

GROUP 5
MGTO 30110
MAY 2021



Spoiled Milk

Exploring the Future of the U.S. Dairy Industry

Sydney Carlino
Lilly Cooney
Amy Craig
Tyler McDonough &
Riley Robinette

Meet the Team and Opening Remarks



Sydney Carlino
Senior
Finance and
Economics



Lilly Cooney
Junior
Finance and FTT



Amy Craig
Junior
Marketing and
American Studies



Tyler McDonough
Junior
Marketing and
Sustainability



Riley Robinette
Junior
Finance and
Philosophy

Our team would like to thank our professor, Timothy Balko, and class TA, Dana Plagenz, for their support in guidance throughout the entirety of the project. We'd also thank to thank our contacts from Dairy Management Inc., Tom Gallagher and Eve Pollet, who gave us valuable insight into the industry. Their perspectives were essential in crafting our report.

Table of Contents

Executive Summary 1-10

Central Question 11

Current Assessment 12-29

- Introduction
- Key Terminology
- Historical Analysis
- Systems Analysis

Trend Analysis 30-55

- Data Sources, Time Projection, and Strategy
- Dependent Variable
- Independent Variables
- Ranking and Cumulative Effect
- Issues and Challenges
- Forecasts
- Cumulative Impact on Dependent Variable

Future Scenarios 56-66

- Method
- Uncertainties
- Scenarios

Insights 67-73

- Emerging Threats to Potential Outcomes
- Insights and Implications
 - Constraint
 - Transformation
 - Growth
 - Collapse

Conclusion 74-75

Works Cited 76-80

EXECUTIVE SUMMARY

In the near future, the dairy industry in the United States will likely see accelerated changes. Several recent elements including the rise of alternative dairy products, shifting consumer preferences, increased environmental concerns, and government regulations will have substantial implications for the dairy industry moving forward.

Central Question

The objective of this report is to consider and evaluate the future of the dairy industry—more specifically the fluid milk industry—in the United States and to answer the following question:

What is the future of drinking milk in the United States as it relates to trends and uncertainties in the popularity of plant-based diets, emphasis on sustainability and environmental protection, economic sustainability of dairy farms, and federal support?

Relevance to Business

The dairy industry in the United States has significant relevance to business through numerous factors. Milk has been a staple product in the American diet for many years, with other dairy byproducts also being largely demanded. However, dairy has seen a slow and steady decline the past several years whereas plant-based dairy alternatives, primarily milk alternatives like soy, almond, and now oat, have conversely been growing. Though dairy will likely remain a staple product in many households, shifting consumer preferences towards more sustainable and healthier alternatives is increasing household penetration for the plant-based dairy industry. The battling relationship between dairy and alternative dairy competitors is likely to continue with a slow decline in dairy and large growth in alternatives in the near future.

With growing concerns for climate change, consumers have become increasingly aware of how their purchase decisions contribute to a global impact. Plant-based alternative dairy products have seen growth in part due to these shifting consumer preferences. The dairy industry has been negatively impacted by this increased desire for sustainable practices and products, yet this could lead to changes in how dairy is produced to reduce its environmental impact. To meet shifting consumer and societal trends for healthier and more sustainable products, the dairy industry will need to change its processes to be able to compete with plant-based dairy alternatives which tend to be viewed as superior in these categories by a growing number of consumers.

Government has played a considerable role in supporting the dairy industry in the past with subsidies and federally funded promotional campaigns. However, the Biden administration will likely constrain the dairy industry with increased regulations and restrictions on agriculture's emissions and environmental impacts. Dairy farm consolidation is expected to continue, as larger dairy companies absorb local farms to improve efficiencies and drive milk prices down with a larger production capacity. Also, with constraints on dairy's emissions, innovations to reduce environmental impacts will be necessary, like widely implementing methane digesters to turn fertilizer into energy.

Report at a Glance

This report consists of four primary components which include: topic in context, trend analysis and forecasts, narratives of future scenarios, and insights regarding implications and opportunities for businesses.

The topic in context includes an assessment of the current state of the dairy industry, which includes a systems analysis of the current stakeholders and the position of the dairy industry as it relates to different trends that will drive or constrain the dairy industry in the future. It lays out for the reader the landscape of the industry, essentially "how things work" for dairy today. The insights gained from curating the current assessment played a monumental role in determining how the industry would be affected by trends and uncertainties in the future.

Next, the report will examine the eight most impactful and relevant trends that have been and are expected to continue affecting the dairy industry. Past data shows the change in certain independent variables, some economic, some relating to societal preferences, and one relating to the government, that work to produce a change in the dependent variable of per capita milk consumption. The history of each of these trends, as well as other assumptions based on new information and the industry's current landscape, are used to project these indicators into the year 2030. This report also analyzes a qualitative trend, the advent and popularity of the "flexitarian" diet, for which graphable historical data is not available. The trend analysis section will discuss how this trend is likely to evolve in the future and the implications of its evolution.

The narratives of future scenarios provide alternative scenarios that depict potential futures and outline some of the likely disruptors and events that could occur in the near future for the dairy industry. Utilizing the alternative future scenarios method, four scenarios were evaluated with the constraint scenario identified as the expected future where dairy steadily declines correlated with the rise of alternatives. The transformation scenario is seen as the preferred future where the dairy industry is driven by rapid changes in sustainability, efficiency, and transparency.

Finally, this report will dive into the business and moral implications of the changes expected to occur within the dairy industry. This section will ponder the various obstacles to and opportunities for growth that those with an interest in the dairy industry are set to face and will consider strategic courses of action for these stakeholders to adopt in response.

Topic in Context

The focal point of the system under consideration is fluid milk, with the next boundary being the U.S. dairy industry, and the outermost boundary being the U.S. food and beverages market.

In order to understand the state of fluid milk within the dairy industry, it is crucial to look at the recent history and any continuing trends that could impact the industry in the coming years. The U.S. Government has played a large role in the development of the dairy industry by supporting the nutritional value of milk and aiding promotional campaigns to boost milk sales or perceptions. Particularly notable was the “Got Milk?” campaign that started in 1993 which was backed by the Department of Agriculture, eventually reaching 90% awareness. The sustainability movement in the U.S. over the past several decades has illuminated the growing concern about agriculture’s impacts on the environment, and has shown several constraining factors for the dairy industry. Though in the past milk has been known for its nutritional value in the American diet, emerging trends the past several years has shown shifting consumer preferences toward plant-based dairy products which are seen as the healthier and more sustainable option. A general rise in economic purchasing power of consumers over time has contributed to dairy’s growth in the past and will continue to drive it forward.

The current state of the dairy industry involves several stakeholders and forces of change that are driving the future of the industry. Some of the key stakeholders are dairy farmers who wield moderate influence but high interest, the U.S. government which has low interest but high influence, consumers who have both high influence and interest, and alternative industries that possess both moderate influence and interest.

Trends and Forecasts

This section projects eight trends and then ranks them based on level of impact on the dependent variable. It culminates in a cumulative impact of all the trends on per capita milk consumption, which is relatively straightforward given that all eight trends are expected to progress in such a way that would produce the same effect, in terms of direction, on the dependent variable. The following chart summarizes the trends in terms of their DEGEST category, shows the direction of the expected change in each trend over the next decade, and lists each trend in order of its weight in the determination of the cumulative impact.

Rank	Classification	Trend	Impact
1	Societal	Increased Health Consciousness	↘
2	Societal	Increased Concern for the Environment	↘
3	Societal	Rise in Popularity of Partially Plant-Based Diets	↘
4	Societal	Shift in Market Share from Dairy Milk to Alternatives	↘
5	Economic	Increased Per Capita Money Income	↘
6	Economic	Decreasing Number of Licensed Dairy Farms	↘
7	Economic	Cost of Production Exceeding Milk Price	↘
8	Government	Dairy Subsidies	Ambiguous

1 *Increased Health Consciousness*

Increased concern among Americans for the healthfulness of the food they consume is shown by the rising percentage of American adults that are actively dieting. Over the past years, Americans have become more conscious of the nutritional content of the foods and beverages they purchase and are altering these purchase decisions based on their perceptions of the health benefits or detriments carried by each item. This trend will reasonably continue onward over the next decade based on assumptions about the current emphasis on health and fitness that has exploded in recent years as well as alarmingly high obesity rates for adults in the United States. The continuation of these preferences spells constraint for the dairy industry, as alternative beverages that are publicly perceived as better-for-you options have become widely available.

2 *Increased Concern for the Environment*

The report will discuss a number of factors that over the last half century have spurred more awareness of and fear regarding global climate change among Americans. Quantifying this trend is the percentage of Americans who are self-reported to be either “somewhat concerned” or “very concerned” about global warming. This percentage has risen from below 50% at the start of 2010 to nearly 70% just one decade later. With the topic of global warming only become more routinely spoken about in politics and popular culture and a new American president who has put combating climate change at the forefront of his political agenda, this trend can only be expected to continue on its rising course. The percentage of Americans worried about global warming is expected to continue climbing, though at a decreasing rate due to estimates concerning a portion of the population that will continue to deny the existence of global warming and who thus would not report themselves to be fearful of it. This indicator impacts the dependent variable in that its environmentally destructive nature has plagued the dairy industry and is an important factor in many consumers’ decision to substitute for more sustainably produced foods and beverages.

3 *Rise in Popularity of Partially Plant-Based Diets (Qualitative)*

A lack of data on the proportion of flexitarians in the United States prevented a quantitative analysis of the next societal trend. This report understands “flexitarian” as an individual who consumes primarily plant-based foods but who also consumes animal products in moderation. Due to the flexibility allowed by this lifestyle choice, flexitarianism has become incredibly popular in the United States as people for several reasons choose to reduce their consumption of animal products. Many individuals scaling back their dairy consumption works to seriously depress per capita milk consumption much more so than veganism, which a much smaller portion of the population has adopted.

4 *Shift in Market Share from Dairy Milk to Alternatives*

The market for milk consumed as a beverage has expanded in recent years to include not just dairy milk, but alternative “milks” made from nuts, soy, oats, and other plants. It is helpful then to analyze how sales in this market are allocated between dairy milk and alternative milk beverages. Data on the market share held by each type of milk is not yet available, but this section of the report uses a strong proxy for plant-based milk’s market share instead; the sales of soy and almond milk in a given year divided by the sum of soy, almond, and dairy milk sales. The level of this indicator has been growing rather rapidly since the early 2000s, exhibiting a major shift in preferences as dairy milk’s share of the overall market drops from its initial position at 100% before the advent of plant-based milks. As alternative milks take up more and more of the industry, they will begin to be more prevalent on grocery store shelves, taking space away from dairy milk and further contributing to a drop in per capita milk consumption.

5 *Increased Per Capita Money Income*

Growing levels of disposable income for Americans increases their access to more expensively priced alternative milk products. Once something of a luxury, plant-based milks are becoming more affordable each year, and preferences for better nutrition and more sustainable products are able to be shown by more Americans when it comes time to check out at the grocery store. The report analyzes the expected future of this trend, which shows per capita money income continuing to grow following a dip caused by the COVID-19 pandemic.

6 *Decreasing Number of Licensed Dairy Farms*

Farm consolidation is an issue pertaining to the central question as the decline in dairy farms indicates a decline in demand for dairy. High demand for dairy products would spur an increase in the number of dairy farms, though since the early 2000s the opposite has been true. Excess milk supply has pushed prices down, pushing many small farmers out of the market as profit margins become unsustainably low or even negative. Large factory farms thus account for a larger percentage of licensed dairy farms, and the scale of production coming from these massive farms continues to erode milk prices and margins. Farm consolidation is expected to continue as the ability of the dairy industry to function in this environment is incredibly tenuous. This trend is a symptom of the overall decline in milk consumption in the United States.

7 *Cost of Production Exceeding Milk Price*

As this trend reflects, the cost of milk production historically exceeds its price. Production costs and the price of milk are relevant to the central question of this assignment as these indicators reflect the archaic pricing structure that forces dairy farmers to lag behind in the agriculture sector. This pricing structure creates real pain in the form of exacerbated farm consolidation when the costs outweigh the benefits for small farmers.

