clear opportunities[4] and next steps for the Yorkshire hemp sector and these are considered in further detail below.

7.1.1 A collaborative working cluster

It is clear from the work undertaken that at the heart of any future action plan is the requirement for a collaborative and integrated supply chain. The niche nature of the hemp sector means that working together in defined clusters provides greater strength and opportunity for the sector as a whole. It also enables all levels of the supply chain to come together and understand key supply and demand features. For example, ensuring that the varieties of hemp grown are fit for purpose for end usage. In France, the majority of hemp farmers are part of a cooperative that allows them to come together to buy inputs such as seeds.

Some stakeholders within the sector are already working together and seeing the benefits, for example placing purchasing orders together to gain better prices through economies of scale. Purchasing groups are a common feature of other agricultural industries and often help to strengthen relationships both between stakeholders and external partners.

Within Yorkshire, Harrison Spinks has developed their own robust vertical supply chain, whereby they grow, harvest, process and manufacture hemp all the way through to its final end use. The business continues to do well year after year and is known throughout the Yorkshire area and beyond in terms of its commitments to hemp. This indicates how having greater partnerships and connections throughout the supply chain can provide a number of opportunities in particular greater time and monetary efficiencies.

Due to the relatively small-scale nature of the Yorkshire hemp sector it is recommended to firstly developing a working group across the whole of the supply chain, encompassing all stakeholders. B2B interviews indicated that there have been issues between some stakeholders previously trying to effectively collaborate together, due in part to an inability to understand each other's demands. As such bringing all stakeholders together will allow the chain to find actions that will best suit (and benefit) the whole supply chain. For example, if manufacturers are ready to increase production, but there is no increased volume from growers then alternative solutions must be sought.

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[4] We recognise that there are an abundance of market opportunities for hemp in channels not covered within this report. This is perhaps a common theme with hemp – so many opportunities leading to a lack of focus and no real headway in one particular channel. Opportunities within health foods and cosmetics are viable and seeing increased demand from consumers across the UK. However, presently, according to the B2B research these opportunities are very much niche and at relatively early stages in comparison to those opportunities discussed within construction and textiles. As such, it is felt these opportunities are concepts to consider as part of a longer-term strategy for the sector.

Once the working group has been established and operating efficiently then there may be an option to create further smaller clusters either across levels (such as a grower's cluster), or vertically along the chain (such as a researcher working with a grower and a manufacturer).

NEXT STEPS – Short Term

- Establish a lead stakeholder/organisation who will take ownership of the working cluster
- Invite interested stakeholders together to discuss development of an integrated working sector
- Utilise the findings within this report to highlight to the sector potential opportunities available, as well as international best practice case studies

NEXT STEPS – Long Term

- Ensure regular meetings of the working cluster
- Consider the effectiveness of mini clusters based upon supply chain level – e.g. a growers' cluster
- Encourage more local businesses to get involved with additional skills – e.g. transport businesses, storage facilities
- Establish a buying group to gain economies of scale

7.1.2 Encourage new entrants into the sector

The Yorkshire hemp sector works well at present because supply and demand are fairly balanced. If the sector is to develop and grow further there must be a conscious effort made to encourage new growers into the sector. This is particularly important as currently just two growers provide the large majority of Yorkshire's hemp production.

B2B interviews suggested that one of the main barriers to new entrants is lack of hemp knowledge. Growers are unsure as to what they can do with hemp once it is harvested. Being able to share knowledge gained from existing growers and clearly set out potential selling channels for new growers will help to break down this barrier.

In addition, showing growers the environmental benefits of hemp in terms of a rotational crop, and its ability to improve soil health are added incentives to new growers.

Investment capacity can also be a barrier as decortication machines can be costly. As such it is recommended that a growers' group could be formed resulting in machinery that can be purchased and shared amongst several growers.

NEXT STEPS – Short Term

- Develop best practice guidelines for new entrants
- Attend regional events to attract new entrants and discuss benefits

NEXT STEPS – Long Term

- Create a growers' group with aim of making joint investments in inputs such as decortication machines

7.1.3 Proactive approach to altering hemp legislation

By far the biggest threat to the Yorkshire hemp sector is the inadequate legislation in place surrounding the growing and usage of the hemp crop. Licensing procedures within the UK are seen as archaic in comparison to other European countries. The British Hemp Alliance are continually working to promote the UK sector and bring about legislation change.

