

# Industrial Hemp as a Sustainable Alternative for Indian Businesses

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**Abstract**— In the current times when the world is facing numerous environmental issues, it is crucial to scrutinize accessible and superior alternatives that are sustainable. Hemp is a valuable plant because all the parts can be repurposed commercially. It has been with human civilization for thousands of years. However, the plant is still considered "taboo" in India. Hemp has gained traction lately in the country, but the growth compared to global market has been staggered. We examined the characteristics of the plant that make it so diverse, expanding on themes like history, biology, ecology, legalities, perceptions and the related industrial market. Primary data was collected to get insights into the industry by interviewing Business Owners and Employees from various start-ups in India. A mixed method study was conducted to understand the perceptions and awareness of the general populace about the hemp plant. India's potentially tremendous industrial hemp output has not been optimized because of the laws that hamper growing commercial quality hemp produce. The study addresses gaps and prospects for the industry and aims to impart relevant knowledge about the boons of the plant and a call-out for a change at the systemic level to incorporate the utilization of this magnificent plant.

**Index Terms**—Industrial Hemp, Sustainability, Indian Businesses, Tetrahydrocannabinol (THC)

## I. INTRODUCTION

It is crucial to develop vital sustainable solutions to combat climate change and enhance overall environmental health in the current times. Utilization of hemp plant in industry is one such solution as all of its parts can be repurposed commercially. Hemp requires less water, grows faster and is very effective in sequestering carbon. Fibres, oil and fuel can be extracted from it for many commercial products for the agricultural, textile, health, wellness and medicinal industry. Though a potent plant, it is still considered a "taboo" and lies in the grey areas of legalisation. The study explores the possibility and opportunities for this versatile plant to be utilised by Indian commercial businesses by eliminating such biases and sharing relevant information and awareness to open a dialogue about hemp products.

### A. History of the Hemp Plant

Humans have been using plant fibre for nearly thirty millennia. The hemp plant was used extensively by ancient civilisations. Its usage has been recorded in ancient oriental

texts (*Shen Nung, 28<sup>th</sup> century*), particularly for its medicinal properties. Roman scriptures have also mentioned using hemp in parts of Europe. Hemp is soluble with the other fibre mix and could be easily amalgamated with organic plaster used by ancient civilisations. Moreover, the plant has insect repellent properties. It has high water and heat retention rate, moisture control, helps in carbon sequestration and even sheathes the plant [15].

In India, hemp was used extensively around 1500 years ago in the construction of Ellora caves. The labourers used an amalgamation by adding hemp fibres to organic plasters. This created a pleasant surrounding for the residing monks. Mixing hemp with lime and cement material gave a solid structure to the caves at Ellora and the fort at Daulatabad, Maharashtra, India [15].

The cultivation of hemp dates back nearly five millennia. Originally grown in the belts of China, the crop was used extensively in the Asian subcontinent. It was not until the early 17<sup>th</sup> century that the Europeans understood the versatility of the crop. Hemp quickly became a vital source of earning money in the agricultural sector. The hemp crop landed in Kentucky, United States in 18<sup>th</sup> century where it became a success on an industrial level. Paper made from hemp fibres was used for drafting the "Declaration of Independence" in the US. Additionally, the fibres were used by Levi Garret to manufacture jeans [6].

### B. Biology and Ecology of the Plant

The hemp (*Cannabis sativa L.*) plant is an aromatic, annual herb. The plant has compound leaves and seed producing flowers. The outermost layer of the hemp fibre is made up of "Bast" (epithelium of a plant cell, consisting of cortex and phloem) [5]. The cell wall has rich deposits of cellulose, hemicellulose, lignin and pectin. The phloem bundles are two to five centimetres tall. This herbaceous and dioecious plant has a life cycle of nearly six months. It needs to be cultivated in the summer season as it demands longer daylight hours [7].

The suitable climatic conditions for hemp agriculture are in the temperate zone ranging from 1200 meters to more than 2200 meters. It needs moisture and aerated soil with slightly basic (6) pH. Hemp is usually cultivated in cropping patterns with other crops due to the constricted space in the mountainous regions of Uttarakhand, India. The more carbon capture potential and

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low capital demand in cultivation makes it a very useful resource for industrial usage more so in the developing countries. [12].

