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An Economic Survey of the United States Hemp Cultivation Industry

By Clarissa Allen and Beau Whitney | October 2019

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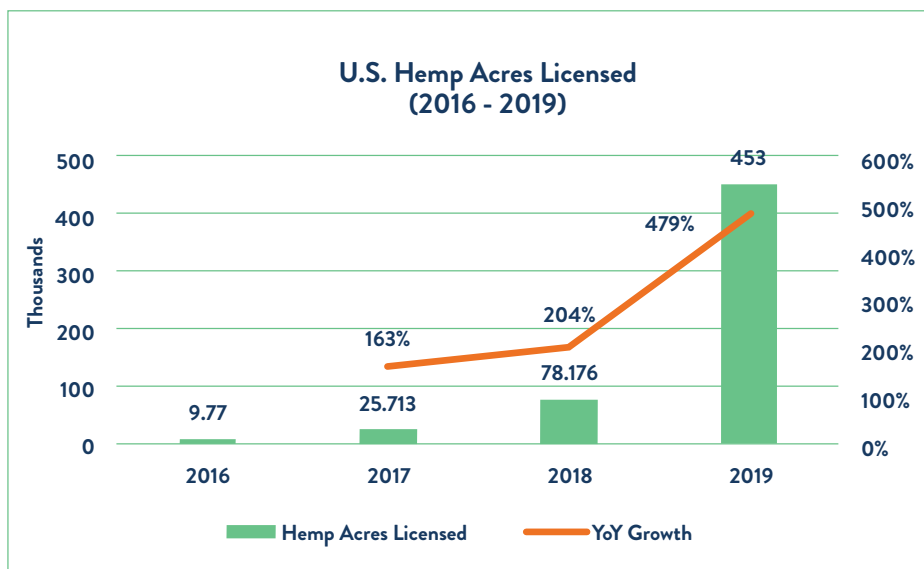
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EXECUTIVE SUMMARY:

After years of prohibition and a series of U.S. congressional reform bills easing the prohibition against cannabis used for industrial purposes (a.k.a. hemp), the initial limited business opportunities significantly increased with the passage of the 2018 Farm Bill and opened the floodgates for firms to begin to legally operate hemp related businesses.

Within months after the bill was signed into law, investment monies and new firms poured into the market. In less than 12 months, Departments of Agriculture from 34 states had issued thousands of licenses for hemp cultivation, processing

and wholesale distribution. In fact, at the time of this publication, between 450,000 and 500,000 acres of land have been licensed to grow hemp and nearly 20,000 licenses had been issued.



The influx of growers was intended to support the significant demand for hemp products, including fibers, industrial and automotive supplies, plastics, paper, seeds, food and beverage products, and most importantly CBD products. With the demand for CBD products seemingly infinite, many farmers jumped onto the CBD bandwagon hoping to achieve riches that the allure of the market seemed to represent.

What was missing though, was market data; data to assess the output capacity, data associated with the supply chain, data on wages, employment and demand. As the hemp market rapidly expanded, there was a dearth of the data which resulted in many of decisions about investment, operations and regulation being made in a vacuum or based on headlines.

In an effort to address the absence of data, Whitney Economics and economist Clarissa Allen, set about to better understand the hemp market by deploying a first-of-its-kind survey to assess employment, wages, output capacity, pricing and the supply chain of hemp. The survey was sent

to nearly 10,000 individual cultivators in 19 out of the 34 states that have hemp programs. The other 16 states either were not willing to support this effort (California, Alabama, Indiana) or did not understand the significance of the effort and opportunity to gather data.

The survey received a statistically significant number of responses and was more than adequate to model the rest of the market. The results were stunning and highlighted many compelling issues about the nascent industry. For example, 65% of the respondents indicated that they did not have a buyer for their crop. This would imply that many of the farmers entered the market unprepared to do business. Another data point indicated that there was enough supply on average to keep every processor fully utilized throughout the year.

While the infrastructure is still in its infancy, many regulatory policy makers are trying to either slow the growth of the industry or exert control over an environment that is overwhelming to them. The infrastructure issues will

inhibit the growth of the hemp industry in the near term, but once resolved will create an environment that will immediately make industrial hemp a major contributor in the agricultural community.

Based on the data from the survey and on research of the overall market, once fully realized, the hemp industry is poised to become the fourth major crop and a foundation to agriculture in the United States. In fact, in its first year, even if a small fraction of the biomass is produced in the U.S. during the 2019 season, hemp has the potential to become the third largest agricultural crop in the United States by revenue. Based on data from the United States Department of Agriculture, the total output of cash crops in the U.S. in 2018 was \$197 billion. If the supply chain issues are resolved and the full value of the acreage is realized, the total value of the hemp biomass is an estimated \$11.3 billion or roughly 6% of the total value of the entire U.S. cash crops.

This, in itself, shows not only the value of the industry, but the significance of the legalization of hemp.

The objective of this report is to be a resource to operators, investors and policy makers from a data perspective and to articulate the nature of the hemp industry. It will also create a baseline of data for others to use as a reference point as the industry develops and matures. The intent is to outline what issues are associated with the deployment of the hemp industry in 2019, how to address them from a policy and business perspective and to predict the direction of the industry as it matures in the years to come.

A special thanks goes out to Clarissa Allen, an economist from Portland, Oregon, who jumped into this project with both feet and has helped lay the foundation for others to build upon in the months and years to come.

About the Authors:

Clarissa Allen has a Bachelor's degree in economics and is pursuing her Master of Economics degree at Portland State University. Her research interests include environmental economics, sustainability, and survey methods and design.

Beau Whitney is an economist and the founder of Whitney Economics. As a recognized analytics expert and cannabis economist, Whitney brings extensive experience and sophistication on every aspect of the supply chain in a vertically integrated cannabis economy.

Whitney's professional experience encompasses business operation successes from Intel and TriQuint Semiconductor, where he oversaw scale amplification for semiconductors and modules to address the rapidly growing supply demands of the global mobile device market. Further, Whitney has designed and implemented efficiencies into the cultivation, extraction, edible manufacturing, wholesale and retail distribution operations of a vertically integrated cannabis operation, which directly expanded the company's revenue from \$100K to \$2M per month.

His expertise on elasticity of cannabis demand, multiplier effects, modeling of illicit to legal consumer conversions, and the economic impact on jobs and taxes in the cannabis industry have been recognized throughout the economics community. Whitney Economics and New Frontier Data white papers analyzing the cannabis market have been referenced in Bloomberg, Forbes, Wall Street Journal,

Washington Post, New York Times, USA Today, the Associated Press, as well as in leading cannabis industry publications.

Whitney is a member of the American Economic Association, the Oregon chapter president of the National Association of Business Economics and participates on the Oregon Governor's Council of Economic Advisors. He has provided policy recommendations at the state, national and international levels and is considered an authority on cannabis economics.

About Whitney Economics:

Whitney Economics is an economics and business consulting firm based in Portland, Oregon. It has clientele in the U.S. and internationally from multiple industries, including high tech, software, as well as cannabis for adult-use, medical and industrial purposed. Whitney Economics also performs business valuations, provides expert witness testimony and helps develop business and strategic plans for large corporations and small family owned businesses.

INTRODUCTION / PURPOSE OF THE SURVEY:

While the legalization of medical and adult-use cannabis has been making headlines for several years, cannabis for industrial purposes (hemp) has taken a back seat to its higher THC cousin. Although not in the everyday cannabis conversations, a lot of work has been done behind the scenes on both the policy side and by the industry to begin understanding the impact hemp could have on the U.S. economy.

With each incremental policy reform, the hemp industry slowly evolved from a pilot program to small farms and then to larger ones. In 2016, U.S. acreage for hemp was estimated to be 9,770 acres. This increased to 25,713 acres in 2017, then nearly tripled in 2018 to 78,716 acres. However, in December 2018 the passage of the Farm Bill changed everything. By removing hemp from the Controlled Substances Act as a Schedule 1 drug, the industry's legal handcuffs were removed and the pace of the industry's growth increased exponentially.¹

As hemp production was increasing, so was demand for hemp-based products; from textiles used in industrial applications, to oils for plastics, seeds for food and fibers for paper. The diversity of hemp-based products was exploding. CBD oils were also creating a buzz. Non adult-use and medical cannabis consumers, hearing about the

purported benefits of CBD oils, wanted a CBD oil-based product, but did not want the psychotropic affects that THC-based products had. With little to no THC content in hemp, the oils, rich in CBD, soon became a hot commodity. Hemp-based oils were quickly in everything, ranging from foods and beverages, cosmetics and skin treatments to vaporizers, tinctures, balms and pills. The growth of the consumer demand had outpaced the supply through the end of 2018.

The skyrocketing demand soon became the focus of industry analysts and attempts were made to try and size the market. Forecasts for the global demand for hemp ranged from \$5 billion to \$25 billion, but given the U.S. market was so new, there was very little data available to model the demand. As a result, global hemp demand forecasts remain very dynamic.

Here are some examples of the wide range of forecasts for global hemp:

- **Research and Markets: \$4.6 billion in 2019 growing to \$26.6 billion in 2025, CAGR: 34%**
- **Fior Markets: \$4.1 billion in 2018 growing to \$14.67 billion by 2026**
- **Hemp Business Journal: \$3.7 billion in 2018 increasing to \$5.7 billion in 2020, CAGR: 17.5%**

Even though demand was exploding in the U.S., with little data, U.S.-based CBD forecasts varied widely as well:

- **Nielson: \$6.0 billion by 2025**
- **Hemp Business Journal: \$975 million in 2019, \$3.8 billion in 2022, and \$6.0 billion by 2025**
- **Brightfield Group: \$467 million in 2017, \$23.7 billion by 2023 (2019 estimate)**

With respect to the Brightfield forecast, the previous 2017 forecast was \$1 billion by 2020, but in 2018 was changed to \$22 billion by 2022. This just shows how dynamic the forecasts can be. Demand forecasts, in general, are seemingly changing overnight with no general consensus

among forecasters. This has made business and investment decision making extremely challenging.