Within the Association's UK Hemp Manifesto one of their key focus points is to

"Remove hemp as a controlled substance from the Misuse of Drugs Act 1971, permitting the use of the whole plant for all applications. Remove all Home Office licencing restrictions and put back into DEFRA's jurisdiction."

In addition, they recognise that developing the hemp industry has the possibility to drive rural economic innovation and encourage investment to develop the existing processing infrastructure.

The three-year renewal of industrial hemp licences often comes under criticism in the industry for providing late responses, meaning growers do not have enough time to plant hemp for that year's crop.

The alignment of both the Yorkshire hemp sectors' future goals and the BHA indicate a potential working relationship. As with the working cluster – being able to work together and share resources will be able to drive growth and development more effectively both within the Yorkshire sector and beyond.

NEXT STEPS – Short Term

- Once the Yorkshire working cluster is established reach out to the British Hemp Alliance
- Set up a meeting to discuss how as a working group you can work with the BHA to push forward in developing the UK market for hemp

NEXT STEPS – Long Term

- Continue to develop and support a long-term relationship between the Yorkshire hemp supply chain and the BHA

7.1.4 Strengthening and developing processing/manufacturing - construction

Investing within the processing/manufacturing stage of the supply chain will help to strengthen the chain and help push the sector forward in terms of its development and local economic impact.

Typically separating the hemp crop into its relative components is done by the grower. As previously discussed, these machines are a large monetary investment and lack of RoI data means that smaller scale farmers struggle to justify the cost. The cost at times is preventative against new farmers looking to use hemp as a rotational crop on a smaller acreage, as they

are unclear as to what they can do with it once harvested. As such developing a growers' cluster whereby a machine could be purchased and utilised amongst a few growers could help to alleviate some of the monetary disincentive. It would also help with the general running of the machines as they typically require a larger volume of hemp to process in order to run efficiently.

With processing technology already available to create hempcrete, plaster and other building materials the opportunities lie here in expanding the capacity and reaching greater audiences. Data from the B2B research indicated that 52% of respondents felt that the most growth and development for hemp would come from the construction channel over the next 3/5 years. Stakeholders involved within the construction channel expect their business to double over the next 3/5 years due to an increased demand for environmentally friendly and sustainable construction materials.

Presently most of the hemp utilised by Yorkshire construction stakeholders is grown in Yorkshire itself. However, on occasions where there is a lack of supply imports are being sent from France. Moving forward if stakeholders want to increase their utilisation of hemp then there needs to be collaboration with growers to ensure that Yorkshire growers can meet the demand, creating further economic benefit for the region.

There is also a requirement for greater knowledge and insight to utilising hemps and its benefits within the construction industry.

"We need to train young people in the region in the use of alternative materials within construction. There is not a lot of knowledge in the use of hemp and its benefits by end consumers."

"The sector could benefit from investment in training contractors to learn how to utilise hemp in construction and the benefit of the material. We need investment into research which shows data on how using hemp vs traditional construction materials compare"

Hempcrete has a number of environmentally friendly outputs such as being carbon neutral, works well in terms of insulation (requiring less energy to keep occupants warm), non-toxic and sustainable. These all fit well with Government initiatives that are focused around improving the sustainability of the UK building trade. There is an opportunity to lobby government to consider hempcrete as a viable material in the development of new 'green homes' across the UK. At present those hempcrete buildings are typically one-off designs rather than mass market housing but there is scope for change.

NEXT STEPS – Short Term

- Ensure growers and construction stakeholders are clear about growth projections – will additional demand be met by increased plantings from existing growers or by encouraging new entrants into the field
- Utilise the knowledge already within the sector to educate other construction stakeholders to the benefits of working with the material

NEXT STEPS – Long Term

- Lobby government alongside the BHA into considering utilising hempcrete on a mass market scale within new housing developments. Bringing additional money to the UK

economy (through additional jobs and upskilling) and strengthening houses environmental benefits

7.1.5 Strengthening and developing processing/manufacturing - textiles

In addition to construction manufacturing, there is a clear opportunity for the Yorkshire supply chain to develop and increase its textile manufacturing offer. 29% of respondents from the B2B interviews indicated that they felt textiles held the greatest opportunity for hemp over the next 3/5 years. Investing within the processing/manufacturing stage of the supply chain will help to strengthen the chain and help push the sector forward in terms of its development and local economic impact.