This is directly related to per capita milk consumption; current low demand for milk means that farmers are cornered into this realm of low margins, as they will suffer if they increase prices to cover production costs.

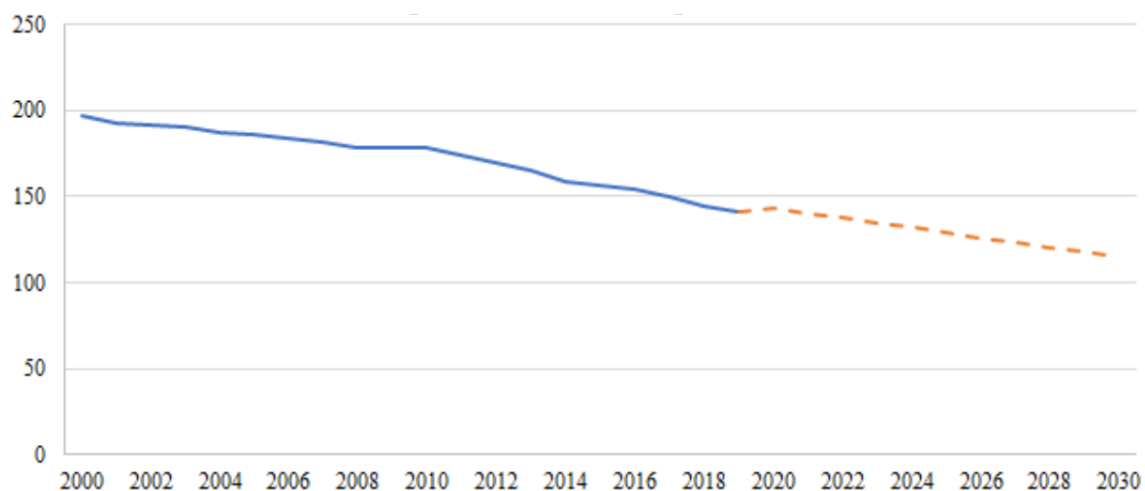
8 Dairy Subsidies (Quasi-Trend)

The level of government subsidies towards the dairy industry is examined as federal support has majorly buoyed the industry for over a century. This section looks at the past history of government subsidies and compares those given by Republican administrations to those given by Democratic administrations. Though there is no clear observable trend to forecast, it is highlighted that Republican governments are far more likely to support the dairy industry. This trend is thus analyzed qualitatively and treated as partially a trend and partially an uncertainty going forward; the level of government subsidies in the future, though incredibly ambiguous, is expected to be lower under the Biden administration than in recent years. This poses a threat to dairy farmers and their ability to innovate and keep prices low during a time of weak demand.

★ Cumulative Impact

Given that each of the aforementioned trends both hurts the dairy industry and is expected to continue on its course, it is more than reasonable to conclude that the amalgamation of these impacts is a further drop in per-capita milk consumption. The graph below incorporates the movements of each trend and shows their cumulative impact, which was determined by combining the effects of each trend and giving additional consideration to those trends deemed to be more impactful (namely, the societal trends.)

Per Capita Milk Consumption in Pounds



Scenarios, Insights, and Implications

The dairy industry is confronted with myriad challenges they will shape whether the industry will shape into more of a constraint, transformation, growth or collapse future. The expected constraint scenario, "Condensed Milk," predicts that consumers' increasing purchases of alternative dairy products signal a decline in the traditional dairy market. The preferred transformation scenario, "Milkshake," anticipates that the transformation of the dairy industry has primarily been driven by innovation of more sustainable, efficient, and transparent methods of production. "Whole Milk," the growth scenario, suggests the growth of the dairy industry is primarily due to efforts to meet consumer demands for increased sustainability and health. Finally, the collapse scenario, "Spoiled Milk," assumes that the industry collapses due to the rise of plant-based and lab-grown alternatives, failure to innovate, and concerns around sustainability and nutrition.

The expected constraint and collapse scenarios will compel current dairy farmers to alter production to alternative products or exit the industry entirely. Conversely, the preferred transformation and collapse scenario will force farmers in the industry to explore alternatives with regard to sustainable technologies and products in order to meet shifting consumer preferences.

Conclusion

This report found that the most likely future of the dairy industry is one of constraint. It would be advantageous for the stakeholders identified in the Current Assessment portion to prepare for a range of plausible futures, the most likely of which includes fewer dairy farms and a greater influence of plant-based alternatives as their production is scaled and their prices fall. With regard to dairy farmers and producers themselves, there are several protective measures to be taken to prevent total obsolescence. While nowhere in this report is it predicted that dairy milk will evaporate completely from the American diet, consumers' relationship to this outdated staple is beginning to change in an irreversible way.

Central Question

*“What is the future of **drinking milk** in the United States as it relates to trends and uncertainties in the popularity of plant-based diets, emphasis on sustainability and environmental protection, economic sustainability of dairy farms, and federal support?”*

TOPIC IN CONTEXT

Introduction

Dairy has long been considered an essential in the American diet. Its versatility and apparent nutritional value have made it a consumer staple in the United States for decades. Looking from the 1930s to 2030, this project aims to explore the question “what is the future of the dairy industry in the United States as it relates to trends and uncertainties in federal support, an increasing emphasis on sustainability and environmental protection, an increased popularity of plant-based eating, and the economic sustainability of dairy farms?”

This report intends to examine the U.S. food and beverage sector and the dairy industry overall. More specifically, the project will particularly concentrate on fluid milk. The industry deserves analysis as this consumer staple industry has faced myriad challenges, specifically within the last ten years. While production has increased considerably, the archaic pricing structure and decline in dairy milk sales has made it difficult for dairy farmers to remain in business. At the same time, changing consumer expectations surrounding nutrition and sustainability have fostered the rise in plant-based alternatives that could pose an even greater threat in the future.

In the next ten years, the aforementioned forces of change will mold the industry’s nature. Indeed, government support, increasing importance of sustainability, shifting consumer preferences, and changes in the dairy economy will affect direct industry players like dairy farmers, but its implications extend beyond that and indirectly disrupts other stakeholders as well. Looking ahead, the future of the dairy industry presents opportunity as it takes on its competition and adapts to changing societal standards.

Key Terminology

Environmental Protection Agency (EPA) Created in 1970, the EPA intends to protect both human health and the environment by releasing regulations and monitoring related parties to ensure they abide by the standards (Environmental Protection Agency)

Agricultural Marketing Agreement Act (1937) The first milk marketing legislation that intended to address inconsistent marketing conditions, increase fluid milk's price stability, and regulate milk quality (ProCon.org)

National School Lunch Act (1946) Legislation that made it mandatory for schools to provide students with nutritious lunches. These orders mandated every lunch included between ½ to 2 pints of fluid milk (ProCon.org)

Agricultural Act (1949) Legislation designed to help expand school-lunch programs (ProCon.org)

Dairy Production Stabilization Act (1983) Introduced a program for dairy product promotion. This program intended to increase consumption of milk and decrease dairy surplus (*Dairy Production Stabilization Act of 1983*)

Fluid Milk Promotion Act (1990) An order that aimed to promote the sale of milk through generic milk advertising that highlighted milk's nutritional value (ProCon.org)

USDA Food Pyramid Created in 1992, the first USDA Food Pyramid depicts recommended food guidelines to ensure a balanced diet. The graphic suggests that a given individual consumes 2-3 servings of milk/dairy products daily (U.S. Department of Agriculture)

Artificial Bovine Growth Hormone Approved by the FDA in 1993, this synthesized hormone increases milk production from dairy cows. This approval contributed to the considerable increase in milk production in subsequent years (FDA)

Dairy Management Inc. (DMI) Organized in 1995, DMI is responsible for increasing demand for dairy products (Dairy Management Inc.)

Historical Analysis

The history of the milk industry can be evaluated best by taking a deeper look into the governmental, nutrition related, economic, and environmental influences that have evolved over time. Gaining insights from these categories that have played substantial roles in shaping the milk industry in the past is essential for preparing for the future.

Government

The U.S. Government has historically been supportive of the dairy industry dating back to 1922 with the passing of the Capper-Volstead Act, which exempted milk producers from monopoly laws to help them raise milk prices (ProCon.org). Throughout the 1900's, several federally funded advertising campaigns and school programs proclaimed the need for students to have milk at school. The Government points to the nutritional value of milk to justify federal mandates requiring schools to serve students milk, including the National School Lunch Act of 1946.

Over time, the U.S. Government has generally expanded its support of the milk industry by passing legislation to increase marketing activities, requiring schools to provide milk, and utilizing the USDA to bolster the nutritional benefits of milk. In the early 1980s, the federal government was spending nearly \$3 billion a year buying surplus milk. When Ronald Reagan abolished government spending on milk surpluses, dairy producers responded by pressuring Congress to pass the Dairy Production Stabilization Act of 1983, a "coordinated program of promotion designed to strengthen the dairy industry's position in the marketplace and to maintain and expand domestic and foreign markets and uses for fluid milk and dairy products" (Dairy Production Stabilization Act of 1983). The Department of Agriculture then pledged support for the widely popular "Got Milk?" campaign that reached a national 90% awareness. In addition to "Got Milk?" ads, the 1990's saw an influx of government-backed campaigns to boost milk consumption. The 1990 Fluid Milk Promotion Act was aimed at ensuring that milk products were readily available and properly marketed so that Americans could receive proper nourishment (Fluid Milk Promotion Act of 1990).

This encouraged producers to create generic milk promotions with the financial support of the federal government. In particular, the USDA's first food guide pyramid released in 1992 recommended that people consume 2-3 servings of milk per day, boosting public perception of milk as a healthy and necessary nutrition source. Again in 2005, the USDA released dietary guidelines recommending that people drink 3 cups of milk per day (ProCon.org).

The dairy industry proactively pursues its interests in Washington, D.C. While origins of this behavior date back to the 1800s, the formation of The National Farmers Union and The Farm Bureau in the early years of the 20th century solidified the practice of farmers appealing to the Government to protect their income. In the 1930s, lobbying by The Farm Bureau had significant impact, and FDR even allowed The Farm Bureau to edit the language of the Agricultural Adjustment Act of 1933. From the 1940s through the 1960s, big dairy grew and increasingly became able to influence legislation and elections via contributions and marketing campaigns. For example, the passing of the aforementioned National School Lunch Act of 1946 helped establish dairy as containing high nutritional value (Ganzel).

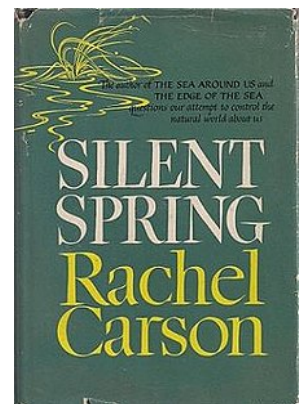
In more recent decades, the industry pours millions into both political parties via campaign contributions and utilizes lobbyists to defend their goals. Larger organizations like Land O'Lakes donate relatively equally to both Democratic and Republican parties while smaller entities largely donate to Republicans. This has changed little since the 1990s. Lobbying totals have grown from \$2.2 million in 1998 to \$6.9 million in 2020 (Bryner). The steady increase in funds flowing to Washington from the dairy industry underscores the industry's increasing need for government support to stay afloat. It has been found that 73% of U.S. dairy producers' revenue came in some form or another from the support of the Government (Baur).

This relationship generates both benefits and challenges for the dairy industry. One benefit is seen in the 2018 Farm Bill. This bill aimed at protecting corporate farm subsidies and reinstating national nutritional programs that serve particularly as fluid milk's lifeline. These initiatives, however, do not affect all parts of the industry equally; they allow for exploitation of tax breaks by large corporations while small dairies continuously go out of business.

Environmental

Dairy and milk production are seemingly inextricably linked with detrimental environmental impacts including methane emissions, fertilizer runoff, water contamination and soil erosion. There is little extensive data available on the direct environmental impacts of the dairy industry before the turn of the century, but between 1944 and 2007, the U.S. dairy industry has worked to decrease its environmental impact primarily through improved dairy cow productivity (Capper).

