Politecnico di Torino

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The potential of the cannabis world

Analysis of the potential of cannabis in several industry sectors; social and economic benefits of legalization

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"Humankind has not learned about balance, let alone practiced it. It is guided by greed and ambition, steered by fear. In this way it will eventually destroy itself. But nature will survive; at least the plants will."

— Brian L. Weiss,

REASONS OF THE CHOICE

While I was attending a Marketing class in 2019, right before the Covid-19 pandemic, the professor said: “Today you will learn how to create customer needs to push people to buy new products, even if they do not really need them”. My mind was literally blown up. “Creating needs in people? Buying something that they do not need to feel satisfied with themselves? Is really that the correct direction for our future? Will tomorrow’s managers worry just for their own interests, at the expense of all the others?”, I was asking myself. “There is no Planet B”, another sentence that I heard frequently, more as a refrain than as a statement. Communism died, but what is consumerist capitalism doing to the Earth? Social networks booming, big data, cookies, privacy renounces in the name of “public safety”, protected-species extinction, prohibitions, wars for oil and gases, spreading depression and anxiety diseases, advertising campaigns pushing people to find and identify themselves in short-lasting, bad quality, and Chinese children exploiting-made products… Is that the right future pattern for the planet? Does something have to change, or had something not been changed in the past? Humankind cohabited with the planet for several thousand years, while succeded in almost destroying it in less than one century. A change in tendency is truly needed, but how? Which are the alternatives? I have been studying hemp since I was 18 for my final project in high school, I always admired that powerful plant and pondered the history of its prohibition. How would be the world without cannabis prohibition? How would have been, if that never happened? This work humbly aims to academically answer all these questions, trying to contribute to an urgent and disruptive worldwide change in perspectives.

As Elliot Alderson (Rami Malek) says in the famous Mr. Robot series: “My father picked me up from school one day and we played hookey and went to the beach. It was too cold to go in the water so we sat on a blanket and ate pizza. When I got home my sneakers were full of sand and I dumped them on my bedroom floor. I didn't know the difference, I was six. My mother screamed at me for the mess but he wasn't mad. He said that billions of years ago the world's shifting and ocean moving brought that sand to that spot on the beach and then I took it away. Every day, he said, we change the world. Which is a nice thought until I think about how many days and lifetimes I would need to

bring a shoe full of sand home until there is no beach. Until it makes a difference to anyone. Every day we change the world. But to change the world in a way that means anything takes more time than most people have. It never happens all at once. It's slow. It's methodical. It's exhausting. We don't all have the stomach for it".

ABSTRACT

Cannabis is the most used drug worldwide: an estimated 219 million people consumed it in 2021. It is the drug with less perceived risk and, after its legalization for medical and recreational purposes in the greater part of the US, its use has significantly increased, with the proliferation of products with high THC contents. Nowadays, the cannabis market is constantly expanding, and gaining interest and inversions by multinationals. Hemp production and comercialization is a disruptive sector that involves several markets, such as textile, paper, construction, cosmetics, food, biomass and biofuels, wellbeing, and even the sin industry.

The goal of this research project is to analyze the potential of cannabis in several industry sectors, the regulatory situation worldwide and its limits, the social and economic benefits of legalization both of medical and recreational use, the complementary policies that could be enforced to rein in demand and evict the black market, and to highlight the changes in tendencies and opinions in the last decades, with a special focus on the Spanish background.

The hypothesis is that the cannabis plant is a very powerful resource that could be employed, in a short and medium-term perspective, to ecologically and sustainably rebuild the economical concept and to try to save the planet from climatic collapse. Moreover, that prohibition was unfair and driven by economical and political interests, and the medical use of the plant also encloses an enormous potential in the pharmaceutical sector.

The research method employed is a specific literature review of several articles, books, journals, and webpages, complemented by interviews with Spanish and Italian consumers, CBD shops, and cannabis club owners.

INTRODUCTION

Cannabis is the most used drug worldwide: as shown in Figure 1.a and 1.b, an estimated 219 million people used cannabis in 2021, highlighting a significantly growing trend (+4,78%) with respect to the 209 millions of the previous year, representing 4% of the global adult population. On the contrary, the consuming of the other substances remained almost unchanged in the last year (UNODC World Drug Report, 2022 and 2023). Cannabis is the drug with less perceived risk (Megías-Quirós and Rodríguez-San Julián, 2016) and, after its legalization for medical and recreational purposes in the greater part of the US, its use has significantly increased, with the proliferation of products with high THC contents (UNODC World Drug Report, 2022).

Auriol et al. (2023) tried to figure out the reasons for this increment in cannabis demand, deeply analyzing the delicate equilibrium between state policies and customers as well as black market possible reactions and suggesting different selling prices based on the government goals: reduce or contain the demand, maximize profit, or evict the black market.

Nowadays, the Cannabis market is constantly expanding, and gaining interest and inversions by multinationals (Lugo-Ruiz et al., 2021). Hemp production and comercialization is a disruptive sector that involves several markets, such as textile (Cacchioni, 2021), paper (Manosalva-Barrera et al., 2020), construction (Muñoz-Veloza, 2018), cosmetics (Martínez-Oró, 2018), food (Fuentes-Pérez, Acurio-Arcos, 2020), biomass and biofuels (Moscariello et al., 2021), wellbeing (MacGuill, 2019), and even the sin industry (Milenkovic, 2019).

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The hypothesis is that the cannabis plant is a very powerful resource that could be employed, in a short and medium-term perspective, to ecologically and sustainably rebuild the economical concept and to try to save the planet from climatic collapse. Moreover, that prohibition was unfair and driven by economical and political interests, and the medical use of the plant also encloses an enormous potential in the pharmaceutical sector.

The research method employed is a specific literature review of several articles, books, journals, and webpages, complemented by interviews with Spanish and Italian consumers, CBD shops, and cannabis club owners.

The agenda is the following:

1. A brief summary of the Cannabis plant structure and worldwide history;
2. Market overview of the main States that legalized cannabis worldwide;
3. Deep analysis of all the possible sectors that cannabis would be able to disrupt;
4. Focus on cannabis growing methods;
5. Comparison between past and future perspectives, and opinion trends;
6. An estimation of the effects of legalization in Spain;
7. Conclusions and confirmation of the hypothesis.

Keywords: Cannabis, legislation, circular economy, disruption, legalization

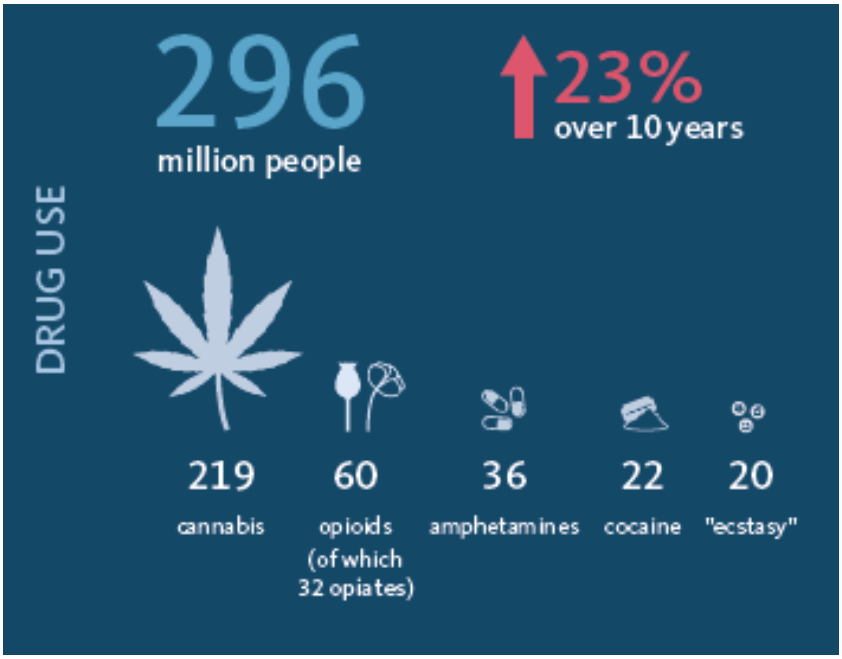


Figure 1.a. World Drug use by substance. Source: UNODC World Drug Report, 2023.

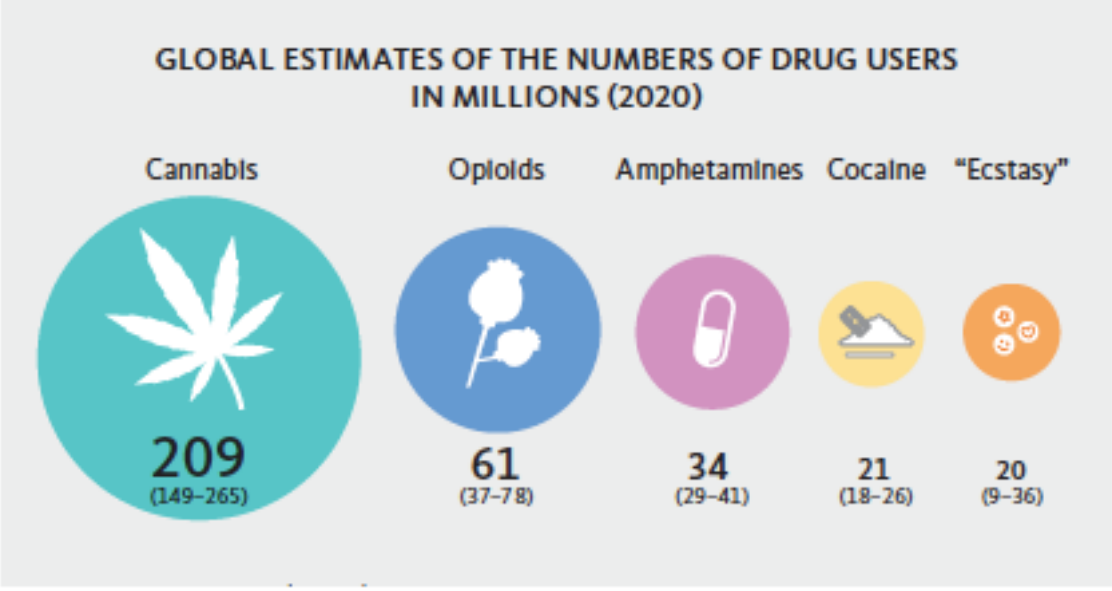


Figure 1.b. World Drug use by substance. Source: UNODC World Drug Report, 2022.

Chapter 1 – THE CANNABIS PLANT AND ITS HISTORY

1.1. A brief description of the plant

The cannabis plant is very hardy, it can grow at almost any latitude and faster than almost any other crop. The scientific name of the cannabis plant is Cannabis Sativa L, but it is also known as "weed, hemp, marijuana…".

It can be classified both according to a scientific and an effect-based point of view.

From a plant structure-based perspective, as shown in Figure 2, there are three types of cannabis (Rubio-Escalona, 2021; Milenkovic, 2019):

- Sativa: tall and thin, it has not very dense foliage and can reach up to 8 meters in height. Its leaf has more slender and elongated leaflets.
- Indica: it is shorter and stockier, and has much denser foliage. Its leaves are shorter and rounded.
- Ruderalis: less widespread but more resistant, it grows mainly in the colder areas of Central Asia.

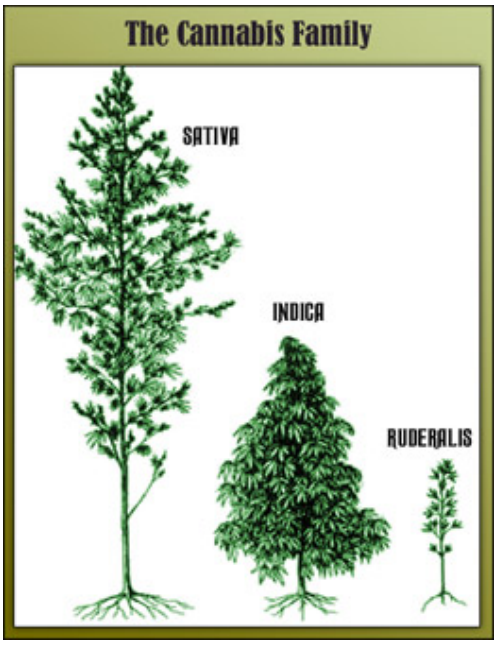


Figure 2. Types of the cannabis plant. Source: Cannabisgrowing.wordpress.com

It contains more than 400 compounds, of which over 120 are phytocannabinoids (Kochen, 2022, Rubio-Escalona, 2021). The most known are CBD (Cannabidiol) and THC (Δ-9-Tetrahydrocannabinol), but there are other compounds with proven medical use as CBG, CBN, and CBC (MacGuill, 2019). The only psychoactive ingredient that causes mental changes, THC, is contained in the cannabis flower and leaf.

1.2. Cannabis origins

The earliest uses of hemp were found at least 8.000 years before Crist, in Central Asia, especially China (MacGuill, 2019; Santos Diéz, 2022), and it had been the most used crop for several thousand years until 1833 AC. Its uses were not just agricultural, but religious, medical, textile, food and recreational. (Herer, Cabarga, 1998; Santos Diéz, 2022)

It was already mentioned in the first medical document worldwide by Emperor Shen Nung, in 2737 BC, as "superior hemp" with several medical uses. Its cultural and religious use in China and India is proven since 1400 BC and, from the 1st Century BC, Chinese people started to make paper out of hemp (Lugo-Ruiz, 2021).

Hemp moved from Asia to Europe thanks to prehistorical people, reaching the Roman Empire and Africa too. Navigation maps, rope, sails, and even Gutenberg Bible were made out of hemp (Díaz-Ordóñez, 2019).

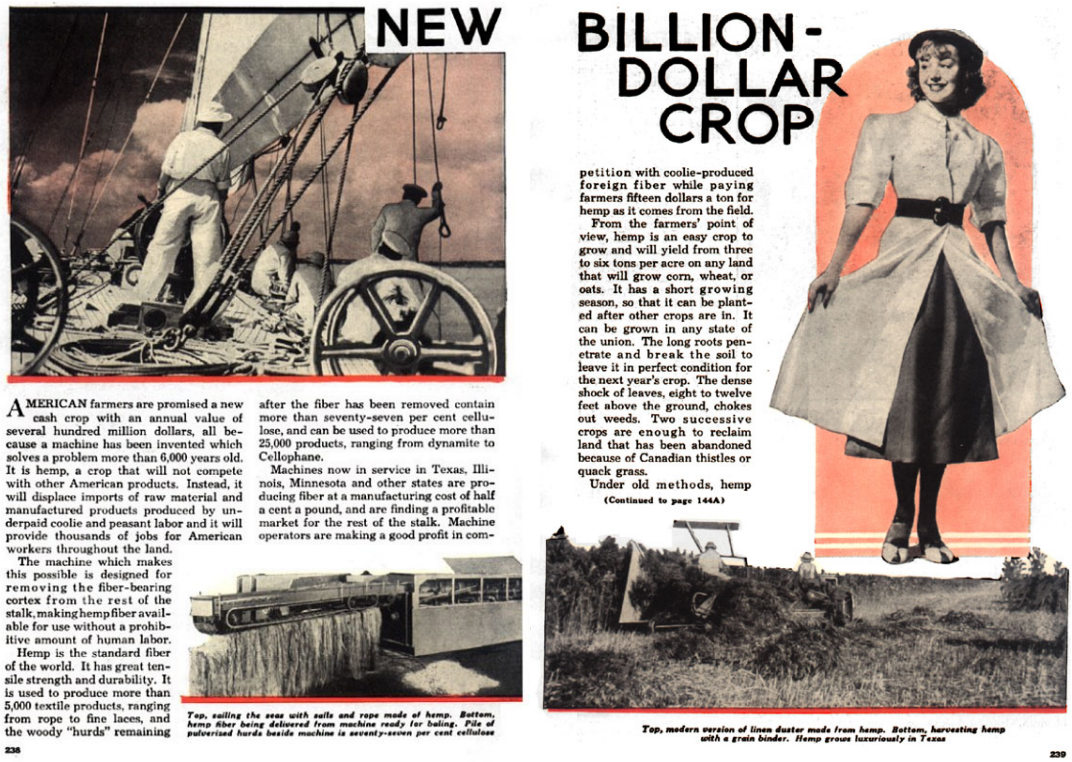
Around 1500 BC it was widely known in different herbaria, including the Old English Herbarium. In those years, the physician and philosopher Paracelsus (1493-1541) in his book "Buch in der Arznei", mentioned cannabis as the most important plant of his time (García-Cabrera et al., 2021).

