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**Case Study****High Stakes: Managing Risk and Policy Uncertainty in the Market for CBD Food Products**Andrew W. Stevens<sup>a</sup> and Joy M. Pahl<sup>b</sup>*University of Wisconsin<sup>a</sup>, St. Norbert College<sup>b</sup>***Abstract**

Consumer demand for food products containing cannabidiol (CBD) has skyrocketed in recent years. This spike in demand has presented an opening for entrepreneurial small businesses to seize a lucrative market opportunity. However, sourcing CBD is risky due to volatile prices and spotty availability in the wholesale market. Consequently, some entrepreneurs have considered producing their own CBD by growing hemp and vertically integrating their supply chains. This strategy poses its own risks: hemp that contains too much tetrahydrocannabinol (THC) must be destroyed; hemp yields are variable; and state- and federal-level policies about hemp production are changing rapidly. This case study follows the story of Levi Budz, a young entrepreneur from northeast Wisconsin, as he founded and grew Budz Butter: a 2017 startup company that produced CBD food products. This case focuses on risk management and decision making under uncertainty with particular attention to a shifting policy landscape, price volatility for a key input (CBD extract), hemp production risks, and uncertainty about consumer demand and competition in the retail marketplace. These themes are broadly applicable to other emerging opportunities in the agricultural and food sectors, and especially applicable to entrepreneurial ventures.

JEL Codes: A22, M13, Q13, Q14, Q18

Keywords: CBD, hemp, risk, start-up, uncertainty

**1 Introduction**

As a new college graduate from Green Bay, Wisconsin, Levi Budz moved to Colorado in 2015 to start his first job in a small, fast-growing supply chain management company. His new employer specialized in the food service industry, and Levi quickly excelled at his job. Even though Levi's creative thinking and shrewd negotiating skills were bringing in hundreds of thousands of dollars in revenue for his company, he felt frustrated that he was not earning more money from his hard work. Soon, Levi began forming ideas for a business of his own.

With the passage of Amendment 64 in 2012, Colorado became the first state to legalize recreational marijuana (Reed 2018). The first retail sales outlets, called dispensaries, opened two years later in 2014 (Reed 2018). By the time Levi arrived in Colorado, hundreds of dispensaries were selling marijuana flower (or "bud") for smoking and other edible products infused with tetrahydrocannabinol (THC), the psychoactive compound in marijuana that creates a "high" or euphoric sensation. THC-infused food products like candies and baked goods were popular, but Levi noticed that many people preferred to make their own THC-infused foods at home. Getting the desired amount of THC in a home-baked product was quite challenging since the process included heating the marijuana flowers to low temperatures to "decarboxylate" the cannabinoid compounds in the plant. Getting this process wrong could lead to unpredictable levels of THC in the resulting product. Levi saw an opportunity to create branded THC-infused cooking products such as butter, peanut butter, coconut oil, or olive oil that contained predictable levels of THC for customers who wanted to make their own THC baked goods.

After eliciting feedback from friends and colleagues about his idea and creating some prototype products, Levi decided to take the first steps toward starting a new business producing THC-infused food

ingredients. Capitalizing on a bit of good fortune with his family name, he decided to call the business “Budz Butter.” Using some of his own money and a zero-interest loan from his parents, Levi founded Budz Butter, LLC in July 2017. He moved quickly to find a building, procure equipment, and satisfy any regulatory requirements to begin production. He soon discovered, however, that starting Budz Butter would be more complicated than he expected.

This case follows Levi’s journey of growing Budz Butter from an idea to an actual business while navigating risk and uncertainty from many sources. In particular, Levi had to manage a shifting policy landscape, input price volatility, agricultural production risks, and uncertainty about consumer demand and competition in the retail marketplace. This case provides an opportunity to examine decision making under uncertainty in the context of an entrepreneurial start-up in a fast-growing product sector.

## 2 THC or Cannabidiol (CBD)?

Even though Colorado had legalized the recreational use of marijuana, it remained a Schedule 1 drug under the Federal Controlled Substances Act (CSA). This meant that cannabis (another name for the marijuana plant) was an illegal substance in the eyes of the federal government, making it difficult for businesses producing or selling cannabis products to access basic tools like banking services (Parker et al. 2019; Abbott and Zack 2018). Levi had to ensure he did not locate his new processing facility in one of Denver’s “dry zones” where manufacturing THC products was prohibited. To start the process of obtaining a zoning permit for Budz Butter, Levi set up a meeting with Colorado’s Marijuana Enforcement Division (MED). While on the phone to schedule the meeting, an MED officer asked Levi if his attorney was planning to attend as well. Levi did not have an attorney and immediately felt discouraged. Was there a feasible path forward for Budz Butter if the regulatory requirements were so onerous that he would need a lawyer?

