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Cannabis legalization in Ghana: Implications for value-addition in medical and industrial research and applications

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Abstract

On 21 March 2020, Ghana's Parliament, through the Narcotics Control Commission Bill decriminalised cannabis for health and industrial purposes. The law empowers the Ministry of Interior to grant licenses for the cultivation of Cannabis of not more than 0.3% tetrahydrocannabinol (THC), the active compound that gives the feeling of 'being stoned' or 'high'. Ghana joins Lesotho, Zimbabwe, Malawi, South Africa and Zambia as the few African countries that have legalised ganja. The race to legalise is strong, and unstoppable. However, knowledge in balancing the benefits and the potential downsides, as well as appropriate conditions for a successful Cannabis industry is in short supply. We review the multiplicity of roles that the Cannabis plant is here to play, and present a model that simulates different supply chain paths. This study is exploratory, and it seeks to pose a variety of questions and puzzles for further research.

Key words: Cannabis; Legalisation; Ghana; Health

Introduction

Cannabis is an ancient plant. Over the past 35 million years, it has provided food, medicine and guidance to humans. It has built industry and reconstructed lives. It is also a modern plant. It is here to open portals of awareness, both now, and in the future. The health benefits of cannabis are well documented. The earliest written records date back to 2737 BC when a royal endorsement by a Chinese emperor made cannabis the lead herb in the treatment of over 100 ailments and diseases. Since the last century, humanity has been at war with various indigenous plants and animal species whose existence provides alternative paths to different realms of existence. This battle is an inner one, and its outer effects have been seen in the criminalisation of indigenous plants such as peyote, ayahuasca, iboga, cannabis, among others. The war on cannabis has been one of the most enduring, most visible and most studied subjects in the history of prohibition for a number of reasons. Cannabis is readily available and easy to grow under almost any condition. There are no supply constraints; hence one

can always guarantee constant flow. This is the property of all-natural phenomenon: unfettered and ceaseless flow. Moreover, cannabis extracts can be made literally by anyone who is willing to spend a few minutes to understand a few basic things about how and why the plant works the magic that it does.

From growing to harvesting, curing to usage, very little investment of financial capital is involved, at least for very localised and personal consumption. Combine this with the ancient knowledge that cannabis is a plant of mystery, a guide to the beyond, and a tool for exploring alternative dimensions – and you have a lethal weapon against the system of domination and control, and ideas of scarcity and poverty. From the 1930s onwards the war on cannabis took a mad turn with ultra-fabrication, deliberate obfuscation and outright propaganda by groups in the pharmaceutical, clothing, paper and pulp, and other industries that see cannabis as a threat to their bottom lines. Even though the level of persecution has reduced as many individuals have begun to think for themselves by disregarding the views of linear thinking upon

which the Schedule 1¹ policies were enacted, draconian policies remain in many countries. In Singapore, Malaysia, Indonesia and China, the penalty for the sin of possessing a certain quantity of cannabis is capital punishment.

However, after several successful campaigns by various groups to project the potential benefits of cannabis, opinions have shifted in recent times as more countries—including Ghana have now legalized the use of cannabis for medicinal and industrial purposes. In the field of medical cannabis, existing data indicates that the plant works by interacting with complex networks in the body through the endocannabinoid system (ECS) which are naturally produced by the body to help regulate pain, appetite, mood, memory, stress response among other activities. The two most popular active compounds isolated in the last three decades are tetrahydrocannabinol (THC) and cannabidiol (CBD)². When ingested, endocannabinoid receptors are triggered to rebalance the body through mimicking or disruption of the ECS.

It is important to highlight that CBD has no correlation with intoxication unlike THC which is the psychoactive substance in cannabis that intoxicates users. Similar to most drugs that individuals (mis)use, THC stimulates the neurons in the reward system to release the signalling chemical (dopamine) through endocannabinoid receptors at higher rates than the normal body activities as a response to any natural stimuli in the body. Dopamine contributes to intoxication among users who abuse cannabis. However, the (mal)functioning of the ECS has an important relationship with the science of chronic conditions which is interlinked with the efficacy of cannabis products. Thus, moving beyond its legalization to understanding the cause-and-effect relationship of medicinal cannabis in addition to its use; is a worthy endeavour that present and future researchers should devote sufficient attention.

While the medicinal benefits of cannabis have been widely recognized, there is little scientific and clinical research to support this claim. The dark ages of cannabis, especially from the 1970s when it was classified as a Schedule 1 drug made scientific and intellectual exploration difficult. The illegal status as well as the unbridled negative campaign from the tobacco lobby and Big Pharma, coupled with widespread stigmatisation consigned cannabis to a drug of the devil. Any mention of the useful properties of cannabis is countered by more repressive policies. Researchers who are interested in studying the plant could not access research grants, and they faced legal barriers in studying the medical effects on humans. Medical insurance companies will not reimburse patients who rely on cannabis extracts for curing debilitating conditions. Financial institutions will not bank roll projects in cannabis and cannabis related industries. To survive in the midst of this heavy onslaught from all angles is a miracle that only a miraculous plant can endure.

The historical perspective of cannabis legalization for either medicinal, recreational or industrial purposes dates back since the 1300s. While the legal status varies across countries globally, the common systems governing cannabis are the United Nations Single Convention of Narcotic Drugs, the Convention on Psychotropic Substances and the Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances ratified by countries in 1961, 1971 and 1988 respectively. In Africa, the King of Madagascar was the first to

outlaw cannabis with even a capital punishment for individual users. This fight against the plant has widely

spread globally until the late 1930s where Burma legalized cannabis production by issuing licenses to growers and all supply chain actors. Japan also followed the call to establish a cannabis control law that facilitates licensing and compliance among all supply chain actors while it monitors and regulates the market to deal with unlicensed dealers.

In spite of the restriction on its recreational use over the years, countries have begun to rethink the potential medicinal and industrial benefits of cannabis. This served as the point of departure for its legalization status. Canada, Georgia, Paraguay, Uruguay, in addition to about 33 states, 2 territories, and few other districts in the United States have initiated the legalization of Cannabis mostly for medicinal purpose. In Africa, Comoros is one of the first to legalize cannabis use in 1975 while Lesotho granted the first ever 21st century Africa medical cannabis license in the continent. Malawi, Zimbabwe and Zambia also legalized for medical and scientific purposes with South Africa decriminalizing it. Ghana is the next country in Africa to have joined the moving vehicle of regulated cannabis legalization for medical and industrial purposes after several calls and debates for its legal status.

Although Schedule 1 status has been rigidly enforced, the general public could not be blinded by a great deal of scientific and peer reviewed research that has established the efficacy of medical cannabis to relieve seizures, diarrhoea, nausea, chronic pain without side effect as compared to opioids. Hill (2015) concluded that cannabis use for “chronic pain, neuropathic pain and spasticity due to multiple sclerosis is supported by high-quality evidence. Six trials that included 325 patients examined chronic pain, 6 trials that included 396 patients investigated neuropathic pain, and 12 trials that included 1600 patients focused on multiple sclerosis”. He argued that “these trials had positive results, suggesting that marijuana or cannabinoids may be efficacious for these indicators”. This has also been confirmed by series of studies that examined the impact of medical cannabis on chronic pain, cancer, multiple sclerosis among other diseases (Birdsall, Birdsall & Tims, 2016; Frame & Marijuana, 2010; Hoffenberg et al., 2018, 2019; Hoffenberg, Newman, Collins, Tarbell, & Leinwand, 2017; Kramer, 2015; Roitman, Mechoulam, Cooper-Kazaz, & Shalev, 2014; Tzadok et al., 2016).