Our B2B research indicates that there is an ever-increasing demand for woven textiles made from environmentally friendly products such as hemp. It fits in with the current growing trend for sustainable materials and provides end products with a unique selling point (USP). Hemp fabrics are more environmentally friendly than cotton due to the low volume of water needed to grow the crop. In addition, as a result of the impacts of Brexit and Covid-19, customers are actively seeking out products that are locally produced so demand is set to continue to grow in the future.

The technology to develop hemp into a woven fabric for use in clothing manufacturing already exists within Yorkshire. The company Sustainable Environmentally Friendly Fibre (SEFF) based in Leeds have developed a technology that utilises hemp and turns it into a high-quality fibre suitable for use with clothes design. Lack of investment opportunities within the UK industry means that they currently license their technology outside of the UK. However, SEFF used Yorkshire grown hemp to process in their Belgium facility when they originally launched the product to market with a global brand – so still adding value to the Yorkshire supply chain. This technology is so leading edge that SEFF are now working with other countries to help grow and improve their hemp textile supply chains utilising their proven technology.

A collaborative approach is needed in order to take advantage of the regional technology and utilise it within the supply chain. Demand within the fashion industry is very much fuelled by designers and large-scale fashion brands, where they lead, consumers will follow. Working directly with a brand will help to push the development of the industry further in the long term, much more so than increasing consumer awareness of hemp textiles.

In addition, there are a number of research institutes offering fashion design courses. Collaborating with these Universities could involve developing a module whereby students work directly with growers and textile manufacturers to design clothes utilising hemp fibre. This would help to establish an early relationship with the material for the designers of the future. Collaborations like this work well in other industries at influencing new entrants. For example, California raisins sponsor UK competitions where budding chefs have to use their product in a new recipe development. It encourages entrants to utilise their raisins over others as they progress throughout their career.

Developing a pilot study between various stakeholders (academic and research institutions, regional textile consultants, growers and SEFF technology) will provide the industry with valuable data to kickstart the industry and encourage outside investment. The Biorenewable Development Centre have stated that they are keen to host a pilot study utilising SEFF technology to help develop hemp textiles. This pilot has the potential to be showcased under a Made in Yorkshire brand (if deemed viable) – particularly if investment can be sought from a Yorkshire based fashion brand.

"We need to produce and demonstrate hemp products like clothes and show consumers the quality of products. People need to physically see samples."

A key threat to consider when developing the textile opportunity is the end cost for the consumer. As this technology and material remains new within Yorkshire and the UK there are other countries that have been working with this technology for many years and have developed cost efficiencies. Most notably China produces a vast amount of hemp material (albeit at a lower quality) and can keep costs low due to low labour costs. As such work needs to be done around the USP of the material – ensuring that consumers understand why the finished article warrants a higher price and what the justifications are for paying for this.

NEXT STEPS – Short Term

- Working collaboratively to develop a textile pilot study utilising resources from academic and research institutions, BDC, input from regional textile consultants, growers and SEFF technology
- Set up direct links with fashion research institutes to encourage use of hemp fibre in modern fashion design modules

NEXT STEPS – Long Term

- Utilise results from the pilot scheme to approach an influential brand or designer to consider releasing a hemp-based range – consider advantages of working with a Yorkshire designer to further cement

7.1.6 Developing by-product sales

One of the core benefits of hemp is that all legalised parts of the crop can be utilised in some form. With the potential development of sectors such as textiles and construction there is set to be an increase in hemp production, processing and of course by products.

Existing manufacturers are currently using by-products for a range of products from animal beddings to biofuels. As well as being beneficial to the environment (no product wastage) it also provides greater value to the grower/processor by increasing their profit margins.

Data gathered from the B2B interviews indicated that there was a stagnation in terms of where else by products could be utilised, and whether there were more viable financial options for THESE products moving forward.

