



Canna Markets Group

A Wearable Solution

Product Development for Industrial Hemp Textiles

Hemp TODAY

Introduction

Author



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Joseph has worked with multiple hemp-based apparel companies since 1997, including design and merchandising projects for hemp-based apparel lines for large-scale US-based mall chain distribution. He has worked in the Garment District of New York with vertically integrated jobbers for brands such as Calvin Klein, Donna Karen, Jones of New York, and others, and on offshore production projects in Eastern Europe and Northern China. Joseph has a deep understanding of infrastructure development for industrial hemp fiber, hurd, and oil. He holds a Bachelor of Arts (BA) degree in Creative Leadership/Liberal Studies and a Master of Professional Studies (MPS) degree in Professional Project Management.

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Hemp won't save the planet, but it makes a great pair of jeans

As someone who entered the industrial hemp space of the 1990s through a traditional retail apparel and preprint branding background, my answer to the question, “What is industrial hemp’s product development lane?” is an unapologetically apparel-based answer. Historically, hemp textiles and cordage are the only product lines that have popular culture recognition, which in my opinion, is necessary for commodifying industrial hemp and creating sustainable supply chains. I know that this opinion may not resonate with the nutraceutical cannabis CBD sector, hempcrete, hemp insulation, hemp seed, and hemp oil investors. Further, the over-invested industrial hemp processors may not be willing to acknowledge that the first-level materials produced by their facilities do not have the forward-facing consumer demand required to recoup the investments made. However, as a person who has been studying, investing in, and engaged in strategic planning in industrial hemp for over thirty years, I believe that it is necessary, to be honest about the state of the hemp industry in the U.S. and to address the question “what is industrial hemp’s product development lane?”.

SINCE RETURNING IN 2019 FROM MY INDUSTRIAL HEMP HIATUS, which began in the early 2010s, I have learned more about industrial hemp supply chains and traditional apparel realities than at any other point in my professional career. What I now understand is that hemp is no better or worse than any other monoculture or wood product crop if it is not managed sustainably and with a circular economy built into the business strategies from the start. Despite the overwhelming influence hemp apparel had on the popular perception of industrial hemp throughout the 1990s and early 2000s, I have observed little to no investment in the domestic apparel supply chain since 2018.

THE GOAL OF THIS ANALYSIS is not to say that industrial hemp sectors such as CBD, building materials, hemp seed, and oil products are not viable. However, we first need to embrace and acknowledge the fundamental roots of what hemp has historically produced well and make those high-quality products available to consumers. Hemp will not save the planet as we once believed, but it could make a great pair of jeans if we invest in the supply chain to support it. The analysis provided in this paper will make the case for investing in an industrial hemp apparel supply chain from field to finished goods.

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When it comes to textiles, hemp has a long tale to tell



Ceremonially, Confucians would wear hemp textiles during their mourning period after the death of a parent.



17th Century sailing was a hey-day for hemp, which was used in ships' ropes and sails.

Current archeological findings and written historical accounts indicate that *cannabis sativa*/industrial hemp has been a well-used agricultural resource, beginning in Asia and spreading throughout the ancient world (Li, 1974b, Pomeroy et al., 2020). *Cannabis sativa* appears to have been first cultivated by humans in Northern China, though there is limited agreement about exact dates and locations. It is widely accepted that hemp was being used as a textile, medicinal, and food source by 4,000 B.C.E. Carbon-dated evidence includes pottery shards with hemp rope imprints from Taiwan (10,000 B.C.E.) and hemp cloth imprints from Pan Po Village, Weishui Valley S. Shensi Province, China (4115-3535 B.C.E.) (Merlin, 2003). Chinese *cannabis* and industrial hemp cultivation have been identified in the Lung-shan Neolithic culture (Li, 1974a). Additionally, hemp is included in an extensive written record identifying its uses in rope and fishing nets (Li, 1974a). Ceremonially, Confucians would wear hemp textiles during their mourning period after the death of a parent (Li, 1974a). The earliest evidence of hemp agriculture in Japan appears in the Jomon period (10,000 - 300 B.C.E.) in the form of seeds and woven fibers (Mitchell, 2014). Hemp was used to produce clothing, bowstrings, and fishing lines, proving to be durable and resistant to mold and decomposition (Mitchell, 2014). Regardless of the exact dates of *cannabis sativa* and industrial hemp cultivation, it is fair to state that *cannabis* was used extensively for textile purposes throughout Asia's history (Li, 1974a, Li, 1974b).