### C. *Hemp as a Sustainable Alternative Crop and Prospects*

Hemp and flax fibres were used extensively in the textiles business before because of their strength and robustness, but cotton became a mainstream raw material post-industrial revolution in the 18<sup>th</sup> century. When compared with hemp, the cotton plant has few limitations, primarily the ecological conditions required to yield natural cotton and it cannot be cultivated in sub-tropical regions. Hemp is a "Bast" fibre crop that can be grown across areas with reasonable climate conditions. The plant also provides higher productivity than its counterpart. Cotton also requires extensive water and chemicals to maintain a decent yield [5].

However, the cotton plant has high levels of cellulose in its cell wall, which makes the crop versatile and the fibre, strong. Organic hemp fibres might not be as soft as cotton fibres, but their durability makes them a viable option in the textiles industry. The introduction of the threshing machine was significant in making cotton a mainstream crop in the 18<sup>th</sup> century [2], [5].

Modern artificial polyester fibres, made from plastics and other synthetic materials are used in the sports and automobile industries as they are light but robust, do not decompose and are accessible. Although it is vital to note that not only these fibres have a high manufacturing price, they extensively require energy usage and do not degrade with time, making them a burden on the environment [18].

Plant-based organic fibres have diverse applications in the auto vehicle and construction industries due to their thermal transmission properties and dimensional consistency. They are a viable alternative to the modern polyester blend materials. Furthermore, the plant fibres can significantly reduce the product's overall weight and energy consumption load during the manufacturing process. The fibres are environmentally friendly and cost-effective [18].

Hemp fibres need less than one-third of the land space occupied by cotton to provide the exact yield [4]. This is useful for the textiles and fashion industry which is one of the biggest generators of carbon footprint. Hemp does not require additional chemicals like pesticides and insecticides, making it a safe crop for the soil and farmers.

The cost can play a vital role in the Indian economy, considering a significant number of the farmers and cultivators in the country belong to the lower socioeconomic sector. The overall cost of cultivation and agricultural labour used for growing hemp fibre is 77% less than the cotton, making it a cheaper option than cotton and bamboo. Once the plant is legalised for cultivation in significant states in the country, it will make the whole supply chain cost-effective and make it easier for consumers to buy more sustainable industrial hemp products. This would also boost the current major players in the fashion industry to switch to hemp. Furthermore, the change can also promote a generation of young entrepreneurs to start their hemp businesses.

### D. *Legal Aspects, Government Norms and Policies*

According to the Narcotics Drugs and Psychotropic Substances Act of 1985, "Industrial Hemp products containing 0.3% Tetrahydrocannabinol (THC) can be sold legally in India." Currently, in India, hemp cultivation is legal in the states of Uttarakhand and Uttar Pradesh, while Madhya Pradesh, Manipur and Himachal Pradesh are to follow. The laws in India for importing raw hemp are similar and offer no restrictions if the natural hemp satisfies the requirements for plant sanitation and safety norms [1], [16].

### E. *Industrial Hemp for Commercial Businesses*

Minimal research has been conducted on usage of Industrial hemp in India. Due to this limitation, we have incorporated research and case studies from the West and other South Asian counterparts. Hemp is a beneficial plant because all the parts can be repurposed commercially. Fibres are robust and resourceful. Hemp seeds are rich in various micro and macronutrients like potassium, iron and zinc and hence are a viable and sustainable option [14]. Using the threads, one can produce twine, paper, concrete supplies, beauty and wellness, and textiles. The oil from the plant is rich in cannabidiol (CBD), which is used in the beauty-wellness, medicine and pharmaceutical industries. The seeds are also viable in manufacturing hygiene products, engineering oil and foods like pasta and other appetisers. CBD has also shown promising results in treating conditions like epilepsy and can be used as a substitute for analgesics and antidepressants [8].

Industrial hemp offers immense possibilities in the energy sector. So-called hemp biomass can be used as an energy crop because of its significant terrestrial usage efficiency, minimal nutrient consumption and chemical pesticides. The oil can be extracted and utilised as bioethanol, biohydrogen and biodiesel. It can be provided as a cheaper and sustainable alternative to fuel [14].

As the global economy is growing and so is the industrial hemp market, it is crucial to assess the current needs in developed nations like the United States to follow the growth trajectory and compare them to the other countries. However, knowledge of the exact pricing and margins of the industry is ambiguous for the populace. The finding suggests that there needs to be substantial market research in the agro-economic hemp industry to assess the state of commerce [9].

