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THE ECONOMIC AND SOCIAL POTENTIAL OF *CANNABIS SATIVA L.* FOR THE SUSTAINABLE DEVELOPMENT OF A COUNTRY: Brazil as a case study

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Resumo

A paisagem global que rodeia a *Cannabis sativa L.* demonstrou uma transformação significativa nos últimos anos, com mais países a explorar os seus potenciais multifacetados. Esta tese busca desvendar os diversos benefícios que as nações podem colher através do investimento na indústria da cannabis, com foco especial no Brasil. Este estudo investiga diversas fontes, incorporando literatura acadêmica, reportagens da mídia e publicações governamentais.

A revisão abrangente de trabalhos académicos, incluindo artigos, livros e trabalhos de investigação revistos por pares, ilumina as vantagens económicas e sociais associadas ao investimento na cannabis. Complementada com *insights* de meios de comunicação e relatórios respeitáveis, esta tese se esforça para fornecer uma perspectiva holística sobre tendências do setor, dinâmica política e estudos de caso do mundo real. A análise temática serve como pedra angular da interpretação dos dados, facilitando a identificação de temas recorrentes, padrões e conclusões principais nas fontes recolhidas.

O objetivo desta investigação é colmatar a lacuna de conhecimento em torno da *C. sativa*, a partir das suas complexidades biológicas e significado histórico e, ao fazê-lo, discernir caminhos para o enriquecimento financeiro e social. À medida que o discurso global sobre a cannabis continua a evoluir, este estudo oferece entendimento sobre as perspectivas e desafios associados aos investimentos em cannabis e aos muitos mercados do negócio, preparando o terreno para uma tomada de decisão informada numa indústria em rápida transformação.


Palavras-chave:

Indústria da cannabis; Investimento; Desenvolvimento sustentável; Benefícios econômicos; Benefícios sociais; Brasil

Abstract

The global landscape surrounding *Cannabis sativa L.* has demonstrated significant transformation in recent years, with more countries exploring its multifaceted potentials. This thesis seeks to unravel the many benefits that nations can reap through investment in the cannabis industry, with a special focus on Brazil. This study delves into diverse sources, encompassing academic literature, media reports, and government publications.

The comprehensive review of scholarly works, including peer-reviewed articles, books, and research papers, illuminates the economic and social advantages associated with the investment in cannabis. Supplemented with insights from reputable media outlets and reports, this thesis strives to provide a holistic perspective on industry trends, policy dynamics, and real-world case studies. Thematic analysis serves as the cornerstone of the data interpretation, facilitating the identification of recurring themes, patterns, and key findings across the collected sources.

The goal of this research is to bridge the knowledge gap surrounding *C. sativa*, from its biological intricacies and historical significance, and in so doing, discerning avenues for both financial and societal enrichment. As the global discourse on cannabis continues to evolve, this study offers insights into the prospects and challenges associated with cannabis investments and the many markets in the business, setting the stage for informed decision-making in a rapidly transforming industry.

Keywords:

Cannabis industry; Investment;  Sustainable development; Economic benefits; Social benefits; Brazil

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# 1. Introduction:

Historically, there has been ample use of *Cannabis sativa L.* for thousands of years (Government of Canada, 2020). After the prohibition of this plant in the 19th century, the legalization and regulation of cannabis is still a controversial topic across the world. However, in recent times, various countries have started to embrace the potential economic and social benefits that come with investing in cannabis and have begun to change their laws. This thesis explores the benefits that a country could potentially derive from strategic investment in cannabis, with focus on Brazil as a compelling case study.

Hemp and cannabis are both varieties of the same plant species - *Cannabis sativa L*. However, they are distinct in terms of their cultivation, chemical composition and uses. Hemp is a variety of *C. sativa* that is primarily grown for industrial purposes (Cosentino et al., 2012) such as producing textiles, paper, biofuels, and construction materials. It is typically grown outdoors and contains very low levels of tetrahydrocannabinol (THC), the psychoactive compound that produces the "high" associated with cannabis use. In the United States, hemp is defined as a cannabis plant that contains less than 0.3% THC by dry weight (Johnson, 2018), although still rich in CBD (cannabidiol), a non-psychoactive compound with potential therapeutic benefits. Meanwhile, cannabis refers to the variety of *C. sativa* that is primarily grown for its high THC content, making it popular for adult (recreational) and medicinal use. This one is typically grown indoors under controlled conditions to maximize THC production, and they can contain much higher levels of THC than hemp plants.

Considering that cannabis is a versatile plant with numerous applications in various industries, including medicine, textiles (Karche & Singh, 2019), and recreational use, its legalization and regulation could stimulate a new industry with vast potential for job creation and revenue generation (Fortune Business Inside, 2021). In terms of some environmental benefits the plant offers, one example is that hemp cultivation requires less water than many other crops (such as corn and cotton), making it a more water-efficient choice (Cannabis Horticultural Association, 2020), with the possibility to integrate proper irrigation techniques in order to further enhance yields. Additionally, hemp plants

have deep roots that help to aerate the soil and prevent soil erosion (Atakan, 2012), improving soil health and reducing the need for chemical fertilizers. Besides retaining more carbon dioxide from the atmosphere than conventional crops (Atakan, 2012), cannabis plants also have the ability to absorb toxins and pollutants from the soil (Backer et al., 2019), making them a useful tool for phytoremediation (using plants to clean up contaminated environments). All these characteristics amount to a reduction in the negative environmental impacts of agriculture, promoting a more sustainable land use.

The social benefits of investing in cannabis are also noteworthy. This plant has been found to have medical benefits, including pain relief, appetite stimulation, and anti-inflammatory properties (Lima et al., 2021). Legalizing and regulating cannabis for medical use can provide relief for individuals suffering from chronic illnesses, meaning that those who need it for medical purposes could access it safely and legally. Furthermore, regulating cannabis can reduce the number of individuals incarcerated for minor drug-related offenses, which can help to reduce the burden on the criminal justice system and promote social equity (Kaya Mind, 2022). Additionally, cannabis cultivation can create new job opportunities, particularly in rural areas where other employment opportunities may be limited. This can stimulate economic growth and reduce poverty.

Cannabis cultivation can also offer several economic benefits to a country. First, it can generate significant tax revenue for the government through the sale and regulation of cannabis products (Braun & Bloomberg, 2021). Second, cannabis cultivation can create new job opportunities, which also helps the country financially. Third, cannabis can be used to produce a range of products, including textiles, paper, and building materials (Karche & Singh, 2019), creating new industries and opportunities for entrepreneurs. Finally, the reduction of the burden on law enforcement frees up resources that can be redirected towards other priorities (Hall, 2020). Overall, the economic benefits of cannabis cultivation are significant, and can contribute to the development of a country's economy.

Besides evaluating the economic and social benefits of investing in *Cannabis sativa L.*, its main purpose is to discuss how such economic and social benefits could materialize in the case of Brazil. Brazil has a favorable climate for growing crops, and it is even better for hemp plantations, which can

lead to high yields and increased profitability for farmers. This country is well-positioned to become a leader in the production of hemp for industrial purposes, which could create new industries and opportunities for entrepreneurs. A study by Kaya Mind (2022) estimated that approximately $4,9 billion BRL would be moved in Brazil after the 4th year of regulation of hemp, and there would be a tax collection of $330 million BRL, which could be reverted into public policies that mitigate the historical damage that the prohibition of cannabis caused, as well as towards public health and education.

This study will involve an extensive review and analysis of academic literature, including peer-reviewed articles, books, and research papers, in order to gain a comprehensive understanding of the benefits associated with cannabis investment. Additionally, media articles and reports from reputable sources will be examined to gather further insights on real-world examples, industry trends, and policy developments related to the topic. It will also hold government published reports regarding data on cannabis and impacted sectors.

The analysis of data will be conducted through a thematic analysis approach, involving the identification of recurring themes, patterns, and key findings across the collected sources. The study will focus on extracting pertinent information, while synthesizing the data to provide a broad overview of the cannabis industry, exploring the economic and social benefits that a country can gain when investing in the many sectors the plant offers. The investigation will also consider the credibility and reliability of the selected sources, ensuring that a diverse range of perspectives and viewpoints are included.

As the main goal of the current research is to understand *Cannabis sativa L.*, its history and biology (to better comprehend how to turn a bigger financial and social profit), the different sectors involved, as well as the difficulties and opportunities, the current study will consider the credibility and reliability of the selected sources. And, as there is a lack of informative academic content on this important matter, the findings will be presented in a structured and coherent approach, highlighting the various benefits of cannabis investment identified in the analyzed academic articles, media sources, and reports. This work unfolds as follows. Chapter 2 delves into the background of *C. sativa*, covering

the biology, applications, history and regulations. In chapter 3, topics such as economic, social and environmental benefits will be presented. The concluding chapter is used to offer a summary with conclusive remarks, as well as to mention some limitations of the study.

2. Background

In the recent past, there has been an increased global interest in cannabis, in particular in nations that have embraced regulatory changes facilitating the cultivation and trade of the plant, as well as its associated derivatives. These transformations have sparked the heightened intrigue, driven by the many applications of *C. sativa* and the potential to enhance user well-being while also capitalizing on the multiple derivatives stemmed from the plant (Karche & Singh, 2019). This unfolding landscape has evoked increased research endeavors aimed at developing and improving products. The present background chapter delves into a comprehensive analysis of cannabis, encompassing its biological aspects, varied applications, historical significance, and its current status. By exploring these dimensions, one is able to have a more holistic understanding of the complexities of the plant, laying the foundation to fully grasp the potential economic and social benefits that nations can attain by strategically investing in cannabis. These advantages will be elucidated in further chapters.

2.1 Biology of *Cannabis sativa L.*

Although hemp and cannabis are both subspecies of the same plant, Cannabis sativa L., they are distinct with regard to their cultivation, chemical composition, and uses. Hemp is a type of Cannabis sativa that is mainly grown for industrial purposes, meaning it produces textiles, paper, biofuels, and construction materials (Cosentino et al., 2012). The production must be pre-pressed in order to be able to use the plant for these ends. It was created from a genetic selection that helped evidence the desired characteristics and contains very low levels of tetrahydrocannabinol (THC) - the psychoactive compound mostly known for its' association with the adult use of cannabis. The United States of America defines hemp as a cannabis plant that contains less than 0.3% of THC by dry weight (Johnson, 2018), although each country has a different regulation, ranging from 0,2% to 1% of THC by dry weight.

Hemp is typically grown outdoors, as this variant does not require a *hands-on* approach, nor a complex infrastructure, and this kind of cultivation allows the plant to grow to its maximum size,

yielding more fiber.  According to Johnson (2018), this fiber is used in the industrial branch of the cannabis industry, and although all of it can be harnessed, the inner fiber is what is used to produce panels, mortar, paper filling, hemp bedding, female absorbents and chemical raw materials (such as paint, plastic and sealants).

In contrast, cannabis refers to the Cannabis sativa variant essentially grown for its high THC content, compound used for medicinal and adult purposes. Because of this need to control the cultivation in order to extract the most THC, terpenes and phytocannabinoids, this subspecies is typically grown indoors, under controlled conditions to maximize THC production and guarantee a product with quality.

In terms of the structure of the plant, Cannabis sativa exhibits clear male and female reproductive structures. The male plant has pollen bags that release pollen when opened, which then lands on the flowers of female plants. The now fertilized flowers evolve into seeds to produce new crops. On the other hand, the female plant produces an inflorescence (cluster of flowers on a branch) commonly known as the bud, in which a high amount of resin and phytocannabinoids is concentrated, highly influenced by how much light the plant has access to (Backer et al., 2020). This last compound is responsible for the therapeutic properties of cannabis and is the most valuable part of the plant in the cannabis market, due to most of the inputs produced with cannabis coming from the buds. Usually, the female and male plants are not cultivated together, so they won't reproduce among themselves. In case they do reproduce freely, the offspring could be a hermaphrodite without the essential characteristics for specific purposes (Government of Canada, 2020).

The understanding of the bud's structure plays a vital role in the commercial use of the plant and its cultivation, in order to maximize its potential for cultivation and utilization in various industries. The stem provides a much needed support above the ground as well as holds the nodes and branches. At the base of the flower is the calyx, protecting the reproductive organs. The pistils, on the other hand, are the yellowish hairs that stem out of the calyx. They serve as the sexual device of the flowers and it is where the pollen sticks to proceed fertilizing. In addition, the color of the pistil can be an indicator of the maturity of the plant, as the white-greenish pistils are signs that the plant is still

juvenile, while orange-brownish pistils are typically associated with mature, ready to harvest crops (Desjardins, 2018).

Nevertheless, the most important part of the bud is the trichomes - small, mushroom-shaped glands on the surface of cannabis flowers and leaves (Government of Canada, 2020). These glands produce a resin rich in cannabinoids, terpenes and flavonoids, rendering them an important component. The head of the trichome is where THC, CBD and terpenes (such as myrcene, caryophyllene, and pinene) are produced in high levels, all compounds which contribute to the therapeutic and psychoactive effects of cannabis. Depending on the strain and growing conditions, the levels of said phytochemicals can vary, and growers can manipulate the trichome production through different techniques, being genetic selection, lighting, controlled stress and soil quality (Government of Canada, 2020). A boost in trichome levels can increase the potency and overall quality of the crop, consequently increasing profits on further product sales.