Dairy and agriculture did not come under much scrutiny until the emergence of the sustainability movement in the United States. This movement can be partly accredited to Rachel Carson's book released in 1962, *Silent Spring*, which exposed the dangers of pesticides used in agriculture. Although not directly connected to the dairy industry, it increased public attention to the impacts of agriculture on the environment and inevitably put pressure on dairy producers to reduce emissions later on. In response to growing public environmental concerns and the first Earth Day protest of 1970, the U.S. established the Environmental Protection Agency to regulate polluting parties. This marked the start of several regulations on agriculture to reduce water contamination and soil degradation from overgrazing, including the Clean Water Act of 1972, which gave the EPA greater power in regulating polluters (Environmental Protection Agency). Dairy farmers became increasingly held accountable for waste management to ensure that water sources were not contaminated.



The sustainability movement evolved to incorporate more stringent regulations for the dairy industry as more research revealed even more damaging impacts, including how methane emissions have over 20 times the warming impact of carbon dioxide (Nyman). As consumers became more aware of the negative impacts of dairy production on the environment, their preferences began to shift toward products that they perceived to be more sustainable. In 2006, the Food and Agricultural Organization of the United Nations asserted that livestock contributed more to greenhouse gas emissions than transportation (Capper). This tarnished public perception of dairy products even though the publication was later revised.

Furthermore, the growth of dairy alternatives to meet shifting consumer preferences for more sustainable products in the past decade has been astounding. In 2016, plant-based beverages reached 33% U.S. market penetration with the milk product category generating \$1.5 billion (Wunsch). Many plant-based alternatives have marketed themselves from a sustainability standpoint, convincing consumers that they are superior to their dairy counterparts for environmental reasons. While the dairy industry has struggled with consumer perceptions in the past, they have an opportunity to improve upon environmental practices and increase the marketing of sustainable products to enhance customer views on dairy.

Nutritional

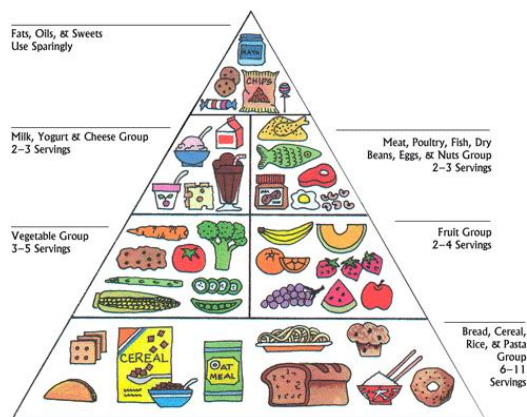
The United States has seen a rise and fall in sentiment around the nutritional efficacy of dairy milk, followed by a recent and growing faith in the nutritional superiority of plant-based milk. Over the course of two centuries, dairy milk has gone from potentially unsafe baby food to Western diet staple to once again being called into question by health-conscious Americans.

In the 19th century, milk consumers were primarily children. But as Americans flocked to urban living far from milk's source, the dangers of unpasteurized milk (e.g. bacterial growth and contamination) began to emerge while infant mortality rose (Greenwood).

Pasteurization, derived from Louis Pasteur's discoveries in the 1860s and 1870s, was introduced to the United States in the 1890s and made mandatory in 1917. Milk became safer to drink for longer (Holsinger). Around the same time, John Harvey Kellogg espoused the idea of treating the sick with pure, simple, healthy food. Milk fit the bill; it had a good balance of fat, protein, and carbohydrates, and its image of a "pure foodstuff" was enhanced by its white color (Greenwood).

At the turn of the 20th century, milk transitioned from exclusively for children to adoption by grown men. Temperance groups opposed to drinking alcohol pressed for the serving of milk in factories and set up milk stands in town centers (Holsinger). Early in the 20th century, researchers identified milk as a source of newly discovered vitamins. Around 1920, the scientific community, agricultural community, and government all came together on the message of the nutritional perfection of milk.

A stamp of approval for milk as a health product came in the form of the National School Lunch Act in 1946. This measure was taken to "safeguard the health and well-being of the Nation's children and to encourage the domestic consumption of nutritious agricultural commodities and other food" (ProCon.org).



This was expanded upon by the Child Nutrition Act of 1966 and its Special Milk Program, which provided milk free or at low cost to children in schools and child care facilities that did not participate in federal child nutrition meal service programs. In 1992, the first USDA Food Pyramid was released, recommending that 2-3 servings of milk/dairy be consumed daily.

1996 marked the creation of the first big non-dairy milk player: Silk. Over the next two decades, plant milk became increasingly favored by milk consumers for nutritional reasons.

With the release of the 2009 film *Food, Inc.* millions of Americans were exposed to the harmful health effects of industrial farming of cows and other animals.

One year later, refrigerated almond milk hit shelves across the country. The “clean eating” craze of the 2010s fueled a widespread embrace of almond milk, soy milk, oat milk, and other alternatives. The normalization of vegan and similar diets occurred in tandem and had a similar effect.

The last decade has also brought reactive measures from dairy milk advocates attempting to reclaim the nutritional supremacy of the original top dog in the beverage milk industry. As part of a national campaign launched in 2014 that sought “to return the sluggish dairy milk category to growth,” the “Got Milk?” slogan was replaced with “Milk Life,” which emphasized milk’s nutritional benefits, including protein content (ProCon.org). It remains to be seen which side of the struggle between dairy and non-dairy milk will ultimately prevail. Dairy milk’s extensive history may serve as a testament to its ability to endure, though never before has it been faced with such a shiny new industry poised to crowd big dairy out.

Economic

The economic history of dairy milk entails a gradual increase of consumer purchasing power. Aggregation of dairy companies and innovation of more efficient distribution methods has brought the inflation-adjusted price of milk down. Concurrently, rising disposable incomes and extended shelf-life of milk has allowed consumers to buy more of it for less.

Two major events on the business side allowed companies to deliver dairy milk at a lower cost. In the 1950s, square milk cartons were introduced (ProCon.org). Compared to the previously ubiquitous glass bottles, the square shape allowed more milk to be carried and displayed in a given space and reduced cost since disposable paper cartons were cheaper than glass bottles. In 2001, Suiza Foods Corporation acquired Dean Foods Company to form “new” Dean Foods Corporation with over 25,000 employees and \$10 billion in revenue, making it the largest U.S. dairy producer (ProCon.org).

Synergies resulting from the merger, condensing of sales and administration, and the combination of market share cut costs across the board for the new dairy company, a reduction that was passed on to consumers.

On the consumer side, disposable income's steady rise since the mid-20th century has combined with the lessening cost of dairy milk to produce an increasing ability for Americans to buy it. Data from the Federal Reserve Bank of St. Louis shows that real disposable personal income has risen from \$2,187 billion in Jan 1959 to \$17,078 billion in Jan 2021 at a compound annual growth rate of 3.4 percent (FRED).

In more recent history, demand for dairy milk has dropped while demand for its substitute, non-dairy milk, has climbed. A 2016 research study from Mintel showed a seven percent drop in dairy milk sales in the prior year and a projected 11 percent drop through 2020, while non-dairy milk shot up nine percent in 2015 (ProCon.org). This trend led to trouble for big players in the U.S. dairy industry. In the same three-month span from November 2019 to January 2020, its two largest companies, Dean Foods and Borden Dairy Co., filed for bankruptcy.



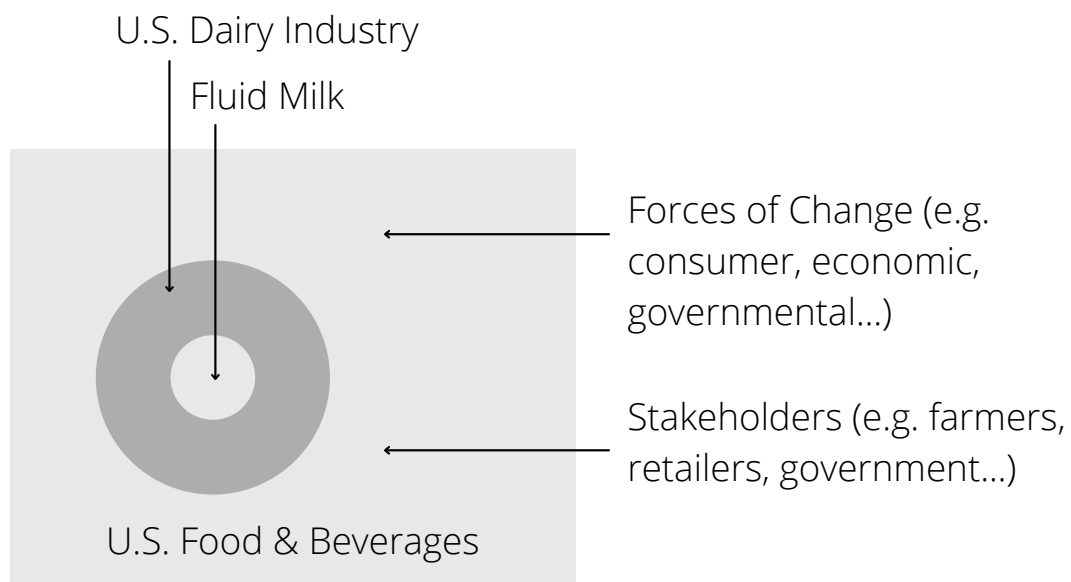
Dairy milk prices remain lower than non-dairy milk due to excess supply and more efficient production. But as the plant milk industry experiences supply chain innovation and a call for more sustainable practices puts pressure on dairy farming, this gap in price could close. Even if it does not, consumers with more purchasing power are more willing to pay for health and sustainability.

Systems Analysis

The overall U.S. dairy industry includes fluid milk, as well as milk powders, cheese, butter, cream cheese, sour cream, yogurt, and ice cream, and other products. As indicated by the systems map, this discussion narrows in on the larger food and beverage industry and considers relevant forces of change and stakeholders.

Products within the industry are experiencing different trends. For example, Americans have continued to consume cheese, butter, and ice cream while there has been a decline in the demand for fluid milk (Semuels). Part of this comes from the greater number of plant-based competing substitutes for fluid milk than for other products.

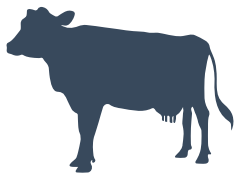
Dairy farmers in the United States primarily raise their cattle for milk (i.e. not also for beef) and then sell the raw milk to wholesalers or to customers that further process the milk into dairy products and later sell them to wholesalers. These wholesalers then distribute the finished products to grocery stores, restaurants, convenience stores and warehouse clubs across the country, where they reach the final consumers. While dairy milk production has increased considerably over the past 20 years, farmers in the industry are confronted with various challenges including farm consolidation, falling and volatile dairy prices, and shifting demand.



Farm Consolidation

The structure of dairy farming has changed significantly since the turn of the century as production has shifted to fewer and larger farms.

Traditionally, dairy farming was concentrated at the local and family level. With larger dairy cow herds and access to more efficient technology, consolidated farms crowd out smaller ones because of their lower costs of production. Presented with financial challenges, many of the smaller farms have had to close. Between 2017 and 2019, for example, the number of licensed dairy farms fell by 15 percent. In 1987, half of all dairy cows lived on farms with fewer than 80 cows total. By 2012, this benchmark herd size had grown to 900 (MacDonald).



This structural shift is driven in large part by costs. Dairy farms have high incentives to continue expanding and adding more cows. The larger players earn drastically higher net returns, not merely in total, but per quantity of milk produced.

Additionally, average production costs fall sharply when herd size is increased (MacDonald). It is not surprising, then, that these movements have also lowered average milk prices and made U.S. dairy products more competitive exports. These exports provide additional markets and an extra source of demand for the industry, but further expose farmers to risks associated with sudden changes in global supply and demand and exchange rates.