THERE IS ALSO STRONG HISTORICAL EVIDENCE for *cannabis sativa* and industrial hemp in ceremonial, medical, textile, and cordage applications in the records of Ancient Greece and Rome. It is commonly accepted that hemp and flax are two primary sources of bast fiber used in various textile weaving applications throughout Italy and the Mediterranean region (Coletti et al., 2021). Regional evidence has shown that both plants had an agricultural foothold in the area, and the processes for utilizing flax and hemp for textile purposes were established and well-known throughout those regions of the ancient world (Coletti et al., 2021, Mercuri et al., 2002). The Scandinavian archaeological record of *cannabis* agriculture demonstrates that *cannabis sativa* was cultivated in Viking culture for industrial hemp textile applications between 375-900 C.E. (Andresen and Karg, 2011). Additionally, research into Viking Age Scandinavia (800-1066 C.E.) has produced conclusive evidence of the use of *cannabis sativa* (hemp) in the production of wall hangings, including the Överhogdal wall hanging (Lukeová et al., 2017).

EUROPEAN PRODUCTION OF HEMP TEXTILES and cordage had become com-



A fragment of the the Överhogdal wall hanging, which dates to Viking Age Scandinavia. Hemp was used in the production of the tapestry.



A 1938 Popular Mechanics article claimed that hemp can be used to produce "more than 25,000 products, ranging from dynamite to Cellophane."

monplace in the international political economy of the colonial expansion era, and the Spanish-held American territories were considered a potential asset in relieving European dependency on Russian hemp (Crosby, 1961, Díaz-Ordóñez, 2019). The hemp production issue (Russian dependence) for naval stores was used throughout the 1700s to encourage England to support the colonies with instruction in agricultural and manufacturing practices specific to industrial hemp (Nettels, 1931). During this period, much of the required materials needed for a robust naval force were imported into England from Sweden, Germany, Holland, Denmark, Norway, the East Country, and Russia (Nettels, 1931). Early records of colonial bounties confirm that hemp was in short supply, as were the proper water retting processing protocols (Boston Daily Globe, 1899). Demand for cordage and lack of domestic hemp agriculture required that the U.S. begin importing hemp fiber and yarn for rope making from other countries, including Italy and Russia (Boston Daily Globe, 1899). This brief sample of historical evidence demonstrates that hemp has been used extensively for cordage and textiles for much of human history and used throughout Asia, Russia, Europe, and the European colonies. For a more extensive historical perspective and further evidence, see J. Carringer's 2022 independent study, "[The Social, Political, and Cultural Aspects of Hemp and Human Society](#)."

IN MORE RECENT HISTORY, a 1938 Popular Mechanics article referred to hemp as the "Billion Dollar Crop." The article claimed that "[Hemp] is used to produce more than 5,000 textile products, ranging from rope to fine laces, and the woody "hurds" remaining after the fiber has been removed contain more than seventy-seven percent cellulose and can be used to produce more than 25,000 products, ranging from dynamite to Cellophane." That article was rediscovered and used as a signpost by industrial hemp and cannabis activists from the 1990s through the present day as confirmation that industrial hemp prohibition was unjust and economically costly and has been used as a rallying cry for the thousands of amazing products that could be made from hemp. While making many products from hemp is theoretically possible, I would argue that we should first look at what hemp has historically made well, specifically cordage and textiles.

INDUSTRIAL HEMP PROVIDES AN OPPORTUNITY for investments that will re-develop and reimagine US manufacturing for domestic use and global export. Investment in V2.0 industrial hemp has existed predominantly in agronomy, processing, and research. Industrial hemp can benefit from textile re-shoring investment opportunities. It is in a unique position to renew apparel manufacturing supply chains in the U.S. without competing with the fragile few remaining (traditional) apparel manufacturers still operating domestically. Existing domestic US and global cotton apparel supply chains operate on thin margins requiring the production of high-volume manufacturing to ensure profitable economies of scale (Dewan, 2023, Kim, 2024, Walker, 2024). It would not be realistic to insert industrial hemp into that supply chain, but would make sense to develop unique, sustainable industrial hemp apparel supply chains.

U.S. Hemp Industry Versions 1.0 and 2.0



Latter-day roots: Hippies, Grateful Dead, High Times

What I call U.S. hemp industry version 1.0 (V1.0) was born out of the pro-cannabis movement of the early 1990s. V1.0 was primarily activist-driven and focused on textile and cordage-based products. Though products were made from hemp, in many cases, they were not necessarily made from hemp in a way that the mainstream population would appreciate or buy, and the companies' cultural identity was oriented toward the anti-establishment activist, Grateful Dead, Hippies, and High Times Magazine counter-culture stereotypes. Two companies in particular that persist today are Hemp Traders and Enviro-textiles. These two companies have given aspiring designers and would-be hemp apparel brands access to predominantly Chinese hemp textile supply chains for nearly three decades.