In order to gain a better understanding of Cannabis sativa and its cultivation, it is essential to dive into the production of phytocannabinoids and terpenes. Although most well-known phytocannabinoids are CBD and THC, there are over 100 varieties already discovered, with many more to come, as the study of this plant is fairly recent (Thomas & ElSohly, 2016). Along with canaflavins and terpenes, phytocannabinoids are primarily responsible for the therapeutic properties of cannabis. When combining these phytochemicals in different ways - from one genetic strain to another - the result can be different therapeutic potentials.

Given the limited research on cannabis and its properties, due to regulations in each country, restricting investigation on the plant, there is still much to comprehend. However, the industry is now exploring the potential benefits of new phytocannabinoids, such as THCV, CBG (Cannabigerol), CBN (Cannabinol) and CBC (Cannabichromene) (Thomas & ElSohly, 2016). Terpenes, though, are responsible for the distinctive aroma of plants and fruits (Government of Canada, 2020), meaning that it is not exclusive to cannabis. The combination of terpenes with canaflavins and phytocannabinoids has shown therapeutic properties, despite the fact that terpenes alone have no scientific evidence of having the same benefits.

## 2.2 Cannabis applications

There are three different cannabis applications to be considered when discussing *Cannabis sativa*, and it is important to understand each when deciding how to regulate and in which branch to invest in. Each one has a different market strategy, revenue, way of planting and approach, contributing to different aspects of society. Furthermore, all have been used for thousands of years by humans, in all three forms. The areas are: medicinal use, industrial (hemp), and adult/recreational use.

The medicinal use of the plant is due to its potential therapeutic properties. Cannabis has active compounds (cannabinoids) that are able to interact with the endocannabinoid system present in the human body and other animals, which regulates various physiological processes. This signifies that medicinal cannabis is capable of alleviating symptoms and conditions such as chronic pain, nausea, seizures, and muscle spasms (National Academies of Sciences, Engineering, and Medicine, 2017). This is done by CBD (cannabidiol), a non-psychoactive cannabinoid used for these medicinal purposes.

Moreover, the industrial use is through hemp, another non-psychoactive strain, with fibers able to produce durable textiles, ropes, building materials (hempcrete), paper, food, bioplastics and biofuels. The seeds can also be used in the food industry, as it provides a rich source of nutrition, with essential fatty acids, proteins, and minerals (Karche & Singh, 2019). Additionally, as its cultivation demands less water and pesticides (when compared to other crops), hemp is considered an environmentally friendly choice.

Lastly, the recreational use of the plant is attributed to THC (delta-9 tetrahydrocannabinol), a compound that causes psychoactive effects (Johnson, 2018). Some feelings include relaxation, euphoria, and altered perception. It is the least legalized use worldwide, with most countries having a strict prohibition stand, however some countries have regulated this market. Where recreational use is legal, it may be consumed in various forms, namely smoking, vaping, edibles or other topical applications.

2.3 History of cannabis use and prohibition

2.3.1 In the world

The history of cannabis is very convoluted, with some contradiction regarding the origins of the plant. However, evidence shows that cannabis has been cultivated in China for at least 6000 years, with records of medicinal uses dating to 2800 BC, mainly through the Chinese emperor Shen-Nung, who documented the plant's therapeutic effects, and was considered the "father of Chinese medicine" (Booth, 2003). Besides this therapeutic application, plant fibers were also found in excavations from the Neolithic culture, as well as indications of smoked marijuana from over 2000-year-old sepultures - for both religious rituals and recreational uses. From then on, the plant is thought to have spread to Japan, India, and other cultures in Asia, proliferating into further regions throughout the years. According to Booth (2003), some scholars believe hemp paper was used to write biblical scriptures, as well as hemp oil used in ancient Egyptian and Hebrew civilizations, mostly for its medicinal use.

Once cannabis arrived in Europe, it was used a lot for paper-making purposes, and later for the fiber (something the Asian community had been doing for a few thousand years, by then). Hemp industries were created and countries with maritime power (such as England, Spain, Portugal and the Netherlands) explored the textile possibilities of making rope and sail apparatus, in order to improve long-distance sea travel, as hemp is more durable and tear resistant, in the 15th and 16th century. Through this, cannabis was then introduced to the American continent, amplifying the hemp trade worldwide (Booth, 2003), although some researchers believe it may have been brought by the Vikings to North America before the arrival of Columbus.

Once established in the United States of America, cannabis clothed nearly half the population and, in order to reduce importation and meet demands, all families were ordered to plant at least one teaspoon of hemp seed in some states, starting in 1637, and expanding this rule to more states when the measure proved successful and lucrative. Cannabis became such an important commodity in the US that the first drafts of the Declaration of Independence (in 1776) were made in hemp paper and, in

southern states, it became the most important agricultural crop, losing only to cotton, both industries operated by the enslaved population (Booth, 2003).

Due to global complications regarding drugs, such as opioids, great conventions condemning and stopping export/import of certain drugs took place. With this caution, came also a fear - the population largely associated drugs with foreigners and ethnic minorities, which led to xenophobic and racist reactions from a portion of white American society. The main groups that were targeted and labeled "enemies of the state" were the Chinese and black community. Around the 1900s, cannabis and its users  also became subject to scrutiny, mainly due to racial aspects. This is due to the fact that, although hemp was an important commodity in the United States, it was largely the black slave population, brought from Africa (where cannabis was already known for its psychoactive trait), that used cannabis, a habit passed down through generations, up to the popularization of jazz and blues, primarily enjoyed by the black culture. Latin American immigrant workers (in great part from Mexico) who moved to the US  also knew about this characteristic of the plant, on account of Europeans that brought cannabis centuries before (Booth, 2003). In 1906 it was installed the Pure Food and Drug Act, categorizing cannabis as dangerous, alongside opium, morphine and cocaine, with the government using racist techniques in order to distress mostly the white population and reiterate the narrative that cannabis was a hard drug. This new mindset lodged in the US spread to other countries, lasting decades.

With this prohibitionist scenario in place, and also with World War I and the Great Depression afterwards, Harry Anslinger was designated as the first commissioner of the Federal Bureau of Narcotics (FBN), under the American President Herbet Hoover. Anslinger's politics revolved greatly around the supervision, regulation and enforcement of anti-drug laws in the country, even receiving "free reign" by the Government to act as pleased to achieve this goal. The commissioner, in 1937, established the Marihuana Tax Act (Booth, 2003), signed by President Roosevelt, banning all cannabis products in the US - with no statistics or scientific evidence to support this measure (as stated by Dr William Woodward, of the American Medical Association, who, at the time, saw cannabis users as "patients in need of treatment", rather than criminals). In this new law, cultivation, transport, sales,

prescription and usage of marijuana was deemed illegal, having to pay a heavy fine if infringed and even large-scale incarceration.

The expression "cannabis is the gateway to other drugs" (associating marijuana with heroin) started with Anslinger as a way to induce fear among the public, along with public statements saying "marijuana is an addictive drug which produces in its users insanity, criminality and death" (Booth, 2003, p. 191). In the 1950s, a new act (the Boggs Act) instituted that first time offenders with cannabis, cocaine or opiate were to be sentenced to two to five years, but from the second offense forward, no parole was afforded. To put into perspective, serial killers and spies were afforded this right. As most of the users of the plant were minorities, with restricted income, this criminalization meant a segregation and marginalization of these populations. Over the years, new Acts were put into place, worsening conditions and public fear.

Matters began to change once John F. Kennedy was elected president, with new, permissive politics, and adopting a more lenient stance on cannabis compared to previous administrations - prioritizing issues such as public health and addiction over criminalization. As the presidency unfolded, more openness towards cannabis and permission for experimentation took place, prompting social acceptance and changing attitudes particularly among the white middle-class population (Booth, 2003). This led to the rise of the hippie culture, during the 1960s, who embraced the plant as a symbol of "rebellion and spirituality", which, in turn, expanded to most of the Western countries. During the Vietnam War, marijuana was further politicized, becoming a "calculated civil disobedience" (deliberate nonviolent protest carried out by individuals or groups who know about the legal consequences but choose to defy determined regulations for a cause). By 1975, cannabis was the most used recreational narcotic in the USA and many other countries in the western cultures (Booth, 2003).

Once President Nixon arrived in Office, the war on drugs was re-installed, labeling cannabis once again as a national emergency and restructuring the law-enforcement organization. Although the National Commission on Marijuana and Drug Abuse conducted a research with millions of Americans, with a final report recommending the decriminalization of cannabis possession for personal use, Nixon was against it (even if legal, medical, religious and public health professionals stood

by the report). Later on, in 1980, new president Ronald Reagan continued to apply a prohibitionist approach.

Although the Marihuana Tax Act led to the US' loss of the hemp industry, the rest of the world continued to cultivate it (even on a small scale, compared to its potential). Booth (2003) carries on, explaining that in the mid 1990s, it was estimated by the UN Food and Agriculture Organization that there were around 650,000 acres of hemp plantation worldwide. In 1993, the global turnover was approximately five million dollars, in 1995, around seventy-five million dollars and, by 2000, nearly two hundred million dollars. Now, this industry is still growing exponentially, with more dialogue and understanding around cannabis and, consequently, loosening regulations in many countries, due to its recognition of its potential benefits in various contexts.

2.3.2 In Brazil

Brazil's history with cannabis started in the 16th century, with the arrival of the Portuguese, when hemp fiber was already being used in the ship's sails and ropes (Carlini, 2006). Later, those subjected to enslavement brought from Africa introduced Brazil to hemp seeds. The cultivation of cannabis was encouraged by some Brazilian governments in the past. In spite of that, a persecution of the plant, largely linked to the social control of the black population, began early in the 19th century. In 1830, Rio de Janeiro's City Council restricted smoking weed, penalizing sellers with a fine, while buyers (many of whom were enslaved) with 3 days in jail, becoming the first country in the world to criminalize cannabis (Costa Netto, n.d.).

The persecution continued after the end of slavery and intensified between the 1920s and 1960s, largely due to the United States' protagonism in the cannabis prohibition agenda, with Brazil possessing many of the same arguments as the US against the plant. While cannabis was being held to the same standards as opium in global conventions and in Brazil (Carlini, 2006), candomblé and capoeira (largely associated with the black population) were also seen as obstacles to "order and progress" - the motto of the national Brazilian flag.

Today, there is a legacy of almost two centuries of prohibitionism, deeply rooted in Brazilian society. According to the Brazilian Senate (Teixeira, 2019), the Anti-drug Law (Law 11.343, from 2016) criminalizes users while overcrowding penitentiaries. This new measure puts into law enforcement officials the responsibility of subjectively determining an individual's drug possession, without criteria. This means that, at the moment, more low-quantity apprehensions are made (for own use, not trafficking), with little to no focus on high-level drug traffickers and criminal organizations.

The biggest heritage acquired is this populous prison system, with approximately 750,000 people imprisoned, turning Brazil into the third-largest incarcerated population in the world. Of this total, approximately one-third (around 220,000) was arrested for what is labeled as drug trafficking. There is currently a vote regarding the decriminalization of certain drugs in Brazil, including cannabis, to relieve the prison system. According to a new research conducted by Ipea (Institute of Applied Economic Research), called "Objective Criteria in Criminal Prosecution for Drug Trafficking: Nature and Quantity of Drugs Seized in State Courts of Common Justice", most of the lawsuits for trafficking happen after seizures of small amounts (for personal use) of substances, cannabis coming up in 67.1% of criminal processes (Ipea, 2023). In a conservative scenario, if the decriminalization of drugs for own use goes forward, permitting 25g of cannabis, around 27% of those convicted of trafficking marijuana would have the right to review the sentence. Since now it is very subjective and the users are at the hands of officials, most of those targeted end up being groups in minorities - such as black and low income populations, furthering stereotypes and prejudices.

2.4 Sustainable development for countries

The goal of the concept "sustainable development" is to meet the needs of the present without compromising the future generations' own needs (Mensah, 2019). It seeks to address the interconnectedness of economic, social and environmental aspects, creating a holistic framework that ensures long-term well-being for both current and future generations. As Earth's resources are finite - and unchecked exploitation can lead to irreversible damage to ecosystems and a diminished quality of

life for humans -, sustainable development is of great importance for the longevity of the plant and its inhabitants.

According to Mensah (2019), embracing sustainable development, in the context of a country, is vital for several reasons. In the first place, it helps mitigate the negative impacts of rapid industrialization and urbanization, such as reducing pollution, resource drainage, and environmental degradation. Secondarily, this notion fosters social equity, ensuring that all segments of society are benefited through economic progress, reducing inequalities, while promoting inclusivity. Lastly, countries that prioritize sustainability attract global investment and collaboration, enhancing their international standing and, consequently, the financial gains as well (Mensah, 2019).

The United Nations, in 2015, established 17 Sustainable Development Goals (SDGs) - a measure to tackle international common goals regarding the continuity and well-being of mankind (Lee & Rhee, 2023) - in order to further emphasize the importance of this concept, to be achieved by 2030. This "call for action" seeks to address the three pillars of sustainable development, being: People (with goals including quality education, gender equality, reduced inequality, sustainable cities and peach, justice and strong institutions), Planet (namely climate action, responsible consumption and production, life on land, affordable and clean energy), and Profit (like no poverty, zero hunger, decent work and economic growth, industry innovation, and good health and well-being).