Efforts are now underway to examine consumer sentiment and preferences as a means to assess market directions. While defining CBD consumer archetypes is still in its nascent

1. Hemp Business Journal / New Frontier Data: "The Global State of Hemp 2019 Industry Outlook"
2. <https://www.brightfieldgroup.com/press-releases/cbd-market-growth-2019>
3. <https://www.brightfieldgroup.com/post/hemp-cbd-market-to-reach-22-billion-by-2022>
4. <https://janest.com/article/2017/08/29/american-cbd-market-will-worth-1-billion-2020/>

stages, studies have shown that consumers are gravitating towards specific product types, do feel that CBD has some benefits to the human condition such as pain management, and has some nutritional, health and lifestyle benefits.

While much of the focus has been on the consumer demand for hemp-based products, little is known of the supply side of hemp. In fact, there is little to no data on the supply chain of hemp. Whitney Economics, with the help of economist Clarissa Allen, set out to create a supply-based dataset by surveying hemp licensees and to publish the results.

This paper will summarize the results of the survey as well as identify key issues to be addressed in future hemp policies. The objective of this report is to serve as a resource to operators, investors and policy makers from a data perspective and to articulate the state of the overall hemp industry. It is also intended to serve as a baseline of data for others to use as the industry evolves and normalizes. The intent is to outline what issues resulted from the deployment of the hemp industry in 2019, how to address them from a policy and business perspective and to predict the direction of the industry as it matures in the years to come.

Methodology

The objective of the survey was to assess the employment and wages associated with industrial hemp cultivation in the United States. It was also to assess the amount of acreage and potential output in the current supply chain. There was an initial assumption by the industry that because of the demand for CBD products in the marketplace, any supply of hemp produced would be consumed. The authors of this report wanted to challenge that assumption and assess the supply relative to the demand. Prior to this survey, data on the available supply of hemp did not exist. Whitney Economics attempted to collect supply related data by surveying licensed hemp growers and processors across the U.S.

Who was contacted:

Contact information for licensed growers, processors, and handlers was obtained through 17 states' Department of Agriculture. Licensees were invited via email to participate in the online survey with a second invitation after seven days if there was no response. Three states' Department of Agriculture emailed licensees on our behalf. The survey was sent throughout July and August. The incentive for participation was to remind respondents that they are pioneers in the industry and that their inputs are valuable.

By participating in the survey, respondents inform policy makers, regulators, and the entire industry.

In exchange for their information, Whitney Economics committed to protecting the privacy of their individualized data and to provide each survey contributor with a summary of the results from their state.

The strength of this study is that it is the first of its kind. There is no other known hemp industry survey of this size. The survey attempted to include over 15,000 people across the U.S. in the survey. However, based on lack of Department of Agriculture support in some states the actual reach was between 8,000 and 10,000 participants. Questions were open-ended which allowed survey takers to enter data based on their own business experience. The survey was 11 questions long and took approximately three minutes to complete.

An 11 question survey was built in Survey Monkey and deployed either directly to licensed industrial hemp cultivators, processors and handlers in states where the licensees contact information was available (17 states), or was forwarded to hemp licensees via the state Departments of Agriculture for those states in which the licensee's contact information was not available.

Below is a summary of the questions:

1. Unique Identifier
2. What is your business type?
 - Intended to differentiate between cultivators, processors and handlers.
3. What is your zip code?
 - Intended to serve as a means to be a unique identifier and quickly assess for duplicate responses.
4. Number of full-time employees
5. Average hourly wage of full-time employees
6. Number of part time employees
7. Average hourly wage of part time employees
8. Size of operation (acres or square feet)
9. Current wholesale price (at time of survey)
10. Do you currently have a buyer for your crop?
 - Intended to assess the maturity of the supply chain.
11. If you do not have a buyer, would you like help finding one?
 - Intended to obtain contact information of cultivator for follow up.

There were several challenges associated with this survey. The timing of this survey was a hurdle. The first post Farm Bill growing season had a sense of urgency as farmers saw hemp a potential cash crop. Many states issue licenses continuously so the number of licensees and growing area varied during the timeframe of this study. Data and data sources were fragmented and information was gathered as it became available from various sources including news articles and direct contacts at state agriculture departments. The number of licensed acres will differ from the number of harvested acres. Once farmers are able to report required harvest yields, it will give a better estimate of hemp growing potential.

Not all states that grow hemp were included in this study. Contact information for licensees in 13 states was either not available to the public or we received no response from state Departments of Agriculture. Additionally, licensees who did not provide an email address on state forms did not receive the survey invitation.

In collecting data via survey non-response bias must be considered since people essentially opt in by completing the survey. Feedback was provided that hemp licensees have been flooded with industry related emails. The email

invitation may also have been filtered in a recipient's mailbox and not opened potentially suppressing the response rate. The final sample size is 431 observations across 19 states.

The survey itself might not capture all hemp business types like seed dealers. Questions were focused on CBD biomass and flower aspects of hemp. Future surveys may be modified to capture additional aspects of the hemp industry.

A number of assumptions were made in calculating potential output. It is assumed that one acre of hemp yields 2,000 pounds of biomass. Actual yield may differ depending on the farm, location, and growing experience. More experienced hemp growers will likely get a larger yield.

Generally, the price of hemp is based on the percent of CBD per pound of hemp. For simplicity, respondents were asked for price per pound of flower and biomass. In the market, hemp containing a higher percentage of CBD hemp may see a higher price. Hemp with lower CBD content may see a lower price. When the price of biomass was not available from survey responses, we use a national median of \$12.50 per pound.

Disclaimer:

- 1) While question number 10 was intended to assess supply chain risk associated with who had buyers for their crop, question 11 asked if they needed help finding a buyer. The way that the question was worded may have given the respondent the impression that Whitney Economics was offering brokerage services. The intent of the question was actually mainly to get contact information for the farmers in order to follow up on additional supply chain related questions. Whitney Economics was flooded with supplier requests to provide ancillary services such as brokerage, drying, transportation and processing. As a result, given the number of responses associated with helping farmers finding buyers, Whitney Economics is now considering forming a brokerage division. This is a byproduct of the survey and is not meant to be perceived as a bias.
- 2) The report is sponsored by two companies. The two companies offered to help underwrite the cost associated with the survey development, deployment and publication. The sponsorships were agreed to after the report was completed. Therefore, there was no bias associated with the sponsorship, since the write up was done independently of any potential influence that a sponsor would introduce.

About the sponsors

Once the report was complete, two firms generously offered to help underwrite the costs of producing this work. They appreciated the benefit the report would have for the hemp farmers in the U.S.



GLOBAL EXTRACTION
Hemp Processing Technology

GLOBAL EXTRACTION was founded by American Hemp Seed Genetics. Global Extraction delivers large scale ethanol hemp processing with disruptive technology. Custom engineered facilities to each clients specific needs. Delivering turn key fully compliant operations along with full support staff to insure successful operation.

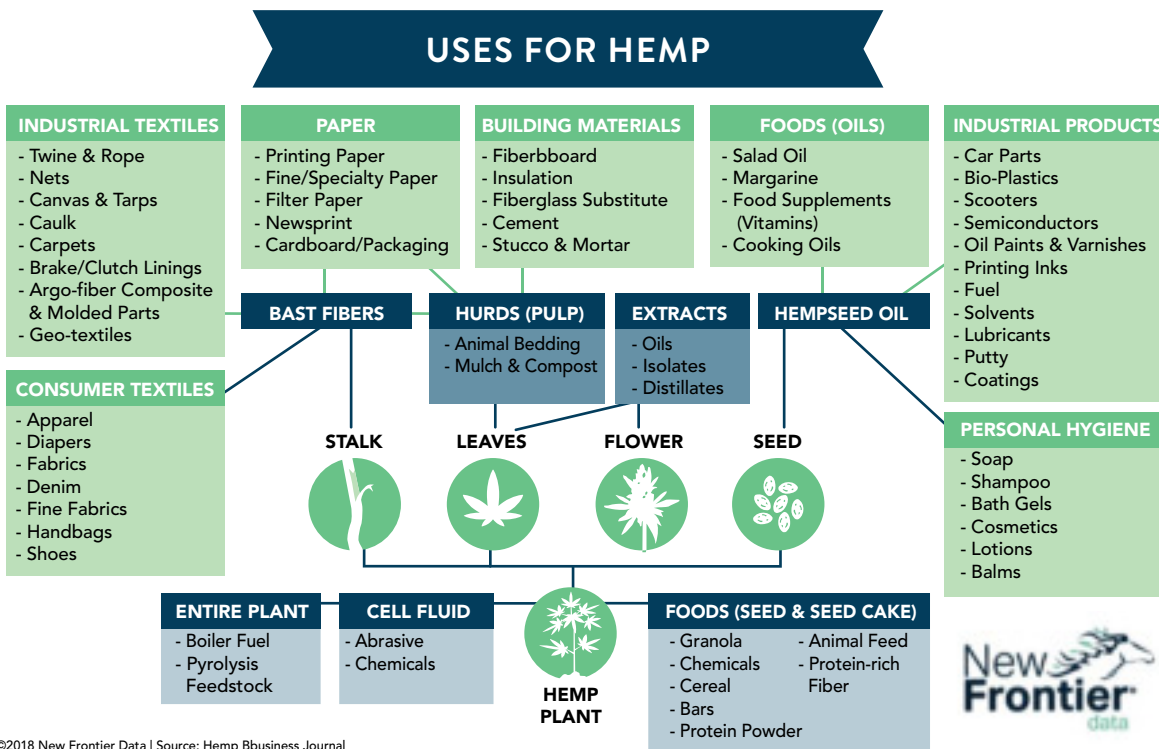
www.GlobalExtraction.org



MATRON LOOP was founded by farmers with the goal of helping our dear friends, the forgotten farmer, to trustfully engage and navigate all aspects of the emerging industrial hemp industry. Our business is to help farmers get the most from their hemp crop by offering custom hemp harvesting and hemp drying services. www.matronloop.com/