Prices

The dairy industry is prone to price volatility both in the price of milk and the price of cow feed, the predominant input to the milk production process. Milk price volatility can be explained by the fact that supply and demand are both relatively inelastic, i.e., neither reacts strongly to a change in prices. This means that a change in demand requires a large change in price to return to stable quantities of milk output, i.e. prices fluctuate. Milk prices have reportedly become more volatile since 1995, and the volatility of feed prices has increased since 2005 as well (MacDonald).



Big dairy has seen falling sale prices in the few most recent years, and this is highly correlated with supply exceeding demand. Whereas dairy milk production was 162,589 million pounds in 1999, total production increased to 192,877 million pounds in 2010 and 223,100 million pounds in 2020 (Milk Market in the U.S.). This means that between 1999 and 2020, then, total milk production has increased by approximately 37.22 percent. This excess supply has put downward pressure on prices in an already thin-margin industry.

Demand

Beginning in the 1970s, demand for dairy products has shifted from fluid milk towards manufactured products such as nonfat dry milk, cheese, whey products, and butter. While fluid milk has been considered a household staple for over a century, its demand has plateaued and even begun to decline in recent years. In one conversation with Tom Gallagher, Chief Executive Officer of Dairy Management Inc., noted how such decline is due to an inherent feature of the dairy industry that prevents it from keeping up with consumer tastes and spurring new demand. He notes that the archaic pricing structure relating to dairy milk hampers innovation. With slim margins and financial tightness, farmers and processors have struggled to advance their core product despite being the most “resilient and imaginative entrepreneurs that exist.” Also during that call, Eve Pollet, the Senior Vice President of Strategic Intelligence at Dairy Management Inc., works closely with Gallagher. She provides color to the product advancement dilemma faced by the industry by giving the example of condensing a glass of milk into a tablet form that preserves all of its nutritional qualities. Ostensibly, it is not that milk producers resist this change or would not be able to execute it. Rather, farmers cannot afford to innovate this way, even if consumers would largely prefer the new product to the age-old cartons of milk at the grocery store.

Unlike with fluid milk, other dairy products have seen growing demand in recent years. Products such as cheese and ice cream made from dairy currently have fewer well-established plant-based substitutes with which to compete, and higher margins are both due to and provide processors with a greater degree of product innovation. On top of healthy demand for these products, the COVID-19 pandemic and its subsequent shutdowns created a further surge in demand as consumers began to stockpile their groceries for the unforeseeable length of stay-at-home orders put in place last year. Bill Beaton, CEO of Agri-mark/Cabot, describes circumstances to those described by Gallagher with regard to fluid milk when he says “there is no doubt that COVID slowed product innovation as we—like all cheese companies—stepped up production to meet demand” (Boisseau). This is inherently different from the issue with fluid milk, however, as it is merely a short-term trend generated by consumer stockpiling behavior. The cheese portion of the dairy industry is poised to continue capturing consumer attention, especially as cheese and charcuterie boards remain popular, and at-home cooking and eating have largely become avenues for socialization as many restaurants remain closed or at limited capacity.

Expert Perspectives

Gallagher explained that the dairy milk industry has particularly suffered in recent years, especially given its outdated pricing structure and consequent inability to innovate; however, he also praised the industry’s emphasis on animal care and sustainability efforts. In fact, he testified that the dairy industry is actually the “world leader in all of agriculture in sustainable practices,” despite public perception. The dairy industry remains in a tentative and pivotal state – something Gallagher himself admits. He nevertheless maintains an optimistic view regarding the future of the industry. Dairy farms have access to manure, which can be, and is, run through an anaerobic process that produces natural gases that can be used as fuel or burned to generate heat and electricity. Gallagher expects this process to become more widespread under Biden. He is optimistic that the supplemental income to dairy farmers from selling the natural gas produced will both keep farmers financially healthy and turn the dairy industry not into a perpetrator of climate changes, but a solution.

While Tom Gallagher remains hopeful about the future state of the industry, Gene Baur, President of Farm Sanctuary, an organization attempting to counter animal abuse on factory farms, contends that the way to address existing issues in the industry is to limit dairy farming altogether. Like Gallagher, Baur also acknowledges the primary issue within the industry as the unsustainable pricing system (Baur). For years, many dairy farmers have only remained afloat because of government subsidies. The federal aid uniquely delivered to the dairy industry, Baur argues, only “perpetuates a dysfunctional system, props up a declining industry predicated on overproduction and wastes billions of dollars every year.” He also contends that dairy farmers should remain in the agriculture industry but should shift to more sustainable practices, e.g. production of fruits, vegetables, nuts, etc.

The difference of thought between Gallagher and Baur illuminates the controversy surrounding the dairy industry today.

Stakeholders



Without question, the primary party with an interest in the dairy industry is dairy farmers themselves. This group is of high interest and moderate influence, because while the production and sale of milk is their livelihood, they exert little control over price movements of their core product. Farmers do, however, control the quantity of milk produced. In part due to the improved economics that come with consolidating into larger farms, dairy farmers in the U.S. have become more efficient at milk production; over the past twenty years, total milk production has increased, even though the number of dairy cows has remained relatively constant (Milk Market in the U.S.). Despite the negative price movements associated with accumulating a surplus of any good, farmers continue ramping up production with such speed that despite the government’s direct purchase of surplus dairy products to support prices, at the start of 2019, the United States held a surplus of cheese amounting to 1.4 billion pounds (Moon).

Farmers protect their interests by joining dairy cooperatives, whose primary function is to ensure a market for its members' milk. These cooperatives are owned by their member farmers and typically process, manufacture, and market dairy products to wholesalers and retailers, or sell them in cooperative-owned stores (United States Department of Agriculture).

Perhaps the stakeholder most capable of affecting significant change is the United States Government. Through the Department of Agriculture, the Government buoys the dairy industry and protects the margins earned by dairy farmers via legislation,  funded campaigns, and subsidies. The Government's involvement over the past century has tended to help American dairy farmers, as shown in the timeline (see Appendix). As the dairy industry continues to rely on federal support to stabilize prices and purchase excess product, it will increasingly need to enact change in order to meet government expectations that have not always been a priority. The Biden administration has made it clear that beyond battling the spread of the coronavirus, its number one priority will be the war against climate change (Herath). The administration and its agencies are expected to hold the dairy industry accountable for the ambitious goals it has already set for itself, such as achieving carbon neutrality and improving water quality by 2050. Making the adjustments necessary to meet these goals may result in a further erosion of margins for dairy farmers. Different administrations also hold different views on the degree to which milk should penetrate school lunches. For example, the Obama administration only permitted fat-free milks in schools, a reform that the Trump administration reversed. It can be expected that the current administration will be less favorable to the dairy industry than the most recent one, but the changes that this governmental pressure may bring about in the industry could later serve to make the industry more favorable to another powerful stakeholder—the consumer.

Consumers wield high influence, though not as high as the government when it comes to enacting direct change, and express high interest in the industry.



Individually, consumers do not possess much power over changes in the dairy industry, but as a whole, consumers' demands drive what retailers decide to put on shelves, which flows back to the dairy farmer and creates a surplus if he or she is not producing what the masses are looking for. The rising obsession with both sustainability and pursuing healthy lifestyles, largely amidst Millennials and Gen Z, has significantly contributed to the increase in popularity of plant-based competitors in recent years. The values held by this group of consumers have evolved from those of price, taste, and convenience towards a new concern for health and wellness, social impact, and experience (Burke). If these consumers believe that purchasing oat milk creamer for their coffee and vegan butter will reduce their carbon footprint, they are more likely now than ever to make these swaps a part of their routines. This group will continue to drive future change in the market for dairy products as they begin to raise new generations to think about what they're putting into their bodies in similar ways.

A class of stakeholders that has only in recent years been a part of dairy's history is anyone involved in the production and sale of substitute products; namely, those farmers and manufacturers that produce inputs such as almonds, soy, and oats, which are used in plant-based alternative beverages and directly compete with fluid milk for shelf space in grocery stores. This group is of both moderate interest and influence. Plant-based milk is one of the fastest growing sectors of the beverage industry in the United States. According to a Nielsen study, sales of non-dairy milk beverages have jumped 23% from 2015 to 2019 (Lucas). But the decline of dairy is not necessarily essential to the success of plant-based milks; as of a 2017 industry report from Mintel, 90% of the consumers of non-dairy milk continue buying dairy milk and other dairy products (Danovich). It would be naive, however, to say that the market for milk alternatives has not benefited from recent changes in consumer preferences that favor plant-based products over those made from animals. As of 2019, plant-based alternatives made up 14% of the overall "milk" market (Poinski).



Though experts in the dairy industry are hardly wary that these alternatives will at any point take over dairy milk, farmers and other parties involved with the production of these products will certainly continue to develop an edge over dairy farmers if the overall growth of the segment provides them with the means to innovate and keep up with consumer demand in a way that dairy cannot.

Uncertainties

Government involvement in agriculture/farming, but particularly the dairy industry, has been apparent since the 1930s. The United States Government has federally subsidized milk advertising, passed pro-dairy legislation such as the National School Lunch Act of 1946, and even purchased milk itself to support prices over the past century. Many of these initiatives, however, were completed while a Republican president was in office. With Biden's stance on climate change and sustainability known, whether or not he will continue, let stand, or overturn the Trump administration's acts to support dairy remains unknown. A significant amount of surplus dairy products are sold to schools. Should Biden uproot Trump's allowance of low-fat flavored milks into schools (a contrast to the Obama administration's only permitting *nonfat* flavored milks in schools), dairy processors will be sent a step backwards in the battle against declining milk demand (Glenza).

Trends and Future Change

Trends in nutrition, sustainability, economics, technology, and governmental behavior will drive and constrain future change for the dairy industry. Changing understanding of nutrition and an individualized approach to diet will alter the dairy industry's delivery of product to the consumer as well as change what type of liquid milk, plant-based or dairy, a consumer intakes. Next, the dairy industry's future involves an increasing involvement in sustainability as pressures on dairy producers to reduce their environmental impact continues to grow from consumers and the government. With regard to economics, the gradual increase of consumer purchasing power drives competition between dairy and plant-based alternatives, amplified by changing consumer standards in nutrition and sustainability.

Technology plays an important role in innovation, creating opportunities in farming efficiency. Lastly, the government's support of the dairy industry and the way in which the government chooses to subsidize it greatly shape the future of the dairy industry.

TREND ANALYSIS

Overview

The trends that were found to hold considerable influence through the Current Assessment were projected into the year 2030 and their potential impact on the industry was assessed. Although difficult to predict with absolute certainty, understanding past trends and the industry's current dynamic provides valuable insight on the future. Different quantitative and qualitative analyses were employed to estimate the future trajectory of these trends as well as their impact on a dependent variable that reflects the health of the dairy industry. For each trend project quantitatively, a regression was performed to determine a linear relationship between the variable being measured and time, which was then used to see what the trend's trajectory would be if it continued at its historical progression. All of these trajectories were altered from their course created using the regression because other assumptions about the future that suggested a deviation from historical trajectory were factored in.

Data Sources, Time Projection, and Strategy

Evaluations of the different trends' trajectories affecting the dairy milk industry were used to create the trend analysis. Both quantitative and qualitative data are essential for creating baseline forecasts and accurate trend analyses. Databases and studies conducted by reputable sources were used to collect the majority of the quantitative data, while qualitative data was collected through credible commentaries and opinion pieces.

Each trend is projected through the year 2030. Many important outcomes stemming from the expected trajectory of the DEGEST category trends will likely come to fruition by that time. Especially from an economic and government perspective, the ten-year period allows time for the U.S. dairy industry to develop and undergo the innovative transformations industry experts are predicting (e.g. selling byproducts that were traditionally discarded). Throughout this predicted modernization and advancement, the industry's position could be strengthened. Alternatively, from a sustainability and nutrition perspective, Millennials and Gen Z will have a larger impact on the economy in terms of purchasing power in the upcoming ten years. Given their higher interest in sustainability and nutrition, these key groups will play a critical role in demand and potential government policy creation.