Russia held the hegemony of the cannabis cultivation market for centuries, followed by Italy (Cacchioni, 2021) and that pushed other European countries, such as Spain, to try to grow hemp in the New World, although without much success (Díaz Ordóñez, 2019).

Until 1820 (the year of the introduction of cotton) all fabrics, clothes, curtains, sheets, etc. were made of hemp.

1.3. The potential of the cannabis market

In 1935, it was introduced in the US the decorticator, a special machine able to separate the fibers from the stalk of the plant. Labor times and costs reduce hugely, shifting from manual to possibly industrialized work. Cannabis was defined as “Billion Dollar Crop”, according to a Popular Mechanics article of February 1938 (Figure 3).



NEW

BILLION-DOLLAR CROP

AMERICAN farmers are promised a new cash crop with an annual value of several hundred million dollars, all because a machine has been invented which solves a problem more than 6,000 years old. It is hemp, a crop that will not compete with other American products. Instead, it will displace imports of raw material and manufactured products produced by underpaid coolie and peasant labor and it will provide thousands of jobs for American workers throughout the land.

The machine which makes this possible is designed for removing the fiber-bearing cortex from the rest of the stalk, making hemp fiber available for use without a prohibitive amount of human labor.

Hemp is the standard fiber of the world. It has great tensile strength and durability. It is used to produce more than 5,000 textile products, ranging from rope to fine laces, and the woody "hurds" remaining after the fiber has been removed contain more than seventy-seven per cent cellulose, and can be used to produce more than 25,000 products, ranging from dynamite to Cellophane.

Machines now in service in Texas, Illinois, Minnesota and other states are producing fiber at a manufacturing cost of half a cent a pound, and are finding a profitable market for the rest of the stalk. Machine operators are making a good profit in competition with coolie-produced foreign fiber while paying farmers fifteen dollars a ton for hemp as it comes from the field.

From the farmers' point of view, hemp is an easy crop to grow and will yield from three to six tons per acre on any land that will grow corn, wheat, or oats. It has a short growing season, so that it can be planted after other crops are in. It can be grown in any state of the union. The long roots penetrate and break the soil to leave it in perfect condition for the next year's crop. The dense shock of leaves, eight to twelve feet above the ground, chokes out weeds. Two successive crops are enough to reclaim land that has been abandoned because of Canadian thistles or quack grass.

Under old methods, hemp

(Continued to page 144A)

Top, sailing the seas with sails and rope made of hemp. Bottom, hemp fiber being delivered from machine ready for baling. Pile of pulverized hurds beside machine is seventy-seven per cent cellulose

Top, modern version of linen duster made from hemp. Bottom, harvesting hemp with a grain binder. Hemp grows luxuriously in Texas

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Figure 3. Popular Mechanics article of February 1938.

In 1941, after 12 years of research, entrepreneur Henry Ford launched the most environmentally friendly car on the market: the Hemp Body Car (Smits, 2016), whose polluting impact was almost zero. He wanted to make a car that "came out of the earth," integrating industry with agriculture and aiming to replace metals with his new ecological plastic material in automotive construction. The prototype was built entirely of soybeans, hemp, and other fiber plastics, and powered by hemp ethanol, obtained by refining the seeds of the plant. Lighter but also more resistant than normal metal bodies, its weight was 900 kg, against 1350 kg of a common car of the time. Unfortunately, Ford

died six years later, and in 1955 the cultivation of hemp was banned in the US so the Ford Hemp Body Car never entered the market.

Moreover, the medical use of cannabis was clearly known since ancient times in all different cultures, like India, China, Africa, and Europe. It had been one of the most used plants to treat nausea and several kinds of chronic pains (Kochen, 2022).
As Herer and Cabarga (1998) pointed out, "from 1850 to 1937, the U.S. Pharmacopoeia listed cannabis as the primary medicine for more than 100 separate illnesses or diseases."

1.4. Prohibitionism evolution and actors

These old and new discoveries might have been seen as an enormous potential new business, but they were identified as a threat by some of the most powerful people in the US at that time.
Henry Hearst, one of the newspaper leaders, bought millions of hectares of forest, almost holding a monopoly in the 1930s (Swartz, 2012; Frye and Smitherman, 2018). Hemp paper would have inflicted him millions of dollars in losses. Lammot DuPont, owner of the homonymous petrochemical company, patented towards the end of the 1930s new processes for obtaining synthetic fibers from petroleum, such as nylon, clothes, car tires, etc. (Swartz, 2012; Frye and Smitherman, 2018). Andrew Mellon, one of the most powerful bankers of the time, was the moneylender of Hearst and Dupont (Swartz, 2012), and owner of Gulf Oil, one of the Seven Sisters. He feared hemp ethanol as it was a much cleaner and cheaper fuel (Moscariello et al., 2021). Last but not least, Rockefeller, a Pharmaceutical industry magnate, wanted to eliminate herbal drugs (especially cannabis) and replace them with products created in the laboratory. He was also the owner of Standard Oil, another of the Seven Sisters.
These four main actors saw the threat of hemp in the newspaper, synthetic textile and plastic, oil, and pharmaceutical markets, so they figured out what to do to make cannabis illegal in the US and worldwide.

In 1930 Mellon, Secretary of the Treasury at the time, named his future nephew-in-law Harry Anslinger, who had already participated in alcohol prohibitionism, as head of the

Federal Bureau of Narcotics, intending to make hemp illegal worldwide (Schievenini-Stefanoni, 2021; Frye and Smitherman, 2018). A campaign of fake news and yellow journalism, defined as "the use of cheaply sensational or unscrupulous methods in newspapers and other media to attract or influence the readers" (Swartz, 2012) started, with the strong support of Hearst newspaper. It was introduced the term "marijuana" from Mexican slang, and it was associated with criminal and racist issues. Hemp was defined as "weed from the devil's garden", and among the declarations of Anslinger, some of the most striking were "reefer makes darkies think they are as good as white men", and, talking about the consumers, "most are Negroes, Hispanics, Filipinos, and entertainers. Their satanic music, jazz, and swing result from marijuana use. This marijuana causes white women to seek sexual relations with Negroes, entertainers and any others" (Solomon, 2020). Moreover, Anslinger pushed the creation of ad hoc movies such as "Reefer Madness", in which hemp was associated with brutal crimes, murders, and suicides, and also wrote articles like "Marijuana, Assassin of Youth", who was published in 1937 in The American Magazine (Martínez-Oró, 2017).
It is important to highlight these quotes because they stated the beginning of the illegality of cannabis worldwide.

In 1937 Anslinger presented to Congress the Marijuana Tax Act (Martínez-Oró, 2017; Swartz, 2012), a law that aimed to prohibit the use of hemp nationwide. Without any public debate or scientific research, the law was approved by the majority and signed by Roosevelt. Most senators and deputies did not know that hemp and marihuana were actually two names for the same plant. Anslinger also invented the "Gateway Theory", according to which the user of soft drugs is naturally inclined to take heavier ones, such as heroin and cocaine (Swartz, 2012). The penalties for these two offenses were so equated, although this theory has never had any scientific confirmation. In 1944, after 5 years of research and studies, the La Guardia Report, commissioned by the homonym mayor, was published in New York, and scientifically proved the falsity of Anslinger's claims (Martínez-Oró, 2017; Swartz, 2012; Frye and Smitherman, 2018). Anslinger used the press to discredit the research and tried to destroy all available copies of the Report.

In a rapid escalation, in 1961 it was created the Unified Convention on Drugs and Narcotics (Martínez-Oró, 2017; Luna-Fabritius, 2015; Lynch, 2008): it was supported by more than 150 UN States and, on one hand, it established an international drug control tribunal while, on the other hand, it committed individual States to fight and ban the cultivation of cannabis as soon as possible.

In 1968 President Nixon commissions a new study on marijuana in response to the requests for the decriminalization of the substance. As he did not get the desired results to confirm his alleged danger, he trashed the report. He also created, in 1973, the DEA, a special police body authorized to spy on communications between citizens. Under the pretext of the "War on Drugs" (Sánchez-Avilés, 2014; Martínez-Oró, 2017; Frye and Smitherman, 2018), it was able to easily control minorities, extremists, and uncomfortable people.

Moreover, marijuana was included in Schedule 1, a table of the Controlled Substances Act that defines it as a heavy and dangerous drug without any medical use, at the same level of cocaine and heroin (Martínez-Oró, 2017; Swartz, 2012). Although its removal was purposed since 1972, and recently in January 2019 by the World Health Organization of the UN, it still remains classified as a harmful drug with no medical benefits.

Chapter 2 – MEDICAL AND ADULT USE: A MARKET OVERVIEW

2.1. Ways to consume cannabis

Cannabis can be consumed in several different forms, leading to slightly different reactions in the body. The most common way to take it is smoking buds, in cigarettes with or without tobacco. A similar but less unhealthy method is to vaporize it or to use pipes, shishas, and bongs. Cannabis resins (hashish) and extracts are derivates that contain more THC, so they give the user a stronger effect, although usually lasting less. Another totally different way is to obtain oils, tinctures, food, and beverages from cannabis (Isorna-Folgar and Arias-Horcajadas, 2022). Processing methods space from ethanol extraction to dissolution in fat aliments like milk or butter, as THC is liposoluble. The so-called "edibles" can be considered an independent category of marijuana products, because the user starts to feel the effects a couple of hours after ingestion, and they use to last longer and affect stronger the body. This is for sure an advantage for medical use but can be a problem for recreational one. That is why some countries regulated the maximum amount of THC allowed in edibles, or the daily quantity the user can buy, to avoid health problems such as psychosis.

2.2. Legalization parameters worldwide

During the last decades, a tendency to change started, pushing several countries worldwide to legalize or decriminalize cannabis for medical and recreational use according to different models (Santos-Diéz, 2022; MacGuill, 2019).

2.2.1. The United States model

At present day, as shown in Figure 4, cannabis is fully legal in 24 states, while medical use is legal in 38 States, and just CBD oil use in 7. It is also decriminalized in 6 of the States in which it is not yet fully legal. Compared to the previous year, Delaware, Maryland, Minnesota and Missouri completely legalized it, while Louisiana allowed medical use. However, home cultivation is not always allowed.

As they are a Federal Republic, it does not exist unique legislation on cannabis, but different measures taken by single States. The common points are the age limit to access weed and the distribution methods. Hemp transportation is an unclearly defined point in many States, although the average permitted is around 1oz (28 grams). Auto-cultivation of weed is also permitted in various States, mainly for medical use (Martínez-Oró, 2018; MacGuill, 2019). The first state to legalize medical use was California in 1996 (Herer, Cabarga, 1998). Moreover, on October 19, 2009, the Ogden Memorandum was issued, which stated not to focus federal resources on medical marijuana use in the states in which it was permitted, although its possession, selling, and consumption are still prohibited under federal law (Anderson, Rees, 2021).

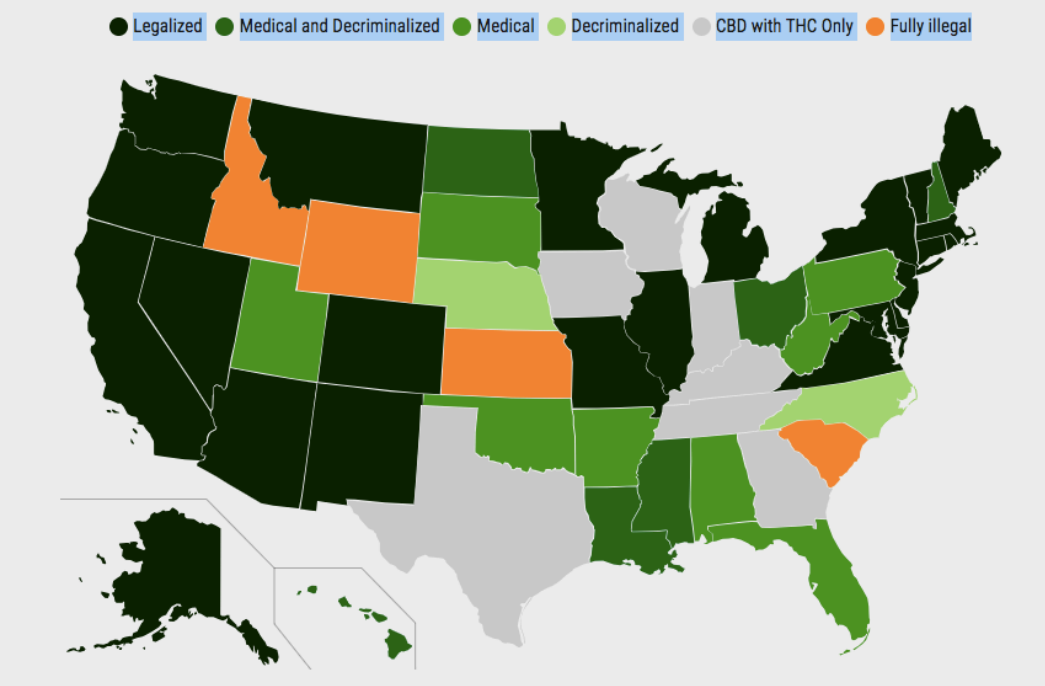

Figure 4. Weed legalization in the US in 2023. Source https://disa.com/map-of-marijuana-legality-by-state

According to a GVR Report (2022) "The U.S. cannabis market size was valued at USD 10.8 billion in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 14.9% from 2022 to 2030, reaching a USD 40.0 billion value in 2030".

As said, the lack of uniform legislation led to problems in implementing the license requisites too. Some States, as Colorado, preferred a vertical licensing method, meaning that the grower has to be also the processer and seller, while others like Washington developed a horizontal one, so that the grower is not allowed to be a processer and seller at the same time (Martínez-Oró, 2018). The first kind of implementation generates huge costs to enter the market, besides the costs of licenses themselves and the ones for fulfilling all the legal requirements. That means that only multinationals, with huge quantities of available economic resources, were able to enter the market without bankrupt, and so they cannibalized the majority of small entrepreneurs. Hundred thousand dollars are required to enter the segment, so it is almost impossible with this kind of system for startups or small growers to even start to legally deal with weed.

2.2.2. Amsterdam and the Netherlands regulation as pioneers

After cannabis being illegal in the US in 1937, several States started to develop different studies on it and reached independent conclusions. This was the case of the Netherlands, which decided to value the results of the Hulsman Committee in 1969 and Bann Committee in 1972 (Martínez-Oró, 2018), and legislated in 1976 marijuana as a soft drug (while cocaine and heroine were and still are hard drugs). This gave birth to the "Coffee Shop" figure that, although being an imperfect model in many aspects, limited the heroin epidemy of the 70s by totally separating the two drug markets. In 1991 Amsterdam became the European Cannabis Capital, and this alimented a strong drug-tourism phenomenon, so the government tried to limitate sales just to the residents, but the measure totally failed. At present day, the minimum age to buy hemp is 18 years old, and Coffee Shops must be located at a minimum distance of 250 meters from schools since 2017.

The weakness point of this model is that on one side it allows personal use and possession, while on the other side it does not allow the production, transport, and wholesale of weed. The consequence of this paradox is that the majority of the providers belong to the black market, meaning a risk both for producers and for customers, and not granting any type of quality control of the selling products.

2.2.3. The Spanish background

The situation in Spain is controversial because marijuana is legal thanks to the legal loopholes. The users are allowed to consume it at home or while not in public places, and the personal use quantity established is 100 grams per person. Nevertheless, it is prohibited to transport it, and being caught with it leads to a 600 euros bill. Moreover, corruption is another huge problem.