At this point, Levi put his plans on hold as he reassessed his options. He began to consider reorienting his business plan around a different aspect of the cannabis plant: CBD. CBD is a chemical compound found in cannabis that is purported to provide relief from seizures, anxiety, joint pain, menstrual cramps, nausea, insomnia, inflammation, and moodiness, among other ailments. However, unlike THC, CBD does not activate the brain’s cannabinoid receptors to produce a “high” feeling. Additionally, CBD can be found in hemp—a variety of the *Cannabis sativa* plant with much lower levels of THC that has been cultivated for centuries for its fiber to make rope and other products.

Despite its long agricultural history, hemp was not commonly grown in the United States in the early twenty-first century due to the CSA’s prohibition of cannabis. That started to change, however, in 2014. The Agricultural Act of 2014, known more commonly as the 2014 Farm Bill, was signed into law on February 7 of that year. Section 7606 of the legislation defined “industrial hemp” as distinct from marijuana and authorized limited production of hemp in states that legalized its cultivation. Most of this production occurred as part of research as part of state-level pilot programs permitting farmers to grow industrial hemp. Later, in the 2018 Farm Bill (officially known as the Agriculture Improvement Act of 2018), the federal government legalized the production of hemp as an agricultural commodity and removed it from the list of controlled substances. The legislation defined industrial hemp as the plant *Cannabis sativa* L. with a THC content of less than 0.3 percent. After the passage of the 2018 Farm Bill, individual states began to adopt their own statutes about how to regulate the production of industrial hemp. As the regulations on industrial hemp began to loosen, entrepreneurs increasingly eyed this agricultural product as a source of CBD.

In 2016, the total retail value of “Hemp CBD” products sold in the United States was \$130 million and growing at an annual rate of 53 percent (Hemp Business Journal 2017). Despite this booming market, CBD’s legal status was still in question. As of August 2016, the U.S. Drug Enforcement Agency (DEA) maintained that “CBD from any source is a Schedule I substance [under the CSA]” (Mead 2017, p. 289). Similarly, the U.S. Food and Drug Administration (FDA) renounced CBD as a dietary supplement

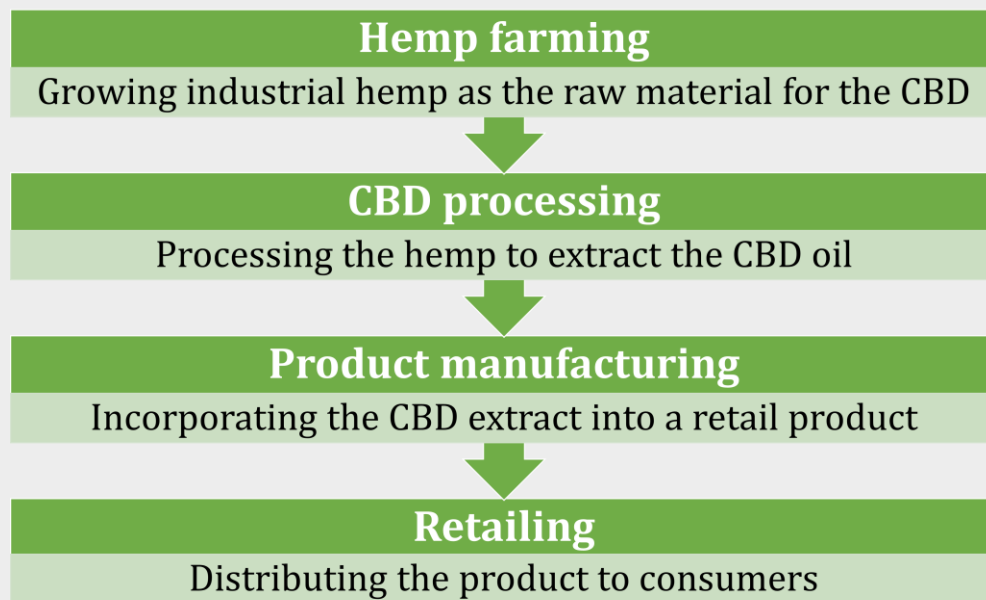
ingredient, thus leaving the substance's legal and regulatory status "complex and evolving" (Corroon and Kight 2018, p. 193).