A study conducted by Kaya Mind (2023) notes that *Cannabis sativa L.* and its benefits and policies can contribute to at least 15 of the 17 SDGs (hemp playing a part in at least 8). To exemplify, hemp seeds, filled with nutritious properties, proteins and minerals, are able to touch on Goal 2 of "zero hunger and sustainable agriculture", cannabis can assist with Goal 3 of "good health and well-being" with phytocannabinoids' medicinal properties, and the Goal 8 of "decent work and economic growth" can be linked to the creation of job opportunities within the legal market.

Meanwhile, ESG was created in order for companies to help countries reach these 17 SDGs (Lee & Rhee, 2023). Consumer preferences are evolving, with a crescent demand for sustainable products and services. This means that clients have begun to seek transparency, ethics, and environmentally friendly practices from corporations. The adoption of ESG into corporate practices

helps fulfill customer expectations, as well as build customer loyalty and enhance market competitiveness (Lee & Rhee, 2023). This leads to a boost in revenue and a recognition from investors that this endorsement positively impacts long-term returns and improves risk management.

From an ESG perspective, cannabis corporations can embrace sustainable cultivation practices, minimizing water and energy usage, while raising a crop that sequesters carbon and harmful metals in the soil (Environment). They can also prioritize employee welfare, diversity and inclusion, community engagement, and responsible marketing practices (Social). Lastly, companies can also maintain transparency, ethical decision-making, and adherence to regulatory frameworks (Governance) (New Frontier Data, 2022).

The integration of ESG considerations is of great importance for both companies and countries. By embracing ESG practices, organizations can enhance sustainability, strengthen social responsibility, and foster good governance (Lee & Rhee, 2023). Countries that prioritize ESG considerations have an edge in achieving sustainable development, at the same time that attracts investor confidence. In connection with the cannabis industry, the integration of ESG practices and alignment with the SDGs allows corporations and countries alike to showcase their dedication to the environment and society as a whole, positioning them as responsible entities within the dynamic and expanding the legal market's revenue and reputation.

The integration of Environmental, Social, and Governance (ESG) in corporate settings has become increasingly important for corporate stakeholders, especially clients and shareholders, in their decision-making processes. Understanding the value of ESG enables organizations to enhance sustainability practices, foster stakeholder trust, and drive positive social and environmental outcomes. Additionally, it also contributes to countries' commitment towards sustainable development, as established by the UN's goal of overcoming the climate crisis and its consequences (Lee & Rhee, 2023).

By pursuing the SDGs, countries are able to align their efforts with a shared vision for a better world, where economic growth, social progress, and environmental protection coexist. Incorporating the principles of sustainable development into various sectors not only ensures the well-being of present and future generations but also contributes to the realization of said goals (Mensah, 2019). By

adopting sustainable practices, countries contribute to the larger global mission of eradicating poverty, protecting the plant, and promoting prosperity for all.

## 2.5 Current state of cannabis legalization and regulation globally

*North America and Europe*

In the United States, significant steps have been made in cannabis regulation. The Farm Bill was updated in 2018, opening the doors to industrial hemp production, while elevating the country as a major player in using the plant's flowers to create CBD products. The growth has been remarkable - with the cultivation area going from virtually nonexistent in 2013 to over 36.000 hectares in 2018 (Kaya Mind, 2021). In the following year, the market had already accumulated approximately 1.6 billion USD. Although recreational cannabis remains prohibited on a federal level, numerous states have taken the path towards regulation. All this reflected in the workforce - an estimated 321.000 jobs were related to the sector in the country as of January 2021 (Kaya Mind, 2021).

Canada introduced the Cannabis Act in late 2018, a federal measure with the goals of: deterring youth access to cannabis, eradicating criminal profits, and prioritizing public health and safety through legal adult access to cannabis (Crépault & Jesseman, 2022). This Act sets baseline standards that all regions must follow, however provinces and territories can impose stricter regulations. To exemplify, the minimum purchase age is set at 18 years, but provinces can establish a higher age limit. According to the Government of Alberta (2023), adults are allowed to possess up to 30 grams of legally-produced cannabis, while being able to cultivate up to four cannabis plants per household, with the production, distribution, and sale of cannabis falling under government control.

Portugal, on the other hand, had a pivotal regulatory development in 2019 (Kaya Mind, 2021), as the State granted authorization for the planting, preparation and distribution of marijuana sold in pharmacies under a medical prescription. This shift led to the creation of jobs across various sectors, such as agriculture, chemistry, and pharmacy, along with attracting new businesses to the region.

Projections suggest that the European Union's cannabis sector could amass approximately 800 billion BRL (Kaya Mind, 2021).

The cannabis landscape in Spain is characterized by distinct regulations. Medical cannabis is still unregulated, but cultivation and production destined for export (only to authorized companies in countries where cannabis is regulated) is permitted. However, some patients can access cannabis-based medications with a valid prescription (Bautista & Espinosa, 2022). Regarding the industrial use of cannabis, hemp cultivation for fiber, grain, and seeds is allowed, as long as the THC content abides to the European Union regulations - below 0.3%. While utilizing cannabis for recreational purposes within a commercial framework is still prohibited, for individual consumption (or within carefully defined shared settings) it is authorized without legal repercussions (Bautista & Espinosa, 2022). Due to this gray area, cannabis social clubs were created, operating within these boundaries, functioning as a noncommercial collective of users who engage in the cultivation and distribution of cannabis, diminishing the dependency of users on the underground market (Barriuso Alonso, 2011).

*Latin America*

In recent years, Latin American countries have emerged as key players in shaping cannabis policies, both for medical and recreational purposes. The progressive stance of these countries has paved the way for a comprehensive examination of the benefits and challenges associated with cannabis regulation in the region. Among the 33 Latin countries analyzed in a report by Kaya Mind (2021), a majority (around 18) have established legal access to medical cannabis, acknowledging its therapeutic potential. Furthermore, nearly half of the countries (16) allow for hemp cultivation, recognizing the economic prospects associated with industrial hemp and its derivatives.

To better grasp the regulatory landscape of Latin America, some insights can be taken by examining the experiences of Uruguay, Mexico, Argentina, and Peru, analyzing their diverse approaches and their respective impacts on the economy, public health, and societal dynamics. By studying the experiences of these countries, policymakers, researchers, and stakeholders can gain valuable insights to shape effective and inclusive cannabis regulations in Latin America.

Uruguay, as reported by Kaya Mind (2021), holds a pioneering role in the global cannabis landscape as the first country to legalize all uses of cannabis. Since its landmark legalization in 2013, Uruguay has successfully established a comprehensive regulatory framework for both medical and recreational cannabis, allowing its citizens to cultivate cannabis for personal and medical use. The economic impact of this decision has been significant. According to the report from the Institute for the Regulation and Control of Cannabis (IRCCA) (2019), the country has earned around $60 million USD annually from cannabis exports. Moreover, the same report indicated that from 2014 to 2018, classic drug trafficking was reduced by 5 times. This financial influx, which would have potentially fueled drug trafficking within the context of the war on drugs, underscores the transformative power of such regulatory measures (Kaya Mind, 2021).

Mexico has taken notable steps towards the decriminalization of cannabis, driven greatly by the urgent need to address the high rate of crimes related to drug trafficking, as almost 42% of adults accused of trafficking were arrested for possession of cannabis (Kaya Mind, 2021). The country initiated its first move towards decriminalization in 2009, allowing the possession of small amounts of cannabis for personal use. The legalization of cannabis is expected to boost the industry's revenue from an estimated $11.5 million USD in 2022 to $54.5 million USD by 2024.

Argentina has adopted a cautious approach to cannabis regulation. In 2020, the country legalized the cultivation of marijuana for medical purposes through Decree No. 27.350, providing patients without health coverage with the product free of charge. The decree also authorized the sale of cannabis-based oils and creams in pharmacies. The recreational use of cannabis, however, remains prohibited, although personal use has been decriminalized. Kaya Mind (2021) reported that the medical marijuana industry could generate over $1 billion USD in exports and create approximately 15.000 jobs over the next decade. This potential economic impact underscores the country's recognition of the economic benefits associated with the cannabis industry.

Peru's step forward in cannabis regulation was in 2017, by allowing its use for medicinal and therapeutic purposes. Despite the initial challenges (as is expected from any country in the adaptation phase), Peru has recognized the potential economic benefits of cannabis cultivation. Estimates, as

reported by Kaya Mind (2021), suggest that within five years, it could be possible to cultivate up to 3.000 hectares of cannabis in the country, with each hectare potentially generating around $1 million USD in revenue. Although there are still hurdles like limited access and bureaucratic procedures, Peru has welcomed the opportunity to provide therapeutic options to its population, while recognizing the economic gains.

Chile began a gradual change to its prohibitionist approach in 2014, permitting cannabis cultivation for medical purposes, providing relief to patients in need. The country's development towards regulation was initially focused on addressing the medical needs of its population. As of 2015, Chile expanded its cannabis regulations, permitting cultivation for personal consumption (medicinal, spiritual and recreational purposes), with a limit of six saplings of cannabis per household and a sworn statement to the authorities (Kaya Mind, 2021). As the country continues to refine its cannabis policies, it is expected to witness further advancement in the industry, such as opportunities for research, innovation, and the development of new therapeutic applications.

Colombia is another country substantially affected by drug trafficking, investing substantial resources in combating the illicit drug trade. The Kaya Mind (2021) report stated that Colombia spent over $140 million USD between 2004 and 2019 in its fight against drug traffickers. The solution to reduce this was the decriminalization of cannabis possession, in 2012, marking a significant shift in its approach to drug policy. In 2016, the country legalized cultivation, manufacturing, import, and export of cannabis products for medicinal purposes, opening up new opportunities and attracting foreign investment to the local cannabis industry.

The economic benefits of this change in Colombia are extremely sizable, with the industry drawing in more than $500 million USD in foreign investment (Kaya Mind, 2021). This influx of capital is expected to continue growing, reflecting the confidence and potential investors see in Colombia's cannabis market. The legalization of hemp in 2017 further expanded the country's cannabis industry, enabling the export of hemp-derived products. One of the key advantages Colombia offers is its favorable production cost. The cost of producing cannabis there is approximately $0.80

USD per gram, while countries like Canada cost up to five times higher. This edge positions Colombia as a competitive player in the global market.

*Brazil*

Brazil is a country with a long history of prohibitionist drug policies, repeating scenarios of other nations worldwide. In 1998, through Ordinance No. 344 (rule that brings the list of plants and substances under special control in Brazil, including those for prohibited use), regulations began to be updated concerning narcotic substances, including cannabis. Now, while the country has taken steps towards the regulation of medicinal cannabis (though with restrictions), it is one of the few countries that lacks legislation encompassing the cultivation of hemp.

In recent years, further changes have been introduced by Anvisa (the Brazilian Health Regulatory Agency) through RDCs (Collegiate Board Resolutions, which are regulatory norms proposed by the agency). These norms have aimed to regulate the importation, production, commercialization, and use of cannabis for medicinal purposes in Brazil. These activities, however, are tightly controlled and require specific authorization and prescription. Besides a few exceptions, cultivation remains prohibited. The result is a limited and bureaucratic access to cannabis-based medicines, impeding the market's full potential. Additionally, a significant portion of the revenue generated from medical cannabis is leaving the country, benefiting foreign companies involved in cultivation and processing (Kaya Mind, 2021).

Although patients seeking access to medical cannabis need a special prescription, there are only a limited number of doctors licensed to prescribe cannabis in Brazil. Out of over 500 thousand doctors in the country, only around 3% prescribe cannabis (Campos, 2023). The availability of doctors willing to prescribe cannabis plays a crucial role in unlocking the full potential of the cannabis economy in Brazil, while also providing a more democratic access to alternative medicine.

In the absence of legal cultivation, some individuals have formed patient associations, bringing together like-minded individuals who aim to either facilitate access to cannabis for those in need or engage in civil disobedience by cultivating the plant themselves (Kaya Mind, 2022). Some associations

have even obtained legal authorization for cultivation, enabling them to offer products at a lower cost compared to imported ones. Another way to bypass the self-cultivation restrictions is through an Habeas Corpus, guaranteeing that the individual who grows marijuana will not be arrested, on an exceptional basis, as he is planting for the benefit of his own health.

As of writing this thesis, the Federal Court of Justice is having a judgment on decriminalization - with no result yet. It is important to note that the current voting and discussions among ministers are focused on the decriminalization of drug use, rather than the legalization or approval of drug sales (BBC News, 2023). This measure aims to address the issue of drug use as a public health concern, instead of a criminal offense. The focus is on shifting the approach towards drug users by providing them with medical and social support rather than punitive measures. Although it is a big step for Brazil, it is far from the ideal scenario of a legal cannabis market generating revenue for the country, as is the global trend.

3. Benefits of the cannabis industry

3.1 Economic benefits of investing in cannabis

There is a growing body of research that highlights the economic benefits of investing in the cannabis industry, as it is a fast-growing sector that can generate significant tax revenue and create jobs. In addition, studies have shown that the industry can contribute to economic growth by increasing exports and attracting foreign investment. According to Fortune Business Insights (2021) the global cannabis market size in 2020 was $10.47 billion USD, projecting a growth up to $197.74 billion USD by 2028, with a CAGR (Compound Annual Growth Rate) of 32.04% between 2021 and 2028, due to the market's demand and growth. At the moment, cannabis is the most widely cultivated, trafficked and consumed drug in the world (World Health Organization, 2023), but it has been gaining power mainly due to the recognition of the different applications of the plant.