Each trend discussed in the subsequent analysis and forecast has a different level of impact and influence on the dairy industry. This section of the report will start by analyzing trends relating to society, namely consumer health consciousness, Americans' concern for the environment, the popularity of partially plant-based diets, and the associated shifting of consumption patterns. Other analyses will center on trends within the economic sphere including disposable income, farm consolidation and closures, and the cost of production. Finally, the report will concentrate on the government's contribution to dairy farms and investigate its relationship with the industry.

Dependent Variable: Central Question Measure

The selected dependent variable—per capita milk consumption—intends to answer the central question, “what is the future of the dairy industry in the United States as it relates to trends and uncertainties in federal support, an increasing emphasis on sustainability and environmental protection, an increased popularity of plant-based eating, and the economic sustainability of dairy farms?”

This indicator allows for a straightforward evaluation of the state of the dairy industry. Unlike an indicator such as milk sales, its value is unaffected by inflation or other changes in the price of milk. The amount of milk consumed encompasses the economic, nutritional, sustainability, and governmental considerations outlined in the Current Assessment.

Independent Variables: Trend Measures

Societal

Four main variables indicate shifting consumer preferences relating to sustainability and nutrition.

- 1 Health Consciousness: Percentage of Americans aged 20+ on a Diet: In recent decades, consumers have evidenced a heightened awareness regarding their nutritional choices. Many consumers perceive plant-based alternatives to be “healthier” than traditional products. In the International Food Information Council’s study on assessing consumer perceptions, 45% of respondents considered plant-based alternatives to be healthier simply based on the label (Splitter). Such perceptions have influenced consumer purchases. Projecting the future of Americans adopting diets could help gauge the potential increase in consumption of healthier food products, including plant-based alternatives.
- 2 Concern for the Environment: Percentage of People Reporting Themselves as Worried about Global Warming: Americans have also expressed a greater degree of concern for the health of the environment. Measuring the percentage of people reporting themselves as “Somewhat Worried” or “Very Worried” about global warming reflects this concern. Such worry has and will likely continue to inform consumer purchasing decisions, favoring products that have smaller negative (or greater positive) impacts on the planet.
- 3 Popularity of Partially Plant-Based Diets: Adoption of a Flexitarian Lifestyle and Decline in Dairy Consumption: While the media commonly highlights the benefits of vegetarian and vegan lifestyles, the adoption of these diets are not proportionally common. As of 2016, only around 3.4% of adults in the U.S. reported following a vegan or vegetarian lifestyle (The Harris Poll) Thus, the low percentage of people following these diets fails to represent the shift in consumer behavior and overarching interest in sustainable eating. Qualitative analysis of the flexitarian lifestyle and purchasing decisions provides a better representation of the shifts in consumer preferences.

Assessing the changes in the number of people projected to adopt such diets also helps to measure the likelihood of growth in plant-based purchases.

- 4 Shifting Consumption Patterns: Plant-Based Milk Sales: Entering the market in the 1950s, plant-based alternatives have earned increasing popularity in recent years (Parrish). Despite the greater demand, however, the market share for any given plant-based milk (e.g. almond milk) out of the entire milk market has not exceeded around 5% (Dairy Management Inc.). Despite this, changes in the overall sales of plant-based goods indicate shifts in consumer buying behavior. Determining the trend of plant-based milk sales will suggest if plant-based alternatives will remain more of a novelty purchase or shift to become consumer staples and replace dairy milk entirely. This projection will suggest whether changes in plant-based milk sales are benefiting or harming the dairy milk market.

Economic

From an economic perspective, three main trends influence and/or are representative of the shifting nature of the dairy industry.

- 1 Disposable Income: Per Capita Money Income: As Americans, particularly Millennials and Gen Z, experience increases in their disposable income, consumers become more capable of acting out their priorities (e.g. health benefits and animal welfare) through purchase decisions. One study conducted in 2020 determined that millennials are less price-sensitive when compared with other generations and also favor ethical consumption over price (López-Fernández). A 2015 Nielsen poll also found that an overwhelming 73% of Millennials are willing to pay extra for sustainability attributes (Nielsen). That same report indicated that 66% of the overall population would pay more for sustainability. The popularity of more sustainable and “healthier” alternatives will increase if price becomes less of a concern for more consumers.

- 2** Farm Consolidation: Licensed Dairy Farms: Increased consolidation and the closure of dairy farms mark a change in the economic stability of dairy farmers. Especially since 2003, many U.S. dairy farms have been forced to close or merge given the unsustainable milk prices and insufficient government support (American Farm Bureau Federation). Partially exacerbated by the declining demand for dairy milk, this trend will have implications that extend beyond the farms and farmers themselves (e.g. higher milk prices given the decreased supply) if it continues on its forecasted trajectory.
- 3** Production and Price: Cost of Production Exceeding Milk Price: Consistent with the historical trend, dairy farming production costs exceed milk prices. This discrepancy has placed farmers in a particularly vulnerable financial position. Forecasting both production costs and price of milk and analyzing the relationship illustrate the economic position of farmers. If this discrepancy is forecasted to continue, farmers will remain in an incredibly tenuous position.

Government

One independent variable measures the Government's contribution to supporting the dairy milk industry.

- 1** Government Aid: Dairy Program Subsidies in the United States: The dairy industry has and continues to be largely funded by the U.S. government for decades, especially during economic recessions. The degree of government funding is tied to the political party in power. Qualitative reasoning supplemented with quantitative analysis surrounding the Government's dairy program subsidies based on the political party provide insight into the degree of support farmers will receive.

Ranking and Cumulative Effect

The cumulative effect of these indicators on the future of the U.S. dairy milk industry will be determined by applying a designated weight based on each indicator's estimated level of impact. The weighting of each indicator's estimated impact is supported by opinions from industry experts and other assumptions with respect to the degree of expected change in that trend over the next ten years. Because changes in the dairy industry are and will be largely driven by consumer demand, societal trends were deemed to have greater influence. Based on these considerations, the trends were ranked in the following order:

Rank	Classification	Trend	Impact
1	Societal	Increased Health Consciousness	↘
2	Societal	Increased Concern for the Environment	↘
3	Societal	Rise in Popularity of Partially Plant-Based Diets	↘
4	Societal	Shift in Market Share from Dairy Milk to Alternatives	↘
5	Economic	Increased Per Capita Money Income	↘
6	Economic	Decreasing Number of Licensed Dairy Farms	↘
7	Economic	Cost of Production Exceeding Milk Price	↘
8	Government	Dairy Subsidies	Ambiguous

Issues and Challenges

While the aforementioned variables are generally reflective of the selected trends, other variables may have been better indicators. With regard to shifting consumption patterns, for example, this assessment analyzes plant-based milk sales, in dollars, as a multiple of dairy milk sales in pounds, to measure possible changes in the overall milk market as well as changes in consumption patterns. In this instance, the alternatives milk market share relative to the overall milk market, or even simply an apples-to-apples comparison of dollar sales to dollar sales, would have been a preferred variable to examine because it would better reflect if consumers are projected to purchase plant-based alternatives in direct replacement of dairy milk. Given the new and dynamic nature of the plant-based industry, however, such data was not published. While preferred data sources were not always available for every trend, the variables analyzed were intentionally selected as the best representatives for each trend.

Forecasts

The dependent variable of this forecast analysis is per capita milk consumption in the United States. The independent variables include health consciousness, concern surrounding global warming, rise in popularity of at least quasi plant-based diets, market share shifting from dairy milk to alternatives, per capita money income, number of licensed dairy farms, production costs compared to milk price, and federal support for big dairy: listed in order of greatest to least amount of impact on the dependent variable. This section takes the trends found to hold the most considerable influence in the Current Assessment and projects them through the year 2030. Understanding the past trajectory of trends and combining them with assumptions about how the industry is currently most poised to change is crucial in order to assess their potential impact on the dairy industry.

Health Consciousness: Percentage of Americans aged 20+ on a Diet
(Societal)

Percentage of Americans Aged 20+ on a Diet



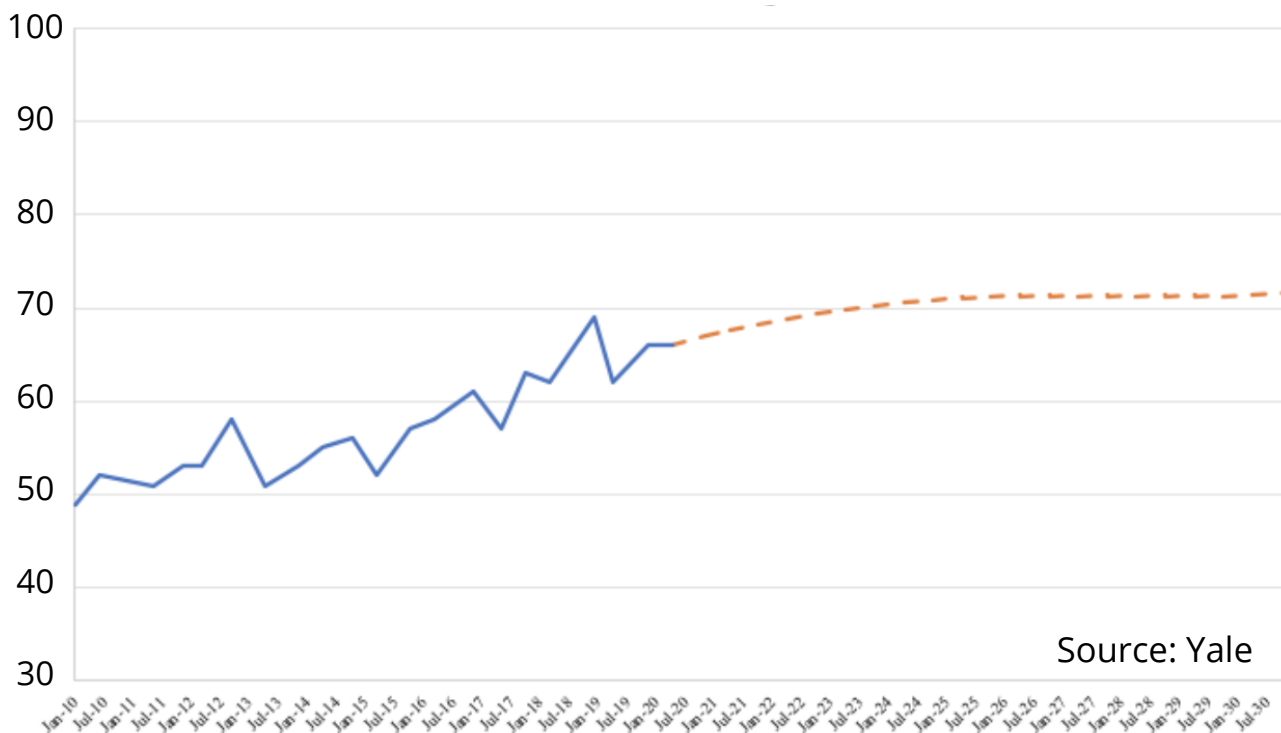
Data from the National Health and Nutrition Examination Survey conducted by the CDC shows an uptick in the percentage of Americans that consider themselves to be on a diet. This trend is reflective of an increased concern for health, as consumers are taking a greater interest in the nutritional value of what they consume relative to previous years. This shift in preferences creates a reshuffling of the typical basket of food products consumers regularly purchase at the grocery store given that Americans are developing more thoughtful perceptions on the healthfulness of the foods they grew up eating. The graph above illustrates the percentage of Americans that are dieting, but a breakdown of types of diets is also available from the CDC; the percentage of Americans who are following a low-calorie or weight-loss diet has increased steadily from 7.5% in 2002 to 10% in 2018 (Gallup). As evidenced by the above graph, more Americans are expected to adopt diets and follow this increasing trend.

The proportion of dieting Americans is partially linked to the obesity epidemic in the United States as well as the availability and affordability of healthier versions of consumer staples. A different CDC report found that the prevalence of (severe) obesity grew from (4.7%) 30.5% in 2000 to (9.2%) 42.4% in 2018 (CDC). As major health organizations such as the CDC continue to publicize information concerning the implications of obesity and develop programs to tackle the obesity problem, the proportion of dieting Americans will rise. At the same time, the increased health consciousness has spurred demand for healthier products and alternatives to substitute long-time favorites, including milk and other dairy products. As companies strive to meet this demand by producing more efficiently, healthier options become more accessible, which further feeds the increased health consciousness seen in the U.S. today.