IN THE LATE 1990S, HEMP INDUSTRY V1.0 was in full swing and, it may be argued, reached its height of popular culture recognition and consumer support. There were a few hemp-based body product manufacturers, including Merry Hempsters, Ohio Hempery, and Bronner's. One company that went all in on "hemp" and the idea of hemp product development was Anita Roddick's The Body Shop of the late 1990s. It is probably responsible for more mainstream acceptance, education, and understanding of hemp as a diverse agricultural commodity than any other business of the last three decades. The Body Shop did something unique: they developed an entire line of targeted, high-quality consumer goods branded with their company's logo and placed hemp front and center. There is a debt of gratitude that the hemp industry owes the collection of entrepreneurs who pioneered Hemp Industry V1.0.

HEMP INDUSTRY VERSION 2.0 (V2.0) is everything post-2018 USDA Farm Bill. Much of V2.0 can be characterized by the heavy influence of big processors like Sunstrand and IND Hemp on industry-wide manufacturing and supply chain development. With this model, it appears that hemp is being cultivated and processed first, with attempts to find products for its use second, instead of first developing consumer-facing products and consumer demand. Product lines that cultivate consumer demand are necessary to achieve economies of scale. Unfortunately, Hemp Industry V2.0 has done little to create these consumer-facing product lines.

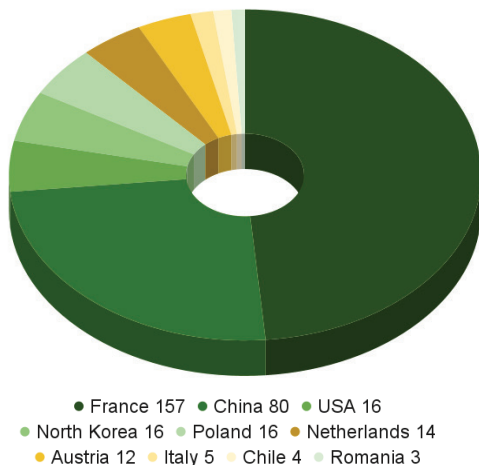


Dr. Bronner's and The Body Shop developed strong brands during Hemp Industry V1.0.

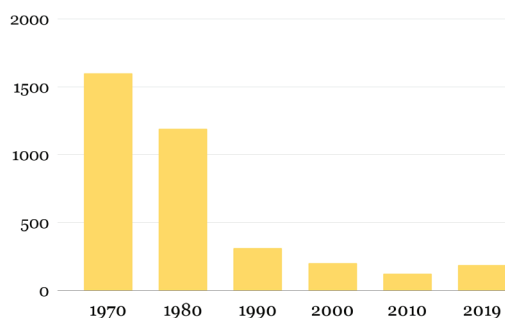


HOW MUCH HEMP?

Top hemp fiber harvesting nations;
in thousands of U.S. tons (2022)



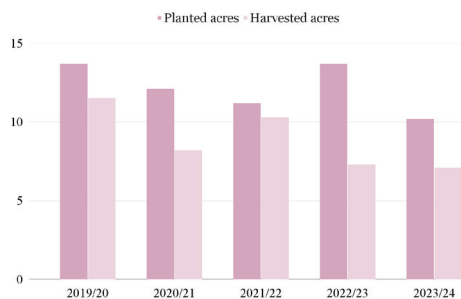
Global fiber hemp harvested
area; in thousands of acres



Source: FAOSTATS

COTTON SHRINKS

U.S. cotton fields in millions of acres



Source: USDA

The need to build demand, and reliable supply chains

Looking across the landscape of industrial hemp product lines, there are few brands the average consumer can point to with name recognition. Bronner's is probably still one of the strongest brands, but the reality is that hemp is just an ingredient in a cocktail of ingredients that comprise its line of soaps (full disclosure: I'm a Bronner's soap user). Nature's Path Hemp Heart Cereal and Hemp Plus Waffles benefit from hemp branding, but Bobby Flay himself might rightfully call foul and challenge the assertion that Nature's Path has made "hemp the star of their dish." Several smaller companies are using hemp as a material or an ingredient in their product lines, but can any be defined as a thriving mainstream popular brand?

AN ONGOING CHALLENGE faced by industrial hemp supply chains is establishing enough consumer demand to support economies of scale to stabilize agricultural production and standardize manufacturing processes. Hemp Industry V2.0's largest business development failure since the 2018 USDA Farm Bill's passing is the lack of examples of cohesive brand development for a mainstream consumer-facing product. In short, without consumer demand, the potential to produce a surplus of material exists. Due to the rising cost of goods sold for all agricultural sectors, hemp's current low per acre return makes it a high-risk crop necessitating careful planning and insurance of demand post-harvest.