If the case for medical cannabis remains uncontested, the prospects of industrial and commercial cannabis in Ghana and other regions that have excellent climatic conditions and geographic location is even much stronger, especially in the light of the recalibrations in the larger local and global economy. Staying on the most superficial level, there is enough empirical evidence that cannabis for industrial use has contributed significantly to the GDP of most countries in the form of biofuel and bioenergy, oil, textile, paper, fabrics and yarns, carpets, food, body care, animal beddings and feed among other important products (Curley & Attwood, 2019; Fike, 2016; Karus and Vogt, 2004; Keller, 2013; Kraenzel et al, 1998; Kreuger et al, 2011; Luginbuhl, 2001; Rehman et al, 2013; Żuk-Gołaszewska & Gołaszewski, 2018).

From these preliminary reviews, there is no doubt that a great deal of effort has been expended in the research into the various uses and applications of this multidimensional plant. What is lacking to date is specific studies that examine strains unique to Ghana and the West African environment. It is important to understand the dynamics of the plant, from growing to harvesting and processing to final consumption; from domestic usage in the building and construction industries, clothing and textiles, to international commerce through the export of cannabis and cannabis based products. For entrepreneurs looking to exploit the various

1 Schedule 1 drugs are defined as drugs, substances, or chemicals with no accepted medical use and a high potential for abuse, such as ecstasy or LSD. (source: www.dea.gov)

2 Over 500 compounds have been isolated since the 1990s. We believe further and deeper research will unearth more dynamics of the plant that is not currently known by modern science.

value chains, and forward and backward linkages, a good understanding of various aspects of the plant is an advantage. For academics interested in hearing a new song and engage in significant research, cannabis offers a plethora of research themes from architecture to zoology. For consciousness explorers, cannabis is an intelligent, worthy and gentle guide. This article opens the gates for scholarly engagement on various aspects of cannabis, especially in the light of the recent legalisation wave that is sweeping across the world. We believe that cannabis and other indigenous plants which have been falsely categorised under Schedule 1 will be freed to play their divine roles as the truth behind the draconian laws begin to seep through into the consciousness of the public who are looking for effective, affordable remedies for various ailments.

The Ghanaian economy and Cannabis

Ghana has followed the linear western paradigm of development over the past 60 years. This archetype consigns the economic and social fortunes of the country to the periphery as producers of raw materials while actively exploiting its resources for the satisfaction of western powers whose grip on the economy has never loosened for the past 400 years or more. In turn, the economy is a dumping ground for all kinds of products from so called developed markets. The western model begins on the premise of the textbook idea of perfect competition while its actual manifestation is characterised by monopoly power, and deep-seated exploitation to feed the military, industrial, and commercial complex. Its politics is the winner takes all type, and it thrives by pushing fiat currency debt to developing countries in exchange for valuable natural resources. This game has been played for aeons, and all so called developing countries in the third world are caught up in an economic system defined by one logic: scarcity, limited supply in all spheres of life. This dynamic has been articulated in works such as Amin (2013), Rodney (1972) and Obeng-Odoom (2020; 2015). The result is that Ghana's economy mimics the pattern set in other places of a similar predatory and exploitative development paradigm. To this end, Ghana lacks the technology, infrastructure and financial wherewithal to roll out robust orthodox medical systems despite evidence indicating the efficiency of orthodox medication among patients (Ayitey-Smith, 1986; Gyasi, Mensah, Adjei and Agyemang, 2011; Sato, 2012). More so, the whole set up of the orthodox medical system is not effective in responding to the health needs of countries such as Ghana whose myelinated populations are harmed by the numerous artificial derivatives that treat symptoms, but never the cause of diseases.

Health indicators such as delivery, longevity, efficiency, equity as captured by the UN Human Development Index (HDI) ranks Ghana 142 out of 189 countries. Although Ghana ranks low, the figures only reveal the position quantitatively. The more nuanced matters of what type of care is delivered by the existing trained doctors and nurses, and the distribution of care remain elusive. Iatrogenic diseases are on the rise. This is the third leading cause of deaths in the USA, a country that spends about 18 percent or more of its GDP on healthcare. This phenomenon has been highlighted as one of the major causes of the spread of HIV/AIDS in Africa. De Graft and Koram (2017) highlighted, "the iatrogenic effects of unregulated ethno pharmaceuticals have been the typical subject of critique". Their work also highlighted that "the role of the ethno pharmaceutical industry in driving catastrophic health expenditure for individuals and households remains to be researched". Even though there is no readily available data, anecdotally, this is a common phenomenon in

Ghana where there has been episodes of inappropriate medical treatments by health workers due to inadequate knowledge and information about patients, health conditions and neglect of natural treatments. In terms of budgetary requirements, less than 6 percent of GDP is allocated to the healthcare sector with a high doctor-to-patient ratio estimated at 7374, inadequate hospital beds, healthcare equipment and unequal distribution of healthcare delivery facilities in the country among other needs. Part of this is a reflection of the inability of existing health care models based on allopathic approach to respond adequately to the realities of the health challenges facing mankind, and the failure on the part of government to tap into the emerging traditional medicine sector which employs about 200,000 individuals (Ghana Health Workforce Observatory, 2011).

Addressing the numerous health challenges related to access, equity, depth and breadth of coverage require significant social engineering and a complete rethink of the present model. This is the point where research of this nature that helps to illuminate the role of indigenous plants in health care, and the provision of relatively cheaper and easily available complementary solutions becomes prominent. It becomes costly for Ghana—a country that records consistent annual budget deficit to spend limited public resources on policing and prosecution of individuals for the mere possession and use of cannabis. The law spells out a ten-year jail period for anyone possessing cannabis (Curley and Attwood, 2019). In similar vein, government budget for the prisons department for administrative, physical and psychological needs of prisoners represent vital resources that can be deployed to improve social service delivery in the country. Emptying the prisons of 'cannabis prisoners' will not free up physical space for the meaningless and pointless prosecution of citizens of a non-criminal activity and make room for a medically and industrially beneficial plant with substantial prospects of economic growth and sustainable development to thrive. It will also help reallocate the idle labour that is kept behind bars for productive ventures. And it is morally reprehensible for law police officers and law makers who are active users of cannabis to make laws and prosecute individuals for using the same substance that they enjoy and derive benefits from. Such double standards and irresponsible behaviour has characterised the entire prohibition debate, and the global scales have to be rebalanced. We believe that tipping point has now been reached, and governments around the world will remain impotent in the face of the overwhelming evidence of the beneficial effects bestowed by the plant world.

Even though Ghana is one of the fastest growing economies in Africa, the economy has been experiencing significant economic fallout, with volatile and unsustainable growth. In recent times, the Ghanaian economy continued to experience a rising public debt, fiscal slippages, rising youth unemployment, lopsided distribution and worsening inequality and household poverty, with deficits in infrastructure like roads, railways, health and education facilities. With the recent decline in exports as well as the significant fallout of global oil prices, the country needs innovative diversification, sustainable fiscal debt and sound economic environment. This would allow the private sector and the small and medium scale enterprises (SMEs) to thrive as well as trending but non-traditional products that do not only have the potential of rebuilding the economy. One such timely and feasible opportunities that can provide a safety net and alternatively viable livelihood strategy especially in uncertain times and crises is a measured approach to cannabis for medical and industrial purposes. Reviewing the economic benefits of legalizing cannabis for either medicinal or industrial uses is an option that earns the country extra points to defray part, if

not all of the budget deficit encountered annually.