ABOUT HEMP

Hemp is a strain of cannabis sativa that contains low amounts of the psychoactive compound tetrahydrocannabinol (THC). The use of hemp fiber for cloth dates back 10,000 years to ancient Mesopotamia. Around 150 BC, the world's first paper was made from hemp by the Chinese, who also used hemp as folk remedies and medicines. In the middle ages, hemp became an important crop around the globe as it was used for food and textiles. Canvas sails and rope for ships were made of hemp as it is stronger than cotton and resistant to salt water. Today, hemp has over 20,000 uses.⁵



Graphic source: New Frontier Data (<https://newfrontierdata.com/marijuana-insights/some-remarkable-potential-markets-for-hemp/>)

Wild hemp was likely found in North America before colonization and was eventually grown in most states. The invention of the cotton gin led to a decline in hemp production. Hemp processing was labor-intensive by comparison and could not compete with the modern production methods of cotton. During the 1930s, hemp processing became more cost-effective as innovations occurred and new machinery was created. Hemp seed oil was a byproduct of production and could be used to make paint and lacquer. DuPont and other businessmen using synthetics saw hemp as a threat and in 1937 successfully lobbied for the ban of hemp production across the U.S.⁶

In 1942, the U.S. lifted the ban on hemp to meet production demands of World War II. The Department of Agriculture used the slogan "Hemp for Victory" to encourage farmers to grow hemp. After the war, the ban on hemp cultivation was reinstated. The Controlled Substances Act of 1970 classified cannabis (including hemp) as a Schedule 1 drug, preventing scientific research and production. At this point, hemp and "marijuana", the strain of cannabis containing higher amounts of THC, became lumped together as controlled substances alongside heroin and LSD.⁷

“There are over 20,000 uses for hemp in products ranging from food, to plastics, fibres for paper and CBD oils.”

5. <https://www.mit.edu/~thistle/v13/2/history.html>

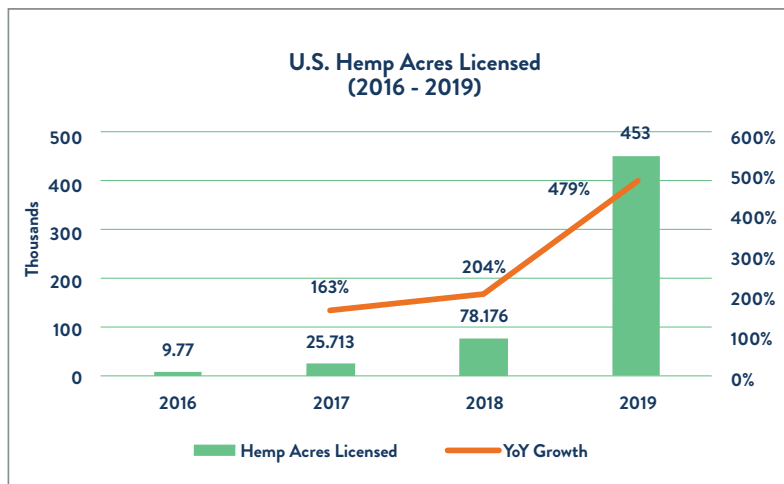
6. <https://www.mit.edu/~thistle/v13/2/history.html>

7. <https://www.mit.edu/~thistle/v13/2/history.html>

Industrial hemp and marijuana differ in their chemical makeup, methods of cultivation, and use. Marijuana, which remains a federally-controlled substance, is legal for medical use in 33 states and both medical and recreational use in 11 states and the District of Columbia. Industrial hemp is cultivated for the historic purposes mentioned above and there is increasing interest in hemp production for its cannabidiol (CBD) content which is non-psychoactive and believed to have many health benefits.

The Agricultural Improvement Act of 2014 (Farm Bill) allowed universities and state Departments of Agriculture to grow industrial hemp under pilot programs, if state law allowed it. The 2014 Farm Bill also defined industrial hemp as *cannabis sativa* containing 0.3% or less THC on a dry weight basis. Between 2016 and 2017, the number of acres of hemp in the U.S. increased from 9,770 to over 25,713.⁸ Production from 2017 to 2018 again tripled to 78,176 acres.

The 2018 Farm Bill removed industrial hemp from the controlled substances list and allows for the licensed cultivation of hemp, crop insurance, and outlines the process for states to create hemp regulatory programs. Presently, hemp regulation varies greatly between states. At the time of this study, hemp growing licenses are available in 34 states. Several more states have passed legislation or began issuing licenses in recent months as demand for hemp increases. The US Department of Agriculture intends to have industrial hemp regulations in place by fall of 2019. These regulations will provide framework and guidance to states who permit hemp-growing but have not started issuing licenses. As a result of the 2018 Farm Bill, investment, acres planted and the number of licenses issued related to hemp all surged considerably in 2019. In fact, acreage licensed increased nearly 5x from 2018 to 2019.



Source: Vote Hemp, Whitney Economics

States seeing the greatest increases in overall acreage planted were Colorado, Oregon, Wisconsin, Kentucky and Tennessee. Wisconsin and Tennessee were the most surprising given how little acreage was licensed in 2018.

“Total Hemp acres licensed has increased nearly 500% since 2018...”

Hemp Industry Overview

At the time of the survey, there were 16,624 cultivation licenses issued and approximately 453,000 acres licensed for hemp cultivation in 2019. Of the 34 states that had deployed a hemp program, only 20 of them actually report the number of acres licensed. The average acreage per grower (based on data from those states reporting both total acres and total licenses) was 27.26 acres. Since not all states reported acres and licenses issued, Whitney Economics estimated the remaining non-reporting states' acres licensed by applying the national acre per grower average to the other 14 states thereby rounding out the entire total U.S. estimate.

8. <https://fas.org/sgp/crs/misc/RL32725.pdf>

9. <https://newfrontierdata.com/product/us-hemp-market-2019-states-ranking-2/>

10. <https://www.votehemp.com/u-s-hemp-crop-report/>

Since the deployment of this survey, other national estimates associated with cultivation licenses and number of acres licensed have been published. A state ranking report from New Frontier Data / Hemp Business Journal⁹ indicated a total of 480,334 acres and 16,462 cultivators were licensed in 29 states (29.18 acres per license), while Vote Hemp estimated there was 511,442 acres, 16,877 cultivation licenses issued¹⁰ (30.3 acres per license). Given that additional acres were licensed in Oregon (+16), Kentucky (+18) and Tennessee (+2) after the survey was completed, the numbers, regardless of which report, all are very close and show how dynamic the growth of the industry has become.

U.S. Hemp Acres Licensed

State Name	Acres licensed (at time of survey)	Number of Growers	Average Acres per Grower
Alabama	8,000	152	52.63
Arizona	3,135	115	27.26*
Arkansas	3,200	80	40.00
California	6,433	236	27.26*
Colorado	80,000	2300	34.78
Connecticut	1,690	62	27.26*
Florida	0	0	0.00
Hawaii	196	30	6.53
Illinois	12,949	475	27.26*
Kansas	3,600	176	20.45
Kentucky	42,000	1047	40.11
Maine	2,700	167	16.17
Maryland	1,745	64	27.26*
Massachusetts	800	100	8.00
Michigan	25,000	331	75.53
Minnesota	8,000	500	16.00
Montana	40,000	277	144.40
Nebraska	273	10	27.26*
Nevada	8,000	207	38.65
New Mexico	2,535	93	27.26*
New York	11,722	430	27.26*
North Carolina	14,400	1212	11.88
North Dakota	4,000	64	62.50
Oklahoma	8,941	328	27.26*
Oregon	46,000	1699	27.07
Pennsylvania	8,696	319	27.26*
Rhode Island	109	4	27.26*
South Carolina	3,300	113	29.20
Tennessee	38,000	2700	14.07
Utah	4,225	155	27.26*
Vermont	7,800	820	9.51
Virginia	8,500	800	10.63
Washington	6,000	44	136.36
West Virginia	2,971	109	27.26*
Wisconsin	38,300	1405	27.26*
Total	453,220	16,624	27.26

* Indicates that the national average acre per license was applied in states where acreage data was not published by the State Department of Agriculture

Source: State Departments of Agriculture, Whitney Economics

The US hemp market is bifurcated between indoor growers with small footprints, small outdoor growers using hemp as a test case and the large commercial growers. Generally, the smaller growers in 2019 have used their land to grow hemp as a proof of concept. Once they receive revenue from the 2019 crop, they will use these funds to expand in terms of both plant count and acreage for 2020.

The larger growers, licensing and planting hundreds or thousands of acres, tend to be already in the agricultural industry. They have entered the hemp market seeing

opportunities to not only generate significant revenues from what would ordinarily be a low revenue crop devoted to another commodity but are taking advantage of the effective nature of hemp as a rotational crop. Hemp tends to leech impurities from the soil, so farmers see other benefits to planting hemp beyond the revenue.

Commercial operators are more focused on large scale agriculture and are already committing large sums of money and resources to take advantage of first mover status.

Current Hemp Related Policy Issues

Immediately upon passage of the 2018 Farm Bill, regulatory agencies began to formulate policies and administrative rules associated with industrial hemp. The Food and Drug Administration (FDA), within hours of the signing into law of the 2018 Farm Bill, reiterated their policy regarding their regulatory oversight domain. The FDA stated that if the intent of the hemp products being sold are medicinal in nature, a dietary supplement or intended to become part of the U.S. food chain, then the FDA has regulatory authority over those products and they must first be approved by the agency. The USDA stated that it has oversight over the testing of the agricultural output. Any other claims, or intentions for use, do not have a designated regulatory authority and fall into a grey area in terms of being regulated.

These grey areas are not trivial. Policy makers and regulators are facing many issues with industrial hemp. Issues of crop insurance, banking, FDA regulation of CBD, interstate transportation, and confusion by law enforcement have surfaced in recent months. There is much uncertainty surrounding multiple hemp sub-markets including seed, cultivation, processing, productization, distribution, and retail.