ANOTHER CURRENT ISSUE to consider is the lack of reliable industrial hemp supply chains and textile manufacturing capabilities in the U.S. Why are we growing hemp in the US to offshore to other countries to finish into apparel? A simple Google search of "U.S. apparel mill closures 2024" will paint a clear and grim picture of the current fragile state of the U.S. apparel industry from the headlines alone:

["America Is Down to Its Last 100 Cotton Mills,"](#) Bloomberg - March 23, 2024

["Where Textile Mills Thrived, Remnants Battle for Survival,"](#) NY Times - Jan 29, 2024

["U.S. cotton mills are rapidly closing,"](#) Successful Farming - April 01, 2024

["Textile Industry Crisis,"](#) The Fiber Year - March 25, 2024

["Impact of potential US shutdown for apparel sector,"](#) Just Style - November 13, 2023

Current State of Industrial Hemp



The U.S. Army is exploring hemp and jute as raw materials for camouflage uniforms used by its snipers.

DOMESTIC U.S. APPAREL MANUFACTURING supply chains within any product category operate with the decades-old offshore competition that has crippled the once thriving domestic apparel manufacturing industry. These headlines clearly indicate a desperate need to triage the situation and stop the metaphorical economic bleeding.

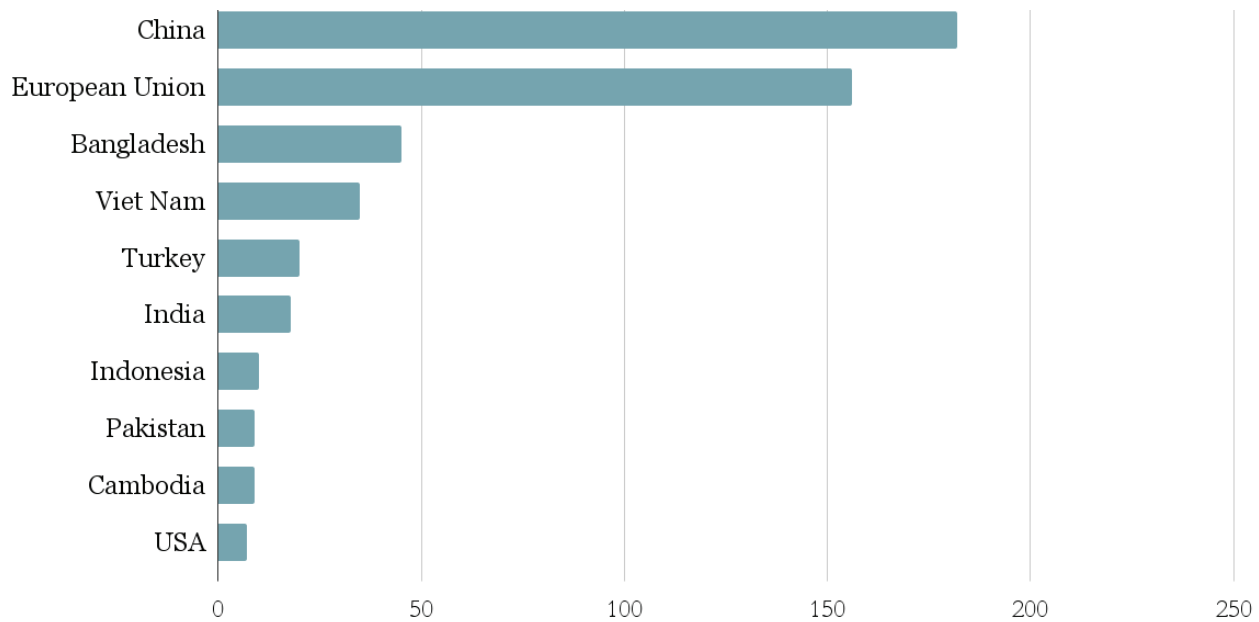
In 2022 the U.S. DOD put out an official RFI for hemp twine for possible use in covert apparel applications. Canna Markets Group submitted a skein of hemp twine sourced from China by Hemp Traders and provided the DOD with a security brief explaining that there are no reliable sources of domestically produced U.S. hemp twine, yarn, or other cordage. This point was then raised to the DOD as a potential national security risk. The current state of domestic U.S. big fiber hemp processors looking to stabilize their supersized business models by offshoring fiber into the international apparel manufacturing supply chains of China and India bolsters those economies while not addressing the lack of domestic supply chains or the national security threat. China has been playing an economically damaging long game of “Go” with the U.S. economy and manufacturing supply chains (while the rest of the world plays chess) for over four decades. If Hemp Industry V2.0 continues to pursue an offshoring model for its fiber sales instead of supporting and developing manufacturing supply chains domestically, it will continue to play into China’s long-term plan of economic dominance over the West by creating dependencies on its goods.