Spanish people, since 2001 (MacGuill, 2019), used the right of association to create places where to smoke and purchase weed in more controlled spaces: cannabis clubs. Owned by user associations, they are places in which every consumer can get marijuana based on an estimation of his monthly or annual needs. Clubs can get weed according to two different resources: community purchase, which virtually means that all the users join their money and buy a bigger quantity altogether, or community farming, meaning that some (or all) members of the association participate in the grown of the plant, that is proportionally distributed after harvesting. One of the main value-adding point of clubs is that associations members can smoke weed in the apposite space provided, sharing the experience, effects of smoking, and knowledges.

Although the community farming is permitted, it is really difficult to seize the right quantity of plants to guarantee the supply of the demand. Both indoor and outdoor death of some plants due to climatic conditions or plagues are possible, and also it is usual to get more or less output than expected. That left this method in a limbo of uncertainty.

On the other hand, providers and transport methods of the community purchase are not well defined. Transport is legalized under the condition to tell in advance the authorities about the location and quantities that will be moved, but as wholesale is prohibited, it generates a huge paradox and no one ever apprise the police unless they want to see the material confiscated and the seller arrested. Associations that recur to community purchase, actually buy weed and derivates in the black market, meaning no quality controls. Moreover, associations exist as no-profit entities, so selling marijuana is considered illegal, and the dispensing price must be slightly equal to the buying price, adding just the allocated cost for maintenance of the club. This never happens, and the result is a much higher cost of cannabis in a club than on the street. Associations had

become black market minor shops, and frequently they are a facade for money laundering too.

2.2.4. The Uruguayan State paradigm

Uruguay was one of the first countries worldwide to legalize cannabis use in 1974 and regulated it in 2013, implementing a State legislation model based on human rights, public health, and State control of production and sales (Martínez-Oró, 2018; Santos-Diéz, 2022; MacGuill, 2019). Access to weed is restricted to residents to avoid drug tourism, minimum age is 18 years old, and maximum purchase quantity corresponds to 40 grams per month. THC percentage is limited to 15%, but to today's date it does not exceed 9%. Cannabis users belong to three mutually exclusive categories: farmers, club members, or pharmacy purchasers, and have to be regularly registered. Self-growing is allowed for a maximum of 6 plants and 480 grams of harvesting per year. In July 2017, purchases in pharmacies started (Martínez-Oró, 2018; MacGuill, 2019; UNODC World Drug Report, 2022), dealing with 100% traceable products derivated from not contaminated cultivations. Apart from creating new jobs, Uruguay became a leader in Cannabis worldwide export, highlighting the efficiency of its model as a pioneer, with several billion dollars in revenues every year in a growing market. However, because to its rigid dispensary approach and understatement of the market's size, the state monopoly-based reform was unable to completely eliminate the black market (Auriol et al., 2023). Even if the price of legal cannabis was initially set at the same level as the illicit one, rationing sales encouraged users to continue buying illegally, and the long-term existence of the black market undermined the objectives of limiting consumption and safeguarding children.

2.2.5. The Canadian situation

Canada was the second country to build a full weed legalization model in 2018 (MacGuill, 2019; Santos-Diéz, 2022). Customers have to be over 18, and allowed quantities are 30 grams in public and four plants at home. A strict control of the purchasing products is applied, both on quality and on THC and CBD contents. The Federal government collaborates with local entities to guarantee marijuana standards

and enforce legislation. Industry standards on types of products, packaging, and sizes, have been implemented to differentiate legal from illegal weed. Public education, protection of youth, and awareness activities, are strongly financed by the Canadian government. According to the UNODC World Drug Report (2022), “In Canada, the retail value of the cannabis market in 2020 was 2.6 billion Canadian dollars and 3.8 billion Canadian dollars in 2021”. Regretfully, the same error that led to the Uruguayan reform's failure is plaguing the Canadian one: rationing. Customers returned to the illicit market as a result, as the price at which marijuana was sold became more affordable. Additionally, the quality and supply of legal cannabis decreased (Auriol et al., 2023). The overall demand increased as a result, but the state had no control over it at all.

2.2.6 The Italian peculiar position

Hemp has been widely produced and utilized in Italy since the XIV Century (Cacchioni, 2021), with agriculture likely beginning before 600 A.D. in the Canavese district of Piemonte and intensifying 6 centuries later, with additional cultivars probably coming from Asia (McPartland, 2020). Its applications range from rope manufacturing to sail building, and it was widely used in the textile sector in general, as well as exported to other Italian areas and Europe (Cacchioni, 2021; McPartland, 2020). Industrial manufactury started around 1870, while in 1950, "of a world-wide cultivation of 300 thousand hectares, Italian cultivation of hemp accounted for approximately a sixth of the total, and in terms of total fibre production, Italy accounted for almost one-third of 2,040 thousand quintals world-wide production" (Cacchioni, 2021), leading the global market (Carrieri et al., 2020). Following the war on drugs and the development of alternative materials (e.g., plastic) that replaced hemp goods, the cannabis market experienced a rapid fall, culminating in its prohibition as an illegal product in 1961.

In 1990, the unified text "Iervolino-Vassalli" outlined a particularly oppressive and prohibitionist drug sanctions system, matched with an existing bewildered war on drugs. It was never entirely accepted, since a referendum in 1993 repealed the prohibition on personal drug use. Later, in 2006, the "Fini-Giovanardi" law was enacted, which abolished the distinction between soft and hard drugs, imposed the same sanctioning system for all substances, and limited the personal use amount of cannabis to 0.5 grams, defining possession of anything bigger than that as drug dealing. As a

result, many consumers found in possession of personal use quantities exceeding the legal limit were sentenced as dealers, ruining their lives on the one hand while incurring enormous and unnecessary legal and prison costs on the other.

Farcomeni and Scacciatelli (2013) studied a database of people captured in possession of the defined "personal use quantity" (0.5 grams) during the two years immediately after the law's implementation, both to investigate patterns of multiple captures and to estimate the total number of cannabis consumers in Italy. They did not concentrate on larger amounts, which the law defines as drug peddling. Their findings revealed that approximately 51 thousand persons were caught in possession of cannabis, as well as a direct estimate of 3.3 million users and an indirect estimate of nearly 5 million, which was more consistent with previous investigations and accounted for 10.6% of the Italian adult population. Further information and thoughts on the law were given in the 5th "Libro Bianco" presented to the Italian Senate in June 2014. According to the report, by the end of 2013, 38.6% of the individuals who were convicted were suspected of drug-related crimes under the "Fini-Giovanardi" reform, with 45% of them charged with cannabis or derivatives offenses. Jails became overcrowded, and as a result of the duty to review all sentences ruled illegitimate by the Italian Supreme Court, tribunals were risking collapse. Fortunately, the "Fini-Giovanardi" regulation was deemed unconstitutional in 2014, and the entire drug legislation, particularly the soft drug legislation, was reviewed.

In order to eliminate some restrictions on hemp production and growing, particularly for the food and textile industries, Law 242/2016 was passed in 2016 (Carrieri et al., 2020). According to European criteria, the law set a maximum THC level of 0.6% and defined the family of strains allowed as "light cannabis" (Amendola et al., 2021). The sale of hemp flowers was not carefully considered by the law, creating a loophole that permitted its commercialization as a collector's item, ostensibly not for smoking or usage by humans. In essence, light cannabis liberalization resulted from this lack of legislation (Carrieri et al., 2020). Since May 2017, a number of startups have begun selling CBD flowers and derivatives like oils, lotions, and edibles. These include EasyJoint, Cannabis Amsterdam, and Hemp Shop, among others. Although the initial vendors of these novel products were already-established grow shops, the market

quickly grew in response to the surge in demand, and cannabis light began to be offered for sale in pharmacies, herbal stores, tobacco shops, and even authomatic devices.

Since cannabis light became available and was touted as having relaxing qualities, patients with a variety of illnesses have begun to look up the effects of CBD. Carrieri et al. (2020) discovered that many people began self-medicating with inflorescences or CBD derivatives that didn't require a prescription after the market was opened to the public for the purpose of treating anxiety, psychosis, and sleep disorders, among other conditions. These people primarily substituted anxiolytics, sedatives, and antipsychotics, whose sales fell by 11.4%, 10%, and 4.8%, respectively.

However, the primary adverse consequence of this legalization gap was the lack of regulations on the use of pesticides, fertilizers, and metals in the growing of cannabis inflorescences for smoking or, more broadly, as consumable goods. Thus, the Amendola et al. (2021) investigation, which examined 31 cannabis samples, found that 87% of them included pesticide residues, mostly from fungicides and insecticides. Moreover, iron and manganese had the highest metal concentrations, in amounts similar to those in neighboring European nations like Bulgaria and Romania. Therefore, the balance between the mild effects and drawbacks of cannabis became extremely delicate in the absence of clear legislation.

The formation of a new government in June 2018 caused a dramatic shift in the political opinion surrounding cannabis. The new Interior Minister, Matteo Salvini, denigrated CBD shops, calling them "chinese massage centers, brothels" (La Stampa, September 2018). He also sent police forces new directives that forbade cannabis light with THC levels exceeding 0.2%, rather than the previously established 0.6%. Furthermore, in May 2019, he reaffirmed his extreme stance in his antiquated "war on drugs," launching a campaign against local traders and ordering a number of them to close while seizing their merchandise as a preventative measure (Carrieri et al., 2020). It's interesting to note that both of these actions were carried out when the Minister was under indictment for the horrifying deaths of multiple refugees as a result of his restrictive immigration policies and received hardly public criticism from the Italian Church (Famiglia Cristiana, July 2018; May 2019). Thus, his campaign against cannabis light and the LGBTQ+ community and its rights, which was launched during the same time period, may have been a ploy to divert attention away from migration and toward regaining the

church's approval at the expense of minorities and those who benefit from CBD products.

The current government, started by the end of October 2022 and led by Giorgia Meloni as Prime Minister of Italy and Matteo Salvini as Vice President, has imposed even stricter policies: contrary to European directives and scientific evidence, CBD has been added to the list of "narcotic substances at risk of abuse" since September 22nd, 2023, and sales of CBD oil are only permitted with a medical prescription. As a result, rather than intervening to control cannabis light production and sales in the interests of customers' health, the new legislation is founded on prohibitionist and political interest campaigns.

2.3. The CBD market trends

Cannabidiol (CBD) is one of the most relevant non-psychotropic compounds of the cannabis plant. It is widely used worldwide to treat several diseases like insomnia, nausea, vomits, chronic pain, weak immunity system, and even apoptotic effect on some cancer cells (García-Cabrera et al., 2021). It has neuroprotective, antiepileptic, anxiolytic, antipsychotic, antibacterial, antidiabetic, analgesic, and anti-inflammatory properties, among others (Rubio-Escalona, 2021). Its potential is clearly enormous in the medical field, nevertheless, its regulation is still on the path. According to a 2016 OMS report, CBD has no addictive potential or psychoactive effects on the human body, so it scientifically can not be considered a drug (Rial-Boubeta et al., 2020).

In 2019 WHO recommended adding a footnote to the Schedule I convention that excluded CBD preparations with less than 0.2% THC from international control, but paradoxically it was denied by an overwhelming majority of votes.

On one hand CBD product purchase like buds, oils, and cosmetics is permitted in almost the totality of the US, Canada, Latin America, Australia, and in a great part of the European Union (Netherlands, France, Spain, Italy, etc…). On the other hand CBD growth in Europe still faces several issues. In Spain, for instance, it frequently happens that farmers face legal problems because THC levels in the plants depend on a wide variety of external factors, and keeping them below the 0.2% threshold is not always possible. Actually, the majority of CBD Spanish products are imported from Italy.

Finally, the global CBD market size was estimated at USD 5.18 billion in 2021, 6.4 billion in 2022, and is expected to reach USD 7.7 billion in 2023 (GVR Report, 2021; 2022).

2.4. Cannabis types of stores

Depending on the country and regulatory model, it exists a wide variety of marijuana purchasing points.

CBD shops are probably one of the most widespread categories: it is common to find them on the streets of almost every city in which it is legalized, and franchising is really usual. Almost any kind of user can access products without being registered anywhere.

On the opposite side, pharmacies are one of the most controlled places because they provide well-regulated products and strictly under medical licenses.

Associations clubs are a typical phenomenon of Spain and, although they have to appear as "hidden" spaces, their location and contact numbers are available on apps like "Weedmaps". Customers need to be enrolled as members and pay a monthly or annual association fee. As mentioned above, they legally are not presented as stores while non-profit entities, but just a few respect this purpose. From a legalization perspective, the government would have to introduce the figure of stores as complementary, setting precise market conditions to avoid cannibalism between these two entities and by multinationals (Martínez-Oró, 2018).

Licensed points are the US's most common way to acquire weeds and, depending on the State, they can also be allowed to grow and process the plants. Customers have to be appropriately registered and, usually, they are not able to consume their purchases inside the shops.

While purchasing methods vary from country to country, one common point of almost all regulatory frameworks is the possibility of home growing. This allows consumers to grow and manipulate the varieties they prefer by choosing methods and fertilizers, and so guarantees personal freedom rights. The number of plants allowed and the ones in the flowering period depends on the single States.

2.5. The Black market role

In the majority of countries, the black market is still the main purchasing market for several customers. The reasons vary from more competitive prices, to access to minors, less statal control, easier accessibility, full-time availability, tourism restrictions, lack of selling points, etc. The black market, both face-to-face and online, mainly on the deep web (UNODC World Drug Report, 2022), is controlled by some mafia or cartel criminal organization. The most powerful are Italian, Chinese, Japanese, Russian, Latin American, and Gipsy ones. This market presents lots of risks both for sellers and customers, and that is why governments are fighting to regulate cannabis selling and production. The origin of the products is undefined, as well as the THC and CBD percentages, that difficult the medical use. Some dealers cut pure marijuana or hashish (cannabis resin) with products like clonazepam, heroin, or bleach, either to increase its weight, to create an addiction in the customer, or to enhance the effect, with a terribly strong impact on consumer health.

Besides corruption, the black market still exists due to the absence or failure of regulations. Prohibition was its foreseeable cause, as it happened with alcohol, and the only viable solution is to give customers a valid strong and better alternative while allowing growers and sellers to keep on their business in a legal and controlled framework. The cannabis black market was estimated to be around USD 140 billion in 2018 (MacGuill, 2019). Auriol et al. (2023) explored the causes for the illicit market's persistence while experimenting with various legalization or control regimes. It is necessary to consider the black market reaction: price reductions, increased quality, and the fear of consequences for unlawful selling and purchase. Furthermore, if the legal market is unable to meet existing demand, the illegal market will undoubtedly retain a portion of it, whereas if the legal market fully meets existing needs, governments must implement other complementary measures to discourage illegal sales while attempting not to increase post-legalization demand. While there are numerous scenarios, the universal consequence is that legalization has reduced violent crimes associated to drug trafficking (Anderson, Rees, 2021). Last but not least, the role of technology in the sale of drugs must be considered: purchasing online cannabis, cocaine, and synthetic drugs, both on the deep web and on social media, is becoming a new alarming and expanding trend (UNODC, 2023).

Chapter 3 – THE CANNABIS PRODUCTS FAMILY

According to Milenkovic (2019), "Cannabis is poised to disrupt virtually every consumer industry, from foods, hot drinks, soft drinks, alcoholic drinks to beauty, consumer health, tobacco, tourism, packaging, and home & garden. Within 10 years, some form of cannabis will be a regular part of consumers' daily routines (Figure 5)."

Moreover, as Sheychenko et al. (2019) mentions, "In modern production industrial hemp is considered to be a highly profitable crop, provided by the absence of waste from its processing. All constituent plants – seeds, fiber (long, short), hemp awn (a by-product of fiber production) have a wide range of uses in many industries and national economy."