The 2018 Farm Bill lists industrial hemp as an insurable commodity however the Federal Crop Insurance Corporation does not offer hemp coverage for the 2019 growing season. Farmers who grow other crops in addition to hemp are still eligible for the Whole Farm Revenue Protection Policy, a safety net protecting against whole-farm loss. Lack of crop insurance adds to the risk that hemp farmers must be willing to accept.¹¹

The National Association of Insurance Commissioners says the largest risks faced by cannabis-related businesses (CRBs) are theft, general liability, and product liability. Crop theft occurs as hemp is easily mistaken for high-THC marijuana. Large sums of cash are sometimes kept on site

since banks generally avoid cannabis-related businesses. General liability risks, like workplace safety, are similar to other agricultural and manufacturing businesses. Product liability issues are a concern as the FDA has yet to regulate CBD. Other questions include what happens if the crop tests at TCH levels above 0.3% and must be destroyed.¹²

CRBs, including industrial hemp, may have trouble opening a bank account for their business and obtaining merchant payment services. This leads to CRBs storing large amounts of cash. There is guidance for banks to serve cannabis-related businesses. The Department of Treasury Financial Crimes Enforcement Network released a document in 2014 which provides guidance to federal prosecutors on how to handle marijuana enforcement under the Controlled Substances Act and the 2013 "Cole Memorandum" provides additional guidance on marijuana enforcement. Even with these provisions, legal and business risks and uncertainty remain.

In order to serve CRBs, financial institutions will need to adjust their Bank Secrecy Act (BSA) procedures. Banks must understand what licenses are necessary in their state and how they will meet BSA compliance requirements. Still, most banks will not touch marijuana-related accounts and are not sure how to treat hemp.¹³

The American Bankers Association is confused as to the differences between hemp and marijuana as well. Banks want confirmation that hemp is no longer a controlled substance and that they do not need to submit suspicious activity report (SAR) paperwork on hemp-related transactions. An amendment to the Secure and Fair Enforcement Banking Act, to reiterate the legality of hemp-related banking, is pending in Congress as of November 1, 2019.¹⁴

11. <https://www.rma.usda.gov/en/Policy-and-Procedure/Bulletins-and-Memos/2019/MGR-19-002>

12. https://www.naic.org/cipr_topics/topic_cannabis_and_insurance.htm

13. <https://www.fincen.gov/sites/default/files/shared/FIN-2014-G001.pdf>

14. <https://hempindustrydaily.com/banking-financing-remain-serious-struggle-for-hemp-cbd-businesses/>

Many farmers are growing hemp for CBD extraction as CBD rises in popularity. The size of the U.S. CBD market demand is unknown. Hemp Business Journal estimates CBD to be a \$1.3 billion market by 2022 while the Brightfield Group's estimate is \$22 billion. The Food and Drug Administration (FDA) has yet to regulate CBD as a food supplement.

CBD is the active ingredient in Epidiolex, a drug approved by the FDA to treat epilepsy. The FDA currently is seeking scientific evidence on CBD and its effects. There are concerns over general safety of CBD including long-term effects, how it effects pregnant and nursing mothers, people with major illness, appropriate dosage limits and safe processing procedures.¹⁵

In some states there is a disconnect between law enforcement and prosecutors when it comes to differentiating between hemp and marijuana. Hemp and marijuana look and smell the same. It is impossible to know one from the other without testing the THC level. For example, in Texas testing available to law enforcement is only able to indicate the presence of THC, not the level. Private labs are able to test THC levels, but the process is costly and time consuming. Law enforcement officers have been directed to issue citations for potential marijuana offenses of 4 oz or less. Marijuana is legal only for medical use in Texas.¹⁶

The 2018 Farm Bill allows states and Native American tribes to declare hemp production illegal under state law but may not prohibit the transportation of hemp. However, transporting hemp through states where it is prohibited is risky. In Idaho, where all forms of cannabis are illegal, a truck carrying 6700 pounds of hemp was intercepted in route to Colorado from Oregon. The driver was arrested on felony drug trafficking charges, and the truck and its contents were impounded. Testing of the confiscated cannabis revealed that it contained less than 0.3% THC and, under federal law, is legal hemp. According to Idaho law, there is no difference between hemp and marijuana.¹⁷

A similar instance occurred in South Dakota when a driver was arrested for possession of marijuana and possession with intent to distribute. The driver was delivering 300 pounds of hemp from a licensed grower in Colorado to a licensed processor in Minnesota. South Dakota also does not recognize a difference between hemp and marijuana.¹⁸

Many of these instances demonstrate the complexities associated with the development of a new, and nascent industry. Regulators need to quickly address these and many more issues before more unintended consequences occur.

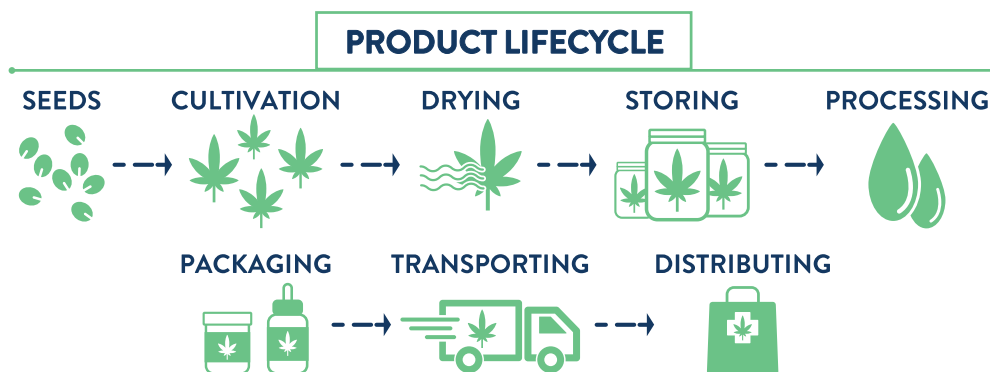
Current Issues Facing Hemp Businesses

Overview of Current Issues Faced by Farmers and Processors

There are many challenges associated with getting the industry up and running quickly. In addition to having an understanding of policy, processors and farmers encounter additional issues. Given how new the industry is in the U.S., there is an element of risk involved in most facets of growing hemp. Many new entrants, for example, have never grown hemp and will need to learn how to grow the crop.

They will also need to ascertain what part of the industry they want to support and who their end customers will be.

Depending upon which market the farmer is trying to support, there will be unique varieties for different sectors of the market. In addition, some varieties grow better than others depending on the region. Hemp grown for CBD has different requirements than hemp grown for fiber. So, in this sense, growing hemp is not as easy as one imagines. In the 2019 surge of new growers, very few have done their due diligence in advance of planting their crops.



15. <https://www.agri-pulse.com/articles/12455-agencies-outline-progress-on-regulatory-pathway-for-hemp>

16. <https://www.nbcwashington.com/investigations/New-Police-Drug-Test-Aims-to-Tell-Pot-From-CBD-512891941.html>

17. <https://www.ttnews.com/articles/usda-general-counsel-opinion-states-cant-prohibit-hemp-transportation>

18. <https://www.argusleader.com/story/news/2019/08/20/minnesota-industrial-hemp-arrested-south-dakota-gov-kristi-noem/2056341001/>

Here are some basics about the hemp production lifecycle:

When planting hemp, farmers can choose to plant a seed or a clone. Clones are cuttings from a mature plant, which are then developed into small plants before being put into soil. Clones are typically more costly than seeds. Seeds should be acquired from a reliable source to ensure they are buying a strain that produces THC content below the 0.3% threshold. Seed suppliers need to be vetted even more so than other ancillary businesses in this space. A batch of seeds that does not produce can be very costly to a farmer and jeopardize a business opportunity right out of the gate. Already lawsuits have been filed against seed suppliers for failed crops.¹⁹ Regulators in other countries are prohibiting propagation through cloning and are requiring certified seed suppliers.

Hemp can be grown indoors or outdoors. Indoor farming is more expensive than outdoor. It requires significantly more energy to produce. This can impact profits, margins and competitiveness. Outdoor farming hemp is a labor-intensive due to its scale. Equipment to efficiently process an outdoor crop is in development across the country although some specialized attachments to farm machinery are already available in the market. Labor requirements must also be considered. It can take significantly more labor to harvest a 10 acre grow than a one acre plot and requires much different equipment and processes. Many farmers who had tested the ability to grow in previous years, did not anticipate the amount of investment and machinery required to produce hemp on a commercial scale. Many farmers have resorted to contracting harvesting and drying services, an unanticipated cost of production and cash outlay.

Hemp must be dried before the crop is processed or shipped. Farmers must have the capacity to store hemp during and after the drying process. When drying a crop, farmers must understand the process and requirements and have back up plans in case of weather-related events. In addition, the lack of regulations has yet to provide guidance on the types of nutrients and pesticides that can be used in the cultivation process. Pesticide use on hemp crops intended for human consumption has yet to be approved by the EPA, FDA or USDA.

Processing hemp is the refinement and transformation of the raw plant matter into value-added products that can be sold or otherwise distributed into the wholesale or retail channels. There are many product segmentations and sales channels in which hemp products can be sold. Processing services are currently in high demand in the market and at this point are considered price makers versus price takers. For the purpose of this study most processors surveyed

were associated with the CBD industry where biomass is extracted for its essential oils and either put into products or further refined into even higher CBD more potent powders that are used in medical and pharmaceutical type products.

Conducting business in states with both legal hemp and marijuana industries can add to the complexity in doing business. The line between higher THC cannabis and lower THC industrial hemp is a blurry one at times. Both were much easier to regulate when both were federally illegal, however now that one has been determined an agricultural product, while the other remains federally illegal, the ability to regulate the two industries side by side is proving challenging. Conflicts are bound to arise. Farmers in some states have even decided to transition away from higher THC cannabis and over to hemp, in part, due to the regulatory environment being more accepting of hemp.

While generally friendly to one another, the ability to coexist in proximity also has its share of issues. For example, in states where growing marijuana is legal, crosspollination between high THC plants and low THC plants is a concern for outdoor growers. Testing for THC content doesn't occur until near harvest and whole hemp crops must be destroyed if the sample contains above 0.3% THC. If oil tests above 0.3% THC, there are ways to remediate the oil, but it is a complex process that takes both time and money.