AS ONE OF THE FEW REMAINING BUSINESS EXECUTIVES from Hemp Industry V1.0, I feel confident in stating that offshoring was a means to an end for the vast majority of individuals and businesses procuring hemp-based apparel from offshore sources during the 1990s and early 2000s. The dream that motivated so many of us was the belief that one day hemp agriculture would be decriminalized in the U.S., and a sustainable, vertically integrated, domestic hemp apparel manufacturing supply chain from field to finished goods would be established. One of the arguments for industrial hemp as an alternative to other crops, such as cotton, is its potential for carbon sequestration. However, processing tons of hemp, shipping it in containers to Asia to be manufactured into finished goods, and then shipping the goods back to the U.S. offsets any potential carbon sequestration benefits of growing hemp. Investing in the development of domestic hemp manufacturing supply chains would greatly reduce carbon use and decrease national security risks. In my opinion, the decision-makers within Hemp Industry V2.0 are risking business failure (such as the [failure of Sunstrand](#)), lack of environmental sustainability, and loss of investors.

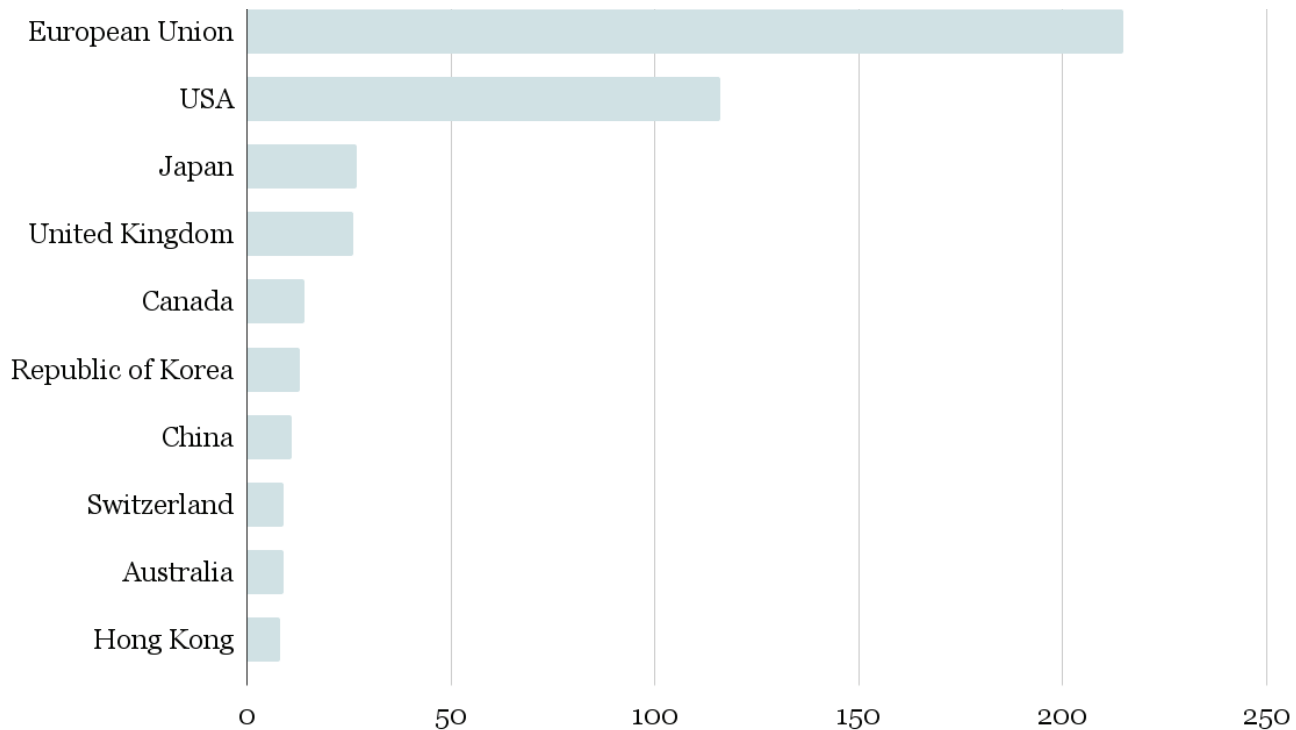


WORLDWIDE TRADE IN APPARELS

Leading exporting nations, all apparels; in \$US billions (2022)



Leading importing nations, all apparels; in \$US billions (2022)



The Future of Industrial Hemp Textiles



Focusing on cottonized short hemp fiber for textiles (top) will prevent the U.S. from competing in the most durable and high-quality hemp yarn and fabrics subsectors.