These trends directly impact annual per capita dairy consumption. As the availability of substitutes with fewer calories and grams of fat increase, consumers can swap milk for less caloric and “healthier” alternatives. Given that the aforementioned linked trends have increased in recent years and are expected to continue, the proportion of dieting Americans is likely to rise over the next decade as well.

Concern for the Environment: Percentage of People Reporting Themselves as Worried about Global Warming (Societal)

*Percentage of Americans at least
"Somewhat Worried" About Global Warming*



Despite decades of public and scientific skepticism with regard to the existence and direness of global climate change, 97% of actively publishing climate scientists agree that global warming and climate change are human-caused phenomena today (Shaftel). A study conducted by the Yale program on Climate Change Communication polled a nationally representative group twice yearly over the last decade and found that the percentage of Americans that report themselves to be either "Somewhat Worried" or "Very Worried" has increased from 49% in January 2010 to 66% in April of 2020 (Leiserowitz et al.).

Public concern about climate change directly impacts the success of the dairy industry. Dairy farms' contribution to the presence of gases such as

methane in the atmosphere is more widely known in the United States than ever before; Kip Anderson's 2014 documentary *Cowspiracy: The Sustainability Secret* exposed the environmentally destructive nature of the dairy industry as well as the lack of initiative, even by leading environmental organizations, to impose restrictions on big dairy. Whether or not dairy factory farms are directly punished or sanctioned for the harm they cause the environment, they can be and have been punished through consumer choices. Sustainability concerns are one of the primary reasons why consumers who previously enjoyed consuming dairy products have switched to alternatives that are produced with a smaller environmental impact. A study by Yale University found that 64% of Americans that purchase plant-based foods do so with the intention of reducing global warming (Hutcherson).

Scientists today believe that global temperatures will continue rising for decades and that this increase will largely stem from destructive human activities. The Intergovernmental Panel on Climate Change, a group of over 1,300 scientists from across the globe, estimates that the net damage costs of climate change will be "significant and...increase over time" (NASA). Despite increasing concerns about global warming, such environmental degradation shows little sign of slowing. Thus, it is expected that concerns about its impacts will only increase as temperatures rise and the planet approaches dire consequences such as deadly heat waves, droughts, storms, and rising sea levels (History.com).

Despite virtually unanimous agreement among climate scientists, still over a quarter of Americans deny that the Earth's temperature is changing at all, for reasons ranging from the fact that the weather has not gotten any warmer (or has actually gotten colder) where they live to the belief that temperature varies naturally, to a trust that God is in control and human action will not bring about any changes Earth's temperature (Bertrand). If the trend observed from January 2010 to April 2020 were to continue exactly, a projected 82% of Americans would be at least somewhat worried about global warming by the end of 2030.

Nevertheless, the prevalence of climate change skepticism is concentrated in a relatively small yet constant proportion of the population. Further, even if all Americans believed in global warming, not all of them would necessarily be worried about it. Thus, it was necessary to flatten this increase in the above graph such that by the end of the decade, the percentage of Americans at least moderately concerned about global warming reaches a more conservative prediction and accounts for the portion of the population that will continue to deny the occurrence of climate change.

Rise in Popularity of Partially Plant-Based Diets (Societal, Qualitative)

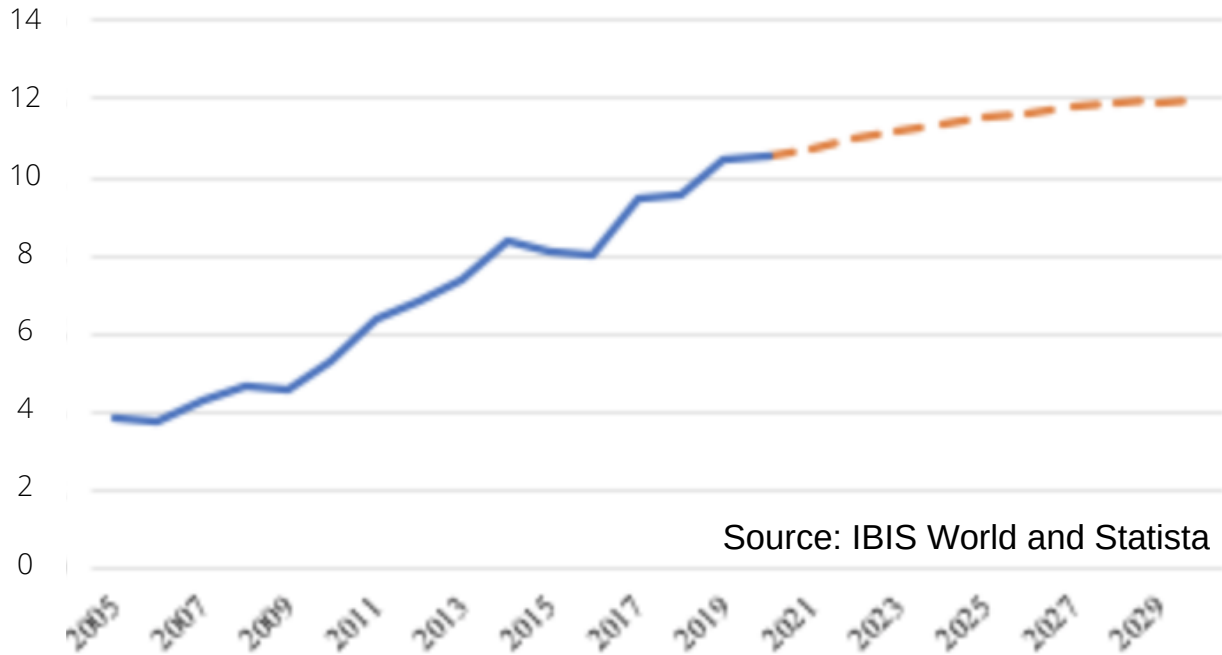
Flexitarian: a person who eats primarily plant-based or vegetarian foods but consumes animal products in moderation

Another nutritional trend contributing to the decline in per capita milk consumption is the increase in prominence of diets that don't entirely exclude dairy products but involve a reduction in consumption of them. A plant-based diet for the noncommittal, the "flexitarian" diet, encourages dieters to eat mostly plant-based foods while allowing animal products in moderation, but not as the major source of calories. More of a lifestyle than a diet, flexitarianism focuses on eating mostly fruits, vegetables, whole grains and legumes and primarily obtaining protein from plant sources (Streit). While followers of this lifestyle incorporate animal products from time to time, they generally opt for plant-based options when available. Year-to-year data on the number of flexitarians is not currently available due to the newness of this trend. This section will therefore focus on a qualitative analysis of its trajectory and impact.

Flexitarianism has become popular over the last decade since the publication of registered dietitian nutritionist Dawn Jackson Blatner's book "The Flexitarian Diet" in 2008 (Cassetty). In January 2020, the US News & World Report consulted input from a group of health experts and published a ranking of 39 diets, in which the flexitarian diet ranked second in "best diets overall" and third in "easiest diets to follow" (U.S. News). Its popularity stems from a combination of its health benefits, smaller impact on the environment than diets including more animal products, and ability for followers to make a positive lifestyle change without depriving themselves of foods they love. A study conducted by OnePoll together with a dairy alternative product company called So Delicious Dairy Free found that of the 2,000 Americans whose eating habits were examined,

31% adopt a flexitarian diet and 59% eat a plant-based meal at least once per day. Additionally, 52% of Americans are attempting to incorporate more plant-based foods into their diets (Gervis). The increase in demand for plant-based foods largely stems from public perception that these foods are healthier and a heightened sense of care for the environment, and greater concern for the conditions faced by animals at factory farms where a majority of dairy products are produced.

The rise in popularity of such diets is in part responsible for the decline in per-capita milk consumption observed in the United States since before the turn of the millennium. It is not an uptick in veganism, under which a small percentage of the population cuts out animal products and therefore dairy altogether, but rather circumstances under which a relatively large percentage of the population reduces its individual consumption of animal products. A Nutrition & Food Poll by Gallup showed the percentage of Americans actively avoiding dairy products increased from 13% in 2002 to 18% in 2018, while the proportion of consumers who actively include dairy products fell from 70% to 64%. The percentage of Americans who consider themselves to be vegans, however, only grew from 2% to 3% over that same period (Gallup). The proportion of Americans totally avoiding dairy is not expected to see a major increase over the next decade, nor is it expected to be the most prominent driver of change in the dependent variable. Based on the totality of data on the matter, one can expect the increase in popularity of diets that call for a reduction of animal products to increase over the next decade as more and more consumers learn about the associated health benefits of a mostly-plant-based diet and feel a responsibility to reduce their carbon footprints.

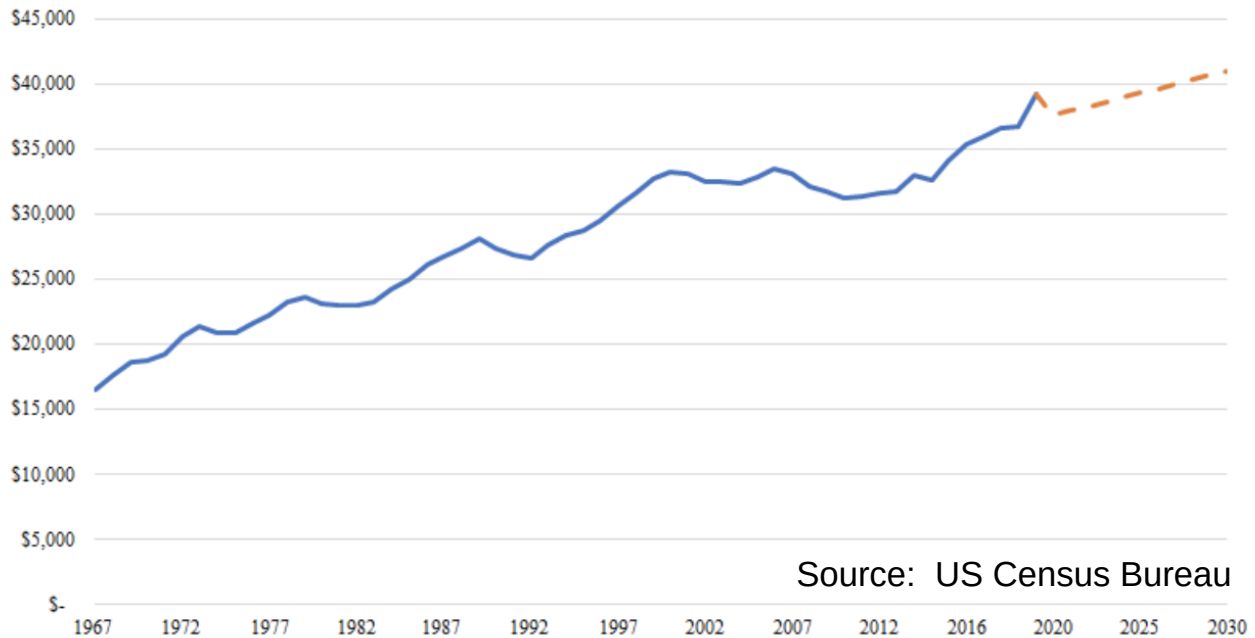
Shift in Market Share from Dairy Milk to Alternatives (Societal)*"Market Share" of Plant-Based Milks (%)*

The trend under evaluation here is the increasing share of the milk beverage market occupied by plant-based "milks." Given how recently this trend originated, there is not proper data available concerning the dollar or percentage market share of the milk beverage market broken down into its components, making it very challenging to compare dairy milk's slice of the pie to that of alternatives such as almond and soy milk. Even more challenging is the fact that data on plant-based milk sales are ubiquitously denominated in dollar sales, whereas for dairy milk these figures may only be found in terms of pounds or gallons of milk. A way to compare the two is to choose a price for milk; the one chosen here was the average price per pound of milk in the United States as of March 2021, or \$0.417, to convert milk sales in pounds to milk sales in dollars. Dividing dollar sales of almond and soy milk by the sum of plant-based dollar sales and this proxy for dairy milk dollar sales gives us a proxy for plant-based milks' market share.