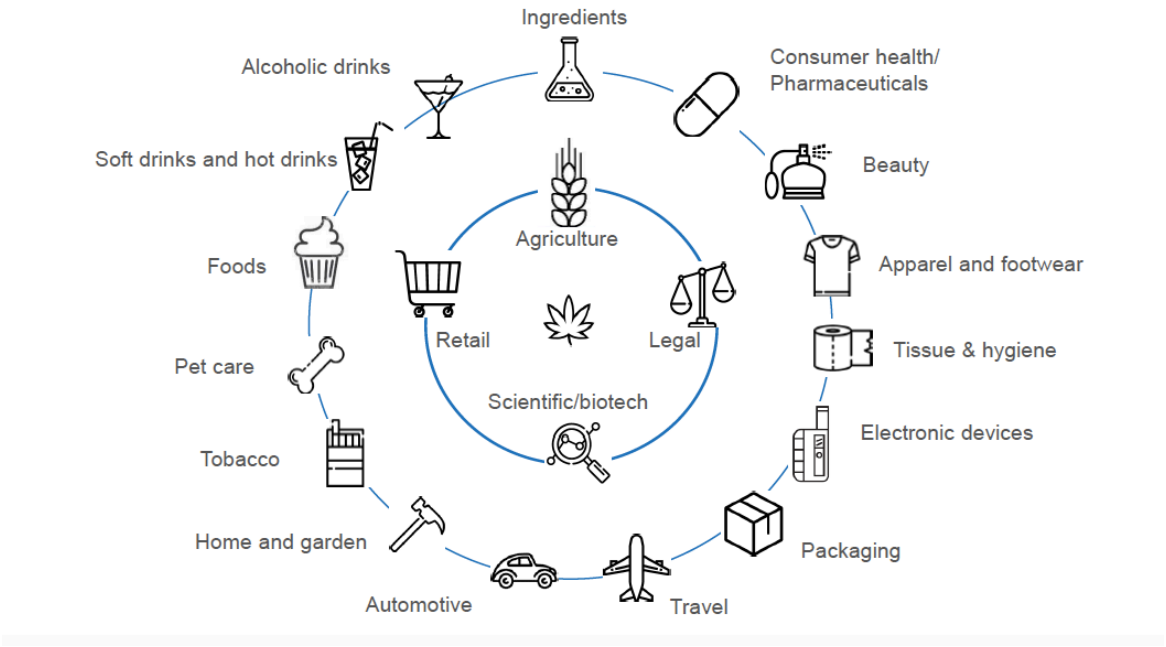

Figure 5. Cannabis as a disruptor: the omnitude. Source: Milenkovic (2019).

All these potential uses, already mentioned by Herer and Cabarga in 1998, will be deeper analyzed in this chapter. It is important to remind that THC, the only psychotropic ingredient of cannabis, is contained just in the flowers and leaves of the plant. For all the uses listed below, except the last two, the source considered is the hemp plant, corresponding to cannabis with THC levels inferior to 1%. All the parts of the plant can serve different purposes, characterizing it as a 100% biological and

biodegradable exploitable material from a circular economy perspective.

3.1. The ancient textile sector

As cited by Cacchioni (2021), during the past centuries "hemp was used for ropes, lines, nets, sacks, rigging, but also cloth, shirts, and sheets". Its fiber constitutes a high-quality material, better resistant than cotton or other textile fibers. It has faster growing times, greater outputs, and less environmental impact, when compared to cotton. The Russian Empire had always been the leader in hemp production. Since the 15th Century, the Spanish Kingdom tried to introduce hemp cultivations in its colonial territory in America, although just with minor successes (Martínez-Oró, 2018). The Italian too had been one of the main hemp industries, still in 1950 (Cacchioni, 2021) and until it became illegal. Hemp clothes can be considered sustainable, ethical, and vegan materials. Although it has higher fabrication costs, it is more versatile and long-lasting (Milenkovic, 2019). Hemp growth needs significantly less use of fertilizers and pesticides than cotton or linen (Martínez-Oró, 2018). In a future perspective, hemp apparel and clothes can be seen as a product of a sustainable and ecological circular bioeconomy rather than a capitalistic polluting economy.

3.2. Hemp for paper production

Since ancient times, hemp paper have been widely used worldwide (Moscariello et al., 2021). It contains less lignin than wood or similar materials, and more cellulose (Manosalva-Barrera et al., 2020; Martínez-Oró, 2018). That means that hemp can be seen as a great and sustainable green source to make paper in the future. Furthermore, it can be easily converted into paper sheets without the needing for strong chemical whitening agents, reducing environmental impact and contamination, and it can be recycled up to nine times compared to the maximum three of standard paper (Martínez-Oró, 2018). The cannabis plant grows at a considerably faster rate than trees, even more than 10 times superior, and with greater outputs, so its use can be promoted in order to definitely solve the deforestation issues worldwide (Martínez-Oró, 2018; Manosalva-Barrera et al., 2020). Cannabis paper can be also used for product packaging, rolling papers, and quality books (Milenkovic, 2019).

3.3. The bio-construction market

In the sector of bio-construction, hemp shives and fibers can be seen as a powerful resource. Hemp-based blocks, usually mixed in variable proportions with lime (Agliata et al., 2019; Moscariello et al., 2021; Martínez-Oró, 2018) constitute a valid and better alternative to classic steel or concrete blocks, and even to glass (Martínez-Oró, 2018). Also, hemp seeds can be used to make paints and sealants (Riboulet-Zemouli, 2021). Hemp generates a low environmental impact due to its fast growth with almost no chemical agents. Furthermore, as a plant, it limits the emission of greenhouse gases, contributing to inverting the polluting tendencies of the last centuries (Hernández-Zamora et al., 2021). In addition, lime is well known for its capacity to protect natural fibers from bacteria and infestations (Agliata et al., 2019). The combination of the two elements generates an isolating, soundproofing, safe, breathable, fire-resistant, healthy, toxic-free, versatile, light, long-lasting, and 100% biodegradable and recyclable material. (Hernández-Zamora et al., 2021; Agliata et al., 2019; Martínez-Oró, 2018; Moscariello et al., 2021). Hemp's growing use in the construction field can generate employment opportunities both for rural and unskilled people (Muñoz-Veloza, 2018) connecting sustainable cities and lands.

3.4. Food and drink industries

As Moscariello et al. (2021) mention, “Global population growth will reach about 10 billion in 2050, requiring an increase of the food production potential by 70% as compared to 2006.” This highlight the urgency to find alternative food sources, a tendency that already started by importing insect-based products from Asia. Hempseeds are an amazing food resource (MacGuill, 2019; Lugo Ruiz et al., 2021) because they are a precious source of omega-3 and omega-6 fatty acids (Milenkivic, 2019) and potassium as well (Moscariello et al., 2021). They will be potentially able to substitute protein bars. Moreover, CBD and THC extractions can be used for the production of bakery, ice creams, snacks, teas, and even pet food and medicines (Milenkovic, 2019). Only THC products would be psychotropic: in fact, hempseeds do not contain any cannabinoids, and CBD, as mentioned above, is not scientifically considerable as a drug. For this reason, these last two resources can emerge as disruptors in the food and drinks

industries in the next years. According to Rial-Boubeta et al. (2020), "by 2022, CBD drinks market value would reach USD 600 million".

3.5. The personal care and beauty paradigm

Cannabinoids, especially THC and CBD, are seen as powerful ingredients in the beauty sector of the future (Milenkovic, 2019; Lugo-Ruiz et al., 2021). The various States would have to implement a regulatory system that enhances the traceability of compounds from the seed to the customer, and also define the quantities allowed (Martínez-Oró, 2018). To protect consumers, it is probable that at the beginning THC derivates find more resistance to legislation changes (MacGuill, 2019). CBD can be successfully employed in the cosmetic sector thanks to its antioxidant, anti-inflammation, regeneration, and relaxation properties (Moscariello et al., 2021; Milenkovic, 2019). The CBD products that can disrupt this market include shampoo and shower gels, deodorants and fragrances, cosmetics, and lip balms. All of them will be natural, and so sustainable purchasing items. It is important to underline that some of them are already present on the market in the States in which CBD is legal, but due to lack of legislation, the exact quantity of CBD present is not mentioned. This allows multinationals to speculate on it and does not guarantee the customer the appropriate protection needed in this delicate segment.

3.6. Plastic alternatives

Plastic is one of the most used compounds worldwide nowadays, and one of the hardest to degrade, as this process takes several hundred years to happen. While the environment is being polluted and the oceans are filled with toxic garbage, natural and ecological alternatives are slowly developing. On one side the wooden part of hemp stalks joined with other biodegradable materials, and on the other side pure hemp fiber cellulose, are able to generate a green alternative bioplastic that would be able to substitute actual packagings (Milenkovic, 2019; Riboulet-Zemouli, 2021). In addition, the fabrication of biopolymers like polyhydroxyalkanoate (PHAs) and polyhydroxybutyrate (PHBs) will be able to provide biological plastic compounds (Moscariello et al., 2021). It is remarkable to note that around 1940 Hanry Ford created

a totally renewable and more resistant type of plastic as a mix of soybeans, wheat, hemp, and other compounds (New York Times, August 14, 1941, Page 19). Alternatives to standard plastic are many, and it is just up to multinationals and governments to adopt them.

3.7. Biomass, biofuels, and oils as emerging trends

In the actual critical planet situation, due to GHG, climate changes, and wars for oil and gas, because of their rapid extinction, the power of the hemp plant's potential can be highlighted one more time. As Riboulet-Zemouli (2021) mentions, "The biomass generated by cannabis crops is an efficient and cheap source of renewable electricity". Moreover, bioethanol, biomethane, and biodiesel can be produced from different parts of the plant through a thermochemical conversion (Martínez-Oró, 2018; Moscariello et al., 2021). Biodiesel can be obtained from hemp seed oil under a transesterification process (Moscariello et al., 2021). Bioethanol can be produced from lignocellulosic or hemicellulosic hemp biomass (Manosalva-Barrera et al., 2020), or from seeds, fibers, or steams of the plant. Last but not least, biomethane can be generated from flowers, leaves, and hurds (Moscariello et al., 2021). That means the whole plant can be used to create different types of fuels and energy. Although some of them had historically other main uses, as reported above, modern technological discoveries can be applied to stop planet pollution destruction and invert the tendencies following a green and renewable-sources path.

3.8. The decline of sin indusrties

Alcohol and tobacco are the two legal and most used substances worldwide. Paradoxically, as shown in Figure 6, they are also the most dangerous in terms of "healthy" life lost (UNODC World Drug Report, 2022). Both, due to their legality, had been the ones earlier approached by youngsters, generally to make better connections or feel more comfortable in social environments (Rial-Boubeta et al., 2020; Milenkovic, 2019). In the last years, thanks to cannabis legalization and market expansion, both experienced a decrease in interest and so of use by people, especially millennials (Milenkovic, 2019; UNODC World Drug Report, 2022). Moreover, alcohol and tobacco

big companies started to invest in the cannabis emerging market (Rial-Boubeta et al., 2020). The cannabis risk perception in countries in which it is barely legal as Spain seems to have decreased too, while alcohol and tobacco are considered more risky substances, although they are legal (Megías-Quirós, 2016). Some studies even highlight the potential of cannabis in treating alcohol addiction (Kochen, 2022).

Anderson and Rees (2021) used the difference-in-differences regression method to examine a wide range of studies and articles that attempted to find correlations between the passage of medical marijuana laws (MMLs) in the United States and other socioeconomic factors such as alcohol and tobacco consumption and opioid or other drug use.

In the case of alcohol, the findings revealed a general decrease in consumption, particularly binge drinking (Alley et al., 2020; Dragone et al., 2019; Sabia et al., 2017), as well as in alcohol demand (Miller, Seo, 2021) or sales (Baggio et al., 2020). Other studies found that the passage of MMLs (Wen et al., 2015) or the establishment of dispensaries (Andreyeva, Ukert, 2019) increased binge or heavy drinking. Finally, some investigations yielded inconclusive results (Veligati et al., 2020). Furthermore, according to the studies and the fact that THC and ethanol are two substances that clash for both brain and body functioning when combined, cannabis and alcohol can be considered alternatives rather than complements.

In terms of tobacco, some studies showed a decrease in cigarette smoking (Choi et al., 2019), or tobacco demand (Miller, Seo, 2021) following MMLs, while others found no link between tobacco consumption and medical cannabis legalization (Andreyeva, Ukert, 2019). It should be noted that, as illustrated in Figure 6, tobacco smoking in the United States is substantially lower than in Europe and Asia. Furthermore, since 2012, cigarette consumption has been dropping (Figure 7).

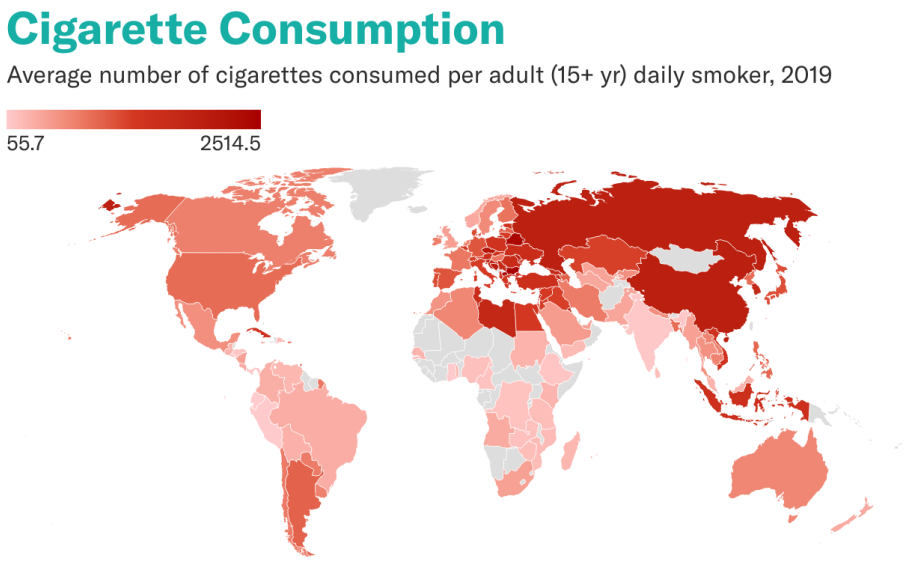

Figure 6. Average number of cigarettes consumed per adult daily smoker, 2019. Source: Euromonitor and WHO GTCR 2021.

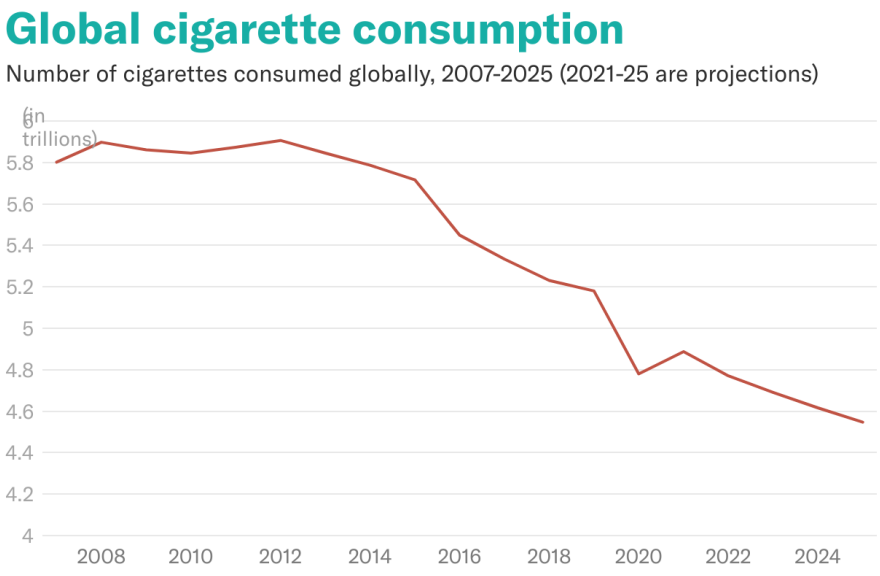

Figure 7. Number of cigarettes consumed globally, 2007-2025. Source: Euromonitor.