A chance to establish a robust U.S. apparel strategy

There is a popular belief amongst hemp-based textile enthusiasts that “cottonized hemp” and hemp knits will be the silver bullet to unlocking industrial hemp’s economically viable textile future. It has been reported that China (and India) have expressed verifiable interest in purchasing hemp fiber produced in North America (HempToday, 2020). Anecdotally, there are ongoing high-level discussions of plans to produce large volumes of short- and medium-length hemp fiber to be shipped to India and China, where it will be processed, spun, woven, cut, and made into garments and then shipped back to the US for retail sale. These companies are hoping to go from zero to high-volume economies of scale that would allow them to compete with the Walmart and Target pricing markets. Proponents of this “cottonized hemp” manufacturing supply chain model are focused on working with fiber that is less than 6 inches. I would argue that focusing exclusively on cottonized short hemp fiber for textile applications will prevent the U.S. from competing with longer fiber, wet and semi-wet spinning, which produces the most durable and high-quality hemp yarn and fabrics and will exclude US-made high-end hemp textiles from domestic US and global markets. “Modifying hemp to mimic cotton fiber suitable for inclusion in America’s cotton textile infrastructure seems convenient, but in reality transforms high-value hemp textile fiber into a high-cost, low-value companion of cotton” (D. Cook, Tuscarora Mills).

HEMP YARN IS NOT EASY TO WORK when weaving or knitting, requiring the appropriate conditions and equipment necessary to produce quality textiles. Products made from flat-woven hemp fabrics often have the same characteristics and require the same care as flax linen. In my experience, few knits made from hemp fiber blends are equal to 100% cotton or synthetic knits. The caveat to that has been the recycled water bottle polyester and hemp knits produced by Toasty Hemp Co. These knits are currently produced offshore and would also require reshoring an apparel manufacturing supply chain to produce them domestically. In a recent conversation, I asked Ryan Zaczynski of Toasty Hemp Co. the following question to gain some additional perspective on current challenges in garnering mainstream acceptance for an apparel brand/label.

“What is the biggest thing holding your business model back from achieving mainstream demand?”

“Everything related to hemp involves some amount of reinventing the wheel, especially if you’re trying to operate outside of the few existing supply chains. This



Recycled water bottle polyester and hemp knits produced by Toasty Hemp Co.

means the required investment for each step of building a brand is much higher than it'd otherwise be for any other brand leveraging existing distribution of cotton clothing, e.g. want a unique color? that'll be MOQ 250 pcs for hemp, whereas Bella or American Apparel probably have that color pre-made in a warehouse somewhere with 2-day shipping."

Zaczynski's answer reinforces the challenges within the industrial hemp manufacturing supply chain. However, it also casts a clear spotlight on the investment opportunity to reshore and establish a US industrial hemp apparel manufacturing supply chain that is vertically integrated from field to finished goods. Currently, with operations such as Tuscarora Mills in Bedford, PA, the US domestic hemp flat woven fabric product production potential is slightly more stable than knit production.

NEW APPAREL PRODUCT DEVELOPMENT requires brand investment and popular cultural acceptance. The current domestic U.S. brand identity of hemp remains arguably positive. The support for cannabis reform widely reflects a national understanding that there are opportunities that exist for industrial hemp. However, the industry must be able to produce consumer-facing goods

The Future of Industrial Hemp Textiles

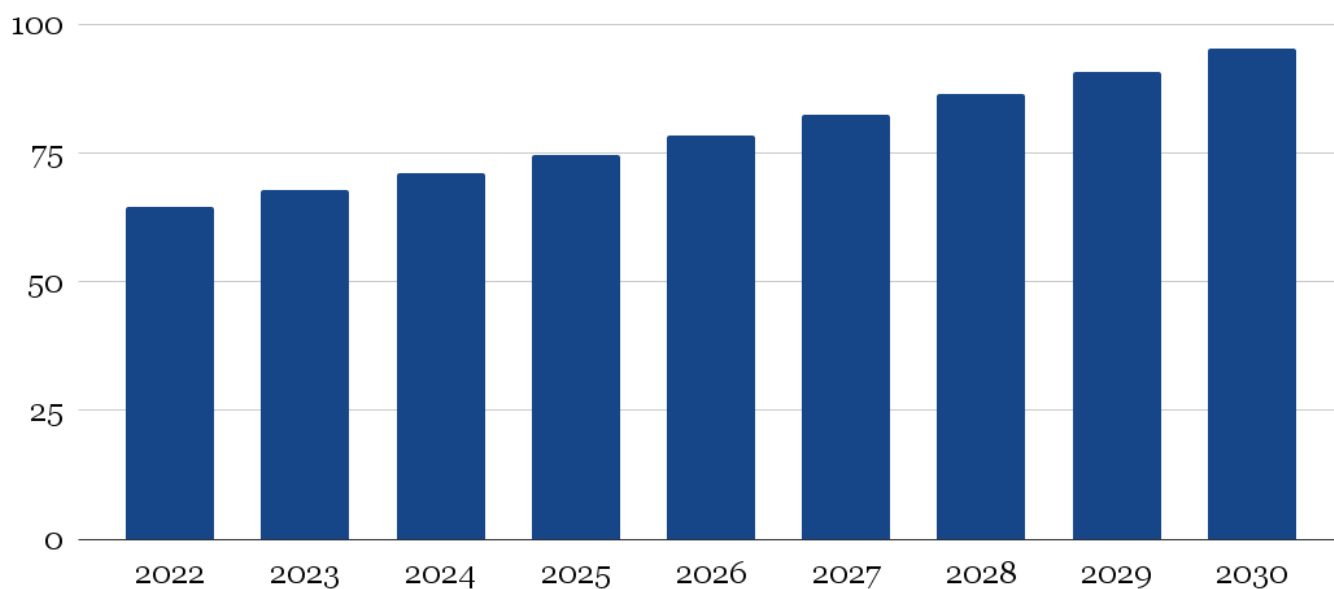
that demonstrate economic viability and customer appreciation for investments to continue. Hemp-based apparel, which embraces the fiber's performance attributes of strength and durability like hemp denim apparel, could provide a tangible product with mainstream appeal and demand.