The most comprehensive time trend data was only available for soy and almond milk, though this data is still incredibly useful as those are the two highest grossing plant-based milks currently available for traditional purchase in grocery stores. This metric is imperfect, especially since a 2021 measure of milk price is applied to data from as far back as 2005 and entirely ignores inflation. Despite its imperfections, the intention is to show that the index has been increasing over time; this means that plant-based milk's penetration of the market is increasing, at a cost to dairy milk's share.

One should be slightly wary of this index for the reason that its increase over time should not be surprising, as newer products (plant-based milks) are always expected to grow faster than products that have been around for a long time, such as dairy milk. Dairy is a very mature industry. Despite experiencing little to no growth, its milk sales still make the newer alternative milk sales look trivial. This would be recognizable if data were available to compare the pounds of almond and soy milk produced each year to the pounds of dairy milk. But the simple conclusion from the above graph is that plant-based alternative fluid milk beverages have been, and are forecast to continue, chipping away at dairy milk's share of the overall market.

This trend can be reasonably expected to continue over the next decade as alternative milk producers experience economies of scale as their products gain momentum and their consumption becomes more widespread. Lower prices resulting from these economies of scale would render plant-based products more affordable and in the eyes of the consumer, more substitutable with dairy milk. Other plant-based milks such as cashew milk, rice milk, and hemp milk are even more nascent than soy and almond milk, and there is a chance they remain niche products and their share of the market does not grow much. It is also possible that as producers gain more experience in crafting these revolutionary beverages, the flavor profile and texture of the lesser known alternative milks improves, bringing other options besides soy and almond milk to the spotlight.

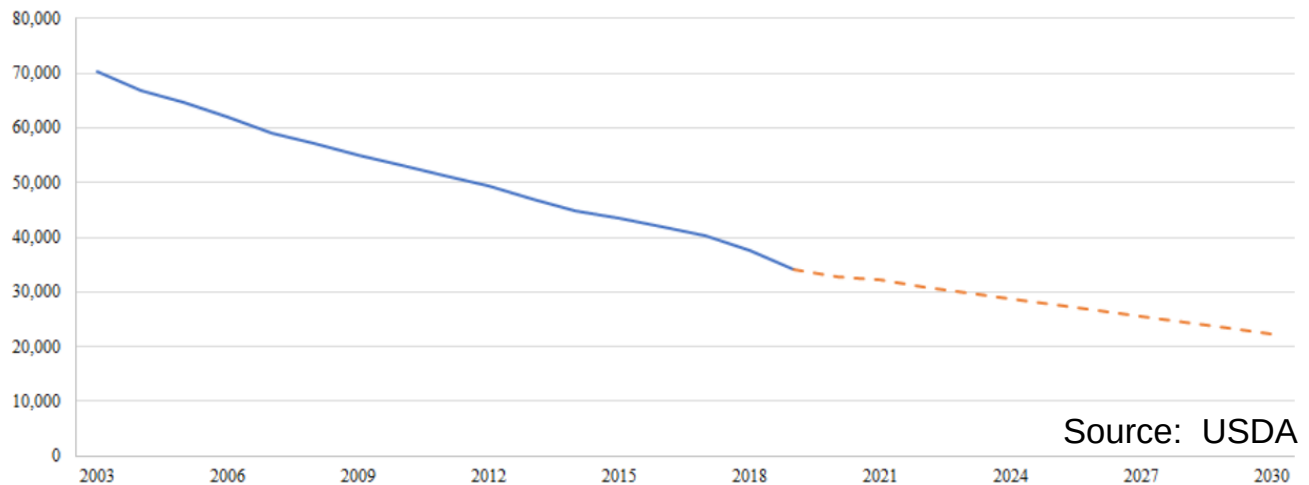
Increase in Per Capita Money Income (Economic)*Per Capita Money Income*

Data from the United States Census Bureau indicates that per capita money income will continue on an incline through 2019, with forecast values supporting this increasing trend through 2030. This demonstrates that with an increasing population, money income has steadily increased and will continue to do so. This is true for all races in the United States, a point of specification in the data. It is also important to note that while this includes all ages, millennials—the drivers of the popularity of plant-based alternatives—lie within this data. For this project, per capita money income pertains to the central question as more options for the consumer are made possible via more funds. If the consumer possesses more freedom to choose, more expensive options, like plant-based alternatives to milk, begin to play a significant role in changing the shape of the dairy industry. When assessing the graph above, it is important to acknowledge that the numeric value of income is calculated in 2019 dollars, meaning values from an earlier date have been Consumer Price Index (CPI) adjusted: a commonplace adjustment used by the government to parallel pricing across time. To note, this adjustment carries over into the forecasting values.

The data shows a significant increase in per capita money income over time: \$16,536 in 1967 to \$39,156 in 2019 in 2019 dollars. The per capita money income more than doubled in 52 years; it is only natural for it to continue to increase given societal, economic, and technological advancements. While innovation drives change, it is striking how the graph above indicates how history repeats itself. In years ranging from 1973 to 1975 and again in the early 1980s, economic recessions and financial distress created dips in the per capita money income. These downturns are alleviated through quantitative easing or an economic boom. An economic boom of note leaving the 1980s and entering into the 1990s was the technological boom. The emerging tech world would drive per capita money income as indicated in the data. This growth came to somewhat of a standstill with the dot com crash in the late 1990s. From the graph, per capita money income does not appear to change significantly until it dips with the 2008 recession (Amadeo). Low interest rates, government spending, and new legislation protecting individual investors brought back the economy and therefore the consumer.

While activity appears to be on the up and up, the global pandemic of 2020 impacted the continued growth of per capita money income, interestingly the forecasting accounts for this. It appears to be a reference to the theory that history repeats itself roughly every ten years. From this slight downturn, a steady increase in per capita money income is expected as employers find at home solutions for employees, making the employee more cost effective and allowing the company to allocate more money into budgets such as wage. With a dip indicative of Covid-19 in 2020, the assumption remains that over the next ten years per capita money income will continue to increase until the next economic recession.

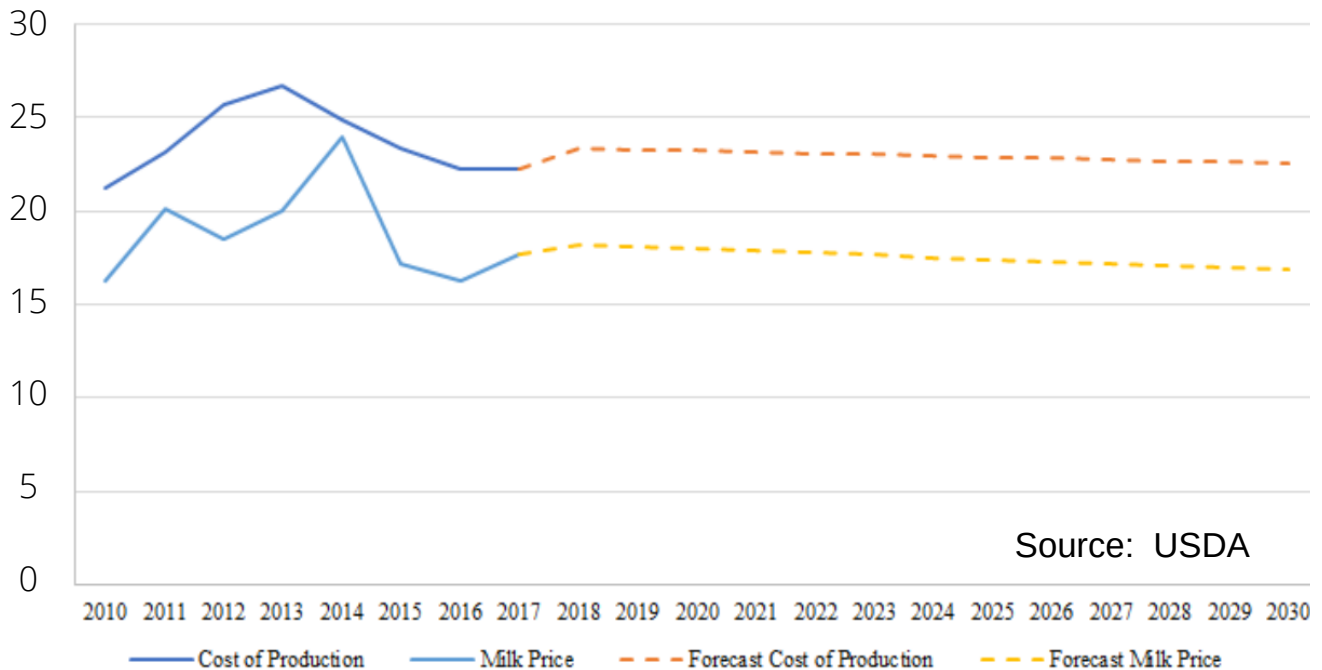
The expected increase in per capita money income is a trend that directly impacts annual per capita dairy consumption. With more money comes more options, today and tomorrow's consumer have more choices to decide between. With regard to the dairy industry, this means that people with the funds can now choose to purchase a plant-based alternative product formed on preferences like taste or health benefit. Budget no longer serves as a dominant deterrent to obtaining a milk alternative and abstaining from traditional milk consumption.

Decline of Licensed Dairy Farms (Economic)*Number of Licensed Dairy Farms*

Information from the United States Department of Agriculture shows that licensed dairy farmers are on a rapid decline, indicating farm consolidation, repurpose, or exit from the industry. Since 2003 up until 2019, over half of the existing licensed dairy farms have disappeared (Acharya). In 2003, there were 70,375 licensed dairy farms. In contrast, there were 34,187 licensed dairy farms in 2019. Given the archaic pricing structure of milk as noted by Tom Gallagher, the industry is in an incredibly strenuous position. Such circumstances make it incredibly difficult to be profitable on a small scale. Being bought out by a larger corporation or breaking away from the dairy industry altogether are options for farmers, especially for small scale or family-run farms.

Farm consolidation is an issue pertaining to the central question as the decline in dairy farms indicates a decline in demand for dairy. If consumers desired large quantities of milk, large quantities of dairy farms would be necessary to meet demand and then supply the product. The declining demand and increasing supply has created this resulting imbalance, causing farm shutdowns across the United States. Milk supply has been in excess for years, and farm consolidation is just one result or form of a solution to the issue.

Unfortunately, these shutdowns harm smaller, family enterprises far more than larger corporations. The forecasted trend projects a continued downward slope for licensed dairy farmers as a result of the currently unchanging archaic pricing structure and larger players, like Land O'Lakes, becoming more dominant as competition shrinks in a relatively stagnant sector. If licensed dairy farms continue to decline at this rapid rate, this will reinforce the larger, overarching trend that milk consumption per capita is declining, despite an increasing number of consumers in the United States market. It should be noted however that these dairy farms are expected to eventually taper off, not dramatically decline to zero in an expedited farm consolidation in the years following 2030.