It is important to realize that despite prohibition, revenue from regulated cannabis legalization for medicinal and recreational use has been significant elsewhere. For instance, Miron (2005) highlighted that, “\$7.7 billion spent to enforce prohibition annually will be saved by the US government in terms of reduced use of law enforcement, reduction in cost to the criminal court system, and the reduced cost of corrections regarding incarcerating individuals”. In terms of revenue generation, the study concluded that cannabis is estimated to generate \$2.4 billion annually if taxed like any other consumable, whereas tax revenue of \$6.2 billion will be yielded annually if taxed using the rates of alcohol and tobacco. While the observed revenue from cannabis legalization is significant, there are no significant differences among states that legalized cannabis compared to states that consider the plant illegal (Maier, Mannes, & Koppenhofer, 2017). In Ghana for example, cannabis is estimated to generate \$326.4 million by 2023 if legalized (The African Cannabis Report, 2019). A well planned and properly guided legalisation framework will improve health and revamp medical research, expand supply chains and instigate new value-added via industrialization. And Ghana has all the ingredients in place for a robust cannabis industry.

The Geography of Ghana and Cannabis cultivation

Unlike other agricultural plants, cannabis can be generally grown organically since it thrives and withstands most environmental and climatic conditions without any nutritional supplements. However, extreme desert climate and high mountainous regions are not ideal for the plant since it needs a well-balanced combination of tropical temperature, regular precipitation and a stable humidity. Therefore, an ideal environment and climatic condition for industrial cultivation of cannabis is a tropical region coupled with well-drained soil that are naturally rich in organic matter. Specifically, cannabis plants need between 12 to 14 hours day length sunshine (estimated 15 degrees Celsius during the night and 32 degrees Celsius during the night), 40 to 70 per cent humidity during the growing stage, 30 to 50 per cent humidity during flowering stage in well-aerated loamy soil composed of a pH between 6 and 7.5 rich in organic matter (at least soil with 3.5 % organic matter). These preconditions for cannabis cultivation mimic the exact climatic condition in Ghana which makes the country a best-fit for a well-coordinated industrial cultivation of cannabis for its medical and industrial benefits.

Ghana is located in the tropics and is one of the few countries in the equatorial region. Average daily temperatures range between 25° C and 35° C (77 °F and 95 °F respectively). The country is situated in West Africa along the Guinea Coast at latitudes of 4–12°N strongly influenced by the West African monsoon. Ghana experiences average annual rainfall of 1184 millimeters with average relative humidity of 85 per cent, mean monthly sunshine of 2,372 hours as well as average high monthly temperature of 29° C with the lowest as 25° C. Due to the African monsoon wind, the country is characterized by two major seasons – wet (rainy) and dry seasons. In terms of rainfall, the northern part of the country experiences rainfall from May to September. In the central part of the region, rainfall is experienced from April to October whereas the south receives rainfall between April and November. The east coast on the other hand experiences a short annual rainy season between April and June with disruptions around July and August until September to October where another rainy season is experienced.

Given the slight dynamics across the landscape, the

country experiences mild temperatures around the higher and mountainous regions, relatively higher humidity along the east coast while the northern part is characterized by hot and warm temperatures. The southern part experiences the highest rainfall with annual precipitation levels slightly above 1500 millimeters. It is important to highlight that the variation in rainfall across the country is not very wide as the driest regions record at least 1000 millimeters of rainfall annually, maintaining a steady balance in the country which is still favorable for agricultural activities. During the wet seasons, daily temperatures are pegged around 31–32 °C (88–90 °F) between the periods December and January while it reaches 34 °C in the month of February. Similarly, the central and northern belts experience a temperature of 35 °C (95 °F) in December and January coupled with dry air and cold nights. There is sunshine throughout the year which is well-positioned close to the central and northern regions. The strategic geographical location of the country and the existing climatic conditions are clear indications that commercial production of cannabis for medical and industrial purposes appears relatively cheaper, and promising since this will provide the economy with the necessary competitive edge, required market share and the comparative advantage domestically, continentally and internationally. While growing of cannabis is relatively easier, especially in the tropics, it is important to emphasize that the purpose of growing the plant influences the type of specific soil to use and the type of soil nutrients that must be present. Also the target market and consumption patterns may influence the growing conditions. In spite of these modifications, we are convinced that Ghana has the right conditions for a reasonable risk adjusted return on any investment in the cannabis industry.

Review of medicinal Cannabis

In order to shift public and society perception about the medicinal, recreational and the industrial use of cannabis, it is important to highlight its benefits. It is equally important to understand the way the different compounds interact with the human body to restore balance and bring about healing.

Cannabis has evolved from different schedules by the US Drug Enforcement Administration (DEA) in the past few decades. According to the official view, cannabis is considered a Schedule 1 drug, which means it has no accepted medical use and is believed to have high potential for abuse with the likelihood of severe psychological and/or physical dependence. With this classification, cannabis is in the same league with substances such as heroin, lysergic acid diethylamide (LSD), (3,4)-methylenedioxymethamphetamine (ecstasy), methaqualone, and peyote (Controlled Substance Act, 1970). There is so far no scientific proof to back this classification of cannabis and other indigenous plants. Other authors have come to the conclusion that the criminalisation of cannabis for medicinal, recreational and industrial purposes lacks scientific evidence and the DEA has taken the world for a ride (Bottorff et al., 2013; Frame & Marijuana, 2010; Goode, 2009; Maier et al., 2017; Stringer & Maggard, 2016). This is one of the numerous reasons for further inquiry in the potential benefits of cannabis, as such, providing the basis for dialogue concerning its legalization.

In order to shift public and society perception about the medicinal, recreational and the industrial use of cannabis, it is important to present a more radical alternative to the Schedule 1 position by appealing to mainstream science and the scientific method. This section reviews scientific works on the benefits of cannabis, provides knowledge to clarify public ignorance on the subject as well as construct a model for three policy options

on cannabis legalization.

Cannabis has been found, both in ancient times and now, to be one of the most medically useful plants with significant health benefits with little or no psychoactive effects when the desired doses are given. In their study, Pacher and Kunos (2013) realized that when the activities of endocannabinoid system are carefully modulated, the therapeutic benefits that could be derived from it are promising. This helps to cure a broad range of diseases: obesity/metabolic syndrome, cachexia, chemotherapy-induced nausea and vomiting, tissue injury, neurodegenerative, cardiovascular and inflammatory disorders, and pain among other diseases. Even though the study observed some levels of complications in issues like obesity, these were due to challenges with little knowledge in the field. Thus, more research in this area is required for efficient use of cannabis in all human health needs. Therefore, the role of cannabis in the endocannabinoid system drifts from only rebalancing the physical build-up and break-down to fighting diseases and injuries (Bachhuber et al., 2014; Vandrey et al., 2015). Bonn-Miller et al (2014) used a convenient sampling technique to examine the specific coping strategy motivations, the frequency of both cannabis and alcohol use, and mental health among patients dealing with post-traumatic stress disorder (PTSD). They concluded that patients rely on cannabis to cope with their conditions, have good sleep, and also to reduce the propensity of suicide (Bonn-Miller et al., 2014).

Relying on opioids for treatment exposes such individuals to opioid-related addictions and death given the adverse effects of these opioids (Bachhuber et al., 2014; Pedersen & Skardhamar, 2010). Their work resonates with the study by Lim, See, & Lee (2017) and another independent research by Swift, Gates, & Dillon (2005) who both examined the impact of cannabis on PTSD.