Finally, studies of MMLs and opioids found a general decrease in their prescription (Bachhuber et al., 2014), use (Bradford and Bradford, 2016; 2017), and mortality (Powell et al., 2018). These are significant findings, given that the opioid epidemic has had a major impact on both prescription drug and illegal heroin usage mortality in the United States (Anderson, Rees, 2021).

When other drugs were considered, almost no link was discovered between cocaine and MMLs (Conyers, Ayres, 2020; Wen et al., 2015; Chu, 2015). Furthermore, Bradford and Bradford (2016; 2017) revealed that MML enactment decreased the prescription of drugs for a variety of symptoms and disorders, including anxiety, depression, nausea, pain, and sleeping problems.

However, while the Anderson and Rees (2021) publication provides a very important and immediate overview of some of the more important findings of correlation between cannabis and other substances in the cannabis industry, it is mostly limited to the United States as a backdrop, so the global trend is slightly different, as it involves a broader range of cultural and socioeconomic backgrounds.

While alcohol sales experienced a smaller decrease, and several brands tried to purpose mixed CBD-alcoholic drinks or include terpenes' flavors in beverages, the world tobacco volumes faced a harder decline, thanks to new vaping methods (Milenkovic, 2019) and to the consciousness that CBD is able to generate better-relaxing effects than nicotine, but remarkably less or no addiction and health problems. Moreover, tobacco cultivation exploits the soil in a heavy and permanent manner, while cannabis can reestablish soil components thanks to its deep roots (Amaducci et al., 2008). From these perspectives, the cannabis emerging market would be a great alternative to alcohol, and definitely an amazing substitute for the tobacco industry (Riboulet-Zemouli, 2021).

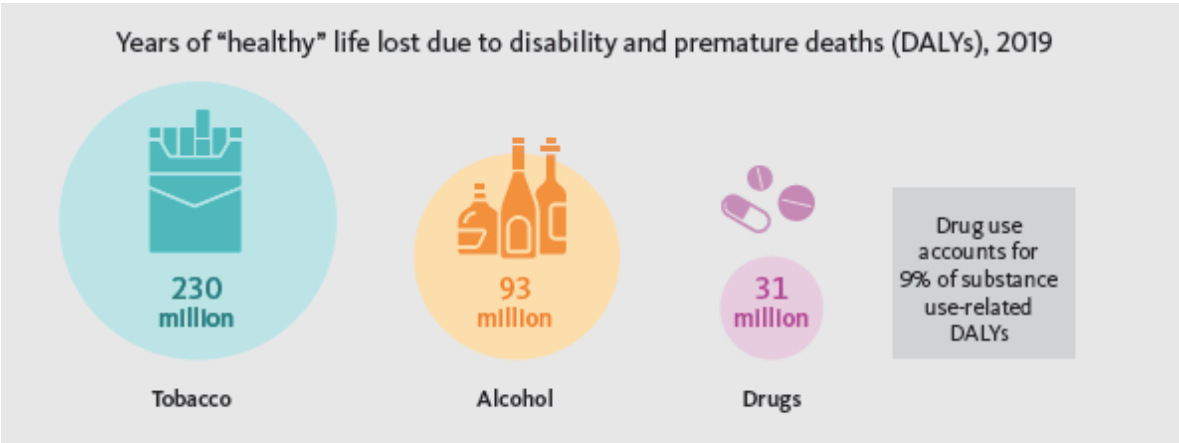

Figure 8. Healthy life loss according to the UNODC World Drug Report (2022).

3.9. Medical use functioning and potential

As mentioned in the previous chapter, cannabis medical use was already legalized in several countries worldwide, as the plant acted as a strong disruptor in the sector (Milenkovic, 2019). There is no historical evidence of any deaths by cannabis use since humankind started to employ it for medical and recreational reasons. Moreover, its side effects are reversible and of minor importance, a key issue for evaluating the safety of the product in the pharmaceutical sector (Kochen, 2022). In addition, on a parallel path with legalization, some studies highlight the benefit of instructing weed doctors and patients on how the compounds work, and their positive and negative effects (Katz et al., 2020, Rubio-Escalona, 2021). As previously stated, the majority of the United States has already legalized medical marijuana use, albeit with slightly different reforms, and studies of short- and medium-term consequences have shown benefits for mental and workplace health, a reduction in the use of other drugs (legal or illegal), and social benefits such as a reduction in crime, traffic accidents, and youth use (Anderson, Rees, 2021). Legalization offers yet another significant benefit: all of the goods' components, including their chemical profile, percentages of each cannabinoid, and presence of pesticides or other chemicals, are tested and certified from the seed to the finished product (Auriol and others, 2023). This makes assessing different health conditions with the appropriate medication much simpler because there is such a large range of cannabis strains available.

CBD was discovered and isolated for the first time in 1942 by chemist Roger Adams, while THC was isolated in 1964 and synthesized in 1965 by Mechoulam and Gaoni (Contreras, 1978).

The endocannabinoid system, a system that involves and processes cannabinoids in the human body as well as in vertebrates and invertebrates world (García-Cabrera, 2021), was discovered in 1992 (Rubio-Escalona, 2021). It consists of two groups of cannabinoid receptors, CB1 and CB2 (Milenkovic, 2019), distributed along the nervous and immune systems (Kochen, 2022). Receptors are differentiated by their location and signal transmission forms. As shown in Figure 9, CB1 receptors are mostly located in the brain, spinal cord, and peripheral nervous system (García-Cabrera, 2021; Rubio-Escalona, 2021), while CB2 ones are spread around human body organs. THC mainly interacts

with the first type of receptors, while CBD with the second one (Rubio-Escalona, 2021).

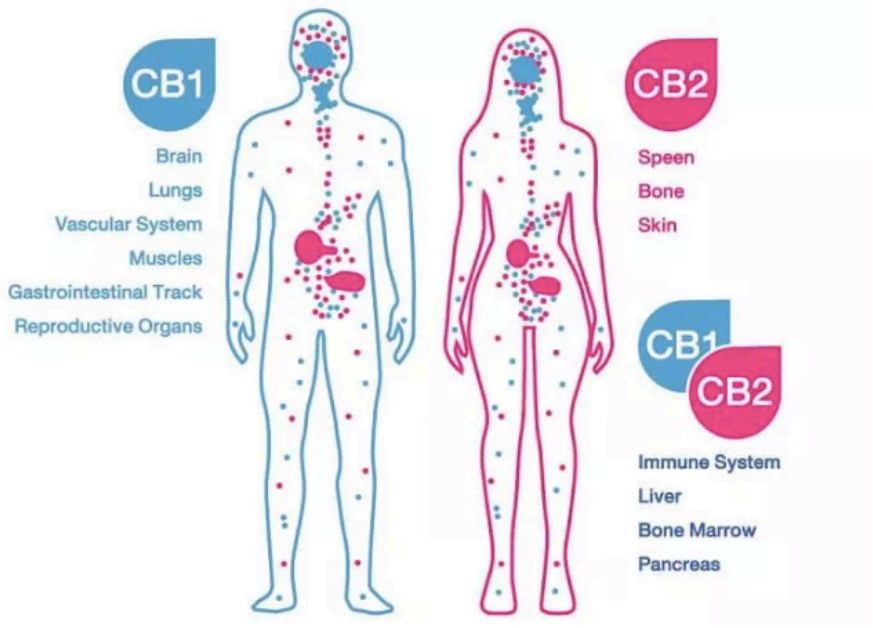

Figure 9. Location of CB1 and CB2 receptors in the human body. Source: https://biologydictionary.net/endocannabinoid-system/

Among the different cannabinoids types, there exist three different categories (García-Cabrera, 2021; Rubio-Escalona, 2021):

· Endocannabinoids, produced by the human body, naturally interact with receptors to keep the balance between the various systems. They were discovered in 1998;

· Phytocannabinoids, produced mainly by female Cannabis sativa plants, like THC and CBD. They are estimated to be around 120 and were synthesized in the last decades for investigation goals;

· Synthetic cannabinoids, like Dronabinol, are produced by the pharmaceutical industries. They have almost the same molecular structure as phytocannabinoids but, as patented, they generate more revenues when sold. That is why most of them are considered legal.

To avoid any misunderstandings, it is relevant to highlight the difference between synthetic cannabinoids and the so-called "synthetic marijuana", a substance that has nothing to do with cannabis. Its chemical compounds act on CB1 receptors like THC, but they use to be fully antagonists and stronger than the natural compound, so usually

generate adverse effects that lead the customers to the hospital (Isorna-Folgar and Arias-Horcajadas, 2022). The name of this substance is tricky and worsened the image of the plant because of people's ignorance and confusion. Another important point to remark, especially for medical use, is the difference between the cannabis plant varieties: the Sativa ones have more psychoactive potential and usually higher THC levels, while the Indica, due to higher CBD concentrations, give the consumer more relaxant body effects. Between these two pure types of strains, there exist a huge variety of hybrid plants, with different THC-CBD balanced proportions and consequently slightly different human body effects.

The various phytocannabinoids of the weed plant can be extracted with different methods (like CO2, ethanol, etc.), and extractions obtained can be classified as isolated or full-spectrum. Isolated ones contain just one pure compound, like THC or CBD, while full-spectrum extractions include all the different cannabinoids present in the plant, like also CBN and CBG, among others, and give the medical customers better and more balanced therapeutical effects (Rubio-Escalona, 2021).

The medical potential of cannabis, as previously mentioned, is quite huge. As Milenkovic (2019) remarks, "A 2016 US study published in "Cannabis and Cannabinoid Research" reported that medical cannabis was used in the management of the following conditions: pain (61.2%), anxiety (58.1%), depression (50.3%), headache/migraine (35.5%), nausea (27.4%), and muscle spasticity (18.4%)". Other relevant illnesses treated include epilepsy, acne, Parkinson and Lyme disease, ADHD, arthritis, insomnia, Tourette syndrome, neurodegenerative diseases, glaucoma, Altzheimer, Chron disease, and pain control in SIDA and cancer patients (Fuentes-Pérez, Acurio-Arcos, 2020; Kochen, 2022; García-Cabrera, 2021; Rubio-escalona, 2021; Riboulet-Zemouli, 2021; Rial-Boubeta ., 2020; Martínez-Oró, 2018). Nevertheless, people must be trained to make informed selections, and they should be encouraged to prefer goods with lower THC levels, as higher amounts might trigger drug illnesses such as anxiety or psychosis. According to UNODC (2023), cannabis use disorders accounted for 41% of all drug use disorder cases worldwide in 2019.

Aside from addressing existing diseases, cannabis legalization could aid in the treatment of several major societal stigmas, including suicide, traffic accidents, and youth use

(Anderson, Rees, 2021). In particular, the majority of studies analyzed in their article found no association between MMLs and youth marijuana use (Choo et al., 2014; Pacula et al., 2015; Coley et al., 2019; Harper et al., 2012). Teenage usage has decreased mostly because of the age restrictions established by the legalization of cannabis and the regulatory structure, which forces dispensaries to check paperwork and prevent sales to minors. In terms of suicides, Bartos et al (2020) discovered that MMLs in California resulted in an 11% decrease in the suicide rate. This is a limited-results study because it only looked at one state, but the findings imply that the research may be broadened geographically and also to include recreational marijuana legalization. Furthermore, legal purchases reduce search expenses as well as personal costs associated with social stigma and ethics, and shopping in a store is usually a better experience than shopping on the street (Auriol et al., 2023). Finally, because cannabis replaces alcohol and is illegal to use in public, traffic deaths could be reduced by 10% (Anderson et al., 2013; Cook et al., 2020).

Cannabis medicines have been used for centuries until prohibition and especially since the 1800s, and it matters to retake the market with increased scientific knowledge and fewer side effects due to the technological advances of our Century. The world is on a slow re-legalization process, as shown in Figure 10, but there is still a lot to change.

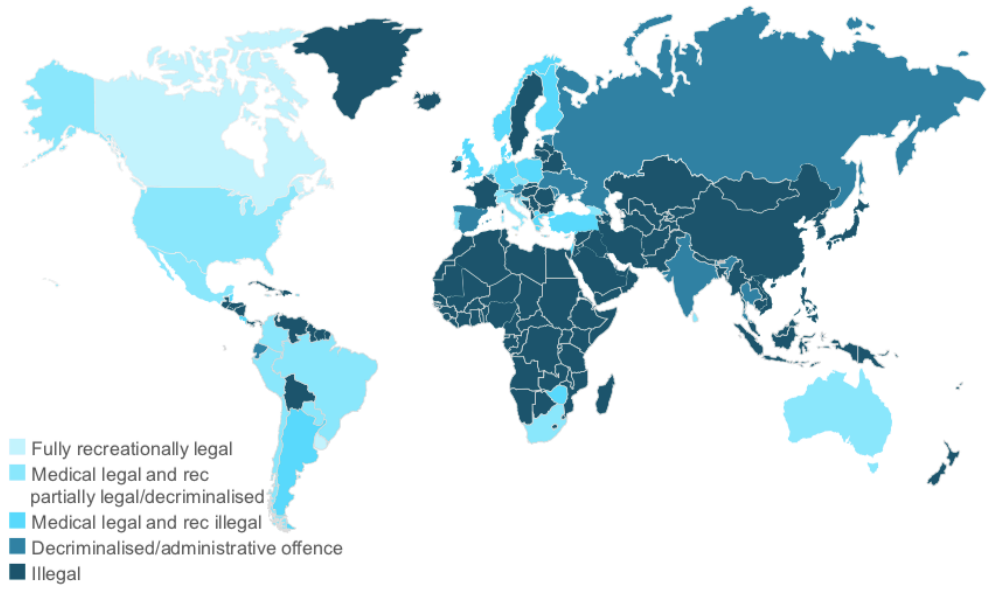

Figure 10: Cannabis worldwide situation as of November 2018. Source: Milenkovic (2019).

Chapter 4 – CANNABIS CULTIVATION METHODS

According to Cacchioni (2021), "in 1950 cannabis worldwide cultivation amounted to approximately 300 thousand hectares (excluding the Soviet Union), leading to 204 thousand tons of fiber production". Nowadays, as the OMS pointed out, "Cannabis is the most used, cultivated and sold illicit drug worldwide" (Kochen, 2022).

The cannabis plant improves soil quality, does not need many pesticides, and so it leads to a low environmental impact (Hernández-Zamora et al., 2021). Hemp water consumption is minimal, its growth is fast (3 to 6 months in optimal conditions), it can adapt to different climates and it is also able to grow in arid land (Manosalva Barrera et al., 2020; Rubio-Escalona, 2021; Milenkovic, 2019; Moscariello et al., 2021).

Worldwide it is now fully or partially legal, although with some state limitations, in the US, Canada, Uruguay, Mexico, Australia, Israel, Netherlands, Germany, Italy, and Spain, mainly for medical use (Santos-Diéz, 2022; MacGuill, 2019).

Hemp cultivation is easier than psychotropic marijuana. As cannabis is a dioecious plant (Rubio-Escalona, 2021), it has both male and female (and in some case hermaphrodite) gender. While it does not matter for industrial use, THC is contained only in the female plant, so pollination of the females by some male plants can even damage an entire production cycle. According to Riboulet-Zemouli (2021), "non-psychoactivity-related crops (hemp) should not undergo the same regulatory burden prevailing for psychoactivity-related crops". Lugo-Ruiz et al. mention, "US 2018 Farm Bill allowed Cannabis sativa L. cultivation, processing, and distribution permits for all agricultural initiatives that comply with the application requisites". There exist three main forms of growing weed: indoor, outdoor, and outdoor greenhouses.