Typically, by products from processing were utilised for animal bedding, construction insulation, plaster, as a matting for use within the horticulture sector, and as a bio fuel in the form of briquettes.

With forecast growing demand for hemp from the Yorkshire regions growers/processors should come together to share their knowledge and experience in regard to best use of by-products. Working together they should pro-actively approach businesses with their offerings. Developing new business relationships at the moment is positive as the impacts of Brexit and Covid-19 mean that many UK businesses are looking to work with other UK based suppliers to fulfil their needs.

Detailed costings should be undertaken to understand which market channels offer the best opportunity for these by products to allow greater focus when approaching new businesses.

The Supply Chain Network provide a supplier directory and opportunities map that could help growers target likeminded local businesses.

NEXT STEPS – Short Term

- Work collaboratively with other growers to share knowledge and information in regard to the best use of hemp by-products
- Sign up to The Supply Chain Network supplier directory
- Pro-actively approach local businesses with by product offerings

NEXT STEPS – Long Term

- Share knowledge and learnings with new entrants to encourage more growers into the sector

7.1.7 Development of new varieties

Research is already being undertaken by BioYork into the development of new hemp varieties, some of which are close to being launched in the market (Europe and the US). A growing demand for plant-based protein options in the food industry has resulted in varietal development being focused towards seed oil varieties.

There is hope that these new varieties will increase interest from the UK food sector and push hemp seed production into the mass market. The utilisation of these new varieties has the potential to grow the reputation of both BioYork and the Yorkshire region.

In the future new varietal focus could focus on features such as improvements to water efficiency, greater disease resistance or increased yields.

NEXT STEPS – Short Term

- Where appropriate encourage collaboration between hemp growers and BioYork varietal trials
- Utilising the hemp working group come together to push the development of hemp seed as a plant-based protein source – with focus upon the Made in Yorkshire brand

NEXT STEPS – Long Term

- As a supply chain consider main hemp seeds improvements and work together with BioYork to develop these

Section 8. Appendices

8.1 Appendix 1 – Topic Guide

We are currently undertaking a project with The Supply Chain Network and Grow Yorkshire, focused on developing a supply chain map of the Yorkshire Hemp sector. We are keen to speak with you in regard to your position within the current supply chain, and to hear your thoughts and opinions on the sector.

The Supply Chain Network and Grow Yorkshire will know that we have spoken with you, but all answers and responses will be anonymised in our final report and findings.

Introduction

1. Can you tell me about your business?
   Consider things like business structure; *how long operating; location (working from one facility, or multiple)*

2. How long have you been working with hemp/hemp-based products?

3. Who are your key customers?
   Processors, wholesalers, retailers, end consumers

4. What are your main channels of supply?
   E.g. textiles, constructions, biofuels, paper etc.

5. What are the key issues that you feel will affect your business and its development over the next 3/5 years?
   E.g. Impacts of BREXIT, Covid-19, climate change, transition from CAP to Environmental Land Management Scheme, etc

Hemp Utilisation

6. What type of hemp do you work with – for example the whole plant; hemp seeds; hemp oil; hemp fibre etc.

7. What volume of hemp/hemp products do you deal with on an annual basis?

   a. Has this figure changed over the last 5/10 years? Why?
   b. How do you forecast volumes/demand changing over the next 5/10 years? Why?

8. How much of the hemp you use comes from the UK, in particular Yorkshire?

9. If hemp is being imported, where is it imported from and what are the reasonings behind this?
   Could include issues such as cost benefits, lack of UK supply, quality issues etc

Yorkshire Hemp Sector

10. What are the main strengths of the Yorkshire hemp sector?

11. What are the main weaknesses of the Yorkshire hemp sector?

12. How do you feel the Yorkshire hemp sector sits against other hemp sectors in the UK and/or global hemp supply chains? Are there any key learnings that could be utilised from these sectors?

13. How could the sector benefit from inward investment? Or any other sector specific support – training/upskilling/trade visits/etc
    Probe for specific examples – for example 'the sector could benefit from investment in a hemp processing plant because…'

14. Are there any key gaps in the supply chain at present?

15. Are there any parts of your supply chain process that are undertaken outside of the Yorkshire region? What are the reasons for this?

    a. If these skills/operations could be developed in Yorkshire would you utilise them?