In another area of pressing health need which has not received full recovery from pharmaceutical products, cannabis became the first organic anti-pharmacological product to cure epilepsy with zero or little (manageable) side effects. It has now been generally accepted that cannabis is the best cure for individuals (mostly children) with epilepsy (Devinsky et al., 2016; Kaplan, Offermann, Sievers, & Comi, 2017; Russo, 2017; Saade & Joshi, 2015; Sulak, Saneto and Goldstein, 2017; Viggiano et al., 2016). In their study, Tzadok et al. (2016) concluded that "CBD treatment yielded a significant positive effect on seizure load. Most of the children (66/74, 89%) reported reduction in seizure frequency: 13 (18%) reported 75–100% reduction, 25 (34%) reported 50–75% reduction, 9 (12%) reported 25–50% reduction, and 19 (26%) reported <25% reduction". They also realized an improvement in behaviour and alertness among epilepsy patients treated with cannabis, with a significant enhancement in their language, communication, motor skills and sleeping order. Hill (2015) also concluded that cannabis use for "chronic pain, neuropathic pain, and spasticity due to multiple sclerosis is supported by high-quality evidence. Six trials that included 325 patients examined chronic pain, 6 trials that included 396 patients investigated neuropathic pain, and 12 trials that included 1600 patients focused on multiple sclerosis". He argued that "these trials had positive results, suggesting that marijuana or cannabinoids may be efficacious for these indicators". However, few cases of negative reactions which include somnolence, fatigue, gastrointestinal disturbances and irritability were recorded. This led to the termination of the therapy among these five patients. Despite the contextual nature of these studies involving different patients with dissimilar health issues at different rates of severity, there was a consensus that CBD-rich cannabis used to treat seizure among children between infant to age 18 is significantly

effective to give them a relieved life.

It is important to highlight that the current significant benefits of cannabis in the field of medicine is not close to the actual potential of the plant, given that this is an emerging field and research is still growing to unpack the unknown benefits of medicinal cannabis. The delay in such realization is deep-rooted in the fact that this plant has been rendered illegal for a long period of time due to the long and vicious war (Svrakic et al., 2012). The war against cannabis is more political than scientific, without any form of moral hegemony established (Bottorff et al., 2013; Goode, 2009; Maier et al., 2017; Stringer & Maggard, 2016). Studies on cannabis and crime have not found any form of association between these two (see Maier et al., 2017; Pedersen & Skardhamar, 2010).

For a plant to have about 143 to 190 million users globally, which represents between 3.3% and 4.4% of the adult population (UNODC, 2017, 2018, 2019), illegal status should not be an option. On the other hand, studies that examined the cost benefit analysis of cannabis legalization forecasted that legalizing cannabis will rather reduce crime and black market related transactions (Shanahan and Ritter, 2014). A plausible reason for this conclusion could be the fact that individuals who use cannabis are able to purchase it in shops with license to trade it. In effect, mobilizing revenue becomes easy since tax evasion is no more an option. It is now clear that the reservations held about cannabis is more for individuals who use it for recreational purposes to 'get high' (Bottorff et al., 2013; Hall & Lynskey, 2016). This point can be counter-argued since regulated legalization will ensure that a balanced or CBD-rich ratio of production is emphasized to modulate the strains from a THC-rich cannabis (Roitman et al., 2014).

Given the above implication of medicinal cannabis on health, it is imperative to further research into this plant especially at an early phase of legalization.

Delta-9 THC, human brain and behaviour

The causal impact of cannabis on humans has been widely contested. Proponents for and/ or against the plant have taken either a far-right or far-left position without much robust scientific research. Declaring cannabis as a Schedule 1 drug means scientists have to undergo an incredible bureaucratic process to obtain license in accessing a limited quantity of cannabis before undertaking research. However, in recent times, the new frontiers of scientific research and the progressively evolving policy landscape in relation to a regulated cannabis legalization have led to significant strides in providing a middle playground on a compliance scheme for all key players in the value-added supply chain of the cannabis plant. The fight for or against cannabis legalization is deep-rooted in either an unfavourable or favourable sentiment displayed about the only single psychoactive compound in the cannabis plant that causes intoxication and to some extent, associated with psychoactive behaviour and schizophrenia. Delta-9 Tetrahydro-cannabinoid (delta-9-THC) which is the psychoactive substance in cannabis stimulates the neurons in the reward system to release the signalling chemical (dopamine) by increasing the activities of the endocannabinoid receptors through the dopaminergic neurons at a higher rate than the normal human brain can accept (Reinarman, Nunberg, Lanthier, & Heddlestone, 2011). This section discusses the effects of a high-THC on the human brain and body.

The transmission mechanism of THC-rich cannabis in the human brain has remained a paradox in the field of research, a dilemma in its use and a major policy debate. There has been a divergent view on the impact of cannabis on the human brain and body. That notwithstanding, both the associated positive

and negative effects of cannabis use are attributed to dosage, underlying health conditions among other factors (Roitman et al., 2014). Therefore, experiencing the impact of a high-THC strain cannabis is contingent on a better understanding of the dosage intake, mode of administration, expectations formed by individual subjects, underlying health condition, individual vulnerability levels, family history of psychoactive behaviour and its combination with other substances. Notable among the effects of a high-THC cannabis is hallucination, illusion, delusion, paranoia, restlessness and psychosis (Svrakic et al., 2012). Low doses of THC-rich cannabis are associated with antidepressant effects as well as the feeling of euphoria, however, an increase in dosage beyond the threshold based on individual's potential may lead to acute depression, paranoia, psychoactive behaviour and schizophrenia. A prolonged heavy use of THC-induced cannabis, especially among teenagers who are still undergoing brain development will lead to a malfunctioning of the region of the brain that affects pleasure, memory, thought, sensory perception among others. Also, this will lead to an abnormal development of the hippocampus as well as physical dependence on the plant.

It is important therefore to highlight that chronic consumption of cannabis, especially high-THC strain is associated with impairment that affects cognitive behaviour, memory, motor coordination and attention behaviour which can last for a maximum of two days. This is mostly prolonged or shortened based on the individual placebo effect. Substantial scientific evidence points to the fact that frequent and chronic users of high-THC dominated cannabis develop schizophrenia and/or other psychoactive disorders (Casadio et al., 2011; Morgan & Curran, 2008). Individuals within the brain development age group are at high risk of oppositional and psychoactive as well as schizophrenic behaviour. Moderately, there is a significant statistical relationship between high-CBD strain cannabis use and better cognitive performance among individuals dealing with psychoactive disorders, severe bipolar disorders, acute depressive disorders, suicidal ideation and anxiety disorders among other abnormal behavioural changes in the mental faculty of the human brain and body. Both the short, intermediate and long term impact of cannabis use on the human body and brain is evidentially inconclusive and elusive.