4.1. An indoor cultivation overview

Although it is the most polluting and energy consumption method, it is also the most frequent due to prohibition regulatory systems, that generate in the consumer the need to hide the plantation, even for self-growing (Riboulet-Zemouli, 2021). Besides the indoor greenhouse, artificial lights, humidity control, fans, air conditioning, heat, irrigation systems, fertilizers, and pesticides are needed. As Megías-Quirós and Rodríguez-San Julián (2016) mention, "the indoor production of one-kilogram weed

generates 4.600 kg of CO2, (…) and so it supposes an unsustainable environmental impact". Indoor cultivation has many advantages: both auto-flowering and photosynthetic crops can be employed, the number of light and darkness hours can be automatically timed, and several methods like lollipopping, screen of green, and low-stress training, among others, can be employed to reach greater outputs. It gives the user the possibility to grow different weed varieties at the same time and to decide when to pass them to the flowering phase. During the growing period, the cultivator is free to choose between a 24 or an 18-hour cycle, and whether to add infrared 6-hours light at night or not. Plants can be grown starting from seeds or cuttings, getting up to 6 harvests per year, independently of the seasons. On the other hand, the full equipment for indoor growing supposes significant costs, mainly for the lighting system on which potency will depend the final outputs. Nevertheless, it is a cost that can be amortized due to the several cultivations that can be made yearly. Electricity cost is the highest variable cost, especially in Europe since the war in Ukraine started. For this reason, most illegal farmers connect their system to public electricity providing, avoiding high expenses and burdening the community. Moreover, hydroponic cultivation (in which plant roots are immersed in a continuously-moving water system) can be implemented, although it requires a lot more chemical products, and usually non of them is biological. Indoor growing leads to a more personalized control on outputs, individual plant-deficiencies assessment, and manipulation of flavors depending on terpenes (Rubio-Escalona, 2021). THC and CBD concentrations can be partially influenced by monitoring trichomes and harvesting the plants in the estimated better moment. In the last decades, a lot of guides, manuals, guidelines, and even mobile apps and games on cultivation were developed (Santos-Diéz, 2022).

Indoor techniques are the most used method for self-growing, which is permitted in the majority of the previously mentioned countries although with plant, space, or output-number limitations, and with the condition that the plants have to grow hidden from the rest of the population. It is, so, the only method allowed. Moreover in Spain, thanks to the association rights, it is also allowed community farming, under special restrictions: associations have to be registered, obtain a special license, pass quality and limitations control, and not exceed the maximum yearly quantity permitted, according to the number of members (Hernández-Zamora et al., 2021).

4.2. The outdoor cultivation paradigm

According to several studies, hemp is a material with high potential for large-scale production. Both the worldwide interest in the plant and its disrupting potential in several market sectors encompasses society, environment, and economy together (Manosalva-Barrera et al., 2020). The environmental crisis the world is living nowadays must be a stimulating factor for switching from indoor to outdoor growth (Megías-Quirós and Rodríguez-San Julián, 2016). At present day, the majority of farmers are exploited by criminal organizations to produce weed. To change the paradigm, strong regulatory changes are needed. An illicit-to-licit shift of production must be pushed while granting farmers' rights and facilitating the creation of cooperatives. Crop diversification among cannabis types and other farming products should be encouraged as well (Riboulet-Zemouli, 2021). Some country associations started projects, like the one in Susa Valley in Italy, whose goals are "bringing hemp cultivation back to the valley, making it and its potential known, developing cooperation around transformation projects in order to rebuild local processing chains" (Cacchioni, 2021). Regarding medical cannabis, the challenge for outdoor cultivation is to ensure access to quality and well-manufactured products for patients (Kochen, 2022).

Outdoor cultivation is characterized by an extremely low carbon footprint, almost no waste in the production process, no energy costs, as illumination is given directly by the sun, and a smaller need for water compared to other plants. The outdoor most used growing method is the so-called "sea of green", in which the number of plants in the field is higher than in the indoor box, so the output-per-plant is inferior, but the whole yield is usually higher. Anyway, it would be difficult to completely switch from indoor to outdoor growing especially for medical and recreational purposes, as customers are used to looking for specific characteristics in the buds. Moreover, indoor flavors are more specific and curated than outdoor ones, and buds are usually bigger. In addition, outdoor growing can provide, depending on the latitude and climatic conditions, a couple of harvests per year, while indoor cultivation cycles are considerably faster.

Regulated outdoor growth can be a powerful driver to fostering rural development and creating job opportunities and local employment for minorities, such as people with disabilities, women, and youths (Riboulet-Zemouli, 2021).

4.3. The greenhouses concept

The middle point between indoor and outdoor cultivations is greenhouses. In fact, they join positive aspects of both methods, permitting more controlled and at the same time low environmental-impacting cultivations. Greenhouses protect plants from severe weather and give the growers the possibility to integrate solar with artificial light. This generates several advantages: besides substituting natural light when absent by integration, it is possible to grow both photosynthetic and auto-flowering crops, obtain more yields per year, also in winter, and decide when to switch the plants to the flowering phase. Energy consumption can be partially or fully provided by solar panels, that can be implanted in the countryside as well. Moreover, greenhouses avoid external contaminations and reduce the risk of thefts, as they do not show their content and can be appropriately locked. In addition, inside them it is possible to efficiently divide male and female plants, so they are suitable for psychotropic marijuana and non-psychotropic hemp or CBD weed even at the same time. That means, they can provide outputs for industrial as well as for medical and recreational use. Last but not least, due to the more controlled environment, it is also possible to dry the cannabis harvested inside them. Greenhouses might be the most suitable alternative to highly-contaminating indoor cultivations because they are both able to guarantee customers' quality needings and to ecologically protect the environment.

4.4. Licensing forms and grow-shops

As mentioned in the previous chapters, the various States of the world implemented different licensing regulations for large-scale growing, pushing vertical or horizontal integration on one side, and favoring big companies or small farmers on the other. In the US, when the market boomed in the last years, licensing costs to enter have fastly become extremely high and unaffordable by the majority of small entrepreneurs, permitting big industries to invert billion of dollars in one single shot and cannibalizing small competitors. For example, in California, the legalization reform completely failed owing to the imposition of extremely high selling prices as a result of taxes and the difficulty in obtaining medical treatments, forcing clients to return to the illegal market. In Uruguay, where governmental agencies manage all elements of farming, the situation

is flipped. However, there were only two licensed providers in 2017, meeting a need of roughly one ton, but the real demand was projected to be between 35 and 40 tons, therefore the bulk of consumers continue to acquire illegally (Auriol et al., 2023). Portugal allowed just some specific corporations to produce cannabis for medical use, leading to frightening costs for the users, that are not even allowed to self-grow. In Spain, the licenses last 5 years and are differentiated by their goal: medical use, research and development, and derivatives fabrication (Rial-Boubeta et al., 2020). Unfortunately, as it is a country with uncertain legislation points on many aspects, it is difficult for authorities to recognize whether cultivation is legal or not, and so many small farmers face legal issues and can see their yields destroyed due to regulatory uncertainties. On the other hand, CBD-producing multinationals never faced this type of trouble, so the interventions of the police might be somehow influenced. Moreover, in the last years, some licenses for psychoactive-weed growing have been bestowed, although with some lack of transparency on the administrative process and basic information (Rial-Boubeta et al., 2020). A fair legislation system should not push already extra-rich multinationals to gain more while acting on the local background and promoting economical growth and integration in rural areas and small environments.

Concerning self-growing, in the last decades, it emerged the grow-shop figure. According to Megías-Quirós and Rodríguez-San Julián (2016), "Grow-shops represent the meeting point between self-growers and cannabis industry". These kinds of shops, worldwide distributed, are designed to meet self-growers needs. They provide them with all the possible equipment needed: growing soil, fertilizers, seeds, plant pots, lights, indoor greenhouses, fans, humidity controllers, etc. Moreover, they sell basic equipment to transform cannabis into derivatives (such as hashish nets, CO2, and heat presses), and to consume it (pipes, bongs, and rolling papers and filters among others). On the other hand, people working there are always available for growing tips, and they also aim to spread knowledge on cultivation methods and products as well as on political consciousness and awareness for legalization (Megías-Quirós and Rodríguez-San Julián, 2016).

Chapter 5 – SUSTAINABILITY AND SOCIAL BENEFITS: A COMPARISON BETWEEN PAST, PRESENT AND FUTURE PERSPECTIVES

5.1. An overview of past activists' standpoints

It was 1998 when Jack Herer and Leslie Cabarga, two of the more important cannabis activists since prohibition, in their "The Emperor wears no clothes" book challenged the world to prove they were wrong and stated: "If all fossil fuels and their derivatives, as well as trees for paper and construction were banned in order to save the planet, reverse the Greenhouse Effect and stop deforestation; then there is only one known annual renewable natural resource that is capable of providing the overall majority of the world's paper and textiles; meeting all of the world's transportation, industrial and home energy needs; simultaneously reducing pollution, rebuilding the soil, and cleaning the atmosphere all at the same time... And that substance is - the same one that did it all before - Cannabis Hemp...Marijuana!"

More than 20 years after, it is quite bloodcurdling to analyze how intense exploitation of the planet generated almost irreversible damages to the climate and to the Earth itself. On Saturday, 19th of September 2020, as the New York Times mentioned, Metronome Clock in Manhattan was changed to a World Climate Clock, promoted by artists Gan Golan and Andrew Boyd, that showed the time remaining to our planet before the effects of global warming become irreversible: around 7 years. The clock is now updated every year, according to new guidelines and actions made to reverse tendency and try to save the planet literally running against time. It now countdowns 5 years and a little more than 250 days (source: https://climateclock.world). That means, on one side, that small changes have been made to recover at least a couple of years but, on the other side, that a complete disrupting change is urgently needed.

As analyzed in the previous chapters, the cannabis plant has enormous possibilities for being used in a huge variety of markets, and already had them before the beginning of the new millennium. As Herer and Cabarga (1998) mentioned, hemp can be used for ships' sails, rope, cordage, cloths, linens, towels, and textile products in general as it has better properties than cotton, paper, canvas, paints and varnishes, lighting oil, ecological

fuels, biomass energy, food oils and proteins, building materials and housing, medical and, of course, recreational use. The most recent studies confirmed and expanded Herer's statements, while in the 1990s they stayed unheard and marijuana was considered just a terrible and harmful drug. It is impossible to travel back to the past and change it, but is still possible to rebuild the future according to this disrupting paradigm.

5.2. Present and future cannabis trends

The independent researcher Riboulet-Zemouli, in his Sustainable Cannabis Policy Toolkit (2021), highlights the alignment of cannabis to the majority of the goals of the 2030 Sustainable Development Agenda. In his opinion, hemp can be a powerful source for 15 of the 17 goals of the Agenda. Of course, just the introduction of hemp alone is unable to change the world, but to participate in the change. Cannabis legalization can reduce poverty, both by creating new job places and by switching to legal actual illegal farmers, preserving their vast knowledge while taking them out of legal risks and cartel exploitation. Besides the variety of its medical uses, it can reduce worldwide hunger and contribute, as an integrator or substitute of existing products, to a healthier lifestyle. Education campaigns can be made to raise awareness among the youth and to substitute brain-washing ancient campaigns in the elders while reducing inequalities. Moreover, it can considerably impact economic growth by taking away the business from the black market's claws and, thanks to an appropriate taxation system, improving both entrepreneurs' and State incomes in a circular sustainable economic perspective, reducing carbon footprint and helping the planet while generating profits. In addition, it can contribute to building sustainable cities and communities, both by integrating the countryside with multi-crop agriculture that includes cannabis and by using green recyclable materials instead of plastic in everyday life. Cannabis legalization would also be able to reduce corruption, abuses, and injustices, while reintegrating into the society the people condemned for it and valuing their capabilities to grow, transform, and sell marijuana. It would strengthen human rights to access medical use with no fear of unfair punishment. Clearly, the change in some countries will be slower than in others, due to the type of government, presence of non-renewable sources, and public opinion.

Anyway, some of the tobacco, drinks, food, consumer health, and beauty multinationals already invested in cannabis as they saw its disruptive potential (Milenkovic, 2019).

Auriol et al. (2023) conducted a thorough analysis of the factors that need to be considered while establishing a legalization reform. Their findings demonstrated that legal and illicit selling prices and production costs, quality, legal penalties, the likelihood of getting detected while selling or purchasing illegally, and tax interests are the primary factors in a legalization change. Furthermore, the objectives of the government can differ based on the social and economic backgrounds of the population. These objectives can include eliminating the illegal market, minimizing demand after legalization, optimizing profits, regulating cannabis use, enhancing the quality of legal marijuana, preventing minors from accessing the plant, and cutting costs associated with law enforcement and prisons for minor offenses. Every nation that has legalized marijuana for either medical or recreational purposes has implemented a different set of regulations; some, like those in Uruguay, Canada, and California, have shown to be ineffective, while others will require more analysis in the coming years. Selecting the right selling price to drive out the black market is a difficult problem because, if it is too low, the demand will increase dramatically; on the other hand, if it is too high, it will be simpler for the illegal organizations to cut prices while maintaining their competitiveness. Furthermore, each of the above described parameters needs to be calibrated adequately in order to achieve one of the various possible state goals. Interestingly, their research indicates that greater legal penalties for illicit trades – rather than a decriminalization of cannabis-related offenses – are better outcomes of legalization.

Although destroying all criminal organizations worldwide is an impossible objective, it is crucial to remember that organizations are made up of people, and small illegal merchants are the most significant and last link in the chain. Rather than evicting them, governments should pass legislation that strongly encourages them to abandon illegal trafficking and transition to the legitimate market, where they could continue to develop the same enterprise without fear of legal repercussions. Taking workers away from criminal organizations and deterring others from entering them by suitable policies combined with information and sensibilization efforts could be an effective strategy to

damage the internal structure of the black market. Of course, the issue is considerably more complex, and other external variables such as the spread of poverty and economic inequities, the legalization of immigrants, social welfare and consciousness, corruption, and monetary interests all play a role. As outlined in Agenda 2030, the mix of goals is broad and complicated, and only by achieving a balance between them can nations achieve meaningful results. In its 2023 report, the UNODC states: "Public health must remain the priority in the context of rapidly developing drug control regulation, in particular in relation to medical use, and countries must invest more in research to monitor the effects of policy and inform responses".

5.3. Public opinions: a focus on the Spanish situation

As highlighted by Santos Diéz (2022), cannabis is not a priority topic for the most known Spanish newspapers (ABC, El País, El Mundo, and La Razón) due to actual legalization uncertainties. Spanish press mostly refers just to official sources, such as police and institutions, and never to associations or people favorable to legalization. It mainly presents weed articles related to crimes and just talks about possible legalization progress during the election period. By the way, Spanish newspapers started to move away from the image of cannabis as a dangerous illegal drug, showing a more permissive standpoint. Thanks to cannabis legalization in the US and some other parts of the American continent, they also began to mention its industrial, medical, and recreational use, as well as its potential contribution to the wellness and healthcare sectors. This happened thanks to the influence of famous figures like David Beckham, Drake, Mike Tyson, Rihanna, and others that already entered the market with their own brands. On the other hand, there is no Spanish journal talking about addiction and preventing programs, or instructing the youth on the risks of an early start in consuming the substance.

While the press is not publishing anything to orient youngsters, their opinion on marijuana is forming and changing. According to Megías-Quirós and Rodríguez-San Julián (2016), the global opinion of Spanish youth on cannabis significantly changed in comparison with other drugs. Their study analyzed a population aged between 15 and 34, both with and without children, and identified four main categories: people

supporting liberalization, minimizing risks and socially accepting the substance although contrary to product promotions; youngsters asking for legalization and normalization of the consume, almost neglecting risk due to their personal use too; others tolerating it and in favor of cultivation and a controlled liberalization, and the lasts in favor of prohibition and demonization of the substance, emphasizing the harms to health.

Such a vast panorama, with the coexistence of strong different opinions, is the result of the press, family, and educational influences. It is known that political and medical concepts, especially when spread on television and social networks, have the power to influence the mostly uninformed masses even when they are not reliable. The negation of risks is dangerous as well as the exaggeration of them made by health centers. Institutions should position themselves in a balanced middle point, acknowledging that any abuse of substances is harmful and that cannabis as a psychotropic substance may create addiction and brain damage to minors and, at the same time, admit that prohibition failed. Marijuana is not the monster painted by newspapers less than one century ago, and its risks are significantly less than the ones of other drugs, even the legal ones like alcohol and tobacco. Moreover, the majority of people nowadays still do not clearly recognize that “hemp” and “marijuana” are the same plant, and that the potential of non-psychotropic cannabis is huge and comprises a wide variety of market sectors. The CBD market, somehow positioned in the middle, either is accepted or considered not interesting by the non-informed majority.