Lastly, the supply chain from farmer to processor and then to consumer is under-developed. Given issues with transportation, the FDA's role in CBD and the high demand for hemp products, farmers and processors should ensure they understand the entire supply chain and not simply that of a farmer.

Even when the supply chain is understood, completing a sale can be overly complex, particularly, for those not familiar with conducting business with an agricultural commodity. Currently there are a lot of brokers in the middle between buyer and sellers, in many instances, brokers do not have the supply available to sell (even though they say they do) or do not have a buyer in place that they claim to have. This is creating a lot of wasted efforts and failed deals. The lack of professionalism and credibility in the deal process is making ever seemingly simple sales very complex and fraught with risk. A deal under normal conditions should be rather streamline. Given that hemp buying and selling will be new to most farmers and processors, here is an outline of the typical process to sell flower or biomass to a buyer:

- 1. Buyer submits a letter of interest to supplier**
- 2. Supplier accepts the letter or negotiates a change**
- 3. Once accepted, the buyer typically wants some sort of proof that the supply is real either in the form of a picture or certification of analysis**

19. <https://hempindustrydaily.com/cbd-producer-sues-oregon-hemp-seed-company-for-44-million-over-ruined-crop/>

4. The buyer provides proof of funds to the seller to prove they have the money
5. The buyer and seller agree to a contract
6. The buyer puts money into an escrow account
7. Once the terms of the deal are complete, the buyer releases fund from escrow, the brokers get paid, the supplier gets paid and the buyer gets the product

If understanding the supply chain, policy and making a sale seems overwhelming, there are organizations that can help individuals get involved in the hemp industry. Support for hemp is growing rapidly. Hemp Associations create a network for farmers and cultivators to share information and lessons learned. Some states' Department of Agriculture are

offering workshops and information sessions for folks interested in growing hemp. Departments of Agriculture in states that are new to growing hemp are learning from hemp growers in other states. These states want their farmers to be successful with hemp and are embracing the knowledge of experienced growers and building communities within the industry. In addition, colleges and universities were among the first to begin hemp research under the 2014 Farm Bill. Oregon State University plans to form the Global Hemp Innovation Center and Cornell University will create the Industrial Hemp Germplasm Repository. These, and other institutions offering courses in hemp cultivation, will bring future benefits to the hemp industry.

DATA AND FINDINGS:

Labor and Wages

The hemp industry requires both skilled and unskilled labor. Labor in processing facilities generally require more skilled

labor to run the processing equipment and is therefore paid a higher average hourly wage.

- Based on responses from 20 states, the average firm has 4.53 full time employees and 4.34 part time workers.
- The average wages for full time employees are \$17.34 per hour (\$36,067 per year) and the average wages for part time employees are \$13.98 per hour (\$29,078 per year).

“The average hemp farm has 5 full time and 4 part time employees...”

Average workers and wages: Full time and Part time

Labor by Type	Full Time (FTE)	Ave FTE hourly wage	Part Time (PTE)	Ave PTE hourly wage
Cultivator	4.53	\$17.34	4.34	\$13.98
Processor	9.83	\$18.96	7.77	\$14.25

Source: Whitney Economics, Survey Data



Source: Whitney Economics, Survey Data

- If cultivation averages are extrapolated to all of the 16,624 farms in the U.S., this would result in there being 75,253 full time employees and an additional 72,192 part time employees.
- Assuming part-time employees average 20 hours per week and full-time employees average 40 hours per week, then the total wages estimated in the U.S. for hemp cultivation are \$3.76 billion per year.

Total U.S. Hemp Labor and Wages

Licensed Farms	Full Time Workers	Part Time Workers	Annual wage FTE	Annual wage PTE	Total FTE wages	Total PTE Wages	Total U.S. Hemp labor
16,624	75,254	72,192	\$36,064.5	\$14,537	\$2,714,008,555	\$1,049,482,008	\$3,763,490,564

Source: Whitney Economics, Survey Data

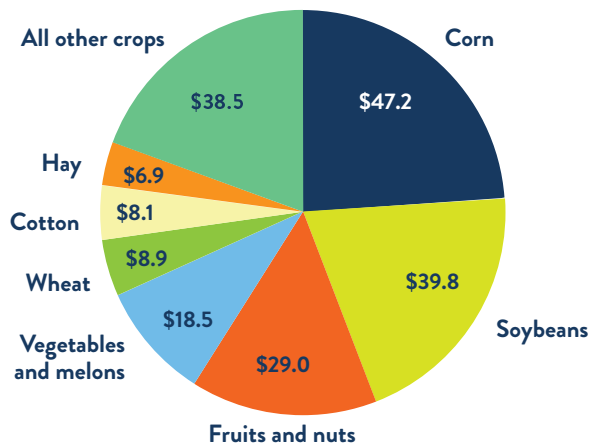
- Hemp is a job creator. While the survey did not distinguish between existing jobs being reallocated to hemp production versus new jobs created solely for hemp production, the amount of labor and wages is a significant economic driver.

Market Sizing

With over 453,000 acres licensed in its first year, the potential growth in the hemp industry is significant. Shortly after the signing of the 2018 Farm Bill, large commercial farmers referring to hemp as the fourth crop. Assuming the supply chain issues are addressed, the revenues of hemp biomass can quickly establish hemp's major role in the U.S. agricultural economy. For example, at \$11.3 billion in potential revenue for hemp biomass alone, hemp would represent nearly 6% of all of the cash crop revenues in the U.S. and

would rank third in value behind corn and soy. Hemp biomass would rank above wheat and cotton. In some states, like Oregon, hemp would immediately become the state's top agricultural crop. The quick rise in standing in the agricultural economy is posing a dilemma for policy makers and is a potential nightmare to regulators: how to quickly deploy a controlled regulatory program without inhibiting the growth of an emerging agricultural market.

2018 crop cash receipts (\$ billion)
\$197.0 billion total receipts



“With over 16,000 licensed farms, hemp requires nearly 150,000 workers, generating \$3.8 billion in annual wages...”

Source: United States Department of Agriculture - Economic Research Service
https://www.ers.usda.gov/webdocs/charts/90819/farms_fig05aug2019.png?v=5154.3

- If each farm produces a total of 2,000 pounds of biomass per acre, then a 453,000 acres licensed environment would produce over 906 million pounds of biomass (assuming it is all associated with the CBD market), and

at a price of \$12.50 per pound, the total biomass market would theoretically be valued at \$11.3 billion.

- Note: This does not include the value of fibers, stalks, processed oils or seeds

The Value Chain: Biomass and Processing

Assumptions -->	2,000 #/acre	1kg = 2.2#	Yield 10%	Yield 6.75%	Yield 4.75%
Acres	Biomass (lbs)	Biomass (kg)	Potential Crude (kg)	Potential Distillate (kg)	Potential Isolate (kg)
453,220	906,440,000	412,018,182	41,201,818	27,811,227	19,570,864
Value -->	\$11,330,500,000		\$30,901,363,636	\$41,716,840,909	\$58,712,590,909

Source: Whitney Economics

- The oil market size depends upon what level of refinement the oil is processed. The more refinement, the greater the loss (and lower yield) but the greater the value. If all of the licensed acreage was dedicated to CBD and all the biomass was able to get to market, the total market value at the wholesale level of the processed output would range from \$30.9 billion to \$58.7 billion.
 - While this is a simple example, it illustrates the value of not only the raw materials planted, but also how much value is derived from the refined oils from hemp.
 - While the theoretical values of dedicating the entire hemp cultivation output of hemp to CBD production are staggering, the potential of the market is a driving force as to why so many farmers and processors have already entered into it.
- Giving the diverse nature of hemp applications, the actual value of the total hemp market will be less than what is theoretically calculated above. However, the data does suggest that the overall potential of the market is substantially higher than the current demand forecasts being published to date.

Data and Impact of the Lack of Buyers:

While the economic potential of hemp is massive, based on the survey results, the full potential of the market will not be realized in the near term. Farmers are having difficulties finding legitimate buyers and are encountering significant issues related to the hemp supply chain.

- 65% of the survey respondents indicated that they did not have a buyer for their crop.
 - This supports the hypothesis that farmers entered the market before the infrastructure was in place.
 - By extrapolating this to all of the states surveyed, only \$2.8 billion of the \$9.0 billion in biomass potential had a buyer.
 - Whitney Economics estimates that only \$3.96 billion of biomass will be able to be realized in the market in 2019, this is 320 million pounds or only 160,000 acres of the total 453,220 acres licensed.
 - Given that the value of the crop declines markedly over time, the raw biomass is perishable. Farmers must utilize tools to dry and store the crop while they figure out the how to bring their product to market.

“Hemp is poised to be the third largest cash crop in the United States within the next year.”

Acres and Value of Biomass with and without buyers

States with respondents to buyer question (n=18)		
Respondent Type	Pounds	Value @ \$12.5/lb
Buyer	224,554,400	\$2,806,930,000
No Buyer	417,029,660	\$5,212,870,750

Source: Whitney Economics, Survey Data

Cultivation Data:

Cultivation acreage has increased every year since early pilot programs were deployed. 2019 saw a significant increase in acreage licensed and this trend does not appear to be slowing anytime soon.

- At the time of the cultivator survey, there was approximately 453,220 acres licensed and 16,624 licensees.
- The average acres per license was 27.26 acres. However, based on the survey, 75% of farmers are growing less than 20 acres.
- Based on an assumption of a harvest of 2,000 pounds per acre of biomass and \$12.50 per pound wholesale, the average revenue per farm is estimated to be \$681,500 for biomass alone.

- Nationally, acres licensed has increased every year since 2016, with year-over-year growth in 2018 and 2019, 204% and 479% respectively.

“65% of survey respondents said that they did not have a buyer for their crop...”