Evidence suggests both positive and negative effects of cannabis use on the human brain (Kaplan et al., 2017). The effect of high THC strain cannabis in the human brain is highly dependent on the region of the brain it hits. For instance, if the THC hits the hypothalamus, it will have effect on hormonal levels and appetite. Within the basal ganglia, it impairs motor coordination and control, while in the nucleus accumbens, it affects the reward system leading to euphoria. If the THC hits the amygdala which regulates mood and emotions, it will lead to paranoia effects whereas in the neocortex, high THC will affect cognitive and perceptive behaviour and altered judgement. Within the hippocampus, high THC leads to memory impairment (Ameri, 1998; Burnett, 2017; Hoffenberg et al., 2019; Mechoulam and Parker, 2013). High consumption of THC among pregnant women will lead to low birth weights and foetal development problems (Grant et al., 2018). While acute and prolonged recreational use is without doubt harmful, the medical cannabis is a valuable source of medicine for almost all diseases. However, there is a lack of uniformity in synthesizing, translating and communicating scientific research into the policy landscape regarding cannabis to key policymakers, stakeholders and boundary partners. The above notwithstanding, we suggest that any individual cannabis user needs to take into account his/her underlying health condition, dosage, mode of administration and above all, from reliable, licensed and knowledgeable experts backed by

scientific research.

Industrial potential for cannabis legalization

In order to gain a full understanding of the industrial cultivation of cannabis, it is important to begin the argument with a consideration of the demand side of the plant. In the industrial sector, the role of cannabis cannot be overemphasized. This has led to its demand in the pharmaceutical, clothing, fibre, paper, pulp and oil among other industries. Therefore it is worth spending time to further discuss its role in the industrial sector. In the paper industry, cannabis has been found to be the most efficient raw material with the highest quality. An acre of cannabis can produce as much paper equivalent to three acres of a normal paper producing tree. Additionally, paper made from cannabis will last up to 150 years before crumbling as compared to paper from normal trees. Above all, whenever "a paper made of cannabis is torn or wet, all one needs to do is set the damp pieces the way they should be and let them dry" (Luginbuhl, 2001).

Between the periods 2008 and 2009, the government of Pakistan invested about US \$9 billion to import energy after the country experienced severe economic downturn as a result of insufficient power supply. This led to shutting down of major industries like the textile, and small-scale businesses. In the textile industry, it is realized that cannabis can produce three times the amount of fibre made from cotton, 10 percent of the irrigation used, and quarter the land area used for cultivation. Thus, cannabis has the transformative edge and is a scalable opportunity for individuals, cooperatives, communities and the economy of Ghana at large. The net profit of an acre of cannabis in the USA is \$1, 200 compared to \$400 from cotton, \$350 from corn and \$250 from soybean with even higher net profits made from cannabis oil (Forbes, 2019).

After realizing the potential benefits of cannabis as a form of energy supply – biofuel energy with little or no adverse environmental implications, Pakistan resorted to this approach. This was not only a breakthrough but also provided an alternative power supply for the country. It has also saved the country fortunes from importation of energy while ensuring a clean and sustainable supply to restore the issue of climate change (Rehman et al., 2013). Cannabis therefore has about 97% of conversion rate into biodiesel with low rate of emission of sulphur dioxide. Even in the automotive industry, cannabis oil is used by manufacturers: it is used by BMW, Audi, Ford, General Motors and Mercedes Benz to manufacture plastic for their vehicles. The recently manufactured Mercedes C-class contains 20kg of cannabis plastic (New Age Hemp Times, 2017). An acre of hemp can produce 1800 gallons of biofuel which is equivalent to two barrels of oil. Given that hemp can be harvested after every three months, an acre then yields eight barrels of biofuel. Against the backdrop of energy and power crisis in Ghana, a focus on industrial production of hemp has the potential to flatten the power and energy crisis curves. Additionally, since government holds the patent for mass production, this will serve as an additional revenue for the government of Ghana.

A study by Karus and Vogt (2004) also highlighted that within the Euro zone, cannabis has contributed significantly to the paper and pulp industries with modest contribution in the automotive industry. Furthermore, the study observed that about 95% of the cannabis produced is mostly used as animal bedding. In terms of consumable food supplies, cannabis has been widely recognized as a super food since it contains 33 percent of protein needed by the body with about 35 percent of essential fatty acid, that includes Omega 3, 6 and 9 as well as Gamma Linolenic Acid (GLA). It also contains all nine amino

acids and produces six times more the Omega-3 acid that can be found in raw tuna and it is also high in dietary fibre. These are essential nutrients needed by the body for cell growth, improvement in the immune, nervous, circulatory, skeletal, pulmonary and other systems to fight against cancerous, tumorous, inflammatory and chronic pains in the body to improve the health of the individual (Bachhuber et al., 2014; Svrakic et al., 2012). In the agricultural sector, cannabis has been found to be environmentally resilient to withstand any form of harsh weather conditions with significant economic benefits.

Cannabis has been found to be one of the few plants that has roots deep enough for percolation and nutrient cycling. When grown densely, it naturally prevents the growth of weeds around it without any investment in weedicides, pesticides as well as herbicides. Cannabis has also been found to serve as a pesticide whenever it is cycled with any cereal by farmers who embark on crop rotation. Specifically, it helps reduce up to 80 percent of the damaging nematode cyst that destroys soybeans (Luginbuhl, 2001). Such benefits from cannabis are timely and convenient for Africa which is grappling with poor yields in agriculture and high losses in production, even though agriculture has remained the bedrock of the continent for millennia.

In terms of environmental preservation, cannabis is one of the best plants that traps carbon in the environment. In fact a metric tonne of cannabis traps 1.5 metric tonnes of carbon in the atmosphere, and this has significant implication on carbon tax credit (Rehman et al., 2013). The above review summarizes few of the major studies on the medicinal and industrial benefits of cannabis with rich arguments to carefully examine deeper the hidden treasures of the plant. It is important to state that the type of cannabis used in manufacturing all these products are low in THC (less than 0.1%) with no psychoactive effects. Below is a framework illustrating the value-added supply chain of industrial cannabis production that provides various uses of cannabis. Also, there is a separate framework that highlights both the benefits from medicinal and industrial legalization of cannabis that will be useful to contribute to the existing emerging knowledge in research and policy.

Legalization policy model

The model below provides different policy options for either prohibition, decriminalization or legalization of cannabis in developing countries by critically analysing the costs and benefits associated with each policy option. This provides a deep understanding of the real impact of either prohibition, decriminalization or legalization in order to inform policy on cannabis in Africa. In the case of prohibition due to the several non-evident consequences attributed to the plant, governments spend resources on policing, adjudication at the law court and sentencing cannabis-related 'criminals'. Since the law stipulates that anyone found with cannabis for recreational or industrial uses is automatically guilty and per the law, is given a 10-year jail sentence, governments will devote resources for administrative, physical and maintenance costs for a cannabis-related prisoner for 10 years. This act will not only deprive individuals of their fundamental human rights, however, this becomes a high cost for the entire household with a prisoner, given their psychic, pecuniary and non-pecuniary costs. The loss of both human and social capital and its effect on the household as well as the societal stigma about such individuals are issues that government cannot carefully manage. The related benefits associated with prohibition is mostly attributed to reduction in psychoactive issues due to substance abuse.

The legalization of cannabis in Ghana for medicinal and industrial purposes does not only have revenue generating potentials, foreign exchange and other benefits for the country, but also provides the country with options in the field of biofuel for power supply. In terms of the manufacturing sector, cannabis has greater potential for transforming the sector to improve and enhance the quality of already existing locally made products as well as introducing new ones.

The envisaged cost associated with cannabis legalization is the abuse by individuals, despite the fact that recreational use has not been featured in the legalization. It is therefore necessary that various authorities in charge of policing, monitoring and controlling the use of substances are empowered to efficiently manage the use of cannabis in the country. That notwithstanding, the study also highlights that the strain of cannabis if legalized by the government of Ghana has no psychoactive effects since the THC levels of this strains will not be above 0.03%. This is a clear indication that the suspected psychoactive implication of cannabis legalization is scientifically baseless and perceptually flawed, since there is no single evidence to point out any slight negative association with legalized cannabis on medical and industrial purposes. In relation to whether this plant has dependence properties, it is clear that addiction is a health issue which must be dealt with singularly and isolated rather than attributing it to products consumed. Therefore, lack of scientific and empirical evidence to support the claim that cannabis has addictive substance in it serves as a point of departure for our work to treat the plant just like any other product ideologically and objectively in this assessment.