The comparison of nowadays news with prohibition yellow journalism of the past highlight how the tendency to change is still not completed. Yet, journals focus on drug crimes, while social networks, the main tool used by the youth, are contaminated by a large amount of fake news and misinformation. As the paradigm did not change yet, in the countries in which the legalization process is on the path a strong conflict of interest is still alive between this emerging market and the actual ones owned by multinationals. For this reason, even though awareness of people is rising, there is still not enough economical interest in changing the public point of view on cannabis. That is why a disruptive and fast change is needed worldwide, especially in Europe, which is facing a strong economical crisis also due to the Ukraine war. Constantly increasing prices of oil

and gas, and a lack of imported resources such as cereals would be solved by the introduction of cannabis cultivation and manufacturing companies, that would be able to replace all these goods with local products while contributing to saving the planet with the introduction of a sustainable bioeconomy.

Chapter 6 – ESTIMATION OF THE EFFECTS OF CANNABIS LEGALIZATION IN SPAIN

As stated by Milenkovic (2019), an estimation of the total size of global markets that, with an appropriate regulatory system, will be disrupted by cannabis is around the US $5 trillion, as shown in Figure 11. Besides that, predicting single States evolution would be much harder, because every Country has economical, political, social, and cultural different backgrounds and interests. This chapter purposes an estimate of the economical and social effects of legalization in Spain, focusing mainly on medical and recreational uses. Calculating the impact on the whole set of markets would be almost impossible at this point, because the costs for reshaping the industries, make-or-buy decisions, and manufacturing are difficult to estimate, as well as the prices for the final outputs, for instance in the textile or construction markets. Moreover, regarding biofuel production, on one side some sectors such as the automotive one would have to be totally rebuilt according to this paradigm, while on the other side the interests of big oil companies will negatively influence the spread of the products. For these reasons, focusing on an already existing market sector in a Country in which cannabis is already barely legal, such as Spain, will lead to more reliable results.

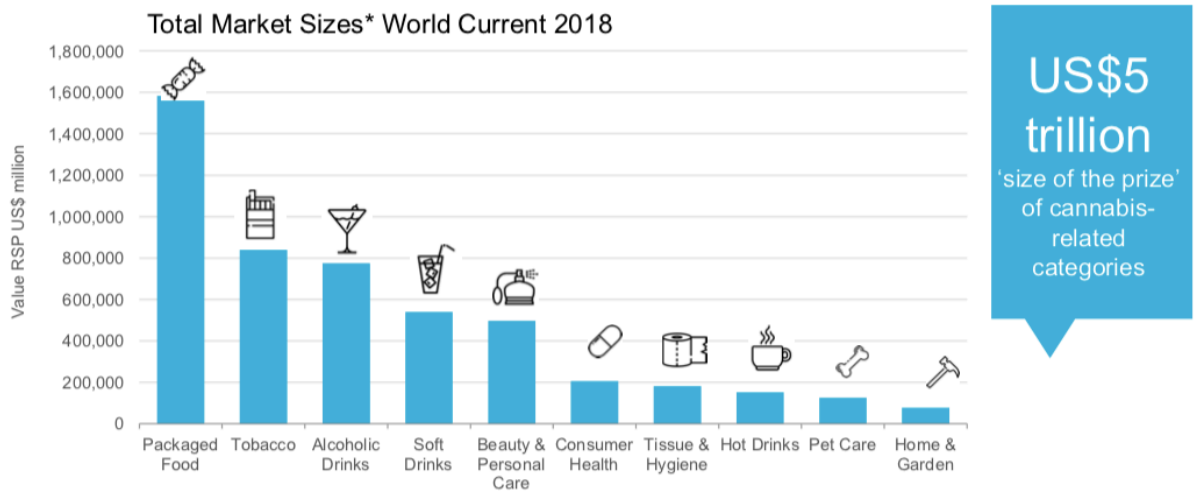

Figure 11. Size of the markets that will be disrupted globally by cannabis. Source: Milenkovic (2019).

6.1. Starting data

For the estimations proposed, several factors will be considered and their reliability will be pointed out.

First of all, cannabis consumption is usually seized as the "number of joints smoked", which is a qualitative and non-quantitative variable: as people use to mix cannabis or hashish with tobacco, the same resulting cigarette can contain a small or big quantity of the product depending on the single user. This is an issue present in both statistical and medical reports and makes that a non-reliable factor to compute the average cannabis use in Spain. Considering the population aged between 15 and 64, cannabis is the fourth most consumed drug, behind alcohol, tobacco, and hypnosedatives with or without prescription. A 37,5% of people recognized to have tried weed at least once in life, of whom 10,5% in the last year, 8% in the last month, and a 2,9% were daily smoking cannabis in 2020 (OEDA, 2022), that leads to an estimated 0,91 million people consuming cannabis or resin every day in Spain. According to the same report, the average number of joints consumed on an episode in 2015 was 2,5 while in 2020 was 2,9, highlighting a growing tendency, but with no precise reference to the number of grams smoked, and whether of resin or marijuana. Moreover, 87% of people mixed cannabis with tobacco.

Another data that has to be taken into account to estimate cannabis consumption in Spain is the quantity of marijuana and hashish seized in police operations. Figure 12 and Figure 13 show respectively the quantity seized of the two types over the years. The average price per gram of the substances confiscated in 2020 was 5,09 for the weed and 5,57 for the resin, while THC concentration was respectively 12% and 28,9% (OEDA, 2022). A rapid calculation shows that the value of the cannabis seized in millions of euros was 356,3 while the hashish one was 2.640, for a total of almost 3 billion euros. Remarkably, these quantities do not reflect the real use of the substances, just the part that was confiscated. Moreover, resin quantities are higher because of strong importations from Morocco, while cannabis plants cultivated in the countryside or in private spaces are more difficult to be found by the police. From a human perspective,

cannabis traffic detentions were 60% of the total 24.114 detentions in Spain in 2020 (OEDA, 2022), corresponding to 14.468 people.

Last but not least, considering the analysis of sewage in Spain would be not a trustworthy parameter because a part of THC is retained by the human body and slowly released, and results are significantly different depending on the cities or regions and periods of the year analyzed.

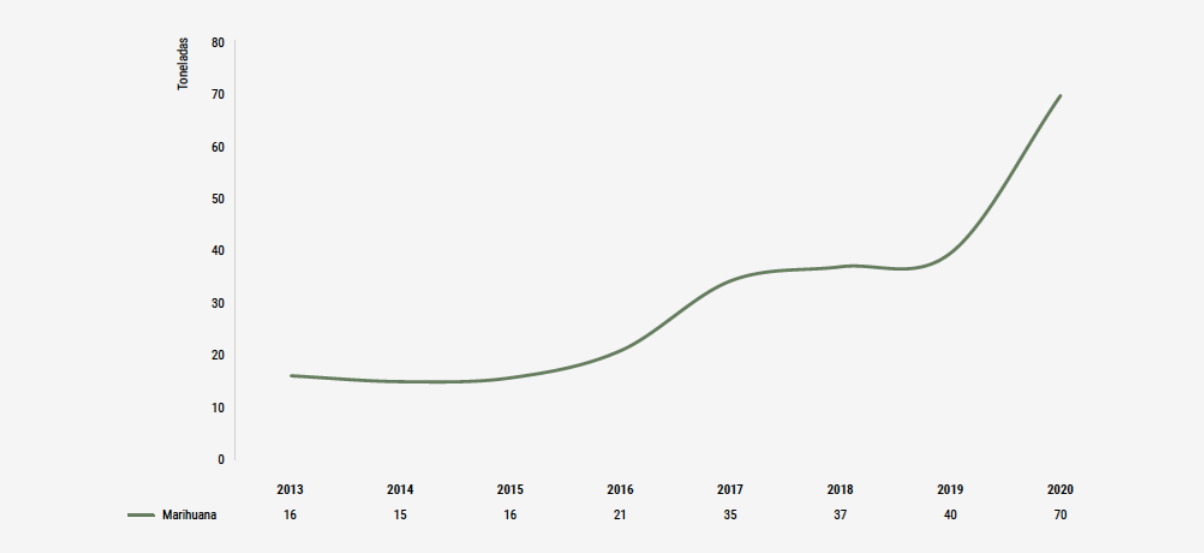

Figure 12. Quantities of seized cannabis in Spain (2013-2020). Source: OEDA (2022).

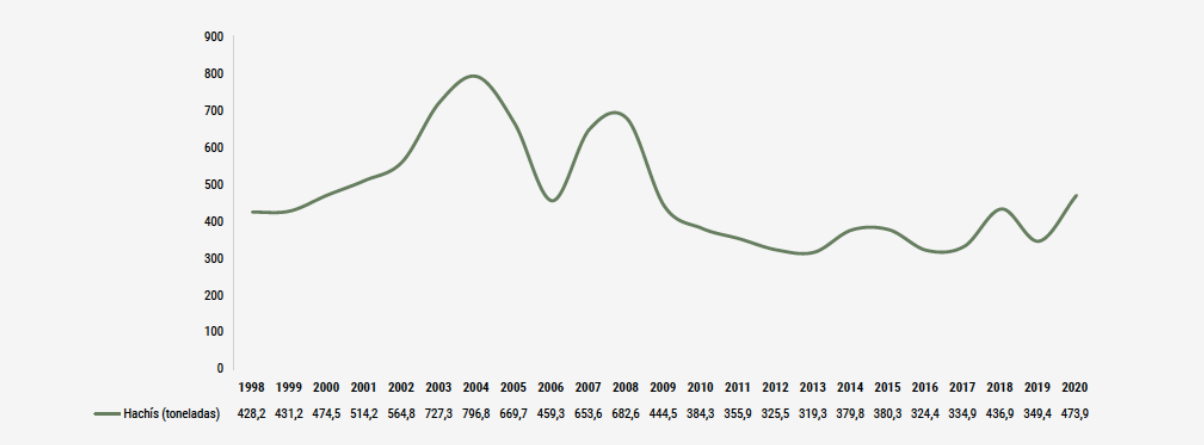

Figure 13. Quantities of seized hashish in Spain (1998-2020). Source: OEDA (2022).

Looking at the existing markets, it is remarkable to take into account the ones of the two most sold legal drugs worldwide: tobacco and alcohol. As mentioned before, the cannabis plant would be able to partly substitute existing sales in the sin sectors.
According to the OEDA (2022), in 2021 the total consumption of alcoholic drinks amounted to 5371 million liters, divided as follows: 3.829 beer (71,3%), 1.229 wine (22,9%), 255 distilled spirits (4,7%), and 57 of intermediate products (1,1%). The average selling price per liter of beer was 1,9€, and 12,56€ for distilled beverages (OEDA, 2022), while 5,69€ for wine in the hospitality industry and 3,96€ in the food and beverage sector (OeMv, 2022), giving an average price of 4,8€ per liter of wine sold. Neglecting the intermediate products, and according to the considered data, the alcohol market can be estimated worthing 16.377,1 million euros.

Concerning the tobacco market, sales decreased in the last years, with a gradual replacement of packs of cigarettes by rolling tobacco, as shown in Figure 14. Total sales in 2021 amounted to 11.327,783 million euros, a value comparable to the one of the alcohol market.

Tipo de labor	2005	2007	2009	2011	2013	2015	2016	2017	2018	2019	2020	2021
Cigarrillos	10.243,640	11.147,600	11.719,617	12.061,477	10.217,073	10.312,166	10.311,177	10.122,349	10.166,996	10.201,155	9.338,247	9.543,794
Cigarros	467,235	443,781	412,240	427,589	512,960	509,563	496,286	483,919	478,243	470,207	438,287	453,127
Picadira de liarr	182,526	209,442	395,411	486,559	1.088,680	1.030,188	1.000,737	975,075	1.002,580	1.038,434	1.074,168	1.081,975
Picadura de pipa	8,107	8,560	9,449	16,738	36,849	52,167	50,655	70,666	105,138	155,297	215,954	248,887
TOTAL	10.891,510	11.809,380	12.536,716	12.992,363	11.855,562	11.904,084	11.859,990	11.652,008	11.752,957	11.865,093	11.067,198	11.327,783

Figure 14. Evolution of revenues from tobacco sales (2005-2021). Source: OEDA (2022).

Furthermore, considering sales decrease in these markets in States that legalized recreational cannabis, it can be observed that in Colorado alcohol purchases decreased a 13% (Calvert and Erickson, 2021) and, according to MacGuill (2019), “Cannabis beverages are expected to replace more and more alcohol consumption.”. However, the consequences in Spain might be different because of the culture and the tendency to mix

several substances, like cannabis and alcohol. Concerning tobacco, it is still not clear the role of cannabis legalization on sales, although there exist already studies that show how CBD can replace nicotine and its addition. Furthermore, a 2018 study on tobacco smokers in California showed that 75% used cannabis to leverage tobacco use, and "a further 13% (about 10% of all tobacco users) substituted their tobacco use entirely" (MacGuill, 2019).

6.2. Estimation of the actual cannabis black market

Besides the provided data, it is not easy to estimate the total value of the cannabis market when legalization will occur. For this reason, some assumptions and hypotheses have to be made.

Starting from the data on consumption and considering the Spanish population aged 15-64 in 2020 (the 66% of 47,35 million people, corresponding to 31,25 million people), different scenarios can be calculated according to the quantity of cannabis or resin employed in one single joint, as shown in Table 1. The two segments considered are the everyday smokers (2,9%) plus people that smoked in the last month (5,1%, as the 8% mentioned before includes the everyday smokers), supposing that they consumed cannabis on an average of four times per month, that means in the weekends. The estimation of the quantity of weed in a cigarette is made supposing four different situations: 0,3 grams, 0,5 grams, 0,7 grams, and 1 gram per joint. Comparing the calculations obtained with the quantity of weed and resin seized yearly (543,9 tons), plus the data obtained by anonymous interviews with cannabis users, Scenarios II and III are the most probable.

Scenario	Quantity of cannabis in a joint (g)	Quantity per sonsumption (g)	Cannabis smoked by everyday users (tons)	Quantity smoked yearly_1 (tons)	Cannabis smoked by monthly users (tons)	Quantity smoked yearly_2 (tons)	Total cannabis smoked yearly (tons)
I	0,3	0,87	0,79	287,66	1,39	66,53	354,18
II	0,5	1,45	1,31	479,43	2,31	110,88	590,31
III	0,7	2,03	1,84	671,20	3,23	155,23	826,43
IV	1	2,9	2,63	958,86	4,62	221,76	1180,62

Table 1. Cannabis smoked yearly in Spain according to four different Scenarios. Source: own elaboration.

Considering the preference for the smoking product, 48,7% of monthly users in 2020 preferred cannabis, 20,6% hashish and 30,8% both them (OEDA, 2022). Splitting in half this last percentage, it can be considered that 64,1% of the population preferred weed while 36% resin. As the total would be 100,1%, it is assumed that the two percentages are 64,05% and 35,95%. This data seems to collide with the seizure ones, but it has to be remembered that not all the seized hashish is destined for the Spanish market, as Spain is just the nearest country in Europe to Morocco, a great resin producer, so part of the material is designed for exportation to other Countries. Moreover, cannabis cultivations are harder to be found because of their hidden nature. For this reason, the data on consumption is more significant than the one on police interventions. Nevertheless, it still remains difficult to estimate how importations from Morocco will change if cannabis is legalized in Spain. The total estimated value of the actual cannabis black market, focusing on Spanish consumption and according to the available data and formulated hypothesis, is shown in Table 2.

Scenario	Total cannabis smoked yearly (tons)	Weed consumption (tons)	Hashish consumprion (tons)	Total revenues of weed (M€)	Total revenues of hashish (M€)	TOTAL REVENUES OF THE WHOLE MARKET (M€)
I	354,18	226,86	127,33	1154,69	709,23	1863,92
II	590,31	378,09	212,22	1924,49	1182,04	3106,53
III	826,43	529,33	297,10	2694,29	1654,86	4349,15
IV	1180,62	756,18	424,43	3848,98	2364,08	6213,07

Table 2. Black market annual revenues in Spain according to four different Scenarios. Source: own elaboration.