U.S. Hemp Acres Licensed by Year

State	2016	2017	2018	2019 (July)
Alabama				8,000
Arizona				3,135
Arkansas				3,200
California				6,433
Colorado	5,921	9,700	21,578	80,000
Connecticut				1,690
Florida				
Hawaii	1	1	2	196
Illinois		0	1	12,949
Indiana	2	5	5	
Kansas				3,600
Kentucky	2,525	3,271	6,700	42,000
Maine	1	30	550	2,700
Maryland				1,745
Massachusetts		0	21	800
Michigan				25,000
Minnesota	51	1,205	710	8,000
Montana		542	22,000	40,000
Nebraska	1	1	1	273
Nevada	216	417	1,881	8,000
New Mexico				2,535
New York	30	2,000	2,240	11,722
North Carolina	70	965	3,184	14,400
North Dakota		3,020	2,778	4,000
Oklahoma		0	445	8,941
Oregon	500	3,469	7,808	46,000
Pennsylvania		36	580	8,696
Rhode Island				109
South Carolina		0	256	3,300
Tennessee	225	200	3,338	38,000
Utah				4,225
Vermont	180	575	1,820	7,800
Virginia	37	87	135	8,500
Washington		175	142	6,000
West Virginia	10	14	155	2,971
Wisconsin		0	1,850	38,300
Total	9,770	25,713	78,176	453,220

Source: Vote Hemp, Whitney Economics



Supply Chain Data and Infrastructure Issues:

- Of the 431 respondents, only 65 (15.1%) indicated that they were vertically integrated. Vertical integration is a business structure whereby a single firm controls all parts of the production process. In this case it means cultivation, processing and wholesale distribution. Vertical integration lowers overall costs and has particular tax advantages.
 - Of the vertically integrated businesses, 54% have buyers for their products, so the vertical integration model does not necessarily eliminate all business risks.

“The average hemp farm is 27 acres, while 75% of U.S. farmers are growing on less than 20 acres...”

- While many farmers applied for and received their cultivation licenses (16,624 cultivation licenses at the time of this report), there are further upstream constraints that are obstacles to getting product to market. These supply chain links are as follows:
 - **Cultivation harvesting equipment.** While many farmers initially tested the hemp farming concept in previous years, these test plot generally were small and could be harvested manually, however as production capacities and acreage increased, farmers have generally been unprepared to harvest a large commercial farm.
 - **Hemp drying equipment:** Drying capacity is at a premium during the fall harvest time. Unsophisticated farmers did not understand the processors requirement for between 8%-10% of moisture content in the biomass. Many farmers chose to field dry their plants, running the risks of developing mold in the plants during the drying process. Few farmers had a contingency plan. Large drying equipment can process the plants quickly, but capacity is constrained at these facilities. Farmers who did not dry in their fields or at a drying facility, have resorted to using barns or warehouses, but many risk having their biomass mold, before they can dry it.
 - **Transportation:** Once the product is dried, farmers have not considered how to get the flower or biomass to the processing facilities, many farmers sell their product at the farm gate and require buyers to provide transportation, but given the lack of buyers, farmers had not considered this critical part of the supply chain and are finding it difficult to get the crop to market.
 - **Storage:** Farmers not familiar with cannabis (either adult-use, medical or industrial) are not knowledgeable about the requirements for the storage of the product. Storage is necessary to hold the dried biomass during the months following the harvest so that farmers can realize the higher prices when seasonality in pricing fluctuates and the farmers are able to sell their goods at a higher price in.

Processing Data and Issues:

Processing is a major function in the supply chain of hemp. It takes the material from a raw material form and turns it into a value-added product. While the number of acres under license has surged in 2019, the production capacity at the processing level is struggling to keep pace. Extraction machines are technical in nature and are not simply a cookie cutter type of machine

- There is limited production capacity in the U.S. market from a processing perspective, at least for now.
- Across the nation, there is one processor for every four growers.
 - In some states, the ratio is much greater and is a market opportunity for investors and operators looking to fill a niche.
- There is one processor for every 100 acres of hemp cultivation.
 - Assuming each acre represents 2,000 pounds of biomass, that would imply that there is 200,000 pounds of biomass for each processor. This is a tremendous amount of biomass per licensed processor, given that most processors have small operations, with one or two extraction machines on site.
 - For perspective, if each Co2 machine can process 30 - 40 pounds of biomass per day, this would take a processor over 13 years to process this biomass,
 - A larger Co2 processor (100 liter) that can produce 200 pounds per day, would take on the average 3 years to consumer 200,000 pounds of biomass
 - Larger ethanol-based units that can process 700 pounds per day of biomass would fill their machines continuously for an entire year.
- Processors generally procure raw materials using three separate strategies.
 - Processor pays cash. Purchases the entire amount of biomass.
 - Processor processes the biomass for a fee and gives oil back to farmer.
 - Processor processes the biomass and keeps some and gives some back to the farmer.
- While processors are a key cog in the machine, not all of them are able to fund the direct acquisition of large amounts of biomass in a single transaction.

“There is one processor for every 4 hemp farms.”

Averages for Growers and Processors by State

State	Acres licensed (at time of survey)	Number of Growers	Number of Processors	Growers per Processor	Acres per processor	Pounds per Processor
Alabama	8,000	152	59	2.58	135.59	271,186
Arizona	3,135	115	57	2.02	55.00	109,996
Arkansas	3,200	80	18	4.44	177.78	355,556
Illinois	12,949	475	100	4.75	129.49	258,970
Kansas	3,600	176	33	5.33	109.09	218,182
Kentucky	42,000	1,047	120	8.73	350.00	700,000
Michigan	25,000	331	223	1.48	112.11	224,215
Montana	40,000	277	10	27.70	4,000.00	8,000,000
New York	11,722	430	79	5.44	148.38	296,754
North Carolina	14,400	1,212	730	1.66	19.73	39,452
North Dakota	4,000	64	9	7.11	444.44	888,889
Tennessee	38,000	2,700	102	26.47	372.55	745,098
Utah	4,225	155	32	4.84	132.04	264,081
Vermont	7,800	820	158	5.19	49.37	98,734
Virginia	8,500	800	57	14.04	149.12	298,246
Washington	6,000	44	63	0.70	95.24	190,476
Wisconsin	38,300	1,405	692	2.03	55.35	110,695
Total	270,831	10,283	2,542	4.05	106.54	213,085

Source: State Departments of Agriculture, Whitney Economics

Pricing Data:

- Pricing is seasonally based, however wholesale prices have decreased considerably over the course of this survey period and have declined again throughout October.
- The average price per pound of flower at the time of the survey (July) (adjusted for outliers) was \$395 per pound and at the time of publication flower prices range between \$100 - \$200 per pound.
- The average price for biomass at the time of the survey (adjusted for outliers) was \$35/pound and at the time of the publication of this report ranges between \$11 - \$15.
- Pricing will continue to be seasonal in nature, but because of the other potential disruptions in the supply chain, the decline in prices will not be as steep as predicted earlier in the year.

Key Issues Summary

2019 saw a tremendous surge in hemp licenses and acres planted. This transition from an illicit system to a legal one, was not without its challenges. The below are some key observations from the 2019 hemp deployment.

- **Popularity of CBD lulled farmers into a false sense of security regarding demand.**

- With CBD products being deployed in so many different markets, there is a certain level of hysteria associated with CBD and all of its uses.
- Farmers seemed to have been caught up in the hype and took the leap before looking.
- The question remains: Is there enough demand to consume the supply?

- **Many farmers took a risk, did not know how to bring to market.**

- Farmers did not know how to grow hemp, and for those who did, they did not research the market enough to identify their target market, the consumer demand and what was required to support the end customers.
- Supply is in various forms and in various stages of production, spread out across the country.

- **Infrastructure is fragmented, farmers may be able to grow it but then what?**

- An analysis of the supply chain shows that there are capacity constraints at drying facilities, storage, and processing. Transportation is also an issue.
- While there maybe capacity available in one location, farmers are either unaware that it exists or are unable to get it from point A (Farmer) to point B (Ancillary operator).

- **While there is a lot of supply in the pipeline, given the challenges in the hemp infrastructure, a significant amount will not make it to market.**

- A production estimate will be provided in the data section, however, with so many fissures in the supply chain, lack of seller to buyer relationships and the fact that this is an agricultural commodity subject to weather and other environmental issues, not all of the production capacity that is currently available will result in agricultural output.
- Whitney Economics is estimating that only 25%- 33% of the current output will make it to market. This is still close to 300 million pounds of hemp biomass, flower and fiber.

- **There are a lot of “snake oil” sales, making claims that are not true, brokers making promises and not delivering.**

- One other aspect of the supply chain that is impacting farmers, buyers and larger potential commercial consumers, like CVS or Kreuger, is that there are a lot of individuals who are taking advantage of inexperienced operators.
- From seed vendors at the beginning of the process to potential buyers at the end of the process, there are a lot of people in the middle trying to make a buck. These brokers are a real problem to both supplier and buyers alike.
- With multiple brokers in the middle of a deal, farmers may be priced out of a deal, and with multiple brokers on the

buyer side, the supplier may not actually be dealing with a real deal, only a bunch of brokers in the middle.

- Without some level of professionalism that connects the buyers and sellers together, greed and the lack of ethics could seriously diminish how quickly the hemp market normalizes and could create significant public safety risks for regulators to address.

- **Lack of federal regulation is creating public safety issues.**

- In a recent sampling of hemp-based oil and CBD oil purchased in the retail channel, online and through direct sales, a majority of the products sold, did not contain the substance that it claimed to have.

- **In some instances, products said to contain CBD, did not have any CBD at all. In other cases, CBD oils contained higher THC levels that are permitted by law.**

- This may potentially to create significant public safety risks and is a reason why the quick deployment of a limited but structured regulatory program is so important.

- **Banking and financing are carry-over issues from higher THC cannabis (Marijuana).**

- Although permitted to provide banking services to hemp operators, banks do not have a good mechanism to assess risks, develop processes to address those risks and enough data to price those risks into their services.
- Banks are simply not offering services to hemp operators in volume. This is creating a limiting effect on the growth and development of the industry and could limit how farmers and the rest of the supply chains operate in the near term.