Hemp is one of the cost-effective materials that can be used for manufacturing paper. This is because of the dense cellulose content, shorter harvesting time and durability of the fibres. Studies have shown that paper hemp can be recycled up to eight times, compared to three from the bark. Additionally, cultivating hemp is a great source to grow the local market and boost the village economy. The industry also opens an opportunity for the farmers to increase their livelihood. However, the industrial hemp produced here is of slightly different quality and progressive technological systems are required to create robust fibres [3].

The scientific society is yet to study the limits of using hemp and the benefits of this versatile plant [3]. It is a definite contributor to the forward-moving "Green" economy. Cultivating hemp in local regions is an excellent source of income for the local towns people in North India.

To gain a strong foothold in the textiles industry, hemp needs to undergo specific processes involving technological changes to enhance the fibres. The procedure incorporates motorised harvesting, retting using water and scutching. The hemp stalk needs to be around three-meter high while harvesting. The plant needs to acclimate to the machinery changes to make it ready to use commercially. Companies can cut costs by using pre-existing machinery used for flax for processing the hemp plant. The process can be more accessible by fragmenting the stem stalk during retting. The fibres can be used according to the size and shape of the branch. Aggressive sowing, around one quintal of seeds for every hectare, is sprayed with a water-absorbing chemical (desiccant) to control the growth of the hemp stalk. Simultaneously, the fibres will undergo nascent pulling, retting, and scutching procedures. The product can be later transferred to a textiles workshop to spin the fibres into yarn. The process is essential to ensure that the hemp stalk can be used for the same machinery for processing flax [13].

Although this process saves the need to invest in newer technologies, it comes with disadvantages. The price of cultivating is more and the straw yield is inferior to growing hemp conventionally. Using these methods also means using chemicals and forcibly controlling the growth of plants results in juvenile fibre growth. Studies highlight that the chemical composition of hemp fibres undergoes a significant change from the primary component after the refining process [13],[19].

Due to the hemp cultivation legalities, companies in India often import raw hemp from countries like China, North America, and Europe because of the comparatively flexible import laws. It can often become cumbersome to maintain the THC levels in the seeds; hence importing becomes an expensive but more accessible alternative [1].

#### *F. People's Awareness and Perception of the Hemp Plant*

Even with all the miraculous and sustainable properties, the plant is considered a "taboo" in our Indian society. Hemp lacks the psychoactive effects of its counterpart marijuana, yet people associate them as same. This misrepresentation is one of the major reasons that people are not aware about the versatile usages of the hemp plant. Although the plant has been exploited in India for thousands of years, the legalisation curve for the plant has restricted the hemp industry. This is a problem for the farmers as well because they are unable to grow and utilise the potential of hemp [11].

## II. METHODOLOGY

The research conducted was a mixed-method study. Primary data was collected by interviewing experts from the Indian hemp industry—the participants in the study work in the industry in the capacity of business owners and employees. The questions asked for the vis-à-vis interviews explored the themes of biology, cultivation, procurement, commercialisation, marketing, legalisation and perceptions of the hemp plant and the industry. The questions were devised carefully to assess the gaps found in the literature and aim at solving the research questions.

The study incorporates insights into the nuances of the hemp plant and the industry by conversing with five representatives

from the hemp industry. They were in the hemp business in fashion and textiles, essential oils, fitness and lifestyle, nutrition and pet products. Apart from the very few Indian hemp businesses, the small sample size is attributed to the time constraint or the unwillingness of the business owner to participate. Finally, the business owners who had a license or had applied for a permit to sell industrial hemp products in the market were chosen. The responses were transcribed and parallels drawn between the literature review and the responses as analysis. To maintain anonymity, the interviewees were renamed to Business Owners 1, 2, 3 and Employees 1 and 2.

The perception of the general populace and consumers on the hemp plant and industrial hemp products was examined by conducting surveys with interval scale, ordinal scale and multiple-choice questions. The second part of the survey was open-ended questions to get insights on spreading awareness and education about the plant. The questionnaire was completed by one hundred and twenty participants from across age brackets (18-25,26-35,36-50 and above 50 years) and various socio-economic backgrounds to avoid biases in the data. Personal Identification details were not collected to maintain complete anonymity. The goal was to educate the people about the beneficial effects of industrial hemp and take a step closer to removing the stigma around the hemp plant. The themes were identified to understand the populace's perception, and the responses were categorised. The study was approved by the University's review board (IRB Approval number: 2022/01/04/FSP/EXP). Through this survey, we tried to answer the reasons for versatility of Industrial hemp; its utilisation by Indian businesses in their commerce; the perception of the hemp plant, and has it resurfaced in modern times?