Around 70 countries have legalized cannabis for medical purposes (26 of them providing legal access to high-THC cannabis for medical patients). Furthermore, 10 countries have legalized beyond medical use, encompassing adult recreational use. This demonstrates a growing recognition of the plant's therapeutic benefits, as well as the changing societal attitudes towards cannabis for non-medical purposes. This shift is well seen in the global cannabis market revenue.

A recent report by New Frontier Data (2023) demonstrated that in 2022, cannabis consumers on a global scale spent $459 billion USD on high-THC cannabis and other products of the plant. By 2025, it is projected to reach $508 billion USD, indicating a clear market demand. Due to the fact that most countries have not regulated cannabis (and even those that have legalized some uses of the plant still have illegal markets), approximately 92% of these sales occurred through unregulated channels.

Although there is a tangible growth in the legal sales, a considerable gap remains between legal and illegal markets. In 2022, only around $30 billion USD was circulated in legal cannabis sales, with projections showing an increase to $51 billion USD by 2025, as more jurisdictions adopt legalization and regulatory frameworks (New Frontier Data, 2023). This displays an opportunity for countries that

are considering expanding their Gross National Income (GNI) through the legalization of certain cannabis sectors.

It is also important to note that these projections do not take into account new consumers, only current ones. As the stigma surrounding cannabis slowly recedes, more adults will become aware of its potential benefits - be it through adult, medicinal or industrial use - and, consequently, the number of individuals who choose to integrate cannabis into their lifestyle will increase. This demographic development can further fuel market growth, as well as expand consumer demand in the following years. It is also relevant to observe that prohibition does not prevent users from accessing these products, but rather it limits their access to tested, safe products.

## 3.1.1 Markets in the cannabis industry

*Medical/Pharmaceutical*

Although cannabis has been used for its therapeutic properties for thousands of years, the war on drugs created a stigma around the plant and all its benefits. However, the paradigm around Cannabis sativa began changing with scientific studies in the 1990s, when research regarding the plant started being permitted in some regions around the world. Since then, it has become better known and more widespread, as well as incorporated in different regulations.

The endocannabinoid system (ECS for short), responsible for homeostasis, is a complex system discovered at the end of the 20th century and found in the human body as well as other mammals, while scientists researched the effects of THC on the body. It is composed of three main integrants that naturally occur: endocannabinoids, receptors, and enzymes. This system is believed to play an important part in the regulation of hormone secretion and the immune system function, and it takes part in several physiological processes - such as inflammation, sleep, pain, mood and appetite. The endocannabinoid naturally produced in the body activates the endocannabinoid system, in addition to plant-derived cannabinoids (like THC and CBD). Due to the great surge in research into the ECS, it is

considered one of the most rapidly evolving fields in psychopharmacology (Pamplona & Takahashi, 2012).

Seeing as THC has a high affinity for CB1 and CB2 receptors in the brain, located in the central nervous system and the immune and system, respectively, and CBD can modulate the activity of these receptors, researchers have been working towards understanding fully how these compounds interact with each other, with the ECS, and how to better use them for therapeutic uses (Zou & Kumar, 2018). So far, research has shown that different medical conditions can be tackled with cannabis and that each compound can be used in different ways to address different symptoms.

Although isolated, THC and CBD have different actions in the body, when combining them the "peak performance" is reached. What happens is the entourage effect, the suggestion that the blend of different cannabinoids, terpenes, and other compounds in cannabis can cooperate to produce a more noteworthy therapeutic effect than said compounds alone, meaning that the effect of cannabis reaches its potential when the compounds work in synergy. Besides choosing the phytocannabinoids desired, other factors also influence medical cannabis products, such as the quality, frequency of use, and dosage. The effect may be different depending on the factors listed.

Cannabinoids have been used for the regulation of pain globally, and it is considered one of their earliest medical applications (Zou & Kumar, 2018). Symptoms such as anxiety, stress, cancer, insomnia, refractory epilepsy, multiple sclerosis, parkinson syndrome, autism spectrum disorder, Alzheimer's, and others, can be relieved with the correct usage of cannabis (Desjardins, 2018). However, there is a need for medical follow-up especially whilst combining cannabis-based medicines and allopathic (prescription) medicine, as a drug interaction may occur.

Cannabis as medicine is available in various forms - oil (most popular), ointment, vaporizers, gummy candies, and others. Each patient may find they have different reactions to these forms, or specific needs for their conditions, for example, a patient who is in pain might opt to use cannabis by vaporization, as it acts faster than oil. There is still much to uncover about Cannabis sativa, there is a gap in information regarding the compounds in the plant, and there is a need to better understand the manipulation of a compound and the formation of the plant. Nonetheless, there are many positive

cases worldwide, which is opening doors for legislation changes and investment in research to tackle the medicinal uses of cannabis.

In a more general scope, the regulations surrounding cannabis in most countries started with legislations aimed at the medicinal use of the plant. The same thing happened in Brazil. There, patients have limited access to medical cannabis products due to regulations not having been well established yet. As a result, the market remains unprofitable, leaving foreign companies to dominate the industry. Many patients who lack access to these products have to turn to associations (a group of people with the goal to facilitate access to those who need it or cultivate cannabis as a civil disobedience. Some may have legal authorization to plant it, meaning the products offered are much cheaper than those imported from foreign countries, while supporting a local community). This lack of plantation on national soil limits access to much needed medicine, creating a bureaucratic and financially inaccessible experience for most part of the population. Brazil is currently having economic and environmental losses as a consequence of regulations limiting the cultivation. Over 65 thousand new patients registered with Anvisa (the Brazilian Health Regulatory Agency) to obtain imported products in October 2022 alone, showing that there is a promising public and market (Kaya Mind, 2022). There are currently over 187 thousand registered patients with access to medical cannabis via importation, pharmacies and associations, even though said access is very limited and bureaucratic, indicating the potential this market has.

Based on a study by the first market intelligence company in Latin America focused on cannabis, located in Brazil, Kaya Mind (2022), there is a potential of Brazil becoming one of the largest cannabis economies in the world. The research predicts that after the fourth year of regulation, the country would be able to generate $ 9.5 billion BRL per year, producing 33.8 tons of oil per year. The market projections are mostly done from the fourth year of regulation onward, as it gives time for the market to stabilize.

According to Campos (2023), since 2018 there has been an increase in sales of cannabis-based products of around 342% in Brazilian pharmacies. Just from 2021 to 2022, the increase was 156%, moving around $77 billion BRL. The legalization of cannabis cultivation would permit a full efficiency

of the market, reducing losses to foreign countries through import and generating a national economy. By regulating the culturing of cannabis, Brazil would be able to provide greater access to medical cannabis for patients and develop a lucrative industry.

*Cosmetics*

Regarding the cosmetics sector, the benefits of integrating cannabis into it are significant and well-documented. Decreasing inflammation, improving acne, promoting skin hydration, and helping with skin diseases are some of the gains (Baswan et al., 2020). There is a large public interest, which companies have taken notice and started to act, going in this direction in countries with broader cannabis regulation to take advantage. Many global businesses, such as Kush, are already selling make-up and anti-aging products utilizing CBD in its composition. Some companies have even started to position themselves with products similar to cannabis in unregulated countries to gain said advantage and get a head start.

This can be done through the promotion of products with CBA (Cannabinoid Active System), an active ingredient that is able to act similarly to medicinal cannabis (Kaya Mind, 2022), while not containing marijuana in the formulation - essentially tricking the customer. Although no cannabis is in it, many companies worldwide are building their brand identity already around the plant. On the other hand, CBA interacts with the endocannabinoid system in a similar manner to CBD, providing related effects. In Brazil, CBA is a natural active (term used in the cosmetics industry to refer to active ingredients derived from natural sources that have a biological effect on the skin - as plants, fruits and minerals) produced from essential oils from the Brazilian biodiversity, mainly in the Amazon (Kaya Mind, 2022). Because of these differences, it must be disclosed to the consumer when selling, being transparent about the absence of cannabis, even if there is allusion to it.

It is extremely necessary to visualize the cosmetics sector as a prominent profitable branch. Regarding Brazil, Natura (Brazilian company) is already selling, abroad, a line with Avon focused on cannabis, as regulation does not permit national sale. Cosmetics sales revenue in Brazil is at $124.5 billion BRL, while just the skin care market's revenue is $2.3 billion USD. There is a great need to

invest in research, technology, and regulation, as the sales around the world have shown significant growth and, as Brazil is the largest beauty market in Latin America - and fourth biggest worldwide -, there is an enormous potential for expansion in the country (Statista Research Department, 2023).

Brazilians' strong affinity for the cosmetics industry and the ease of integrating cannabis into beauty products create the potential for significant revenue growth in Brazil. By embracing cannabis-infused cosmetics, an already thriving sector can experience further financial success, especially in an age of increasing demand for natural and sustainable products. As research continues to highlight the positive effects of cannabinoids on skin health, consumer interest is likely to rise, leading to higher sales and revenue. Establishing robust regulations will not only ensure consumer safety but also build trust in the market, attracting more investments and boosting the overall economy. In this context, the cosmetics industry in Brazil has a valuable opportunity to seize the potential of the emerging cannabis market and reach new heights in financial gain.

*Agribusiness*

These are extensive topics that are extremely relevant to advance in the cannabis industry, as this sector provides the business for the entire chain and it is seen as lucrative by many countries. The impact of cannabis on the agricultural sector has great potential, due to the fact that the market cannot evolve without proper cultivation and extraction. Even so, there are many challenges to overcome, from legal barriers to the adaptation and development of technologies (although hemp grows in places where other plants have difficulties, there is also a lack of efficient machinery to extract it).

Albeit the challenges, Brazil has a unique opportunity, as it is a world reference in farming (easyBrasil, 2018), having already the space, workforce and know-how. Also, conscious consumption is becoming more valued by consumers, and cannabis is an extremely sustainable plant - cultivation sequesters a lot of carbon from the atmosphere (Atakan, 2012), performs soil regeneration, requires much less water, and takes less time to grow than cotton. Cannabis is also versatile, resistant and has a low maintenance cost, becoming a profitable and sustainable crop in Brazil. The investment in this

sector would also mean a new revenue stream for farmers. With multiple harvests per year, producers have the opportunity to plant cannabis for different purposes in a short span of time.

Going against today's products' planned obsolesce, cannabis fibers are the strongest and longest of the natural fibers, providing durable products (Karche & Singh, 2019). In terms of the paper industry, cannabis produces four times more pulp for paper in the same planted area as other trees, resulting in savings in agricultural space, as well as uses less water. This can also be looked at as a marketing opportunity. Additionally, there are even cryptocurrencies in the market, such as Cannacoin (Cannacoin, 2014), which generates credits with the planting of hemp.

Cannabis also has the ability to remove heavy metals from the soil, cleaning up the environment and benefiting auxiliary crops that grow around this plant (Backer et al., 2019). In result, there would be no need for pesticides, meaning in financial savings for the producer and healthier and more natural crops, with the possibility of incorporating it into crop rotation. Lastly, cannabis competes well with other spontaneous plants, as it has a dense root system which allows fewer expenses with control and herbicides, another benefit (Visković et al., 2023).

Cannabis can be grown outdoors and indoors, through greenhouses, depending on the final product desired, as explained in a report by Kaya Mind (2022). To exemplify, the cultivation of hemp does not require as much control and attention, making open-air planting a possibility. Meanwhile, for cannabis cultivation for pharmaceutical purposes, it is more favorable to opt for a greenhouse , as it is necessary to select specific soil compositions and climatic conditions. This type of cultivation is also beneficial for managing infesting weeds and pets, in addition to unforeseen weather - like heavy rain and frost.

In regards to outdoor cultivation, as the crop is more exposed to sunlight, there are lower production costs (saving on energy for temperature control). It also does not require a complex infrastructure and can be sold on a larger scale, due to more farming area. On the other hand, this type of plantation has a need to control weeds and pests, as it is less controlled (Kaya Mind, 2022). The number of crops produced in a year can also be affected by severe and unanticipated climatic conditions, elevating the risk. As cannabis plants require above 12 hours of sunlight per day to remain

in a vegetative state and grow in biomass (Backer et al., 2020), they are much more vulnerable to these conditions, making it necessary to factor these variables in when deciding the purpose of cannabis that will be planted. In Brazil's case, depending on the region, there is a low difference in sunlight between winter and summer, which can affect the plant.

While indoor cultivation provides more control over the growth of the plants, which results in a higher quality of the flowers and leaves, there are disadvantages such as high costs in the production - for water, electricity and skilled labor (often scarce, due to the lack of professionals in non-regulated countries). On a hybrid approach, uniting both indoor and outdoor elements, there is the greenhouse cultivation. This solution is able to use the sunlight during the day, and control the light at night, saving in costs when compared to exclusive indoor cultivation. The greenhouse can be expensive to build, as opposed to outdoor cultivation, but indoor cultivation is generally more expensive than greenhouses (Kaya Mind, 2022).