Even though there was lingering legal and regulatory uncertainty around CBD products (Raszap Skorbiansky, Thornsbury, and Camp 2021), Levi thought the market for CBD was much less risky than the market for THC. Additionally, CBD products were being sold across the country—not only in states that had legalized marijuana. By focusing on CBD products, Levi could reach a larger pool of potential buyers and tap into a market that was projected to have \$1.9 billion in retail sales by 2020 (Corroon and Kight 2018). Levi decided to reorient Budz Butter from a company that manufactured THC products to one that manufactured CBD products. Using the capital he and his parents had lent the company, Levi purchased the necessary manufacturing equipment and began to produce and sell hemp-derived CBD-infused food products including peanut butter, coconut oil, butter, and olive oil. Once he had made the decision to focus on CBD products, Levi realized he could locate his company in any state. He quickly decided to move back to Wisconsin where he would face less competition and benefit from an existing network of family, friends, and business relationships. Furthermore, real estate and labor were both less expensive in Wisconsin than in Colorado.

### 3 Vertical Integration

In June 2018, Levi moved Budz Butter to northeast Wisconsin where he continued to produce cooking ingredients and food products containing CBD. He also expanded his product offerings to include four different types of CBD tinctures and hemp flowers sold in jars. Upon relocating to Wisconsin, Levi secured a building for Budz Butter's processing facility for less than a third of what a comparable building would have cost in Colorado. Then, he arranged for his manufacturing equipment to be shipped to the new facility in December of that year. As Levi was setting up his new location, he contemplated how vertically integrated he wanted Budz Butter to be.

The supply chain for CBD food products contained several steps, summarized in Figure 1. Levi knew that the core of Budz Butter's business model was the product manufacturing step. The bigger question, however, was how many of the other steps he wanted to tackle as well.



**Figure 1. Supply Chain for CBD Food Products**

Although Levi planned to sell Budz Butter products directly to consumers through his company's website, he did not want direct-to-consumer marketing to be his only retail strategy. Leveraging his mother's experience and connections in the area, Levi was able to secure several health and wellness retailers—plus some organic food stores—as sales outlets. He also won the account of a major regional supermarket chain after a year and a half of effort. Building on this success, Budz Butter developed a robust regional network of retailers who carried the company's products. Thus, Levi largely outsourced the “retailing” step of the CBD supply chain.

The next question for Levi was how to source the CBD extract he would use during the product manufacturing step. He had essentially two choices: he could either buy CBD extract on the open market or self-source CBD extract by growing his own industrial hemp. If he decided to grow his own hemp, he would need to either process the hemp biomass himself or find someone else to do the job.

In 2018, CBD extract (also called refined hemp oil) cost roughly \$3,200 per pound on the wholesale market. At this price, the extract represented ninety percent of Budz Butter's cost of goods sold. To make matters worse, Levi did not have a good idea of what CBD extract prices would be in the future. The wholesale market for refined hemp oil was in its infancy, and accurate price data were hard to come by—let alone reliable price forecasts. A 2017 report about the cannabis wholesale market read in part:

*[P]rices have continued to move in unpredictable ways, creating wholesale price uncertainty for buyers, sellers, and the ancillary businesses whose products and services support the primary market participants. Price uncertainty, regarding both today's prices and those in the future, creates risk in the overall economics of this sector. (Cannabis Benchmarks 2017, p. 1)*

The same report noted that the price volatility for cannabis on the U.S. spot market—calculated as the annualized standard deviation of weekly log price changes—was 29.7 percent in 2016, considerably higher than other commodities like corn (22.1 percent), soybeans (17.5 percent), or gold (13.9 percent; Cannabis Benchmarks 2017). Levi knew the wholesale price for CBD extract could easily rise or fall. Exploding demand for CBD products would push prices up, but an expected boom in industrial hemp production could also flood the market with hemp biomass pushing prices down. It was anyone's guess what wholesale prices would do.

Levi ultimately decided to grow his own industrial hemp rather than rely on the wholesale market for CBD extract. Even though he did not have previous farming experience, he felt it was better to vertically integrate his supply chain than to expose himself to the uncertainty of the market for refined hemp oil. He also saw integrated hemp production as an opportunity to diversify his lineup of products. Specifically, Levi wanted to get into the market for smokable CBD products. Many consumers were interested in smoking hemp flowers that contained CBD but that did not have the THC found in marijuana. Traditionally, dried hemp flowers were sold in bags or jars and had to be rolled into cigarettes by the end user. Levi thought there was market opportunity to produce pre-rolled hemp cigarettes. By growing his own hemp, he could produce both hemp biomass (which would be processed into CBD extract) and intact hemp flowers (which he could dry and turn into hemp cigarettes).