## III. FINDINGS AND ANALYSIS

The responses were collated and assessed to analyse the answers to the research questions. One important finding in the process is non-availability of ample studies in the industrial hemp commerce conducted on Indian businesses. We have answered the hemp plant's versatility and sustainability through secondary research and information given by the industry experts we interviewed. Further analysis shows how the Indian businesses are utilising hemp currently and the perception of the Indian populace of the hemp plant.

### *A. Brands, Motivation and Stories*

The interviewed business owners were from fashion & textiles, essential oils, fitness & lifestyle, nutrition and pet products sector. They had ventured the industrial hemp industry because of curiosity and passion for the versatile plant. In words of one of the interviewees, "It is shocking not to see more people taking up this plant and using it for sustainable values. We are not new to this plant as our ancestors have also used it extensively. The motivation was simple, to use this diverse plant at the heart of sustainability since it is not limited to a few industries." It is established that every part of the hemp plant can be reprocessed, used and sold commercially [8].

### *B. Cultivating, Sourcing and Procuring Hemp*

While the laws and regulations for the hemp cultivation in the country are stringent, the experts mentioned that it was not challenging to procure hemp for their businesses. Cultivation of

hemp in India is legal in the States of Uttarakhand and Uttar Pradesh. Naturally, most of the enterprises procure raw hemp from there. Of around two hundred legal hemp start-ups in the country, only about 10% of them cultivate hemp. In contrast, the others rely on local farmers for cultivation and only procure the harvested hemp, mentioned one of the experts.

One of the cofounders of a physical fitness brand that sells yoga mats made from hemp fibres procured hemp from Nepal because of the ease of access, the plant's superior quality and legal flexibility of its procurement. The so-called "Big players" based out of Mumbai and Bengaluru also import raw hemp seeds from the West to comply with the legal requirements of maintaining < 0.3% Tetrahydrocannabinol (THC) in the final product.

### C. Legalities and Regulations

As mentioned earlier, the Narcotics Drugs and Psychotropic Substances (NDPS Act) of 1985 regulates the cultivation and commercialisation of industrial hemp in India. One of the respondents had criticised the law as it is challenging to maintain consistency of the seeds because the seeds growing in the wild might not have less than 0.3% THC. Hence, the seeds procured be genetically modified, or should have THC levels under compliance, making them legal to cultivate and sell. The cultivation power and inventory of raw hemp are often stored with the excise department and the businesses must procure the plant from them. However, the participants provided a mixed opinion on procuring hemp from the excise department due to the issues of quality and accessibility. Hence, most of them preferred to deal with the local cultivators directly.

One of the business owners highlighted that India allows the hemp cultivation only in Uttarakhand and Uttar Pradesh, while the same would follow in Himachal Pradesh, Madhya Pradesh, and Manipur. Another leading insight from the discussion was a proposed change in the Integrated Drug Policy Act to allow the cultivation of seeds with around 1% THC levels in the state of Himachal Pradesh.

The experts also highlighted the significance of legalising cultivation state-by-state rather than at a Union level. This would ensure the states where hemp is naturally grown can capitalise on the industry while maintaining the quality of the plant. Further, the Goods and Services Tax (GST) is around 12%, while the same for organic cotton is 18%. This is a potential move for promoting businesses to use more hemp-based sustainable products.

On a positive note, the Food Safety and Standards Authority of India now recognises the selling of food products infused with hemp if the THC levels in the raw seeds can be maintained at 0.3%. This is a bold move by the authority and will open more opportunities for Indian businesses to make industrial hemp-based nutritional products. Additionally, the amendment will apply to beverages, hemp flour and seed products. The authority also mandates that the products are safe for the general populace aged two and above [10].

Another critical insight from one of the interviews was that the Government has made laws based on THC and CBD and has neglected vital cannabinoids like Cannabigerol (CBG) and Cannabichromene (CBC). These hemp compounds are non-psychoactive and have medicinal and therapeutic properties.