It is also important to understand the type of cultivation for each final product wanted, as to be able to reach the maximum potential of raw material and, consequently, more profit. For a cultivation seeking cannabis fiber, large, tall and dense plants are needed (Government of Canada, 2020), as well as large machinery able to harvest the whole plant. The production of the cannabis seeds requires less control and less dense plants. The harvest of the seeds happen in specific periods, as they are extracted from the flower and it may take some time for it to be ready. Lastly, when cultivating cannabis for the bud - either for adult or medicinal use -, the density of the plant is lower than for seeds and much lower than for fibers, requiring a highly controlled environment, and laborious and careful harvest to ensure an adequate quality.

In regards to the existing cannabis strains, these were developed and enhanced in countries with regulations permitting research on the plant, such as the United States and the Netherlands. This means that the strains have characteristics to survive in the ecosystems where they were developed and, since most of the countries being in locations with a temperate climate, Brazil would need to advance studies in order to develop strains appropriate for the different regions of the country.

In 2016 in Brazil, agribusiness was responsible for 20% of the national GDP (Gross domestic product), as reported by easyBrasil (2018), becoming a major world supplier over the last decades. In the same study, it was shown that less than 10% of the plant production area is being used. It has the market, the soil, agricultural potential, and export potential, with a big future and space for hemp and cannabis cultivation. Every year that regulations fail to advance, Brazil loses financially.

*Legal*

One of the sectors that has been gaining traction in the cannabis industry worldwide and in Brazil is the legal sector, as it is a critical component for the development and growth of the market. This branch covers all the fields of legal practices, including executive and legislative bodies and regulatory agencies (like Anvisa, which plays an important role in shaping the cannabis market, setting guidelines and standards for production, distribution, and consumption). As every new market requires regulation, it is also essential to have professionals in touch with current legal norms in order to seamlessly assist in the transition, as well as formalize and adapt new businesses, with many law firms adhering to specialized internal areas focused on legal cannabis dealings. In addition to law firms, academic institutions worldwide have also recognized the importance of the legal sector in this industry, with many offering courses and programs focused on cannabis law and policy.

In Brazil, however, the cannabis industry is having difficulty operating in a clear and predictable regulatory framework, as the Legislative has been resistant to adapt to this new and globalized market. Pleas have been made to the judicial system in Brazil to assist in conditions such as the failure in importing derivatives without cannabinoids, guaranteeing basic rights of access to health. Each change made in regulations has significant impacts on business models and consumers that are not yet clear, making the legal sector an important player in this stage of debate and adaptations. To summarize, this sector is responsible for seeking rational ways to continue bringing new solutions and drive up the market, as it has been hard for companies to navigate the always-changing legal landscape.

The legal field in Brazil, as well as many other countries with similar cannabis history, also has an important role that brings further positive societal impacts. At present, nearly one-third of the

population arrested is for drug trafficking and/or awaiting trial, and this overcrowding is seen and tried to mitigate through the judiciary system (Ipea, 2023). A legal network for the reform of drug policy, called The Reforma Network (Centro de Liderança Pública, n.d.), has already managed to obtain the first preventative habeas corpus for cultivation in Brazil. This network has the goal to help the population have more access, more rights, and less imprisonment, confronting public power and injustices.

It is crucial that the legal sector stays updated and able to adapt to new regulations and market conditions as the cannabis industry evolves. From comprehending laws and regulations, to advising clients on potential legal risks, and advocating for legal reform, the scope of the possibilities of areas of activity for professionals in the justice system is numerous. The legal sector can assist in ensuring that the cannabis industry operates in a safe, regulated and responsible manner, at the same time shielding the rights of patients, consumers and businesses.

*Pets*

The cannabis industry also encompasses the pet sector, and has been seen as a significant market, as the urbanization rates and trend of domesticated animal ownership increase. The use of cannabis can be incorporated in the pet industry in various ways, including: the use of plant seeds for food, hemp sawdust for animal bedding, and hemp fiber for resistant fabric (Kaya Mind, 2022). The most relevant product, however, is medicinal oils, used to treat different animal conditions. The endocannabinoid system and receptors are also present in animals, acting in a similar manner to human receptors, making them fit for cannabis pharmaceutical products.

In Brazil, regulations on cannabis prescriptions are only applied for humans, despite the potential benefits for animals and, right now, veterinary treatment is in regulatory limbo (even though some official bodies have made favorable decisions regarding cannabis use in veterinary treatments). Unlike the regulations for human use, which go through the Ministry of Health, the animal treatment is under the scope of the Ministry of Agriculture, slowing the process. However, many veterinarians have found ambiguity in RDCs (Kaya Mind, 2022), which give them the possibility of prescribing (for

example, one RDC dictates that only health professionals are allowed to prescribe legally qualified products but the loophole is that veterinarians can also be seen as health professionals).

Brazil has close to 80 million pets, being a significant market opportunity, both in products and in tax collection, which in turn would be an advantage for the government. Kaya Mind (2022) has estimated through a report that this market will achieve $1.45 billion BRL after the 4th year of regulation. Cannabis products have helped many animals deal with difficulties such as severe pain, inflammation, and palliative measures, also indicating the potential for this market. Yet, the pet market's cannabis products are more expensive than the human market, which could be seen as a drawback. Nevertheless, Brazil finds itself as the 4th largest spender on animal care on a global scale (Kaya Mind, 2022), further reinforcing the potential gain (both from the government and businesses) from regulation.

This promising market has significant potential for growth, both globally and in Brazil. It has been shown that the use of medicinal oils in veterinary treatments can be extremely beneficial for the wellbeing of the pet, however regulatory changes are required in order to fully permit the use of these products for said treatments. Besides this industry providing several products for the pet sector, more research and investment is needed to unlock this market's full potential as the demand for domesticated animals increases.

*Health tech*

The ability of professionals to prescribe medication and forms of treatment with cannabis for many medical conditions has expanded. Besides doctors, other specialists like nutritionists, veterinarians and pharmacists have been able to specialize and work with cannabis around the world. This fact shows the applicabilities in different areas inside the health sector.

Moreover, an emergence of health techs has been seen worldwide, focusing on the use of technology within the health area (Tracxn, 2023). The combination of cannabis with health and technology can potentially bring forth a significant improvement in the medical field. An example of what is being done is the creation of digital platforms with the goal to connect patients with healthcare

professionals who can help obtain medical cannabis prescriptions, while also providing guidance about different cannabis strains, the respective effects and potential side effects, and dosage recommendations. This also applies for telemedicine services, which allow patients to have virtual consultations and can be beneficial for patients who live in remote areas or have mobility issues.

In addition, some of these health techs are developing cannabis-based products that are easier to use, as well as more precise and consistent - inhalers, transdermal patches, and sublingual sprays are some examples of innovative products in the industry. These advancements can provide patients with a more controlled and targeted delivery of cannabinoids, managing their symptoms in a better and easier way. These technological advancements have been generating millions of USD (Tracxn, 2023) due to the well-being it has provided to patients. However, in order to continue the search for more effective ways to improve the medical industry, more investment in cannabis research is needed.

*Technology*

Another crucial sector with great impact is the technological sector, as it helps with the growth and development of the cannabis industry. There have been many adaptations of technological items from other markets to be used in the cannabis industry, one example being the machinery designed for mainstream crops of the agribusiness adjusted for planting and harvesting cannabis. Furthermore, many companies in this new, growing business are building their technologies to boost the efficiency and quality of their own products.

Another example of specific technologies that still need to be developed is the genetic enhancements in order to obtain better strains, demanding technological knowledge and specific equipment. Also, methods that seek more control of the cultivation, such as indoor cultivation, requires technologies and softwares important to supervise and monitor the plant and ecosystem. Although cannabis companies require, mainly, the same technological infrastructures as other sectors, the investment in these advancements is key for cost management and more crop productivity. In Brazil, companies in the cannabis industry must follow pre-established minimum requirements for crop control, as dictated by the Bill (PL) 399/2015 (Brazilian National Congress, 2015), which is the

bill that regulates the planting of Cannabis sativa L. for medicinal purposes and the sale of medicines containing the plant.

There is also a lack of cannabinoid extraction and purification machinery in the market right now, as well as equipment for testing and product research. Once the regulatory frameworks evolve, there will be a great demand for these tools, especially in the first years. Concerning isolated cannabinoids, around 100 cannabinoids are known (but not all fully understood), and many more are still to be discovered (Thomas & ElSohly, 2016). Technology can be a great asset in isolating and studying new cannabinoids, as this enables the development of strains with specific levels of desired cannabinoids.

To finalize the examples, technology can pave the way to transform the cannabis plant into other materials (Karche, & Singh, 2019), like bioplastics, biofuels, and batteries. It can also help improve components and provide cheaper, more profitable, and efficient materials and energy sources. This outlook shows that the cannabis industry is able to "close the cycle", providing its own market with better options for materials and energy sources. Given this, assistance in the technological sector is critical, as it carves the way that a country heads when investing in the cannabis industry.

*Communication and Advertising*

A significant amount of prejudice still roams the cannabis industry, with few countries regulating the plant, thus the dissemination of information on the subject is still limited. In Brazil, approximately 50% of the population accepts the medicinal use of cannabis, however there is still a prohibitionist culture that prevents an advancement in the discussion. The law in the country does not permit public disclosure on cannabis, and these community rules often include the medical community, even for therapeutic uses. One example of this is Dr. Cannabis, an online platform for education created for professionals who wish to advance their career on the cannabis market, which had the accounts deleted multiple times.

It is essential to learn how to communicate in an effective manner, understanding the audience, who they are and what they want. As each media outlet has a different audience, the first step is to

discern the tone of voice and how to approach. Kaya Mind (2022) reported that, although "cannabis" and "marijuana" are the same plant, there is a difference in public perception regarding these two words, due to social and historical construction. While "cannabis" has European origins and is mainly associated with its medicinal traits and business opportunities, "marijuana" has African roots and is largely linked to adult recreational use. If the strategy is to use the mainstream media, one should know most of the spectators may not have a great understanding of the many uses of cannabis, meaning that there should be more informative character in the communication, in order to destigmatize the plant.

Nonetheless, although the mainstream media has given more recognition to cannabis, there are still restrictions in terms of advertising. Anvisa limits the promotion of approved cannabis products by stating in the Article 12 of Resolution 327 of 2019 (Health Ministry of the Brazilian Government, 2019) that "any advertising of cannabis products" is prohibited, even those legalized. GreenCare, a pharmaceutical company that manages one of the world's largest cannabis funds (Greenfield Global Opportunities), announced about the possibility of delivering their products to Brazil, however was banned by Anvisa to disclose further, as the legislation does not allow it. In order to comply with the regulations for the sale of controlled drugs, stated in Ordinance 344/98 (Health Ministry of the Brazilian Government, 1998), pharmacists can only dispense a cannabis product upon the submission of a physician's Prescription Notification, and each sale must be registered through the National Controlled Product Management System.

To surmount this challenge, marketers have had to alter their focus, looking towards education, while associating with health specialists (Kaya Mind, 2022). Another solution that companies have encountered is to host the website in a country where disclosure on cannabis is allowed., protecting themselves from unexpected bans. In order to successfully promote their products and avoid sanctions, companies have tried to find a balance with more traditional and discreet techniques that will be less likely to spread quickly through social media. Other marketing strategies include word of mouth, good sales representatives, and presence at events (such as health seminars and cannabis conferences).

As shown, there are significant obstacles in communicating and advertising about cannabis, largely due to the stigma and limitations of propagation of information. In spite of that, with the potential for growth and success in the cannabis industry, the marketing sector is sure to expand in the next few years in Brazil. There has been an increasing need for open discussion and new advertising strategies that can both reach target audiences and comply with regulatory restrictions. And, as the rules change in the following years, assuredly more and more freedom will come to broadcast the topic. In this rapidly evolving sector, companies that are able to overcome these challenges will be better positioned to thrive and capitalize on the opportunities.

*Retail and eCommerce*

Two of the sectors also rapidly expanding in the cannabis industry are the retail and ecommerce markets, which, in turn, bring its own series of obstacles. There is ample opportunity for business to enter this market, as sales show constant demand. There are three main routes for distribution of cannabis products so far in Brazil, them being through import, pharmacies or associations, each with their own specific regulations and dynamics (Kaya Mind, 2021).

The most practical options for consumers right now are through importers and online marketplaces, along associations. Because companies are not allowed to openly post their products in their marketplaces, some use their websites to show the product while covering the label, concentration of compounds in the medicine and prices. Some may even overstep and disclose the label, but if a report is made to Anvisa, there could be problems such as fines and a website block.

In this stage, it is important to analyze how to create a user experience for a consumer when the communication on cannabis products is restricted. Inside retail, in order to effectively drive sales, these new businesses must learn how to take customers to their site and facilitate purchases at the same time that regulations are met. For this, effective communication and differentiation strategies are key.

*Finance and funds*

As the cannabis industry faces significant growth in the past years, the financial sector has also been put in an important position in order to drive this advancement in the market. Thanks to the regulation of cannabis in many countries, which helped with discovering new scientific evidence regarding the plant, many notable adaptations have been made in various areas of society - namely finance. This is all due to the new found recognition and acceptance in the industry, which returns as an advantageous investment opportunity, especially since companies in this sector have been included in reputable stock exchanges recently. Kaya Mind (2021) reported that, as a result, thematic assets aimed towards cannabis were created, including investment funds, cryptocurrencies and ETFs (exchange-traded fund).