While public perception has completely influenced views on cannabis use, research indicates that alcohol and tobacco users are more likely to be violent, abusive in homes, more likely to initiate assault (Cherpitel, 1994; Galanter, 1986; Heishman, Arasteh, & Stitzer, 1997; Lachenmeier & Rehm, 2015). To reiterate this, a longitudinal approach on how alcohol use impacts aggression among adolescents by White (2002) found that "a large majority of the drug-related sexually assaultive crimes involved alcohol use while marijuana use was underreported in offenses against persons... also; marijuana was selected as the drug most likely to decrease assault". Therefore maintaining the illegal status of cannabis is a major hindrance to undertaking a rigorous research in order to unleash both the medical and industrial potentials of the plant while also acknowledging its associated adverse effect. This also serves as a sound foundation to better understand the chemical makeup, potential uses and side effects which will inform policy formulation and provide rich information for individuals, households, communities, countries and the world at large. In effect, regulated cannabis legalization is an effective, timely and realistic policy option and a flexible approach as it serves as a useful point of departure to undertake evidence-based research to unpack knowledge in order to better inform the populace about the potential benefits for medicine and industry as well as its associated likely risks (Crépault, 2014; Maier et al., 2017; Miron, 2005; Moeller, 2012; Shanahan and Ritter, 2014; Svrakic et al., 2012).

Value-added supply chain actors in the cannabis industry

A better understanding of the legalization model of cannabis is contingent on a holistic, comprehensive and cross-cutting analysis from the viewpoint of both the supply and value chain actors comprising growers, processors, distributors, consumers and regulators among other key actors in the supply and value chain. In an attempt to outline the role of all

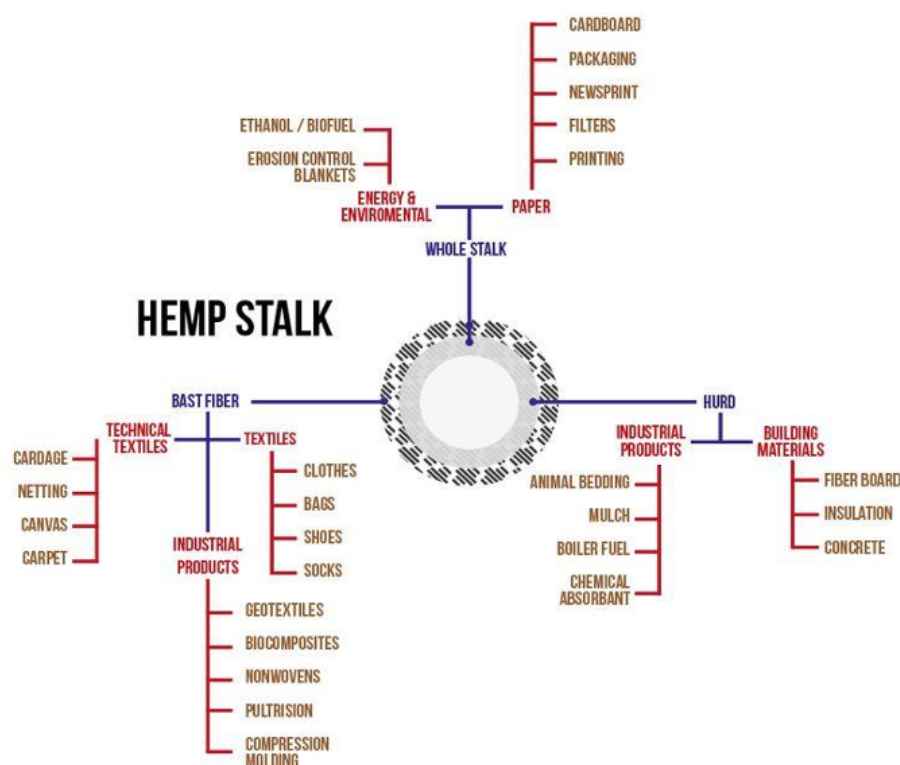


Figure 1. Value-added supply chain framework of cannabis/hemp. Source <https://www.stexfibers.com/hemp>

actors, this section provides a detailed role, responsibility and contribution of each agent of the supply and value chain. Given the long illegal status of cannabis cultivation, possession and use in Ghana, an important prerequisite for decriminalization and legalization is a binding legal policy framework with guiding principles that specifies both medicinal and industrial cultivation of cannabis. Our work indicates the potential benefits of cannabis for industry and medicinal purposes based on existing literature, policy frameworks and best practices from countries that have legalized its use. This is only the beginning of the free and unfettered use of cannabis for various purposes once the initial hurdles have been cleared.

It is important to also highlight the differences between Hemp and Marijuana since there is little understanding among populace, which affects their perception about the plant. The type of cannabis that the government has legalized is hemp, which is different from marijuana in terms of its use and chemical content. Hemp contains less than 1% of delta-9 THC, the chemical component that is associated with making individual users 'high'. A better understanding of the types and differences solidifies the foundation for its acceptance as a 'good' plant that benefits humanity, instead of classifying the entire plant as a living devil. Ghana must build a timely competitive edge and efficient comparative advantage in the cannabis industry for its potential medicinal and economic benefits. However, this is dependent on a sound, workable and comprehensive regulatory policy framework with guiding principles and realistic action plans. Additionally, it is important to have a transparent, open and formidable investment regime which is backed by cutting-edge research and development (R&D) with a forward-linkage knowledge pathways between theory and practice to engage all key actors and players from growers, regulators, processors, exporters, consumers among other agents in the value-added supply chain. Such a system backed by reliable empirical research will be able to lead the cannabis industry with the assurance

of standardized and high quality, unfinished, semi-finished or finished cannabis products at a relatively lower cost. In effect, ensuring a perfect policy interplay that will prioritize a value-chain system and an equitable investment regime that will be pro-poor in design to revive the poor farming communities in order to provide both their financial and non-financial needs will be necessary and sufficient to recoup the maximum returns from a regulated cannabis legalization for medicinal and industrial purposes. Thus, drifting away from its popular name as 'weed' and proper reclassification of cannabis as an agricultural plant is a precursor to dealing with the social stigma and community perception that has swamped the plant for years. In light of this, this section provides preconditions for a regulated legalization with measures for improved health among users from the perspective of supply chain agents spanning producers or growers, distributors and final consumers.