### D. Business and Marketing

Except for one, all the companies interviewed targeted the Direct-to-Consumer business space. They feel it is significant to directly sell to the customer to generate awareness and educate them about this beautiful plant. All the interviewed businesses had been set up in the online space. Additionally, two companies were also in the export sector, primarily because of a higher level of awareness overseas. Their products are exported to Nepal, Vietnam, Japan, The United Arab Emirates, Belgium, Italy and Russia.

All the businesses have their personalised website domains to sell their products. Only one of the brands was available on marketplaces like Amazon. The cofounders highlighted the difficulties for an industrial hemp-based business to get accepted to online retail stores due to a perceived lack of awareness about the products and the legalities. Interestingly, one of the interviewed companies planned its business around becoming an online retail platform for all things organic, sustainable and fashionable.

Furthermore, one of the business owners mentioned the adverse effects of aggressively marketing sustainable products drive the consumers away as the phenomenon becomes repetitive. Hence, businesses should also focus on specifics. An example would be to focus on the hemp plant's monetary value and quality and creating a positive atmosphere around the brand. Corporations often include only destructive imaging about sustainability and climate change, which can become overwhelming and deludes the idea of harnessing solutions.

### E. Perception and Awareness

Due to hemp's numerous viable industrial uses, the plant should be at the core of the sustainability revolution, especially in industries like fashion, construction, energy and pharmaceuticals, which generate a heavy carbon footprint and wastage. However, the speciality of this plant often goes unnoticed due to two reasons; lack of general awareness and law enforcement.

We found that the split between the general population was equal in terms of gender representation (49.2% females and 50% males, 0.8% being others). 56.7% of the respondents were from 18 to 25, while 31.7% from ages 36 to 50 with 5.8% respondents from each 26 to 35 and the 50+ age bracket.

Around three-fourths of the respondents knew the term hemp but most of them have misinformed opinions and perceptions about the plant. Of all the respondents, one-third of them were aware through word of mouth from family and friends. Social media has had a significant impact with a quarter of them. Interestingly, a small number of respondents were introduced to hemp via school curriculum and academic journals. One-fifth of the total respondents had never heard about hemp (Fig.1)

How did you first come across this term?  
120 responses

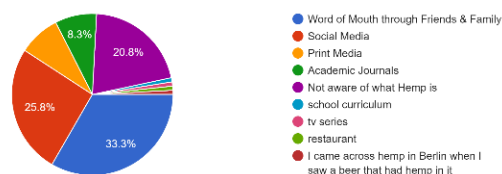


Fig. 1. Different sources of the hemp awareness in general populace.

A majority of the respondents were aware of the medicinal uses of hemp, while the awareness of its industrial use was not very prominent. One-third of the respondents were aware of hemp's versatile benefits in textiles, nutrition, and agriculture. In contrast, only a handful of the people were mindful of hempcrete and bio-energy from the hemp plant. Every fifth respondent was not aware of industrial hemp (Fig.2).

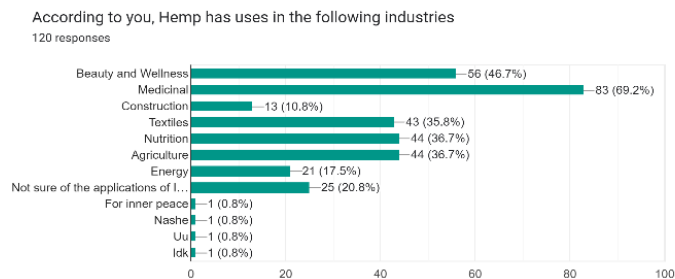


Fig. 2. Awareness on hemp industry and commercial products.

Although 75% of the respondents were aware of hemp, only 25% had consumed or used products made of industrial hemp. Questions were also asked to challenge people's perception of hemp products regarding legality. Around 40% of the respondents feel that selling hemp products in India is legal. In contrast, around the same number of respondents were unsure about the legalities involved with industrial hemp production and commercialisation (Fig.3). However, half of the respondents (60) were unaware of the Indian industrial hemp market. The study found a lack of awareness and education about this plant in most samples.