Having decided to grow his own hemp, Levi next had to decide whether to process the hemp biomass himself or to outsource that step. Processing hemp to produce CBD extract was a complicated process, and Levi would need to procure expensive machinery to do the work himself. Furthermore, it did not make sense to incur a large fixed cost to buy machinery to handle what would be, ultimately, a relatively modest processing job. Levi decided to try and find a processor who would agree to take Levi's hemp biomass and turn it into CBD extract on a contract basis.

Luck struck again for Budz Butter when a mutual friend introduced Levi to a local hemp seed supplier named Mike. In addition to selling hemp seed and providing farm consulting services, Mike owned the machinery necessary to process hemp biomass into CBD extract. Levi and Mike developed a business relationship where Mike would sell hemp seed to Levi and provide free advice about how to grow the crop. He then agreed to take Levi's hemp biomass and process it into refined hemp oil for a



predetermined cost. The two entrepreneurs also worked together to develop new products for Budz Butter.

Finally, Levi had figured out his vertically integrated CBD supply chain: he would grow his own hemp, pay Mike to process some of the hemp biomass into CBD extract, use the extract to manufacture branded CBD foods and ingredients, and market his products direct-to-consumer through his website and through a regional network of traditional retailers.

## 4 Agricultural Production Risks

Levi had made the decision to grow his own hemp and was planning to plant his first crop in the spring of 2019. He would need to plant seeds in the spring and harvest in the fall. First, he calculated how much CBD extract and how many hemp flowers he would need in order to produce enough of his products to meet internal sales projections. He ultimately decided to grow 3,500 hemp plants. Some of the plants would be harvested for hemp biomass, which Mike would process into CBD extract, and others would be harvested for dried hemp flowers to be used in smokable CBD products. At the start of the season, Levi developed a rough production budget and expected to spend \$12,000–\$13,000 growing and harvesting his hemp crop.

Having decided how many hemp plants to grow, Levi leased a shed, tractor, and three acres of land from his grandmother for \$3,600 and borrowed some additional farming equipment for free from a local farmer who was an old friend. At three acres, Levi's hemp growing operation was on the small side; the average Wisconsin hemp farmer in 2019 grew nearly 13 acres of the crop (Drotleff 2020). Although Levi was confident about his farming operation—after all, he could rely on Mike, family, and friends to answer questions and offer advice—Levi had never farmed before. There were many things that could go wrong, and if he could not produce enough hemp to supply Budz Butter's needs, he would have to incur even more costs to purchase CBD extract from the wholesale market.

There were many risks involved in growing hemp. If the weather was bad or Levi made a mistake like planting his crop too late, his plants might not mature in time for harvest. One estimate suggested that up to 40 percent of planted acres in 2019 would not be harvested due to crop failures (Raszap Skorbiensky, Thornsby, and Camp 2021). If his hemp plants ended up with too much THC and a state inspector found out through random testing, Levi's entire crop could be destroyed by the state. Indeed, some estimates suggested that 20 percent of lots tested in 2019 would test high for THC content (Raszap Skorbiensky, Thornsby, and Camp 2021). If Levi lost his hemp crop for either reason, there was no federal crop insurance program that would protect him from his losses. More than anything else, though, Levi was not sure just how much yield he could expect as a first-time farmer growing a relatively uncommon crop.

In early 2019, there was very little public information about how different hemp varieties performed in Wisconsin. There had been hemp variety trials in other states like Kentucky (Williams, Perry, and Keene 2017) and Vermont (Darby 2018), but Levi was relying heavily on Mike's advice. An article written by University of Wisconsin researchers that was posted online in early 2018 provided some more useful, if vague, predictions: "Yields can vary widely depending on the variety, local climatic conditions, cultivation method, and grower experience. For grain, new growers have reported yields between 250–700 lbs/acre. More experienced growers can expect between 800–1,800+ lbs/acre" (Conley et al. 2018).

Levi set out to grow 3,500 hemp plants and started by buying 5,000 seeds from Mike for one dollar each. However, these seeds only ended up yielding 2,000 plants. To make up the difference, he bought 1,500 seedlings from Mike for three dollars each. Luckily, the seedlings survived, and Levi reached his goal of growing 3,500 plants.