Growing of Cannabis

There are a lot of controversies about who has the right and legal backing to grow cannabis, the quantity to grow, the type of strain, the chemical composition among other flagged issues, even in countries that legalized cannabis. While some proposed that government should monopolize the production, others suggest individual farm ownerships and some promoting public-private partnership agreements in terms of cultivation, processing and distribution backed by state laws and guiding principles. In the Ghanaian context, historical farming activities have been undertaken by individuals who receive seasonal supports from governments and non-governmental organizations (NGOs). Farmlands are predominantly owned by individual families with state controlling only some few pockets for public infrastructure. Based on practices in other countries like Canada which is the leading producer of Cannabis in North America and a major exporter to the USA, government

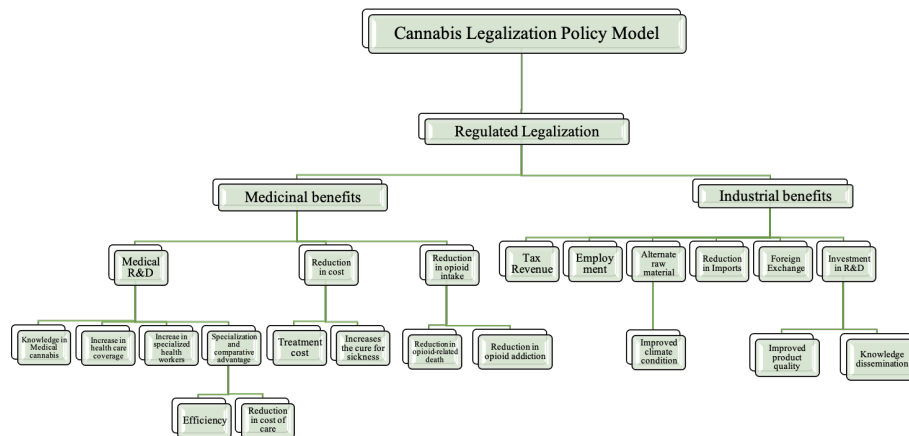


Figure 2. Policy Guide for regulated cannabis legalization

monopoly has been proposed (Crépault, 2014). However, this approach may not be feasible given the governance system, political environment, socioeconomic conditions among other factors that has rendered the agricultural sector almost fruitless in the country.

A possible approach to this effect is the issuance of compliance certificate by government to growers. This will ensure that cannabis growers are certified by Government of Ghana with information on land size, location, number of acres to be cultivated, machinery and resources to harvest. This provides government with needed information to inspect pre-production, during and post-harvesting of cannabis plants to ensure consistency and compliance with the law. Given the high rates of corruption in the country, engaging with the private sector who are mostly known for their strict supervision, monitoring and evaluation as well as feasibility studies will be necessary to identify potential growers with the necessary resources. Occasionally, government can issue a press to invite submission of applications to cultivate cannabis by potential growers which must undergo screening, interviews and exhibition for selection of individuals who will be issued license to cultivate. Based on their knowledge, government can organize short training workshops to train growers with valid farming license on best practices who will be assigned field extension officers to guide these growers from land preparation stages to harvesting time.

Anecdotal evidence points to government failures in properly managing most African economies of which Ghana is no exception. The usual socioeconomic fallouts and poor economic resilience with lack of adequate supervision, monitoring and evaluation systems in most countries are attributed to failed leadership, massive corruption, mismanagement and lack of trust in the governance system. Despite efforts made by government of Ghana to revamp the economy, the country is not immune to the aforementioned incidence that has equally gloomed other African economies. This has led to the new wave of private public partnership (PPP) agreements due to state failure and lack of trust in the public sectors. The country has experienced a new age of privatization of publicly owned firms as well as PPPs. Empirical evidence also highlighted the relative importance and efficiency of PPPs and have strongly recommended this model in most sectors including the agricultural sectors (Dong, Wang and Yang, 2016; Ke, Wang and Chan, 2010; Osei-Kyei and Chan, 2017).

A careful approach Ghana can adopt in the cannabis industry will be contingent on recommendations that follows a detailed review of existing empirical evidence, programmes, policy and legal frameworks on PPPs previously used to assess the viability and feasibility in the cannabis industry. In addition to the above, lessons, proposals and best practices from other countries will also serve as relevant information that will inform the government of Ghana to propose a more contextual, workable, innovative and timely production model, be it private individual owned production, autonomous private community organised growing, processing and distribution centres supervised by the government or a hybrid private-public partnership agreement that will facilitate the new economy of exchange through cannabis legalization for both medicinal and industrial purposes.

Processing of Cannabis

Growing cannabis is necessary but not sufficient to recouping the expected returns. Therefore, processing the plant with value addition is key to realizing the maximum benefits from the investment. It is important that the appropriate facilities are put in place to ensure the flow of value-added supply chain of cannabis production. This forward linkage approach will enable a full utilization of resources to transport harvested cannabis from the field to a finished product. In Ghana, one key obstacle to the sustained growth in the agricultural sector is lack of value addition and disruptions in the supply chain. This spans across poor road networks, limited and high cost of transportation, lack of storage facilities and warehouses as well as processing factories to turn agricultural produce into finished products. Recognizing this weakness in the sector is key to providing durable solution that will ensure industrial regulated cannabis legalization becomes beneficial to the country.

Government needs to devote resources to construct processing plants for cannabis. This can be achieved in two ways: a separate processing plant for medical cannabis and another for industrial cannabis. Within the industrial plant, there are both intermediate and further processing stages where cannabis plant undergoes hulling into food, crushing into oil and cake and decortication into fibre and hurd depending on the type of product needed. It is important that there is a clear documentation on the percentage of cannabis plant that is processed into medicinal use and industrial

use. Based on this, a comprehensive breakdown is needed to detail out product focus based on the competitive edge and comparative advantage of the industrial hub, following the European cannabis industry which devoted about 15% of cannabis to the automotive industry (Karus and Vogt, 2004). In terms of medicinal use, it is clear that medical cannabis is an emerging field with a growing body of knowledge to provide a better understanding of the potential medicinal benefits of the plant.

Cannabis has not been captured in the medical pharmacopeia in many medical schools globally, given the controversies surrounding its use and impact on users. Therefore, Ghana needs expertise from trained specialist to embark on medical research to provide some ground-breaking evidence of the medical impact of cannabis. It is also important that individuals in the field of medicine, pharmacy, clinical health and pharmaceutical industries undergo training to gain proper understanding of the chemical composition, strains, the dosage and its application on different categories of patients who will be monitored over a period of time through a repeated controlled trial research. Individuals who work in private dispensaries must acquire valid license in order to sell medical cannabis products to ensure proper regulation and control of illicit use and abuse of cannabis products. Government must strengthen public private partnership agreements with private individuals with the necessary resources who will not violate ethical protocols surrounding quality assurance and health (mental and physical).

Distribution of Cannabis products

Cannabis is consumed by wide range of individuals for various reasons and it is obvious that cannabis grown in Ghana will be consumed domestically and internationally. Therefore, the quantity to be distributed and sold domestically and exported must be made explicit. This can be done through market research which will provide an idea of the average quantity and type of cannabis products locals consume monthly, quarterly and annually. Based on country-specific situational reports, it will be known which countries are the likely cannabis export dominated countries in order for government of Ghana as well as private individuals engage in either bilateral and/or multilateral trade for foreign exchange. In order to control a larger market share, certain products made from cannabis plant must be made primary consumables nation-wide. This may include plastics, textile, paper, pulp among other basic domestic consumables. In order to build a competitive edge in the international market, product quality, packaging, service delivery and R&D must be strengthened as they represent the core for gaining comparative advantage in the resource, product and service markets.

Conclusion

The call to legalize cannabis for medicinal and industrial use was answered by Ghana in March 2020. In terms of practical research and knowledge, there is a wide gap to be filled to better understand the role of cannabis in medicine, industry and the associated risks as well as dealing with public perception and social stigma. This paper contributed to the call for knowledge and research by first: setting the pace for cannabis research, providing a better understanding of the potential benefits of the plant in the fields of medicine and the industrial sector as well as highlighting the risks. The paper also provided a model for regulated cannabis legalization, a proper guide on value added supply chain mechanism and guiding principles that will

ensure a proper functioning of the model based on lessons and best practices from countries such as The Netherlands, Canada, Lesotho, Malawi, Zambia, South Africa and Zimbabwe who have legalized cannabis.