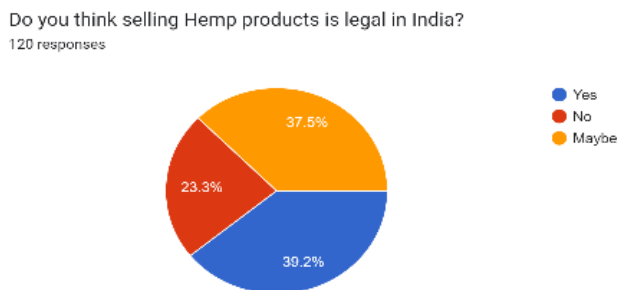


Fig. 3. Awareness on legality of hemp products.

Only a handful of the respondents knew about the untapped potential of the industry, which is at a nascent stage in the country. The global industrial hemp market is valued at 4 billion dollars and is expected to reach 15 billion dollars by 2027 [17]. However, India's contribution to the industry is a mere 0.1%, worth just over 4 million dollars. As of 2019, the Asia-Pacific region accounted for over 30% of the total industrial hemp market, with China being the largest exporter of the material.

An intriguing insight indicated that a proportion of the respondents confused hemp with its psychoactive counterpart, "Marijuana" as it is the same plant *Cannabis sativa*. A small percentage of the respondents also highlighted the importance of legalising hemp cultivation as it could be a financial boost for the economy and a viable crop for local farmers to grow. Rightly stated by a concerned respondent, "The hemp industry in India is booming, with a new crop of entrepreneurs ready to

battle the odds and bet big on the versatile plant by creating innovative products that fit right into the wellness Zeitgeist." We found that the vote was statistically equivalent between the respondents who agree that hemp is a taboo plant to those who disagreed and have a neutral opinion about the plant.

The respondents conveyed the Government's significance in promoting and marketing hemp products to ensure its reach in the masses. Marketing through the Government channels also reassures the public that the products associated with industrial hemp are legal. State-wise, legalisation will also encourage the farmers and industries to invest in the plant and eliminate the bias.

Our study clearly indicates that the demand for industrial hemp will grow in the future. This will create a new wave of entrepreneurs while also opening possibilities for the already established companies to utilise the potential of the hemp plant. This will rely heavily on legalising hemp cultivation, which so far is only permissible in Uttarakhand and Uttar Pradesh. It is at the State's disposal to legalise hemp cultivation and devise policies. Currently the laws only focus on maintaining the THC levels but do not entirely consider the presence of other cannabinoids in the plant.

A majority of the populace had heard of the term hemp but often confused it with marijuana. Many respondents were unaware of the commercial sale of industrial hemp products which clearly indicates the lack of awareness and education about this plant in our society. Furthermore, according to the analysis, it is also a challenge to get into online retail platforms due to a negative perception of hemp. Hence, companies prefer to market and sell on their customised websites and their social media handles.

#### IV. CONCLUSION AND FUTURE PROSPECTS

The hemp plant is versatile, with every part of the plant usable for repurposing into sustainable products. The plant has been used extensively and holds historical value. However, as per the current status, guidelines, rules and regulations, only two states are allowed to cultivate the plant. The plant ranks significantly higher than its counterparts like organic cotton in terms of cost-efficacy, water and carbon footprint, disease resistance and yield.

Hemp is a potent crop as it can be used in an array of industries. The sector is booming and developed overseas, but the market is still at a nascent yet promising stage in India. The industry still has not attained its summit due to the Government's feeble support. The laws for cultivation have not been updated and the value of the plant is demoralised. The hemp plant can only boost the local farmers and the economy if its potential is maximised. Thus, with the mentioned plethora of advantages, using Hemp is aligned with United Nations Sustainable Development Goals; SDG 7 (affordable energy and biofuels), SDG 12 (sustainable use of plant resources), SDG 13 (combating climate change) directly [20].

While most companies in the sector prefer a direct-to-consumer product business, some also focus on exporting raw materials. People are aware of the term hemp but lack the correct representation and meaning behind it. Furthermore, the plant comes with many stigmas attached to it, due to which hemp's sustainable properties are overlooked. This can only be

changed through active efforts and support from the Government.

Since cultivation and procurement are crucial elements of the hemp industry, future research prospects can establish a dialogue with local farmers and cultivators to get a more practical approach to growing hemp and its nuances. Devising clear cut guidelines, policies and boost from the government can support tapping the full potential of the plant. Our study anticipates adding value to this field and potentially encouraging more profound research in the future.

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