Despite a cool, wet spring in 2019 that threatened his seedlings, Levi was able to successfully harvest his crop of hemp plants in the fall with the help of his father and brother. The three Budz men

first cut the hemp plants from their stalks, transported them on flat-bed wagons to a nearby shed, and hung them from rafters to dry for a month. Levi harvested 2,500 pounds of hemp biomass from 3,100 plants and sent this biomass to Mike for processing into CBD extract. The remaining 400 hemp plants yielded 250 pounds of dried hemp flowers that would be used in Budz Butter's smokable CBD products. In the end, Levi ended up spending nearly \$23,000 to grow and harvest his hemp crop (Table 1). He estimated that his hemp biomass production costs were \$8.00 per pound, not including labor costs. This compared to an average wholesale price of hemp biomass that was around \$40 per pound and an average wholesale price of dried hemp flowers that was around \$400 per pound in mid-2019. By the end of the year, the wholesale price for hemp biomass fell to around \$10 per pound thanks to a boom in hemp production during the 2019 growing season (Owram 2020). After Mike had processed Levi's hemp biomass into CBD extract, Levi calculated that the effective cost of his extract was about \$225 per pound of extract. This was much lower than the 2019 wholesale price of \$1,600 per pound and just a fraction of the previous year's wholesale price of \$3,200 per pound.

**Table 1. 2019 Hemp Production Expenses for Budz Butter**

Expense	Cost (\$)
Seeds (5,000 at \$1 ea.)	5,000
Seedlings (1,500 at \$3 ea.)	4,500
Greenhouses (4 at \$200 ea.)	800
Worm castings (fertilizer)	2,400
Other fertilizers	500
Rent (land; shed; water; tractor; drag)	3,600
Electricity	300
Harvest labor	1,000
Licensing and testing	750
Post-harvest processing (hanging, drying, shucking)	4,000
<b>Total</b>	<b>\$22,850</b>

## 5 Assessing Consumer Demand and Competition

In addition to the risks of growing his own hemp, Levi had to weigh the risks of uncertain consumer demand for his products. CBD products were still relatively new in the marketplace, and it was challenging to predict how large and how quickly the market segment would grow. One 2019 report predicted that CBD would grow from a \$4 billion industry that year into a \$24.4 billion industry by 2025 (Brightfield Group 2019). Despite this predicted explosion in consumer demand, Levi was concerned that others would have some of the same ideas as him. Indeed, in a 2019 marketing study, researchers in Wisconsin found that 27 percent of hemp growers had not found a buyer for their crop (Burney and Remble 2020). This suggested that farmers were quickly flooding the market with hemp to supply CBD processors. Even if the consumer segment for CBD products flourished, the high prices of 2017 and 2018 might not be sustainable given an expected boom in supply.

Levi knew that Budz Butter's success would depend on understanding his consumers' wants and providing a high-quality product. A 2017 industry study surveyed CBD consumers to compile market research about the sector. Of those who consumed CBD products, 46 percent indicated they consumed high-CBD flowers (like in Budz Butter's smokable products) and 34 percent indicated they consumed CBD baked goods. Roughly 44 percent spent between \$20 and \$80 per month on CBD products, and 43 percent reported a high degree of brand loyalty, defined as purchasing a particular product at least 75 percent of the time (Brightfield Group 2017).

Levi was confident he had built a strong brand manufacturing products that consumers would enjoy. He had developed a regional network of retailers to distribute his products throughout northeast

Wisconsin. Compared to other CBD startups, Levi felt he had developed a comparative advantage. Nonetheless, as he considered the 2020 growing season, he knew he may be forced to cut his product prices to stay competitive in the marketplace. On the other hand, demand for Budz Butter products might soar along with the entire CBD industry. Levi was struggling with his decision of how much he planned to produce in the new year.

Reflecting on the 2019 growing season, Levi identified three options for 2020: first, he could reduce his hemp production to 750 plants, focus on self-sourcing dried hemp flowers, and purchase any extra needed CBD extract from the wholesale market. This approach would let him emphasize producing high-quality flowers that were harder to procure from the wholesale market than CBD extract. Second, he could double his hemp production to 7,000 plants building on the lessons learned from his first year of farming and hopefully benefit from increasing returns to scale. Finally, he could keep his hemp production at 3,500 plants and seek to replicate his experience in 2019. Each option had its own risks and rewards.