There are at least three investment funds from large institutions as of now, in Brazil, operating in the cannabis industry. Cryptocurrencies directed at reducing environmental impacts and moving the economy of this market have also been created, such as Cannacoin (Cannacoin, 2014). Nevertheless, careful analysis is important before investing, as each asset should be studied to find the best suited to the investor's profile and investment portfolio. In Brazil, most cannabis funds are aimed at long-term investments with high risks, so it is also crucial to check if the chosen investment accepts the investor's profile.

Even with the high risk, this industry has shown to be extremely profitable, with great prospects of opportunities - both for small and large investors - as more countries legalize the many uses of cannabis. One should also note that this market is primarily based on international performance, as most countries, such as Brazil, still have a long way to go to decriminalize cannabis and, consequently, it still has not achieved its financial potential. Yet, in 2019, the first Brazilian investment fund catered to the cannabis industry was created, growing 182% in the next two years (Kaya Mind, 2021). The company then launched a new fund, which grew 398% also in two years. Although the cannabis market is relatively new and there is still much to uncover and mature, the evolution of the debate has been revealed through the movement in the financial market, both at a national (in Brazil) and international level.

*Education*

Cannabis is a very wide-ranging topic, relevant to the social, political and economic development of a country. Despite the relevancy, it is still a challenging matter to tackle due to a scarcity in professionals who can provide the necessary knowledge in the subject, in different sectors. In the medical field, professionals are especially at a disadvantage, as their training seldom includes specialized courses designed to expand knowledge, although this also happens in different fields.

Given the broadness of the topic, each specialization can benefit from its own course on cannabis. These programs can raise awareness regarding the best practices, innovative products, and latest research in the industry. While improving the comprehension of the plant, the stigma also reduces, and more professionals will be able to prescribe medical cannabis (now, only certain medical experts in Brazil are allowed to advise cannabis, but other sectors, such as veterinary and dental, are heading in the same direction. The same has happened in other countries as well), resulting in more patients having access to the information and to the products. As the market grows, certainly more players will join the industry, increasing opportunities and revenue streams, benefiting the overall economy.

The health area now has more research available than any other field, given that most legislation worldwide initiates the liberalization of cannabis first for medicinal purposes and for research in the pharmaceutical industry. These courses can include topics such as the science behind cannabis, its therapeutic properties, and how it interacts with the body's endocannabinoid system. Additionally, many companies in Brazil are partnering with universities to develop their own cannabis ecosystem, with specialized physicians who understand the quality of the products prescribing them to patients. Another example is USP (Universidade de São Paulo) and Hempmeds creating a curriculum focused on the medicinal use of cannabis (Hempmeds, 2023).

The importance of these courses is due to the need in improving the quality and credibility of products and services offered in the market. This also creates and expands the networks between the players, establishing a platform of knowledge sharing, collaboration, as well as development of innovative products. Having this opportunity to develop a new sector of the economy, while

improving the livelihoods of people who need access to medical cannabis and other products, it is crucial to look at courses directed to cannabis as a means for social and economic development of the country.

*Content and press portals*

In recent years there has been a rise in content and press portals in the cannabis industry, one of the most proliferating business models in Brazil being specific portals for cannabis, with the goal of educating and informing those who still hold prejudices on the plant and deconstructing stereotypes. The history and role of the press is important to understand, due to the media having an immense capacity for mass mobilization. The popular awareness of this plant and its influence on society (both in a positive and negative light) has impacted the media's portrayal of cannabis.

Websites (like Smoke Buddies, Sechat, Cannabis Monitor, umdois, Cannabis & Saúde, among others) entirely dedicated to cannabis related content have been gaining visibility in the last few years. These informational forums play an indispensable role in promoting conscious consumption and educating the public on the topic and many uses of cannabis. In order to accurately pass on facts, these media outlets have learned to adapt their language and use statistics to hold credibility and reduce stigma.

Kaya Mind analyzed over 20.000 articles with the goal of understanding the behavior, positivity, scope and repercussions of the topic in Brazil and their released report (Kaya Mind, 2022) concluded that there are different agendas within similar editorials. For instance, although O Globo and g1 are both from the same group, the report shows that 85% of cannabis-related articles by O Globo shed a positive light on the topic, while g1 (press vehicle in Brazil that speaks the most about marijuana) only has 11% of positive published stories. The other percentage is dedicated to trafficking, violence, incarceration and seizure of drugs.

This report also showed the difference in words used by the media and public perception. The word "cannabis" is more commonly used in positive articles (around 88%), while "marijuana" is not (approximately 14%). There has been a long-standing debate in the cannabis community, as this

disparity may derive from the African roots of "marijuana", while "cannabis" holds European origins (Kaya Mind, 2022). Understanding this media treatment between the words is essential to those entering the media market, as well as recognizing the ability to influence public opinion that these outlets contain. And, as the cannabis industry expands, more professionals will be needed to disseminate reliable and impartial information regarding this sector.

*Events*

Another crucial sector that has an important role in the cannabis industry, and that greatly aids in the advertising and dissemination of the cannabis industry, is the events sector. This branch has served as a meeting point for the main spokespeople in this business and, because of this, has gained strength and adherence, on a worldwide scope and in the last 2 years in Brazil. However, in order to be a spokesperson, one must have a deep understanding of the subject, which demands study and preparation for the role.

Today, many workshops about the medicinal and adult use of cannabis have been created in Brazil, with healthcare having the most visibility, as it is the division with the most advancement and information. The Medical Fair Brazil has held workshops, as well as the CICMED and the Brazilian Medical Cannabis Congress - all events catered towards doctors and health professionals. Also, for the first time in the country, the Expocannabis 2023 is going to happen, based in São Paulo - the largest prescribing and consuming city of cannabis derivatives, and also considered a world business capital.

Although there are still not many cannabis congresses in Brazil, and most of them focused on the medical sector, there are many workshops widespread in all markets. As specialized professionals pass on quality information through these events and, so far, the dissemination of knowledge on the subject on public forums is still limited, it is of extreme importance to value the event sector - to provide professionals both a platform for learning and for networking.

*Data*

In any market, especially new ones, it is important to understand the key metrics, standards and consumer behavior, and the cannabis industry has been attracting the attention of specialists of the data sector. There is still a great scarcity of information in the world, especially in countries where regulation and prohibition are preventing further data collection, such as Brazil. To tackle this problem, Kaya Mind was created as the first market intelligence company in Latin America focused on cannabis (Kaya Mind, 2020). Their goal is to collect, analyze and deliver information about the cannabis sector to investors, entrepreneurs, government agencies, and enthusiasts, in order to help develop the market in the country, and simultaneously restore the damage caused by prohibitionist policies.

Countries such as the United States, the United Kingdom and Spain already have specialized companies focusing on this field, helping companies embrace this new market. Most top data companies emerged after 2010 - namely the US, with particular emphasis on the Farm Bill of 2015 (Industrial Hemp Farming Act of 2015, Sen. Wyden) - and the top 18 global companies focused on the cannabis market are headquartered in the US. The data sector is expected to gain more and more traction in the coming years.

Despite difficulties in obtaining information in Brazil, due to limited access to government data, there is great encouragement of information sharing among foreign companies, which in turn form an information ecosystem that supports each other. The data sector holds a high level of seriousness and responsibility, and must overcome difficulties such as the potential changes in regulations and rapid pace of development in the industry. The understanding of which sources to target, which data to generate, and which metrics to disclose to clients is necessary to guarantee an above-average market performance.

*Food*

In Brazil, the food sector is one of the largest sectors, and because a variety of products can be derived from hemp - such as milk, meat, flour, oil, protein supplements, and even gummy bears infused with cannabinoids (in legalized countries) -, there is a big potential of growth in the country. Hemp is

considered a "superfood", thanks to its high levels of omega-3 and omega-6 fatty acids, fiber and minerals, besides being a sustainable type of crop (Karche & Singh, 2019).

There has been a significant reduction in meat consumption among the Brazilian population in the past few years for various reasons - such as health, rise in meat prices, and climate change mitigation -, and this number is expected to grow in the next few years. Besides this, around 8% of the general Brazilian population is vegetarian (Kaya Mind, 2022). Hemp provides a potential alternative for both meat and milk, with seeds containing high levels of protein and dietary fiber, making it a popular choice among this group, showing that there could be great potential for revenue. Kaya Mind (2022) estimated in a report about the cannabis market tendencies in Brazil that the "healthy food market" in the country has reached an annual turnover of 35 billion USD, making it the fourth-largest market globally.

In countries such as the United States, the use of cannabis in cooking (commonly known as "cannacusine") is gaining popularity. This trend challenges chefs to create recipes integrating THC and/or CBD in the cuisine, and branching out into cooking shows on Netflix, as well as cannabis-themed restaurants and cafes, offering a unique dining experience. It is also important to note that many adults do not like or can not smoke, having to ingest cannabis through food. All these factors demonstrate that there is a market for cannabis foods, as many countries are already generating millions in revenue through this sector.

As with any food product, it is important to properly regulate and do due quality control to ensure consumer safety. This includes testing for contaminants such as pesticides and heavy metals, accurate labeling of ingredients and dosage, and adherence to food safety standards. However, in order to properly achieve this, plenty of government assistance will be needed - from investment, to facilitation in regulations, appropriate education of the public, and research for new products to be created. This thriving sector, closely linked to overall well-being, has seen hemp emerge as an alternative to many unsustainable consumption patterns, aligning with a global trend. As a result, the food industry stands out as one of the key areas where cannabis can make a positive and wide-ranging impact.

*Drinks*

Another area where the cannabis industry is thriving worldwide is the drinks sector. As shown in the Kaya Mind (2022) report, companies and manufacturers have started to infuse drinks with THC, CBD, and even terpenes (catering to leisure and well-being), doing this process with teas, juices, soft drinks, wines, beers, and other products. Different concentrations of cannabinoids and terpenes from the plant can be used, but this technique is not simple to achieve, needing specific technologies - such as nanotechnology (Kitdumrongthum & Trachootham, 2023) -, as it is difficult to mix cannabinoids and oils into water.

Medically, this solution is very interesting for children who need specific CBD medication, for example, being able to combine juice and oil to balance. In addition to CBD and THC, other cannabinoids such as CBN (cannabinol) and CBG (cannabigerol) have also been explored to use in drinks, due to them having their own health benefits and effects (Thomas & ElSohly, 2016). Cannabis-infused drinks have also been researched as a healthier alternative, as traditional sodas and industrial juices have harmful components, while cannabis can be made with natural sweeteners and offer low-calorie.

Experts predict that the cannabis drinks market will continue growing in the coming years (Fortune Business Inside, 2022), focusing on CBD-infused drinks, on account of it being a non-psychoactive cannabinoid with health benefits. One of the key market insights published by Fortune Business Inside (2022) was that there was a 56.49% market growth in the global cannabis drinks market just in 2020. They also highlight a projection of $19 billion USD by 2028, as more countries permit the sales of this type of drink.

Up to this point in Brazil, there is only the option of medical regulation for cannabis, so in order to participate in the infused drinks tendency, the country opted with the infusion of terpenes. As previously stated, terpenes are present not just in cannabis, but in various other elements found in nature (Government of Canada, 2020), making it possible to create and sell terpene beers in Brazil (Kaya Mind, 2022). There is substantial potential for this market in the country, as drinks are one of the biggest markets in Brazil, and Ambev (one of the biggest beverage and beer companies in Brazil) has

already launched its own drink with cannabis abroad (Kaya Mind, 2022), having the know-how to expand to Brazil. Alongside them, other companies such as Constellation Brands, Heineken and Coca-Cola have shown interest in this new business opportunity in the country.

As the global cannabis beverage market has demonstrated a promising growth rate, big players have begun to display interest in participating. Despite challenges and the need for specific technology to infuse the drinks with cannabis, many countries have been generating great revenue through this sector. As regulations continue to evolve globally and in Brazil, more companies and manufacturers will participate in the market, guaranteeing its incessant growth.

3.1.2 Job creation and tax revenue

According to an article by Fortune, strategists at the British universal bank Barclays have stated that cannabis tax revenue in the United States surpassed $2 billion USD in 2020, and estimated a growth reaching $12 billion USD by 2030 (Braun & Bloomberg, 2021). The increasing legalization of cannabis, for its different uses, across different states have and will continue to impact these projections, especially as the cannabis tax has become a significant source of revenue for many states. This new income is able to fund various public projects in US Municipalities, such as infrastructure improvements and water upgrades.

The state of California amounted nearly $1 billion USD in the first three quarters of 2021, exceeding the previous year by 21%. Furthermore, by 2026 the state is presumed to generate $1.7 billion USD in cannabis revenue. Other states, like New York, New Jersey and Connecticut have the potential to reach up to $2 billion USD in cannabis revenue as legalization is embraced. The state of Colorado, on the other hand, has accumulated over $2.1 billion USD in cannabis tax revenue since the legalization of adult-use cannabis in 2014, destinating at least $745.6 million USD towards the state's school system (Braun & Bloomberg, 2021).

It is important to note that the above data pertains to the adult-use market, as it is more tangible, while estimating the total revenue potential of all applications of cannabis (such as medicinal and hemp) is challenging. In spite of that, it is possible to see the immense economic potential of the

cannabis industry based on the revenue generated from the adult-use market alone. The revenue generated from taxation is expected to increase exponentially as the legalization trend of all uses continues, providing a significant source of revenue for governments and local communities.