- **Regulations are still in development at the federal level, states have different definitions of hemp.**

- While the federal line of demarcation is 0.3% THC content, states have different interpretations of how 0.3% is measured. In some states, it is delta 9THC content and not THCA, while others combine them both to determine THC percentages.
- This is creating issues, particularly when it comes to interstate transport. A farmer wishing to ship from Arizona to California for example, will need to examine the definitions in both states to determine whether they are in compliance or not or if they are allowed to ship from one state to another.

- **Similar states versus federal issues to marijuana are cropping up, particularly when it comes to food.**

- 33 states have legalized higher THC cannabis for medical purposes while 11 of those, have also extended this to adult use purposes as well. This has created a dynamic between federal and state whereby the laws are incompatible.
- Industrial hemp also faces this same type of issue, just in a more nuanced way. For example, the FDA asserts regulatory oversight when it comes to items that are entering the food chain, however, in Oregon the state regulators of hemp and CBD do not consider CBD to

be an adulterant, and so they permit the hemp-based substance to be used in food preparation.

- Suppliers of hemp-based food have to decide between which state and federal rules to follow.
- **Many hemp-based finished goods suppliers are selling anyway, regardless of the federal regulatory direction.**
 - Given there are over 16,000 growers and even more entrepreneurs looking to take economic advantage of both the hemp and CBD craze, it is impossible for the FDA and USDA to regulate all of the new entrants in this space.
 - Many are choosing to operate in this regulatory grey area, even while in violation of U.S. law, because they do not think that they will be caught by regulators or law enforcement official.
- **Larger companies who want to enter the market for large scale distributions are waiting until supply chain issues are ironed out.**
 - Large reputable companies do not want to run the risk of investing in the development and launching of a product only to have the launch impacted by supply chain issues and disruptions in the supply chain.

- Larger consumer facing companies are developing products now, but waiting until the industry matures a little before they jump in. This could result in a second wave of growth within the hemp industry.

There are a lot of issues related to the 2019 ramping up of hemp industry post passage of the 2018 Farm Bill. While these can create hardships for farmers and businesses alike, they are not atypical of a newly formed industry. What is atypical is how quickly people jumped into the market, the pace of growth and how this accelerated growth exponentially magnified the impact on the industry.

Now that the season is near its end and all of the warts have been exposed, the industry and its supply chain will adjust and normalize over the next 12 - 18 months and once again as more regulatory structures are put into place.

Policy Implications

There are several key policy challenges that federal and state regulators face given the rapid pace of growth in this newly formed market.

- **Farmers need crop insurance in order to protect themselves financially. According to the USDA, there is not enough historical data on hemp to create an insurance policy for the crop.**
 - Policy makers need to know the value of the crop, risks involved in cultivating it, and best practices for growing.
 - Developing insurance policy guidelines for hemp insurance could take several years.²⁰
 - Farmers and processors may currently be able to find insurance through companies catering specifically to the cannabis industry. Private insurers offer marijuana cultivation insurance in states where it has become legal.
- **In developing its federal policy, the USDA could look to this sector for guidance in order to speed up the policy development process.**
- **Banks must provide services to hemp companies. Farmers are taking risks in producing hemp and need the support of their banks and credit unions.**
 - If financial services are not provided to all aspects of the hemp market, the economic potential of the market will be lost.
- Producers must be able to sell their crop to processors without fear of having their bank accounts closed by their institution. Hemp companies need to establish financial services relationships, like any other business.
- Federally regulated banks do not serve CBRs because marijuana is still considered a controlled substance. Handling transactions related to a controlled substance puts the bank at risk of being prosecuted for money laundering.
- This is viewed as a public safety issue since high dollar amounts of cash increase risk of theft, leading right back to issues with insurance.
- Federally, there is bi-partisan support and congress members are calling for clarity on hemp banking rules; hemp is legal and hemp-related transactions are not cause for suspicion.
- **In April, Senator Ron Wyden (D-OR) and Senate Majority Leader Mitch McConnell (R-KY) sent a letter to the Farm Credit Administration, the Office of the Comptroller of Currency, the Federal Deposit Insurance Corporation and the Federal Reserve calling for an end to discrimination against hemp business owners in banking.**
- **The slow development and deployment of USDA and FDA testing and other rules have opened the door for abuse.**

20. <https://www.usda.gov/media/radio/daily-newsline/2019-07-26/what-about-crop-insurance-hemp-producers>

21. <https://senmccconnell.app.box.com/s/6383dmky9nklo9kvp33rkcdyec4mnnkk>

- A recent report published in the Journal of the American Medicine Association showed that out of 84 samples tested that were purchased online, most did not contain an accurate amount of CBD that was listed on the label.
- **Some did not contain any CBD while others contained high levels of THC.**
 - There are public safety implications associated with the lack of regulatory oversight and testing.²²
- **While FDA has asserted its domain over the drug, supplements and food area, there are so many suppliers that the FDA cannot begin to regulate them. This lack of control over the market will make it difficult to put the genie back into the bottle and eliminate the volume of illicit sales that are occurring today.**
 - FDA Principal Deputy Commissioner Dr. Amy Abernethy says that the FDA is expediting processes surrounding CBD regulation, acknowledging the urgency of the issue for many stakeholders. However, it could be several years before rules are developed. Meanwhile, some states are creating their own CBD regulations. This lack of consistent regulation makes hemp for CBD risky for producers.²³
 - Given that hemp could become the third largest cash crop in the U.S. in its first year of legalization, the USDA, FDA and other regulator are already behind the eight ball when it comes to deploying rules and regulations to control the market.
- **The state’s rights versus federal dynamic is creating a mish-mash of rules from state to state, further complicating how to conduct interstate commerce.**
 - Some states are deploying rules that allow hemp-based products to enter into the food and beverage markets (Contrary to FDA rules)
- There is also a conflict between federal and state laws over transportation.
- **Issues in both Idaho and South Dakota have involved the arrest of individuals transporting hemp through those states.**
- **Both states claim that hemp is illegal and cannot pass through their jurisdictions, however the federal government claims that it is.**
- **On May 28th, after an arrest of a trucker in Idaho, the General Counsel for the USDA Stephen Vaden issued a legal opinion stating that transportation between states is legal. Specifically, “Thus, while a State or an Indian tribe cannot block a shipment of hemp through that State or Tribal territory, it may continue to enforce state or Tribal laws prohibiting the growing of hemp in that State or Tribal territory.”²⁴**
 - Food and transport are just two examples of many where the lack of federal clarity has created risks to hemp businesses operating under the assumption that they are doing business legally when in fact, they might not be.
- **Given the rapid expansion of the market, combined with the volume and diversity of products being introduced into this space, it is imperative that rules be deployed quickly, even if they are not perfect.**
 - Federal regulators are not afforded the opportunity to perform their normal process of rules development and deployment.
 - A basic framework must be created and then refined over time. The industry is moving too fast for it to be done any other way.

Business Implications

With supply chain issues, regulatory uncertainty and a large surge of firms entering into the market, the business environment is complex. Understanding the market dynamics and their associated risks will separate those who succeed and those who struggle. While it appears that there are a lot of challenges (of course there are, this is farming) there remains a lot of business opportunities in hemp. It is not too late to jump into the fray.

- **Lack of regulation represents both a risk and an opportunity for businesses as one can operate in the grey areas until the market tightens up from a regulatory perspective.**
 - The risk is that as legitimate businesses will be forced to compete with those that are not. Nearly 70% of hemp based CBD related business in 2018 was driven either on line or via direct selling.
- Traditional businesses will have to first compete with non-traditional channels and then adapt to a changing regulatory landscape.
- On the flipside, there are opportunities given the limited regulatory enforcement. Companies willing to take the risk or are more comfortable with the regulatory ambiguity, can enter into the retail space and capture first mover advantages which can solidify a national branding opportunity.
- **Regulatory deployments may impact business models. It is difficult to know what one does not know and in an ambiguous regulatory environment, hemp operators must be nimble, but more importantly, aware.**
 - Keeping up with regulatory developments may prove every bit as important as maintaining one’s crop.

22. <https://jamanetwork.com/journals/jama/fullarticle/2661569>

23. <https://twitter.com/DrAbernethyFDA/status/1149766446106497025>

24. <https://www.ams.usda.gov/sites/default/files/HempExecSumandLegalOpinion.pdf>

2018 U.S. Hemp Derived CBD Sales by Channel (USD\$ Millions)



Source: New Frontier Data / Hemp Business Journal

“68% of all CBD sold in the U.S. in 2018 was either from the direct or internet channels.”

- Even though legal, banking continues to be an issue gating the development and growth in the market.
 - Hemp-based businesses will have to establish relationships with financial institutions and make the extra effort to assuage the fears of the bankers from a risk perspective.
 - Farmers, at least in the near term will need to deal with lack of financing to acquire materials to plant their next crop or bridge financing to pay for labor prior to harvests.
 - This may tip the advantage over to farmers who are better funded.
- While many hemp farmers and processors thought that they did not have to think about taxes much anymore (IRS code 280e), they now have to consider the impact that the U.S. Supreme Court case, *South Dakota v. Wayfair, Inc.*, will have on their businesses, particularly those that do significant business in other states.
 - This is a ruling that forces businesses to pay state tax, even while not present in that state.
 - This could add cost and complexity to an operation.
- Businesses must do their homework. Due diligence is critical.
 - Knowing how to conduct business, who one is conducting business with and whether or not those entities are legitimate will be critical over the next few years.
 - There are many people looking to take advantage of unsuspecting, well-intending farmers, looking for a home for their crop. Be suspicious.
- Given the immaturity of the supply chain, there is tremendous opportunities on the ancillary side of the industry.
 - From equipment manufacturers, dryers, processors and transportation providers, given the sheer volume of farmers and supply, there is a market opportunity to support the industry, even on a local or regional basis.
- Processing capacity is critically important. Regional processing, that can scale is still in limited supply.
 - As more farmers come on line, there will be more demand for those who can prepare the product for market.
 - Large scale processing capacity takes large amounts of capital to deploy. However, those that have adequate financial backing, have a great opportunity to capture significant market share.
- Given the small average size of the farmers in this space, there is opportunities for cooperative arrangements (Co-Ops) or supply that is consolidated from a group of farms and sold to processors in large bundles. Again, a market opportunity.
- Cash is king and access to capital is critical to capture market share.
 - While processors may have equipment available, farmers will need to get paid.
 - The amount of biomass required to keep a large-scale facility up and running 24/7 will cost tens of millions of dollars.
 - The question is whether or not the processors will have that amount of money at their disposal.
- Know the end customer.
 - Once all of this processing is completed, who will this be sold to, in what form and to what location?
 - The supply chain issues do not stop with the processors. The big question is where is all of this supply going?
- Contracts are essential to address risk and loss at every step of the way.
 - Forward contracts to farmers, contracts between seller and broker and buyer and contracts between processors and retail providers.
 - Having a strong legal team will save in the long run.