One might ask, "Of all the theoretical apparel and non-textile products that can be produced from industrial hemp, why denim?" In my earliest days in the apparel industry, I had the opportunity to assist with apparel sales for many thousands of people while working in high-end, high-volume retail clothing stores. Having those deep roots in the retail side of apparel has provided me with a sense of perspective regarding the nuances of cultural trends that aren't always obvious to those whose background is in manufacturing. Having that perspective makes me contemplate what industrial hemp apparel products are wearable and desirable across popular culture. My answer is that the value of and necessity for a good pair of jeans in anyone's wardrobe cannot be overstated. I once read that Giorgio Armani said that the two most essential pieces a man could have in his wardrobe were a pair of blue jeans and a navy blue T-shirt.

DENIM IS AN APPAREL ITEM AND FASHION CATEGORY that traverses

DEMAND FOR DENIM

Value of the denim jeans market worldwide from 2022 to 2030; demand in \$US billions.



Source: Statista



The U.S. market for denim fabric is projected to surpass \$35 billion by 2027.

across socio-economic, academic, and cross-cultural demographics. Statistics show that “the (U.S.) market value for denim fabric was estimated to be worth 27.1 billion U.S. dollars in 2022 and was expected to increase to over 35 billion U.S. dollars by 2027” (Smith, 2023). In my experience, if a fashion-forward person is given a reason to spend money on a new pair of designer jeans, they will spend the money. In the mid-2000s, men’s and women’s pants became tighter and more peg-legged; however, current fashion trends have shifted to the more relaxed fit looks of the 1990s and 2000s. This is an exciting opportunity for hemp denim as it performs exceptionally well in classic relaxed and baggy relaxed designs. As an aside, relaxed box weave canvas hemp is also a fantastic fabric choice for cargo pants which are returning to fashionable status within integrated tech apparel communities.

Hemp denim jeans are a product that I believe consumers will consider adding to their collection if they are the right cut and the brand development team tells the right story, regardless of how many jeans they currently own. This was demonstrated throughout Hemp Industry V1.0 with a wide range of design attempts, both good and bad, that sold well.

WHEN DESIGNING A PRODUCT LINE in most product development categories, immediate mass market appeal for a broad target audience is a primary goal. Today, we are inundated with new product advertisements everywhere, from email, social media, television, and our streaming services. Although this type of mass marketing can be effective for common consumer goods, typically, it does not have the same effect on fashion. Fashion trends and popularity usually begin in small markets. They are typically cultivated with unique and exclusive labels with smaller manufacturing numbers and higher retail sales values. It may seem counterintuitive to work within developmental business plans that focus on realistic manufacturing numbers with planned scalability, but that is what I believe is called for with hemp apparel brand development.

THE EVALUATION OF DOMESTIC US AND GLOBAL SALES numbers for 2023/2022 demonstrates that there is a substantial market for denim products across varying designs and price points. Designing a hemp denim jean for mainstream popular culture acceptance should not begin with the idea of selling hundreds of thousands or even tens of thousands of units, but instead should set realistic manufacturing goals of 1000 to 10,000 units in year one to establish scalable business models with realistic sales goals. This is why it’s vital to strategically plan for product development that includes strategic business and strategic brand partnerships.