In relation to industrial hemp cultivation in Brazil, a report by Kaya Mind (2022) evaluates a potential collection of $4.9 billion BRL from the sale of derivatives for the fourth year of hemp legalization, with an additional $330 million BRL destined for State tax collection. To achieve this scenario, the country must overcome challenges, like lack of machinery and technologies for cultivation and harvesting, and selection of suitable seeds adapted to the Brazilian territory. It is important to give time for the market to stabilize, as the embryonic phase involves extensive studies to comprehend the workings of the industry within the country (and each country has its own particularity, customer profile, market prospect and approach). Regarding the overall cannabis market in Brazil, another report by Kaya Mind (2022) estimates that by the fourth year of legalization, $26.1 billion BRL will be traded among the three regulated uses of cannabis, $9.5 billion BRL just for the medicinal cannabis market. Their projection for cannabis tax revenue was of $8 billion BRL by the fourth regulated year.

This industry has not only sparked substantial revenue growth, but has also played a pivotal role in employment generation across a spectrum of sectors (Fortune Business Inside, 2021). This shift has led to the creation of jobs in diverse fields, including agriculture, chemistry, and pharmacy. The profound advancement of this industry in Brazil is estimated to catalyze the creation of approximately 328 thousand new jobs, spanning both formal and informal sectors (Kaya Mind, 2022). Just in the medical marijuana industry, around 15.000 jobs can be generated in the next decade (Kaya Mind, 2021). This substantial rise in employment is expected to have a far-reaching impact, fostering opportunities and stimulating economic growth development within the country.

3.1.3 Cost savings in law enforcement and criminal justice

The exploration of cost savings in law enforcement, particularly in the context of cannabis-related offenses, is also an important topic, as it delves into various countries' experiences and

their respective financial and societal outcomes resulting from cannabis decriminalization. Some highlights include: significant disparities in policing expenditures, the implications of arrests and incarceration, and the fiscal costs (as societal benefits will be touched upon later) associated with these practices (Hall, 2020). This chapter aims to provide an insightful analysis of how reforming cannabis policies can lead to substantial savings and contribute to more efficient law enforcement practices.

According to the UK's TaxPayers' Alliance (2018), an estimated 891.72 million GBP would be saved annually through cannabis decriminalization. These savings are rooted in reduced spending across various sectors - police operations, the criminal justice system, and the public health system due to a shift toward alternative pain relief treatments. However, this underscores the strain on law enforcement, as over a million police hours are dedicated to enforcing cannabis prohibition. Furthermore, the financial burden of imprisoning marijuana-related offenders in the UK amounts to 50 million GBP per year. The TaxPayers' Alliance (2018) also emphasized that legalizing cannabis has the potential to alleviate these financial pressures, particularly within police budgets specifically, with projected savings of approximately 200 million GBP annually.

In the United States, the enforcement of cannabis-related laws has resulted in significant financial burdens, not only on law enforcement agencies but also on taxpayers. In 2018, the country witnessed a staggering number of over 663,000 arrests involving marijuana. Of these arrests, more than 608,000 were solely for cannabis possession, indicating that a substantial portion of law enforcement efforts is directed towards apprehending recreational cannabis users rather than large-scale dealers (Jorgensen, 2020). With each arrest costing between 1,000 USD to 5,000 USD, and each inmate costing from 30,000 USD to 35,000 USD per year, the estimated expenditure for apprehending recreational marijuana users is from 600 million USD to 3 billion USD. Critics argue that these tax dollars could be better allocated to equipment update and bolstering officers' salaries (Jorgensen, 2020).

A closer look at individual states reveals the financial commitments required for cannabis possession enforcement. New York, for example, allocated 574.5 million USD to cover the combined expenses of police and judicial/legal services (ACLU, 2013). California spent 425.5 million USD on

similar services. The financial implications extend beyond arrests and incarcerations. The "war on drugs" in the United States is estimated to cost around 47 billion USD annually (Jorgensen, 2020), with consensus among criminal justice scholars, drug policy experts and criminologists that the War on Drugs has not yielded the expected benefits - failing to reduce drug use or curb the associated crimes linked to the illegal drug trade.

Regarding Brazil, Kaya Mind (2022) examined the societal consequences of cannabis prohibition in Brazil, focusing on the exponential growth in the prison population, driven primarily by drug-related offenses, jumping from 361,000 imprisoned in 2005 to over 759,000 in 2020. Racial disparities, particularly the disproportionate convictions of black individuals for drug trafficking, despite having fewer drugs seized, were also highlighted (Kaya Mind, 2022). A staggering 70.9% of the defendants are convicted, with only 5.2% classified as users.

A study conducted in 2016 (Teixeira, 2016) estimated that each inmate in Brazil costs over 21,000 BRL to the State per year (this sum amounts only for expenses within the prison system, not including the police phase, investigation and trial). In 2014, the estimated spending on prisons related to drug trafficking in Brazil was 3.32 billion BRL. Teixeira (2016) also pointed out the expenses with police repression related to the fight against drugs in the same year, amounting to 409.5 million BRL.

3.2 Social benefits of investing in cannabis

In recent years, the growing recognition of cannabis' medical benefits and its potential as a tool for tackling opioid, tobacco, and alcohol addiction has sparked a transformation in public perception and policy surrounding this once stigmatized plant. As countries around the world explore the therapeutic potential of cannabis, the focus extends beyond individual health improvements to encompass broader social benefits. When evaluating the potential economic benefits of investing in cannabis, it is crucial to fully examine all the multifaceted advantages of the plant's uses, exploring how it not only holds promise as a therapeutic agent for various medical conditions (Lima et al., 2021), but also offers potential solutions to address the opioid crisis (Wiese & Wilson-Poe, 2018) and reduce

addiction rates for tobacco (Nasrin at al., 2023) and alcohol (Coelho, 2022). Furthermore, it highlights the pivotal role of cannabis in advancing social justice and equity, as diverse communities seek to rectify the historical injustices associated with cannabis prohibition. By inspecting the intersecting domains of medical, public health, and social equity, one is able to gain valuable insights into how cannabis can pave the way for a more holistic and inclusive approach to promoting health and wellbeing in society.

3.2.1 Medical benefits for patients with certain conditions

Due to its potential therapeutic benefits in various medical conditions, *Cannabis sativa L.* has become the subject of extensive research. The endocannabinoid system, a complex network of receptors and endogenous cannabinoids found throughout the body, is one of the key reasons behind the plant's medicinal properties. This system plays a crucial role in regulating pain sensitivity and inflammation (Lima et al., 2021).

These remedial effects appear in different pathologies. It has been shown to have anxiolytic and antipsychotic properties, benefiting individuals suffering from anxiety disorders and certain mental health conditions. Additionally, cannabis has displayed promise in the treatment of diabetes, HIV/AIDS, arthritis, glaucoma, diabetic retinopathy, and cancer (Lima et al., 2021). The findings above have significantly contributed to a shift in the cultural perception and acceptance of marijuana as a legitimate medicine.

Notable efficacy has been seen in the treatment of epilepsy (Lima et al., 2021). Patients with said condition who do not respond well to traditional anticonvulsant drugs have found reliefs through the use of cannabis-derived compounds, particularly CBD (cannabidiol). This compound also possesses neuroprotective and antioxidant properties that may help slow the progression of Parkinson's disease and provide relief from its symptoms, as it is a neurodegenerative disorder characterized by the degeneration of dopaminergic neurons in the brain (Oliveira & Lima, 2016).

Another condition that has been investigated in the context of cannabis is multiple sclerosis. The plant showed results in alleviating spasticity, a common symptom in multiple sclerosis identified

by muscle stiffness and involuntary contractions (Brucki et al., 2015). However, although studies have reported improvement in self-assessment scales related to this trait,  the efficacy of cannabis in managing neuropathic or central pain associated with multiple sclerosis has shown variable results.

In Brazil, the medical benefits of cannabis became more evident through the experiences of mothers whose children suffer from health problems that can be alleviated or even resolved with CBD. Faced with limited options within the country, these mothers resorted to importing cannabis-based products or even cultivating the plant themselves as an act of civil disobedience. Many of them (family members and patients) even founded cannabis associations in the country, raising awareness and providing the medicine for other people in need.

These actions, as well as the compelling results, sparked a nationwide conversation about the medical potential of cannabis. As a result, in 2015 Brazilian law underwent  a significant change, authorizing the exceptional importation of cannabidiol-based products upon prescription by a qualified medical professional (Kaya Mind, 2022). This pivotal moment, driven by the determination of these mothers, highlighted the undeniable medical benefits associated with cannabis. It brought relief, healing, and improved the well-being of patients, and consequently families, who had previously struggled to find effective treatment within the confines of traditional medicine.

It is through these real-life experiences and the grassroots efforts of individuals seeking relief for their loved ones, both in Brazil and worldwide, that the importance of exploring the medical benefits of cannabis becomes even more evident. However, further research is still needed to better understand its mechanisms of action, optimal dosages, and long-term effects. Nonetheless, the existing findings provide valuable insights into the medical benefits of cannabis and its potential to improve the lives of patients who suffer from various conditions. And by embracing scientific research, conducting clinical trials, and implementing comprehensive regulations, countries will be able to unlock the full potential of cannabis as a valuable medical resource, providing hope and improved quality of life for countless individuals in need.

3.2.2 Reduction of opioid use and addiction

Besides the previously mentioned potential benefits of cannabis, in recent years studies have explored the plant as a promising alternative for addressing addiction to opioids, tobacco, and alcohol. This emerging area of study delves into the possible role of cannabis in alleviating withdrawal symptoms, reducing cravings, and offering a safer pathway towards recovery from addiction. There is still a shortage of studies at a global scale regarding this subject, as regulation on cannabis is still recent, however, current researches show promise in the battle against addiction.

The opioid overdose epidemic in the United States of America is a severe public health crisis, and researchers are exploring potential solutions to combat its damaging impact. A promising study by Wiese and Wilson-Poe (2018) stated that cannabis was able to ease opioid withdrawal symptoms, while also reducing opioid consumption, and curbing cravings. This resulted in less opioid relapse and, consequently, lower number of overdose deaths. Due to cannabis' analgesic properties, it can also be prescribed as a first-line pain relief option, instead of traditional opioid-based medicine.

Wiese and Wilson-Poe (2018) also disclosed that California (where medical cannabis has been legalized since 1996) holds the lowest rate of opioid overdose fatalities in the U.S.A. Their study further analyzed national death certificates and found that the annual rate of fatal opioid overdoses reduced by 24% in the first year following medical cannabis legalization. Additionally, individuals who reported opioid withdrawal symptoms have described relief through cannabis use, especially in reducing anxiety - the most common withdrawal symptom (Bergeria et al., 2020). Only a minority of individuals reported worsen symptoms.

CBD has shown promise in also helping tobacco users reduce their cravings for cigarettes (Nasrin at al., 2023). Smoking-related causes account for one in five deaths in the US each year, hence the pursuit for life-saving alternatives by researchers. A study by Nasrin et al. (2023) reveals that CBD, even at relatively low concentrations, inhibits enzymes related to nicotine metabolism, which could potentially reduce the urge for the next cigarette.

Another study (Hindocha et al., 2018) explored CBD's effects on tobacco withdrawal, recruiting 30 cigarette smokers for this effect - half taking CBD pills, half placebo pills. The results

indicated that CBD's anxiolytic properties could help ease withdrawal symptoms. Participants who took CBD pills showed the same attentional bias as when they had just smoked and were satisfied, suggesting reduced cravings. They (who took CBD pills) also rated cigarette stimuli as less pleasant during abstinence, indicating a reduced desire to smoke. Although more research is needed, these findings suggest that CBD may have unique effects on how drug cues are perceived, potentially aiding in tobacco addiction treatment.

Another addiction CBD could potentially help with is alcohol addiction. Coelho (2022) explains that both THC and CBD interact with the endocannabinoid system (ECS), and also that rats have shown that chronic alcohol use and withdrawal can affect the levels of endocannabinoids in the body. Due to this, although more research is needed, many experts believe that CBD may have a role in preventing the breakdown of endocannabinoids, helping the body stay healthier and more balanced (Coelho, 2022).

An article by Room (2006) highlighted that alcohol, tobacco, and cannabis are ranked as causing the most to least harm, respectively. Furthermore, the study cited European articles indicating a "strong general toxicity" for alcohol, and "very weak general toxicity" for cannabis. Lastly, it disclosed that alcohol was considered "socially dangerous", while cannabis had "weak to no social dangerousness". Another study conducted suggested cannabis might be a potential substitute for alcohol, and it could be safer and less addictive than other pharmaceuticals, such as benzodiazepines - used for alcohol withdrawal (Subbaraman, 2014).

In order to explore the self-reported use of cannabis as a substitute for alcohol, the Canadian medical cannabis program organized a study involving 2012 people (Lucas et al, 2020). The results showed that 44% of those who participated disclosed a reduction in alcohol usage frequency over 30 days. It also reported that 34% lessened the number of usual drinks per week, and 8% did not consume alcohol in the 30 days stipulated.

Alcohol is the most used recreational substance in North America, and is largely associated with high rates of criminality, morbidity and deaths (Lucas et al., 2020). Additionally, the World Health Organization (WHO, 2018) listed CBD as "not addictive". These discoveries could lead to

better health results for patients using medical cannabis, contributing to enhanced public health and safety on a broader scale.