16. Do you collaborate/work closely with any other specific businesses in the Yorkshire hemp sector?

17. Would the sector benefit from identifying and implementing collaborative working clusters of businesses across the sector?
    a. If so, how do you think this would work?

18. Do you feel the Yorkshire hemp sector, and your business, would benefit from inclusion within the 'Made in Yorkshire' brand?

Environmental Impacts

19. Does the current Yorkshire hemp supply chain provide any specific environmental benefits to the community and beyond?
    This will be dependent upon stakeholder: Growers – consider soil health, whole plant usage, ability to grow without herbicides etc. Construction – consider carbon capture benefits of hempcrete etc.
    Consider the Y&NY LEP initiative – Greener Fairer Stronger economic recovery

20. Could these environmental benefits be improved/extended further?

21. Are you aware of any countries, or industries which offer best practice examples in terms of fully utilising the environmental benefits of hemp?

22. Do you feel there are any gaps within the supply chain that could be fulfilled by local businesses?
    E.g. packaging, transportation, storage

Future Development of Industry

23. In which supply channels do you envisage the most growth and development for hemp in the next 3/5 years?

24. In what way(s) can the Yorkshire hemp supply chain take advantage of these growth opportunities?

25. What do you think end consumers thoughts/knowledge are about hemp and its products?
    a. Is there anything that could be done to improve hemps visibility among end consumers?
    b. Do you believe greater visibility and knowledge in regard to hemp and its products by end consumers (particularly its environmental benefits), would improve demand for the product?

Close

26. Any further questions

8.2 Appendix 2 – Stakeholders

In order to develop the supply chain map, we spoke to 24 stakeholders associated with the Yorkshire hemp supply chain, these were:

1. Biorenewable Development Centre – Research Centre York University
2. Bio York (2 Interviews) – Research Centre York University
3. British Hemp Alliance
4. Cultiva Kingdom – Textiles
5. Fera Science – Research Centre (CBD focus)
6. Future Fashion Factory – Research Centre Leeds University
7. Haenep London – Textiles
8. Harrison Spinks – Grower/Processor
9. Independent Hemp Farmer – Grower
10. Kuilderd Consulting – Research/Consultant Textiles
11. Leeds University (2 Interviews)– Research Centre
12. Native Chartered Architects
13. Omnia – Supply Chain Technology
14. Quantech Solutions
15. Sustainable Environmental Friendly Fibre – Processing Textiles
16. Tatham – Processing Machinery Textiles
17. The Carbon Farm - Grower
18. Valley Northern – Packaging
19. Yorkshire Hemp - Grower
20. UK Hempcrete – Construction

8.3 Appendix 3 – Supply Chain Map Assumptions

Due to lack of data a number of assumptions were used to develop the Yorkshire hemp supply chain map, and these are detailed below:

The British Hemp Alliance indicated that in the UK 2,000 acres (810 hectares) of hemp is planted presently. Of this total c. 35 – 40% of plantings were located in the Yorkshire region, the equivalent of 700 – 800 acres (280 – 320 hectares).

This was further evidenced by data from the B2B interviews which suggested there were two main established growers of hemp in Yorkshire and one fairly small new entrant. The planting data they provided equalled around 98% of the figure provided by the BHA. The remaining 2% is made up of small scale contract farmers according to interview data.

The yields provided by the three growers were used to estimate the total production volume in Yorkshire.

Production splits of the hemp crop into straw shavings, fibre and dust is based upon equivalent data from Inter Chanvre the French hemp growers' association. This data detailed that:

- Straw shavings account for 43% of the hemp plant weight
- Fibre accounts for 25% of the hemp plant weight
- Dust accounts for 14% of the hemp plant weight

The price of hemp fibre (£160 per tonne) was taken from a 2020 report by Savills.

Other prices were calculated from a price indices from Inter Chanvre which detailed:

- Straw = 50% of fibre price per tonne (£80/t)
- Animal litter = same price as straw (£80/t)
- Insulation = 2.5 x price of straw (£200/t)
- Horticulture use = 1.1 x price of straw (£88/t)
- Buildings use = 1.2 x price of straw (£96/t)

8.4 Appendix 4 – Supply Chain Map