The evidence before the authors shows that the illegal status of cannabis has no empirical backing. It is based on strategic propaganda and politics by the alcohol, tobacco, textile, paper and pulp industries. In medical cannabis research, it is observed that cannabis, in the correct dose, and in the right hands, cures a broad range of diseases. Industrial cannabis can be used to make a broad range of products in the pharmaceutical industry, textile industry, fibre, paper, pulp, oil, biofuel and significantly used in the automotive industry. Our work also highlighted that chronic consumption of cannabis, especially, high-THC strain is associated with impairment that affects cognitive behaviour, memory, motor coordination and attention behaviour which can last for maximum two days. Individuals within the brain development age group are at high risk of oppositional and psychoactive as well as schizophrenic behaviour. High consumption of THC among pregnant women will lead to low birth weights and foetal development problems. While acute and prolonged recreational use is without doubt harmful, the medical cannabis is a valuable source of medicine for almost all diseases.

A first and necessary step that must be taken before growing, distributing and consuming cannabis is to identify all key actors in the value-added supply chain to better understand their roles at every stage in the cannabis industry. This provides the basis to clearly define policy frameworks, protocols, action plans and guiding principles that will effectively guide the cannabis industry from farm-to-final consumer. Therefore, a proper cannabis governance and policy framework must promote compliance, ensure inclusion, understand the ethics to achieve a shared growth for all without leaving any one behind. For the industry to take off properly in Ghana and elsewhere, domestic laws ought to evolve, proper regulations must be put in place and a fair playing field must be created for equal opportunity for all citizens.

In terms of future research, a better understanding of how medical cannabis can be regulated, advanced and incorporated in mainstream medicine, pharmacy and traditional medicine curricular, and pharmacopoeia is needed. Additionally, future research must focus on how Africa can maximize its market share, competitive edge as well as gain a comparative advantage in a more innovative, cost-effective and value-added approach to commercial cannabis industry that will yield maximum benefits in both medical and industrial sectors, especially, in an era of the African Continental Free Trade Agreement (AfCTA).

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Imhotep Alagidede

Imhotep is a metaeconomist, and a transdisciplinary scholar with a vivid interest in the noumenon behind phenomena. He founded the Nile Valley Multiversity as an integral system of education that incorporates indigenous and modern knowledge in all spheres of human endeavour. He is a student of plant medicine. He is one of the brains behind the Wits Cannabis Campus, a multidisciplinary world class Centre for Cannabis research.

Table 1. Guiding principles to regulated cannabis legalization

Priority Area	Best practices, lessons, guiding principles and action plans
Production/Growing	<p>1. A first option for growers is based on the existing legislation where growers need a certified license issued from a responsible agency that would keep the rules fair for all players. The rules around cannabis legislation is a pathetic copy and paste version of what the North Americans have evolved over the years for their temperate climates. They are also suitable for large scale producers. A second option which is even superior is to allow production to flourish without any centralised intervention. For a plant of balance, all concerns would be sorted without human intervention. It is precisely government intervention over the years that has brought up the current challenges. And it is the fear of the ruling elite that makes cannabis cultivation a problem.</p> <p>2. The certified licensing approach is practiced in Lesotho, Malawi, South Africa, Zimbabwe and Zambia. Existing licenses allow for only medicinal research and use. In newer countries such as Ghana, both medical and industrial use is emphasized. The preconditions for obtaining license, and the cost involved excludes local entrepreneurs and delivers the emerging cannabis industry into the hands of foreign conglomerates and concerns. We propose that individuals who would like to cultivate for small scale use should go into production straight away without need for any licenses. For growers targeting foreign markets and consumers, government should regulate, and steer the incentives for both the small and large scale grower.</p>
Processing	<p>1. This industry is best driven by private initiative, however, government has a role in providing the necessary public goods that make the cultivation and utilisation of the plant more beneficial and easy.</p> <p>2. Expertise in the field must be engaged through any form of meaningful coalition, committee and/or commission that will administer all the affairs of cannabis right from the farm to the final consumer.</p> <p>3. Medical and pharmaceutical labs interested in investing in the new industry can maximise their potential by providing processing equipment and plants and trained expertise</p> <p>4. An intermediate or long term plan is needed to add medical cannabis to the medicine curricular and pharmacopeia. The Nile Valley Multiversity has developed advanced level courses on different aspects of the plant from growing to final consumption and research institutes and universities can contribute to this effort to deepen the research.</p> <p>5. Quality control assurance is needed to monitor and constantly check the quality of cannabis products. This must also include recycling system to limit or avoid any form of wastage and negative spill overs that will be hazardous to nearby community members.</p>
Distribution	<p>1. Cannabis distributors need to be regulated. Licenses based on needs approach, equity and capability in order to regulate any form of black market trade, influx of fake products by other agents and also, to ensure there is regulated use domestically.</p> <p>2. At the international level, government must tighten regulations in order not to allow unscrupulous actors to export fake products that will reduce the international trust and good will for Ghana's cannabis products.</p> <p>3. There must be checks in place to deal with corruption and corrupt officials.</p> <p>4. Internet sales and distributions must be properly tracked to ensure that right customers are engaged. This will help boost cyber security and checkmate fraudulent practices.</p> <p>5. In terms of labelling and packaging, it is important to include information on the chemical make-up, instruction on usage, dosage, and respective manufactured and expiry dates as well as key side effects of consumption to pre-inform consumers before using cannabis products.</p>
Pricing	<p>1. Pricing of cannabis products must be based on market research and consumer behaviour at the individual, household and national levels.</p> <p>2. Taxing must be based on how individual consumers perceived tax, current and projected economic situations and existing revenue regulatory frameworks in the country.</p> <p>3. Economically, using both elasticities of demand and supply will also inform the decision on how best to share the tax burden on different types of cannabis products.</p>
Cannabis Governance	<p>1. Cannabis governance must include but not limited to ethics, compliance, diversity and inclusion.</p> <p>2. In terms of ethics, there must be guiding principles and policy frameworks that will clearly define, explain and reinforce conducts acceptable in the cultivation, processing, distribution and final consumption of cannabis products for either medicinal or industrial purposes.</p> <p>3. Government must ensure there is transparency, accountability and clearly defined laws in place to deal with any incidence of corruption.</p> <p>4. Any member issued cannabis license for either growing, processing or distribution must comply with all protocols, laws and guiding principles that will ensure consistent and regular assessment, monitoring and evaluation for a smooth operation in the industry. This must apply to any form of use – medicinal or industrial.</p> <p>5. In line with the UN SDGs which promotes shared growth for all without leaving any one behind, government must put social protection measures in place that promotes zero discrimination and equal opportunity for all citizens without leaving no one behind.</p>
Public Education	<p>1. Cannabis growers and organisations such as the Nile Valley Multiversity and government design programmes that will provide a better understanding of cannabis, its potential benefits and associated risks to the larger population.</p> <p>2. Programmes must also focus on all segments of cannabis users and potential users that will educate them on both the industrial and health needs and types of cannabis products that may be of help. .</p> <p>3. Both the medical benefits and associated risks must be made clear to general public to understand better their needs and all forms of possibilities in using cannabis products.</p> <p>4. A Media contents that advertise cannabis products for firms must do that based on compliance to every ethical protocol so as to be able to make sales without misleading the general population</p>