6.3. Estimation of the disruption in the sin industry sectors

Considering the mentioned data plus some interviews with people living in Spain, the most probable tendency would be a decrease in the consumption of tobacco and alcohol linked to cannabis legalization. At present day, while CBD oils are legalized, CBD buds consumption is still considered illegal and it is illegal as well to grow them in Spain, so they are sold as “collection products” and almost the totality is imported, mainly from Italy. While THC legalization would have more impact on the alcohol market, especially in the sector of cannabis beverages, CBD proper regulation and sales as a smoking

product would affect mainly the tobacco one. As some preliminary studies pointed out, CBD can reduce tobacco use by up to 40% in active smokers (MacGuill, 2019). Taking into account a total uncertainty about the possible evolution in the Spanish market, and considering that cannabis is already widespread in the Spanish culture and more socially accepted, 15% would be considered as a significant percentage of reduction in the alcohol market, and 20% for the tobacco one. Moreover, as an assumption, these revenues would be allocated to the new emerging cannabis market as a consequence of legalization. These values correspond respectively to 2.455 million euros for alcohol, and 2.265 million euros for the tobacco industry, for a total of 4.720 million euros. This result is comparable to the value of the cannabis black market computed in Scenario III.

6.4. Potential evolution of cannabis medical use

Concerning medical use, as mentioned in the previous chapter, the potential of cannabis is huge. As Milenkovic (2019) pointed out, in Spain, more than 20% of people reported 6 or fewer hours of sleep per night, and a part of them used medicines to regulate their emotional and physical state. As mentioned by the EMCDDA (2020), the use of licit drugs instead of illicit ones, like alcohol, anxiolytics, and benzodiazepines experienced significant growth during the Covid-19 pandemic, both to increased stress and anxiety in people due to the lockdown and to the lack of availability of illegal substances. According to the Dirección General de Cartera Común de Servicios del SNS y Farmacia (2021), in 2021 in Spain there were sold approximately 1.033 million prescription medications, for a total of almost 13,5 billion euros. The ones that could be partially or fully replaced by cannabis introduction, like analgesics, psycholeptics, anti-inflammatories, and psychoanaleptics, among others, sum almost 450 million products, for a total of 4.34 billion euros. Moreover, CBD or extracts from seeds could replace several integrators, beauty and personal care goods, cosmetics, essential oils, and pet care complements. It has to be remarked that big pharmaceutical companies use to pay doctors according to the amount of selling of specific medicines, like antidepressants and anxiolytics, so big conflicts of interests are massively present when talking about cannabis medical use full legalization, and substitution of conventional prescription medications. Furthermore, as cannabis is a plant, it can not be patented, so the most

probable tendency would be to introduce synthetic and chemically generated cannabis compounds rather than natural ones, to maximize profits on patents.

From a medium and long-term perspective, medical use will probably overwhelm recreational one, while in the present day the situation is the opposite. As mentioned by Schauer et al. (2016) in a US study, "among current users, 10.5% self-reported medicinal-only use, 53.4% self-reported recreational-only use, and 36.1% self-reported both". This happens because traditional medicines are still the most prescripted and sold, as doctors do not possess sufficient information on cannabis medical use, or are conditioned by economical interests. Moreover, the CBD market is an emerging and non-mature one, so big companies are still investing a relatively small amount of money in product development, and the majority of Spanish CBD is imported. In addition, some users consume marijuana to relax, control anxiety, or cure insomnia and depression without any medical prescription. For this reason, they consider themselves mostly recreational users, while they are medical ones as well. On one hand, more information studies and campaigns on the positive and side effects of cannabis medical use are needed, while on the other hand an efficient regulation and control system must be implemented to guarantee customer safety and responsible use, whether medical or recreational. Finally, at today's date the Spanish black market, directly or indirectly, is the main provider for a great part of medical users too. The estimation of the initial revenues of cannabis legalization in the pharmaceutical industry would be made considering a 10% of the actual ones, that means 434 million euros, with huge growth potential in the next years if driven by an efficient regulatory system.

6.5. Employment of cannabis scraps in the other markets

Estimating the number of plants that have to be grown to satisfy cannabis demand is another difficult issue. It depends on indoor or outdoor production, the genetics and type of plant, the power of light, the growing methods employed, the size of the flower pot, and available space. Considering that during the drying process a plant loses around 60% of its weight, and assuming that the average production of buds per plant is around 50 grams, approximately 16 million plants are needed to satisfy the Spanish demand. This means a huge amount of fibers as scraps after harvesting, that could be employed

as raw material in other sectors. The most interesting ones nowadays are the ones of bioenergy, as well as the plastic, construction, and paper industry. Moreover, seeds could be used as food complements or in the production of varnishes and personal care goods. Calculating the potential of these markets in economical terms is still very complex because it would depend on changes in the whole industrial processes as a result of the integration of hemp in manufactury chains.

Furthermore, non-psychotropic hemp and psychotropic marijuana require different spaces and methods of care: for instance, to get soft fibers to be employed in the textile sector, it is better to grow an elevated number of plants per square meter, while for getting good buds for medical use it is indicated a significantly smaller density of plants. Growing hemp in Spain is apparently easier from a legal point of view, although getting a license and not risking subsequent police controls or seizures is not, due to important lacks in the actual regulatory system.

6.6. Potential revenues and benefits of cannabis legalization

According to a study 2018 made by the "Unidad de Políticas de Drogas del Servicio de Psicología y Logopedia de la Facultad de Psicología de la UAB", published in the magazine Cáñamo in October 2018, the cannabis demand was estimated to be 820.597 kilograms, and the total volume of the market 8.514 million euros. Moreover, it pointed out that legalization would reduce the black market incomes to 15% of the actual ones. The demand almost perfectly coincides with the one plotted in Scenario III, while the revenues calculated by joining an 85% of the black market value plus the estimation of the sin industry and medical substitution markets sum 8.851 million euros, again a very close result to the one obtained by the mentioned study. As an emerging market, these estimations constitute just the beginning, while it would be able to evolve and expand more from a medium and long-term perspective. Of course, as highlighted also by the previously mentioned study, another assumption that has to be made is that the new regulating system would allow three possible distribution channels: self-growing, already permitted in Spain, social clubs, as non-profit entities with paid workers, and new selling market, with cannabis shops like the CBD ones already present in Spain. This would create more than 100 thousand workplaces, permitting skilled and unskilled or

unemployed people to obtain a job. Furthermore, the tax income for the State would amount to more than 3 billion euros, considering a 21% IVA, a special tax like the existing one on alcohol and tobacco, and the enterprise costs for the Social Security of workers. It would also reduce detentions up to 60% (OEDA, 2022), while enhancing people's capabilities in the sector and permitting them to apply their knowledge legally. Last but not least, it would reduce crimes, thefts, and deaths connected to drugs, as at present day it exists a great component of violence in the cannabis market due to its illegality. As the Spanish weather is favorable to weed-grown, and there are lots of unused lands, legalization will be an occasion to better and sustainably exploit Spanish soil.

For these reasons, it is important to remark that full legalization of cannabis would give Spain three main kinds of benefits. Firstly, economical ones for entrepreneurs, workers, and the State that could invest part of the money in information and prevention campaigns. Secondly, social benefits as the creation of workplaces, the non-detention of cannabis growers and sellers (that includes a positive impact on their families), and a reduction of cannabis crimes. Last, environmental benefits to growing a non-aggressive crop and fully integrating it into the economic system, not only for medical and recreational use but also by recycling scraps in other sectors, following the concept of a circular economy.

As cannabis is already quite socially accepted in Spain, and CBD shops are spread around its main cities, the image of a “green leaf” is already present in the Spanish imaginary. Nevertheless, it has to be remembered that early use would seriously damage the brain cells of youngsters, so apart from prevention campaigns, some constraints on sales must be enforced. Looking at the States in which legalization is more advanced, like Amsterdam or the United States, one of them is the distance between cannabis shops or clubs from schools and children's places. Other measures would be to avoid any type of advertisement, as happens for the tobacco industry, while edibles or drinks might be allowed if compared to alcohol commercials. Black market sellers are present and visibly spread around cities, and frequently their selling points or neighborhoods are well known by the police and by public opinion. The lack of sufficient intervention is already an issue, so changing the situation to a regularized one

in which unsightly street vendors are substituted by authorized and good-looking shops, would be an important gain in the image of the cities. Although the most conservative part of the population will object to the presence of purchasing points, government appropriate interventions to enhance their safety compared to the potential danger of the actual illegal cannabis selling system could make them look like an improvement of actual conditions. Moreover, inversions of a part of the cannabis tax income to control and contrast sales to minors would reduce their potential risks.

As mentioned in the previous chapters, one of the most difficult issues would be regulating the coexistence of cannabis clubs and shops, as the formers are not subject to taxes, and are directly or indirectly managed by black market exponents, while the latter could be managed by multinationals and create a price war to cannibalize associations. This is maybe one of the most delicate points to deal with, so legislators would have to clearly define the role, description, permissions, and limits of each figure. Efficient licensing models have to be implemented too, and they might be different for clubs and shops.

CONCLUSIONS

This document attempted to present the Cannabis sativa L. plant from every angle: it began with a technical explanation of the different types of plants and their origins, moved on to discuss the prohibitionist movement and its spurious arguments, examined the wide range of products that can be made from hemp and its cultivation techniques, and then looked at the steps taken toward legalization from a global standpoint, highlighting the variations between the different states, particularly with regard to the Spanish market, the efficacy of the policies on the welfare of individuals and society as a whole, and the criticisms that surfaced and required more research.

In light of the results obtained, it can be asserted that cannabis is a multifunctional crop that can efficiently be integrated with today's agriculture, and whose derived products involve a great variety of industries, from old to emerging markets. Apart from medical and recreational use, textiles, paper, cosmetics and beauty care, food and beverages, plastic, and biofuels are the primary application industries. Cannabis' new paradigm would be able to disrupt the present economy by the introduction of 100% recyclable and reusable goods that, in addition, reduce GHG and carbon footprint and contribute to saving the planet from climatic collapse. Cannabis medicines have been shown in clinical trials to be effective in the treatment of pain, anxiety, depression, headache, nausea, muscle spasticity, epilepsy, acne, Parkinson and Lyme disease, ADHD, arthritis, insomnia, Tourette syndrome, neurodegenerative diseases, glaucoma, Altzheimer's disease, Chron disease, and pain control in SIDA and cancer patients. Furthermore, because their side effects are less severe and cannabis overdose is impossible, they are able to replace a wide range of genuine drugs, such as anxiolytics, sedatives, and antipsychotics, which are normally linked with social stigma. Cannabis legalization has also been shown to reduce tobacco, opioids, and alcohol usage, particularly binge drinking, since cannabis has been recognized as a substitute for these legal and illicit substances. Last but not least, the introduction of medicinal marijuana legislation has resulted in a general decrease in drug-related crimes, traffic accidents, teenage usage, and suicide rates in the United States.

Developing an appropriate regulatory model for cannabis use and cultivation is a very complex issue that must take several variables into account: legal and illicit selling prices and production costs, quality, legal fees, the likelihood of being caught while selling or purchasing illegally, and tax interests. Governments should set goals based on the demands and conditions of the market and its customers, which differ from state to state. Different goals (e.g., maximizing profits, minimizing demand increases and controlling the market, evicting the black market, improving the quality of legal strains) produce different outcomes, some of which are successful, while others are disastrous, depending on the state's peculiar situation and market response. Furthermore, controlling cannabis production entails placing constraints on the pesticides and metals used in the growing process, resulting in safer and more regulated items for customers. Given the potential dangers of smoking crops, it would be prudent to unify the list of permitted compounds globally.

The many state efforts detailed in this paperwork, although pursuing different ways, accomplished the same goal of obtaining more control over legal production and youthful consumption. Another significant element has been the defining of personal use amounts and the authorization to self-grow a restricted number of plants. This allowed clients to choose the strain, production method, and pesticides used, removing some of them from the hazards of purchasing in an illegal and uncontrolled market. Furthermore, sensitization programs were critical for making cannabis users aware of the possible advantages and downsides of marijuana and encouraging them to use it responsibly. Some of the countries that have legalized cannabis should be included as instances of the difficulties in selecting the correct legalization combination of policies for achieving clear goals.

First, both Canada and Uruguay failed in their reforms due to the same error: rationing while providing legal products of poor quality. Both enforced a carefully regulated state model, with the former cooperating with local entities but underestimating true customer demands and the latter imposing a monopolistic market incapable of meeting demand. As a result, both saw a quick movement of customers back to the illicit market. Second, the greater part of the United States legalized cannabis, despite the fact that it is still illegal under federal law. Each state established its own rules: although the majority approved medicinal usage, some also permitted recreational use, and some

decriminalized consumption. A key miscalculation was made in California: although it was the first state in the US to start a legalization program, it imposed relatively high selling prices owing to taxes, therefore the bulk of customers decided to remain in the cheaper illegal market. Third, both the Dutch and Spanish models did not succeed due to significant gaps in their norms. As a result, wholesale is in the hands of the black market in the Netherlands because it is illegal to transport or wholesale cannabis, and in Spain because weed is dispensed in associations that should grow it themselves but prefer to buy from the only existing wholesale market, which is the illegal one. Fourth, Italy created an unusual phenomenon: the unintended legalization of cannabis with very low THC and a high CBD content. As a result, there has been a significant movement toward CBD products as self-medication for patients suffering from certain psychiatric problems, proving the efficacy of this component in various conditions. However, because there was no control over crop quality, it underscored the necessity for adequate laws. Unfortunately, it appears that this change will be quickly canceled owing to political machinations.

All of the above nations have one thing in common: they committed huge legislative mistakes that sent clients back to the illicit market. Personally, I believe that the error is to perceive the black market as something to fight for rather than incorporating its members into the regulatory system and removing them from organized crime. It should be noted that the cannabis clandestine market began less than 100 years ago as a result of a disastrous prohibitionist effort, thus what changed were not the clients but the providers. In concrete terms, criminal groups were able to seize control of the market away from farmers. While a completely reverse step would be utopian, it would be preferable to legislate in a way that allows current illegal producers to keep doing what they do best, but in a legal and more controlled framework, discouraging criminal entities from intervening by enforcing stricter repressive methods for illegal production and purchase. Governments should undertake simulations for multiple scenarios before enacting any legislation, thanks to existing technology and the advent of artificial intelligence. In all cases, states must legislate with the purpose of preserving consumers' health and ensuring their safety while regulating demand by establishing a fair price and providing high-quality crops, rather than enhancing public income.

With an emphasis on Spain, this research aimed to estimate the magnitude of the illicit market by analyzing information on joint consumption and the amount of marijuana and hashish confiscated by police interventions. The findings suggested an annual need of roughly 820 tons per year, which was corroborated by another independent investigation. Furthermore, replacement tendencies for tobacco, alcohol, and prescription medications were examined, yielding a potential market value of 8.8 billion euros. These estimates were based on the assumption that cannabis would be legalized through three separate channels: self-growing of a restricted number of plants, non-profit social clubs, and cannabis stores. To minimize club cannibalization by shops and, on the other side, money looting in the formers, the government should impose tougher control measures and a licensing system to clearly differentiate the two. In my humble view, it would be wise to pass legislation that permits social clubs to sell only marijuana cultivated by themselves while permitting stores to acquire from registered growers.

Finally, as previously mentioned, the potential of cannabis is enormous, and public opinion must look beyond the traditional view that frames cannabis as a drug only considering its medical and recreational use, and begin focusing on the plant as a natural raw material that can substitute a vast majority of the actual polluting goods, in almost every sector. A disruptive innovation beyond legalization would be assisting growers and producers in taking advantage of all plant components rather than just the flowers and leaves, which contain THC and CBD. The residual scraps should be incorporated into other fields from the standpoint of a circular economy, which is critical to helping the planet survive through greener industrialization processes. There is no Planet B, and the change must be made before it is too late.

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