The promise in creating real value for markets, consumers

With all of the theoretical product development possibilities of industrial hemp, there remain only two products from a consumer standpoint that have stood the test of time, and those are cordage and textiles. For industrial hemp to continue to develop as a commodity in the United States, there needs to be equal investment made into historically stable product line supply chains as there has been in agronomy, processing, and theoretical developmental markets, such as building materials and food.

According to Dave Cook, co-owner of Tuscarora Mills, “There are structural / economic reasons hemp textiles are mostly absent from the American landscape. Revitalizing the hemp textile market demands new performance-based products offering real value for markets and consumers. Modern answers to old fiber production and processing challenges are also necessary. Re-branding hemp as a vital part of addressing our planet’s climate crisis and as an alternative to our civilization’s toxic reliance upon plastic for all things, including textiles, is the challenge at hand. In a world awash in toxic textile fibers and forever chemistry, hemp needs to be promoted as a wearable solution to many of our modern material ailments.”



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About



Canna Markets Group is a hemp industry information repository, think tank, and consultancy that provides data, analytics, strategic planning, business planning, and project management services to a wide variety of customers throughout various industrial hemp supply chain sectors based on a diverse industrial hemp and environmental sciences knowledge base.

Industrial hemp is a hearty agricultural crop that can be harvested for applications including but not limited to food, fuel, building materials, pulp, textiles, and composites. Global hemp markets are poised to become an integral component of growing trends toward circular economies and sustainable industry. Currently, every industrial hemp supply chain sector has the opportunity for development, innovation, and growth.

CMG clients have access to the data and experience necessary to make informed strategic planning, business modeling, and operational decisions in the ever-changing and dynamic global hemp marketplace.

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HempToday offers a wide range of information and communications services anchored by the world's leading business news platform that has been covering the hemp industries for more than a decade.

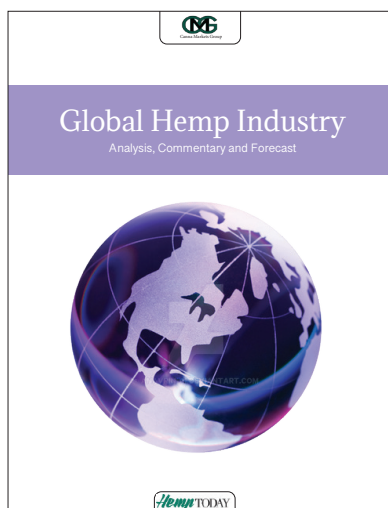
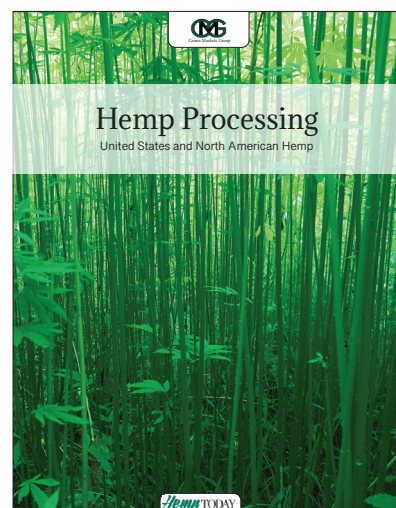
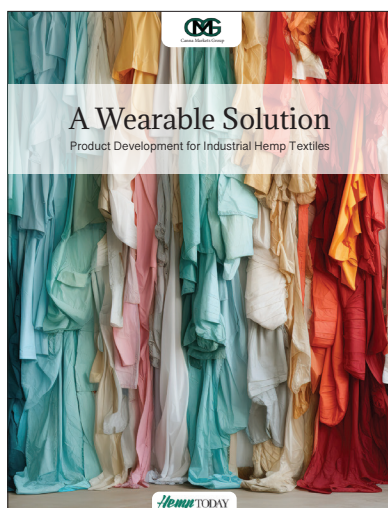
HT's mission is to reflect the dynamics of a legacy industry revolutionizing itself, and staking a claim to the future – the news, the policy and politics, the latest research and knowhow, the companies and, most importantly, the people – the scientists, entrepreneurs and innovators who are leading the hemp revolution.

We help hemp stakeholders in all facets of the industry to develop communications in a "media-first" world as a developer of websites and custom publications, a provider of content and SEO services, public relations, media relations, advertising and media consulting.

HempToday was founded and is led by Kehrt Reyher, who has more than 30 years experience in the communications industries.

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Special Reports from Leading Hemp Experts



After being overlooked as a vital agricultural commodity for nearly a century, industrial hemp is poised to become a globally strategic manufacturing resource once again. The current industrial hemp marketplace is complex, dynamic, and ever-changing. In this landscape, the Canna Markets Group / HempToday Special Reports stand out as a reliable source of expert analysis of this developing global commodity, providing critical insight and perspective of market trends to support strategic planning and business development of industrial hemp-based businesses worldwide.