## 6 Policy and COVID-19 Considerations

As Levi considered his options in the spring of 2020, one thing he had not prepared for was a global pandemic. COVID-19 forced much of the world into a lockdown for longer periods of time during 2020, and Budz Butter was forced to suspend in-person product demonstrations at local retailers, thus missing out on potential new customers. The company experienced a slight decline in sales, but thankfully the pandemic did not put Levi out of business. Similarly, the CBD industry continued to expand as consumers spent more of their time at home.

As the COVID-19 pandemic progressed, national- and state-level hemp regulations continued to evolve. After releasing an “Interim Final Rule” for the Domestic Hemp Production Program in late 2019, the USDA Agricultural Marketing Service published the official Final Rule in early 2021 (Raszap Skorbiansky, Thornsby, and Camp 2021). The Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) then updated its own Emergency Rule for hemp producers in 2021 to take advantage of new provisions in the USDA rule (Wisconsin emergency rule EmR2111). These two new rules provided producers like Levi increased confidence about how their crops would be regulated moving forward.

Finally, the federal government began to allow hemp growers to participate in certain federal crop insurance programs, thereby giving producers access to a crucial risk management tool. Specifically, many hemp growers were permitted to participate in the Risk Management Agency’s Multi-Peril Crop Insurance Program, the Noninsured Crop Disaster Assistance Program, the Whole-Farm Revenue Protection Program, and several Nursery Programs (Raszap Skorbiansky, Thornsby, and Camp 2021).

Looking beyond 2020 and the COVID-19 pandemic, the long-run outlook for Budz Butter and the entire CBD industry remained uncertain. One thing was clear, however: if Levi was going to stay in business, there would always be risks and uncertainties to manage.

## 7 Discussion

All entrepreneurs face risks as they start a new business. Levi Budz’s experience with Budz Butter highlights the unique risks faced by an agricultural business operating in a new market segment in an evolving regulatory environment.

First, Levi had to navigate complex and evolving policy at the state and national levels about the legality of cannabis, marijuana, industrial hemp, THC, and CBD. Although THC was legal in Colorado, it was illegal federally and in Wisconsin. And even though sales of CBD were skyrocketing across the country, the DEA still technically considered CBD a controlled substance. The federal government and state governments were also rapidly changing guidance about whether a low-THC variety of the *Cannabis sativa* plant could be legally grown as industrial hemp, and even when it was ultimately permitted, state



regulators were destroying entire crops when plants exceeded maximum THC levels in randomized testing. Hemp farmers were excluded from crop insurance programs and other supports available to most agricultural producers.

Second, Levi had to determine whether to purchase CBD extract as an input or to vertically integrate and grow his own hemp. The wholesale price of refined hemp oil was extremely volatile and very high in the year or two before Levi began operations in Wisconsin. Even so, many people expected prices to fall as more farmers began producing hemp in 2019 and 2020. Growing his own hemp meant that Levi could control this key input, but it would also open him to other agricultural production risks.

Third, Levi had to manage the risks of growing hemp as a first-time farmer. He did not have previous experience growing hemp—or any crop—before, and he did not know how much hemp biomass he could expect to harvest. Available yield estimates varied widely and were not always relevant to the area where Levi was farming. In addition to all these uncertainties, Levi faced the same risks all farmers face: bad weather, hail damage, or pest outbreaks that could decimate his annual harvest.

Finally, Levi had to predict consumer demand for his goods in a rapidly evolving market for CBD products. Industry experts were predicting an explosion in the CBD market sector, but there were many other entrepreneurs like Levi looking to take advantage of this hot new opportunity. Would the expanding consumer demand be enough to maintain the high prices of 2017 and 2018, or would a flood of competitors drive prices down to where Budz Butter would suffer losses? What could Levi do to insure against such an outcome?

The case of Budz Butter is a clear demonstration of how an agricultural business must manage risk and uncertainty. First, a firm must identify the different sources of risk so threats to the business can be addressed. Second, the firm must quantitatively assess how risk might affect its costs, revenues, and profits. This might also include coming up with methods to analyze unknown or uncertain risks. Third, the firm must choose a course of action that balances the risk-reward trade-off. In some cases, a decision might be to insure against a bad outcome or to choose a less volatile course of action. In other cases, a decision might be to take a big risk and hope it pays off. Levi's experience with Budz Butter includes examples of both and demonstrates how even nimble start-ups must carefully consider risk and uncertainty in their businesses.

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