Recommendations and Predictions

- > Do due diligence before entering the market. Given how so few of the respondents had buyers lined up, many could have already been set up for failure without even knowing it.
- > Understand the various layers of the supply chain and form alliances and business relationships so as to minimize the risks associated with bringing product to market.
- > Know the customers and the demand and develop products that are not only in vogue now, but will be in demand in the years to come.
- > Expect and prepare for commoditization of prices. Farmers and suppliers should have or develop a diversified portfolio of products so that they are not overly dependent upon one market or customer base. This will minimize risks to revenue and protect margins in a very dynamic marketplace.
- > Know the cost structure of the business and know when to wave the white flag. Knowing one's costs will be key to any managerial and operational decision-making process.
- > Have a good lawyer. Write down everything and agree to terms via contracts. There is too much money to do business on a handshake. Trust is earned.
- > Develop an exit strategy at the beginning.

PREDICTIONS: WHERE WILL THE MARKET GO FROM HERE?

- > Big agriculture will enter, pushing smaller growers to the side. Given the revenue per acre and the value of hemp as a rotational crop, smaller firms must be prepared to compete with larger commercial-oriented operations.
- > Small growers will still find an opportunity but they will be fewer and more focused or niche markets or regionally oriented versus national. The small firms will band together.
- > Regional drying, storage, transportation and processing hubs will develop, servicing a local market, while supplying a national one.
- > Look for consolidators and cooperatives to enter into the market that will help smaller farms bring product to market and to drive economies of scale farther into the supply chain.
- > Hemp will be traded on an exchange.
- > Licensed brokers will be required when representing buyers or sellers, just like any other agricultural commodity. Given how many unscrupulous brokers there are, licensed brokers will be demanded by both buyers and sellers of this commodity.
- > Prices will decline in 2019, rebound slightly in early 2020. Once the supply chain normalizes, then commoditization of prices will occur much more rapidly and above average profits will be eliminated from the market.
- > Regulatory oversight will evolve quickly, but will not keep up with the development of the market and product offerings.
- > To align with other international standards, look for a federal mandate to certify seed suppliers
- > CBD related demand will wane, as the craze peaks.
- > Large firms, who have waited to enter into this space due to the lack of a mature infrastructure, will enter the market in a significant way, in the next 12 - 18 months, driving a large increase in hemp-based products, but not necessarily CBD only.

CONCLUSION

The hemp industry is transforming quicker than anybody imagined. It has evolved from a small pilot industry to one of the largest agricultural industries in the U.S. While it has done so in an extremely short period of time, it has not done so without challenges. From lack of farming best practices, to lack of infrastructure to a lack of regulatory oversight, all of these obstacles have failed to inhibit the growth and deployment of a significant industry.

The hemp industry is capable of many things, from the employment of nearly 150,000 people to the generation of over \$3 billion in wages, hemp has proven to be an economic driver. Hemp has expanded into markets not imagined even five years ago. It is a true testament of a successful emerging market.

While the market and involvement has surged significantly in the past 12 months, regulatory deployment has lagged and is now on the cusp of generating potentially significant public safety risks. It is not due to the entrepreneurs who took a chance on an economic opportunity, but more so due to bad actors that have entered into the grey areas of a limited regulatory environment.

As more and more consumers and suppliers enter into this space, the industry and regulatory structures, whose wrinkles are obvious now, will eventually iron themselves out. As the industry evolves, there will be more and more products in the marketplace and more and more reasons that justify the passage of the landmark bill in 2018. As more data is available, the opportunity to make informed, data driven decisions will be made easier and policy making will become more streamlined. However, while these issues continue to get ironed out, expect a little more of a wild ride over the course of the next 12 - 18 months ahead.

- Hemp Business Journal / New Frontier Data: “The Global State of Hemp 2019 Industry Outlook”
- <https://www.brightfieldgroup.com/press-releases/cbd-market-growth-2019>
- <https://www.brightfieldgroup.com/post/hemp-cbd-market-to-reach-22-billion-by-2022>
- <https://janest.com/article/2017/08/29/american-cbd-market-will-worth-1-billion-2020/>
- <https://www.mit.edu/~thistle/v13/2/history.html>
- <https://newfrontierdata.com/marijuana-insights/some-remarkable-potential-markets-for-hemp/>
- <https://www.mit.edu/~thistle/v13/2/history.html>.
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- <https://www.rma.usda.gov/en/Policy-and-Procedure/Bulletins-and-Memos/2019/MGR-19-002>
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- <https://www.argusleader.com/story/news/2019/08/20/minnesota-industrial-hemp-arrested-south-dakota-gov-kristi-noem/2056341001/>
- <https://hempindustrydaily.com/cbd-producer-sues-oregon-hemp-seed-company-for-44-million-over-ruined-crop/>
- <https://www.usda.gov/media/radio/daily-newsline/2019-07-26/what-about-crop-insurance-hemp-producers>
- <https://senmccconnell.app.box.com/s/6383dmky9nklo9kvp33rkcdyec4mnnkk>
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- <https://twitter.com/DrAbernethyFDA/status/1149766446106497025>
- <https://www.ams.usda.gov/sites/default/files/HempExecSumandLegalOpinion.pdf>

Appendix 1

Average workers, Wage and Employment Income from Respondent States:

State	Average PTE Hourly Wage	Average FTE Hourly Wage	Average FTE Workers	Average PTE Workers	Number of Licenses	Growers Potential Employment	FTE Grower Potential Wage Income	PTE Grower Potential Wage Income
AR	\$15.00	\$16.00	4.67	5.00	80	773	\$12,424,533.33	\$6,240,000.00
CO	\$14.66	\$17.86	8.80	4.76	2,300	31,200	\$752,310,000.00	\$166,962,774.19
HI	\$14.67	\$19.00	3.33	1.67	30	150	\$3,952,000.00	\$762,666.67
KY	\$15.00	\$20.00	10.00	2.00	1,047	12,564	\$435,552,000.00	\$32,666,400.00
MD	\$13.00	\$16.00	0.33	1.33	64	107	\$709,973.33	\$1,153,706.67
ME	\$14.50	\$19.80	1.00	1.75	167	459	\$6,877,728.00	\$4,407,130.00
MN	\$12.83	\$16.80	0.55	5.00	500	2,773	\$9,530,181.82	\$33,366,666.67
MT	\$13.64	\$14.83	3.88	1.72	277	1,549	\$33,098,591.50	\$6,755,090.18
NC	\$12.15	\$14.10	5.43	4.99	1,212	12,622	\$193,012,465.26	\$76,371,453.04
NV	\$18.60	\$15.70	2.57	1.14	207	769	\$17,382,322.29	\$4,576,237.71
NY	\$17.33	\$23.20	2.75	1.75	430	1,935	\$57,062,720.00	\$13,565,066.67
OR	\$15.40	\$19.31	8.06	7.31	1,699	26,119	\$549,928,262.69	\$199,035,259.05
PA	\$15.19	\$19.25	2.06	3.13	319	1,655	\$26,343,817.50	\$15,745,640.63
TN	\$12.66	\$17.38	0.97	1.97	2,700	7,912	\$94,186,567.84	\$69,834,607.01
VA	\$10.00	\$12.00	6.75	5.50	800	9,800	\$134,784,000.00	\$45,760,000.00
VT	\$14.73	\$15.86	1.61	1.64	820	2,665	\$43,484,493.51	\$20,641,820.95
WA	\$15.31	\$19.29	5.07	11.67	44	736	\$8,944,798.72	\$8,171,363.20
WV	\$9.00	\$12.00	0.57	1.71	109	249	\$1,554,651.43	\$1,748,982.86
Not listed*								
Grand Total	\$13.98	\$17.34	4.53	4.34	16,624	147,446	\$2,714,008,555.29	\$1,049,482,008.33

** Note **: Some states were excluded in this list due to lack of data or limited numbers of responses.

Source: Whitney Economics, Survey Data

Appendix 2

Percentage of Respondents with Buyers by State:

State	State Wide Licensed Acres	Percentage with buyer	Potential Biomass in Pounds (With Buyer)	Potential Biomass in Pounds (Without)
AR	3,200	67%	4,288,000	2,112,000
CO	80,000	44%	70,400,000	89,600,000
HI	195	33%	128,700	261,300
KY	42,000	100%	84,000,000	0
MA*	800	0%	0	1,600,000
MD	1,465	0%	0	2,930,000
ME	2,700	0%	0	5,400,000
MN	8,000	0%	0	16,000,000
MT	40,000	44%	35,200,000	44,800,000
NC	14,400	53%	15,264,000	13,536,000
NV	8,000	57%	9,120,000	6,880,000
NY	18,000	22%	7,920,000	28,080,000
OR	46,000	28%	25,760,000	66,240,000
PA		38%	0	0
TN	38,000	26%	19,760,000	56,240,000
VA	7,000	100%	14,000,000	0
VT	3,500	21%	1,470,000	5,530,000
WA	6,000	27%	3,240,000	8,760,000
r-value	1,532	71%	2,175,440	888,560
Total	320,792	35%	224,554,400	417,029,600

*Indicates single observation

Source: Whitney Economics