3.2.3 Social justice and equity in drug policy

Traditional business models have historically tended to be for-profit (focused on profit) or not-for-profit (focused on social impact). New leaders, however, are leaning towards social entrepreneurship, uniting profit and impact - bringing social change together with self-sustaining and revenue-generating business models. Much of this motivation is due to changes in the consumption habits of a population that has been demanding better corporate positioning. The cannabis industry was created at a time of grassroots social change, when consumers were seeking positive social impacts from the brands they supported. And within this industry there were (and still are) many social justice issues to be overcome- racial equality and reparations, overturning cannabis incarcerations and convictions, access to medicinal cannabis for those in need, and the ongoing fight to end the war on drugs. Therefore, it is important that the pioneers who help shape the sector include means to impact society as a whole, making the scenario propitious to situating the cannabis industry as an example of a model to be followed (Nison, 2020).

Issues such as cannabis incarceration are often influenced by racial factors. Some state programs in the United States, like the Massachusetts' Social Equity Program, have implemented programs that help historically oppressed communities and individuals with commercial licenses and other services to the cannabis industry. Other non-profit organizations focus on drug policy reform, which are essential to support social entrepreneurship, while some cannabis companies hold a social volunteering branch, providing assistance to individuals incarcerated for drug possession (for all uses). Nison (2020) also referenced other measures companies can install to positively impact society, such as installing a pro-bono program for new ventures with the same goals - providing service (such as consulting or access to certain tools or knowledge) to help newer companies grow.

The war on drugs in many countries, especially those with low socioeconomic and human development indicators, has contributed to the exacerbation of inequalities and oppressive practices against marginalized communities. This has resulted in a surge in incarceration rates, police violence and declined access to basic human rights for affected communities. A report by Kaya Mind (2022) emphasizes the need to address said issues, as with a recognition of the adverse effects of the war on drugs, policymakers and stakeholders can work towards implementing more inclusive approaches.

The report also highlights the importance of improving the quality and safety of cannabis products available to consumers. The accessibility of clandestine and substandard cannabis products pose health risks for the public. The situation becomes even more critical when considering that many individuals in need of medicinal marijuana are treated as criminals in countries where its use is prosecuted, despite the availability of low-quality products.


3.3 Environmental benefits of investing in cannabis

There are various environmental benefits when cultivating cannabis, making this crop a sustainable and eco-friendly option. Visković et al. (2023) highlight many of them, the first one being the capability of capturing and storing more CO2 than most commodity crops, absorbing up to 22 tons of carbon dioxide per hectare, while also mitigating soil emissions of other greenhouse gasses, such as methane. The roots absorb toxic, harmful elements and substances such as lead, nickel and cadmium, which in turn allows cannabis to be used for remediation of contaminated soil. This ability leads to the lack of necessity of pesticides when cultivating this plant and can be easily included in crop rotations.

According to a report by Kaya Mind (2022), hemp cultivation has an efficient use of water resources - 1kg of hemp requires 300 to 500 liters of water, while 1kg of cotton demands 10.000 liters. It also needs a smaller area in order to grow, with plants cultivated at a distance of only 10 to 15 cm from each other, capacitating higher plant density. Having a short production cycle (70 to 120 days), hemp is able to be harvested three times per year; cotton takes 130 to 220 days to harvest. The fibers are

also three times the tensile strength of cotton, making it a durable and resilient material, and contributing to less waste, as products such as hemp clothes will be able to last longer.

Brazil is currently one of the world's biggest pesticide users - in 2017, around 550 thousand tons were dispersed in plantations. However, as hemp acts as its own pesticide, herbicide, and fertilizer (resulting in the reduction of extensive chemical use), it is viewed as a more environmentally friendly cultivation, especially when compared to cotton's requirement of 28 liters of pesticide per hectare. This plant also contributes to a healthy soil, as Kaya Mind's report (2022) continues. Hemp returns around 60% to 70% of all nutrients back to the soil, leading to fertility and preventing soil degradation, while cotton is a monoculture, degrading soil and creating sterility. Lastly, outdoor hemp production is seen as carbon negative (absorbs more carbon dioxide than it releases), further confirming its positive impact in combating climate change.

Going beyond the direct environmental impacts, one of the most promising aspects of *C. sativa* is its potential to serve as a sustainable alternative to resource-intensive products, such as plastics and textiles (Karche & Singh, 2019). The versatility of the plant, particularly hemp, stands out as an eco-friendly alternative as hemp fibers offer a renewable source of raw material for textile production, compared to cotton. Furthermore, its utilization in the production of biodegradable plastics is gaining traction, providing a sustainable solution to the pervasive problem of plastic pollution (Karche & Singh, 2019). These hemp-based plastics not only decompose naturally, but require fewer fossil fuels for their production.

The report (Kaya Mind, 2022) also states that, out of UN's 17 Sustainable Development Goals (SDGs), *Cannabis sativa L.* and its policies are able to contribute to 15 goals. This is mainly because the plant is able to tackle issues from all three pillars of sustainability - people, profit and planet. With Brazil placed 55th in a worldwide sustainability ranking, it is crucial for the country to take action towards a more sustainable future. There could be great benefits in embracing hemp cultivation as part of a green initiative, improving the country's sustainability profile. Additionally, one is able to use the entirety of the hemp plant without waste, maximizing resource efficiency and reducing environmental impact.

4. Summary and conclusion

In conclusion, this thesis has provided a comprehensive exploration of *Cannabis sativa L.*, encompassing its biology and diverse applications, as well as the consequential advantages that can derive from its regulation. This ancient plant, steeped in a complex history, has emerged as a subject of significant interest and research in recent times. Its multifaceted biology and adaptable applications have garnered attention across a spectrum of sectors, ranging from medicine to industry, personal care to environmental concerns (Karche & Singh, 2019). The potential of *C. sativa* extends far beyond its traditional perception, and this exploration seeks to unveil the dimensions of this plant's contributions, highlighting both its economic and social benefits within various global and regional contexts.

*Economic benefits and industry growth*

From its therapeutic potential to its role in industrial sectors, cannabis has shown remarkable versatility, with great promises of economic growth. The economic benefits of investing in the cannabis industry are substantial and diverse, with numerous markets poised to thrive, including pharmaceuticals, cosmetics, agribusiness, pets, and the food and drinks sectors (Karche & Singh, 2019). The cannabis industry has the potential to generate significant job opportunities on a grand scale (Kaya Mind, 2022), contributing to employment growth. Furthermore, the taxation of cannabis products could offer a substantial source of revenue for governments, supporting various public initiatives (Kaya Mind, 2022). Additionally, this industry boom stimulates adjuvant sectors like research and development, tourism, and the manufacturing of cannabis-based products, fostering economic diversification and attracting investment.

Within the Brazilian context, some economic benefits can be highlighted as:

- Diverse markets: cannabis industry can flourish in pharmaceuticals, cosmetics, agribusiness, pets, and food and drinks sectors.
- Job creation: significant potential for generating employment opportunities across various sectors of the industry.

- Tax revenue: taxation of cannabis products can provide a substantial source of revenue for public initiatives.
- Reduction of imprisonment costs: cannabis regulation reduces imprisonment costs by decreasing non-violent cannabis-related incarcerations

*Public health and medical benefits*

The social benefits of cannabis, in a medical viewpoint, are equally noteworthy. Motivated by a commitment to providing patients with alternatives for treatment and an improved quality of life, medical cannabis programs are spreading worldwide. Its potential to alleviate medical conditions and its role in reducing opioid addiction (Wiese & Wilson-Poe, 2018) and other substance dependencies could significantly improve public health outcomes. Patients suffering from certain conditions can find relief through medical marijuana (Lima et al., 2021), while its use as a substitute for opioids, tobacco, and alcohol could contribute to a healthier society (as well as alleviating withdrawal symptoms from said addictions). Moreover, cannabis can promote social equity by creating opportunities for marginalized communities to participate in the industry.

Some main medical social benefits in Brazil include:
- Medical relief: cannabis could offer relief for patients with specific medical conditions, enhancing healthcare outcomes.
- Addiction reduction: cannabis as an alternative to opioids, tobacco, and alcohol could contribute to curbing substance dependencies.
- Social equity: participation in the industry could empower marginalized communities, fostering a more inclusive economy.

*Social justice and impact*

The global shift towards cannabis regulation carries profound social implications while also serving as a catalyst for drug policy reform. By dismantling the barriers of prohibition, countries aim to address persistent social challenges tied to drug policies, such as reducing drug-related violence,

particularly in vulnerable communities (Hall, 2020). Regulation offers an alternative path that diminishes the incentive for illegal trade and the associated violence (Jorgensen, 2020). This transition also acknowledges the historical injustices inflicted upon marginalized communities by drug enforcement policies and replaces punitive approaches with harm reduction strategies (policies and programs designed to minimize the negative consequences of drug use, emphasizing health and safety rather than punitive measures). This comprehensive approach demonstrates that the impact of drug policies extends beyond individuals' drug use and reaches into the broader fabric of communities and society as a whole.

A few societal benefits gained by Brazil in a regulated scenario are:

- Cannabis regulation: could reduce drug-related violence in marginalized areas by shifting law enforcement focus from minor offenses to large-scale dealers
- Social equity: aims to reduce the impact of drug enforcement on marginalized communities and promote equal access to cannabis opportunities (including medical and industrial uses)
- Social justice: addresses concerns by ending cannabis user criminalization, reducing incarceration rates, minimizing exposure to violence in jails, and lowering the potential for future criminality

*Environmental impacts*

Beyond its economic and social advantages, *C. sativa* offers a range of environmentally friendly attributes that are increasingly critical in this era of heightened environmental awareness. One of the most promising aspects lies in its potential to act as a sustainable alternative to resource-intensive products, such as plastics and textiles (Karche & Singh, 2019). By harnessing hemp, for example, one is able to reduce the environmental strain associated with industries heavily reliant on fossil fuels and non-degradable materials. Furthermore, cannabis crops, in general, demand less water and pesticides, while also harvesting more $CO_2$ from the atmosphere than regular plantations (Kaya Mind, 2022). The plant's potential to reduce environmental strain could contribute greatly to sustainable agriculture practices.

The focal points correlating to Brazil are:

- Sustainable Practices: Hemp cultivation's minimal water and pesticide requirements align with sustainable agriculture.
- Resource Replacement: Cannabis products could replace resource-intensive materials, such as plastics and textiles.

In the context of Brazil, these benefits hold immense potential. The nation's rich biodiversity and agricultural heritage position it well to capitalize on the cannabis industry. As Brazil seeks to diversify its economy, embracing the cannabis industry could stimulate economic growth, providing jobs and generating tax revenue. The country's population stands to benefit from improved healthcare outcomes, reduced substance dependencies, and increased access to alternative treatments. Embracing sustainable practices in the cannabis industry could contribute to Brazil's environmental goals while fostering a more resilient economy. Thus, the confluence of economic, social, and environmental benefits makes investing in the cannabis sector a compelling proposition for Brazil's future. And, as many countries have already begun taking steps towards cannabis regulation, Brazil has the opportunity to learn from other nation's mistakes and apply these lessons to build a well-informed, responsible, and sustainable framework that maximizes the benefits of cannabis regulation while minimizing potential pitfalls.

In summary, the global shift towards cannabis regulation highlights the necessity for countries to recognize the significance of investing in this sector. However, the key lies not just in investment, but in thoughtful and strategic action. Nations must approach cannabis regulation with a commitment to responsible implementation, encompassing robust research initiatives, comprehensive frameworks, and equitable access. This worldwide movement presents a unique opportunity to set a precedent, demonstrating the economic potential of reform that bolsters public finances, reduces illicit trade, fosters economic equity, and addresses societal inequalities. In this dynamic landscape, countries have the possibility of shaping a progressive approach to cannabis regulation, contributing to a global

dialogue centered on effective and equitable drug policy reform that fuels economic prosperity through the many sectors created by *Cannabis sativa L*.

Limitations of this study should be acknowledged to provide a broad understanding of its scope and implications. Firstly, a significant limitation lies in the overall lack of research and concrete data regarding cannabis regulation, both globally and specifically in Brazil. Many countries have yet to fully regulate *C. sativa*, leaving much of the available data as projections and estimations of the potential impact - which are often based on the current markets and landscapes, as well as data from other nations. Additionally, in some regions, strict regulations prohibit comprehensive research of the plant, impeding the acquisition of concrete data. This scarcity of information creates a challenge in offering conclusive insights, especially on a global scale. Secondly, even in countries where cannabis has been regulated for a few years, the data available remains relatively recent. The cannabis market is still evolving, and it takes time for trends and implications to stabilize. Consequently, obtaining concrete and long-term information about the economic, social, and health impacts of cannabis regulation can be challenging. The lack of historical data limits the ability to draw definitive conclusions about the lasting effects of these policies, even if the data at hand looks promising.

However, it's worth noting that these limitations present an opportunity for countries like Brazil. By examining the experiences and challenges faced by early adopters of cannabis regulation, Brazil can proactively address potential negative implications. This learning process allows for the creation of more tailored and effective policies that align with the country's unique context and objectives. Brazil has the advantage of leveraging the experiences of others to make informed decisions and avoid potential pitfalls, ultimately ensuring that cannabis regulation is implemented in a way that maximizes benefits while mitigating risks.

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