Cost of Production Exceeds Milk Price Consistently (Economic)*Dairy Milk Costs of Production and Price (\$)*

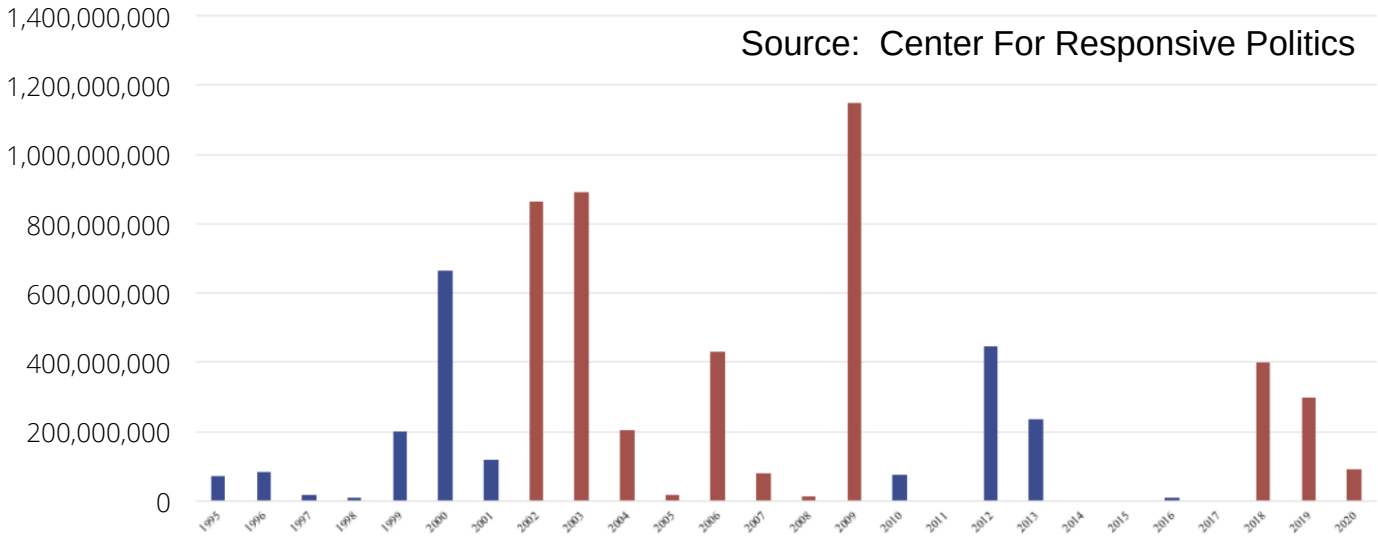
The United States Department of Agriculture reports that the cost of production of milk exceeds milk price historically. As an industry shaped by both economic and natural shifts, hardships appear in the forms of recession, drought, or increasing prices impacted by both economics and harvests such as the price of feed for the animals.

These forces for change have a direct impact on the dairy industry, and their weight tends to eb and flow. Production costs and the price of milk are relevant to the central question of this assignment as these indicators reflect the archaic pricing structure that forces dairy farmers to lag behind in the agriculture sector. This pricing structure creates real pain in the form of farm consolidation when the costs outweigh the benefits for small farmers.

Despite some recovery, with prices peaking at \$23.97 the milk price in 2014 was still less than the cost of production then at \$24.86. As of 2017, milk prices hover around \$15, which shows little to no progress considering the price of milk was roughly the same in 2009 when the

milk market imploded due to the market crash. The forecasting holds the price paid to farmers at around \$17, which is correct by current industry standards. Likewise, cost of production holds at around \$22. Difficulty persists in forecasting the fluctuations in price and production as many different sectors, economic health, and environmental conditions play a role in shaping the dairy industry. The horizontal nature of the lines in the forecast indicate that the situation is not going to be better for the dairy industry at the current rate. At these slightly declining rates, the industry is almost stagnant in pricing structure and cost of production.

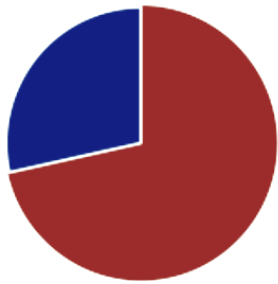
The price paid to farmers and the cost of production is important to the per capita milk consumption as prices tend to increase as demand increases and supply shrinks. That is not the current state of the U.S. dairy industry, however. Currently, demand is low and supply is abundant. The slight decline in the forecasting reflects that as demand decreases the farmers are going to get paid less as low demand equals low prices in order to spur demand.

Federal Support for Big Dairy (Government)*Subsidies to Dairy over Time (\$)*

The graph above shows the dollar value of direct government subsidies paid to dairy farmers from 1995 through 2020. Such subsidies are granted to cover expenses such as marketing, protection for farmers from income loss, and providing margin coverage. The bars are colored to represent the political party in power during that year. Because the level of federal support by way of subsidies is largely dependent on the objectives and agenda of the prevailing administration, there is no clear trend throughout the period and future levels of dairy subsidies are incredibly challenging to predict with any level of accuracy. This section will qualitatively analyze federal support and its expected future impacts on the dairy industry using some quantitative data to support its assumptions.

As evidenced from the graph, the three years in which federal subsidies have been highest since 1995 were 2002, 2003, and 2009, during which the government granted roughly \$862.4, \$891.7, \$1,147.7 million in aid to dairy farms. During these years, the presidents in power were from the Republican party. Such political associations are rather unsurprising given that federal contributions from the dairy industry were split in such a way that about 70% or more of the total contributions were given to the Republican party during these years (Center for Responsive Politics).

Breakdown by Party in Power



The pie chart summarizes the bar graph above and breaks down the sum of all dairy subsidies during the period into those given during Republican presidencies and those given during Democratic presidencies.

Given this information, it is reasonable to conclude that dairy subsidies during the Biden administration, i.e. at least through 2024, will be

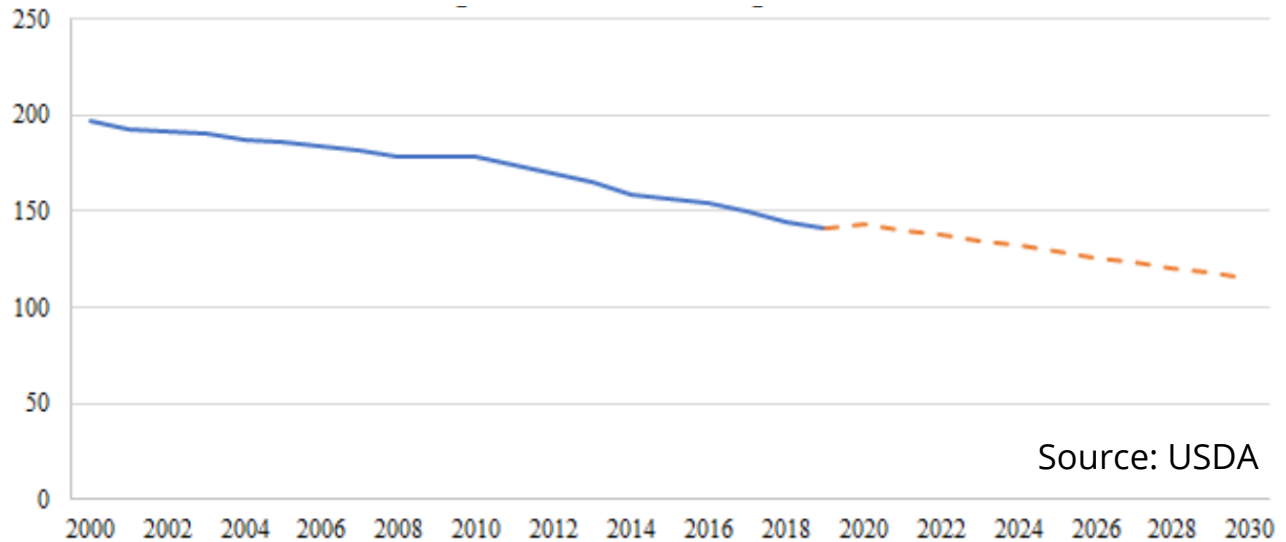
smaller than they have been over the past four years, especially given President Biden's intention to bring climate change to the forefront of his term in office. A helpful metric is to look at the value of dairy subsidies from the Obama administration, which averaged at about \$95.7 million per year. In contrast, the value of subsidies from the last eight years with a Republican president were considerably higher and averaged around \$307.7 million per year. Subsidies under the Biden administration are expected to trend closer to those from the Obama administration.

The dairy industry is incredibly dependent on support from the government. Not only does the industry rely on government subsidies for bailouts during difficult economic times (e.g. during the Covid-19 pandemic), but to keep them in daily operation. Data from the U.S. Department of Agriculture shows that most dairy farms operate at a loss before subsidies are added to the farms' income (Business Insider). Should dairy subsidies fall significantly from what the players in the industry are expecting to receive, many factories and production companies may end up insolvent. In this case, farms will have to shut down or reduce their number of cows. Such consequences would restrict the supply of dairy and ultimately drive prices up, which could serve to further hurt dairy sales. Without enough federal support, giant food companies similar to Dean Foods, which filed for bankruptcy in 2020 citing declining fluid milk consumption as the reason for its demise, could meet a similar fate.

It is important to note that subsidies are not the only way in which the government supports and influences the dairy industry, as many works of legislation have been and can be expected to continue to be passed by Congress, which are extremely difficult to quantify. A dollar amount is a very helpful gauge at the level of governmental support the dairy industry receives, though it does not encompass all of this support.

Cumulative Impact on Dependent Variable

Per Capita Milk Consumption in Pounds



The dependent variable measuring the answer to the central question is per capita milk consumption measured in pounds. Eight trends from the independent variables shape this dependent variable. Across the board, these independent variables have a negative impact on the per capita milk consumption. The independent variable trends that impact the dependent variable the most to least are: increased health consciousness, concern surrounding global warming, rise in popularity of partially plant-based diets, shift in market share from dairy milk to alternatives, increased per capita money income, cost of production exceeding milk price, decreasing number of licensed dairy farms, and dairy subsidies. The general negative impact these trends have on per capita milk consumption created the logical forecast result that per capita milk consumption is decreasing; however, the forecast does not suggest it will decline rapidly to zero. Over time, consumption will taper off to a lower consumption level in close competition with plant-based alternatives, which over time will increase in availability, affordability, and consumption.

Cumulative Impact Determination

Trend	Indicator	Trajectory	Impact on Per Capita Milk Consumption
Health Consciousness	Percentage of Americans aged 20+ on a diet	Increasing	Negative - More alternatives and the awareness of them cause consumers to swap dairy milk for less caloric alternatives.
Concern Surrounding Global Warming	Percentage of Americans who are at least "somewhat worried" about global warming	Increasing	Negative - A growing concern for the environment drives consumers to be more conscious about the products they consume, and dairy produces a significant amount of carbon emissions
Popularity of Partially Plant Based Diets (Qualitative)	Rise of new lifestyles such as flexitarianism	Increasing	Negative - Increase of popular diets that require a reduced intake of dairy.
Shift in Market Share from Dairy Milk to Alternatives	Proxy for market share of plant-based milks created by the team	Increasing	Negative - Rising popularity of dairy alternatives visible through market share shows a decline in consumption of dairy milk relative to alternatives.
Increased Per Capita Money Income	Per capita money income	Increasing	Negative - More income presents the consumer with more options. With more alternatives to dairy, consumers are presented with and sometimes choose the alternative, driving dairy milk consumption down.
Decline of Licensed Dairy Farms	Number of licensed dairy farms	Decreasing	Negative - The closing of dairy farms indicates a decline in demand.
Cost of Production Exceeding Milk Prices	Comparison of historic milk production and sale prices	Decreasing	Negative - The poor pricing structure reflects why dairy farmers are forced to leave the industry and simultaneously shows how the demand for milk is low.
Dairy Program Subsidies	Historic dollar amount of dairy subsidies and breakdown by party in power	Ambiguous	Ambiguous - While the Biden administration can be expected to support the dairy industry less than the recent Republican administrations have, there is not enough information to determine the exact level of subsidies in each year with any precision.

Future Scenarios

Method

The alternative futures scenario development method was chosen to forecast scenarios for the dairy industry because major societal transitions relating to dairy are likely over the coming decade. Additionally, the archetypes associated with this method—growth, constraint, transformation, and collapse—closely match expected outcomes.

The double uncertainty scenario matrix and aspirational futures methods were both considered, but were determined to be less suitable for the dairy industry than the alternative futures method. The dairy industry is subject to several uncertainties, each of these with the potential to substantially influence future outcomes. A double uncertainty method would limit us to examining only two potential uncertainties. With the interests of dairy farmers, companies, and other parties in the dairy supply chain at odds with the interests of the dairy alternatives industry, the environment, and certain consumers, no consensus on a preferred future for the dairy industry exists. Therefore, neither the double uncertainty matrix method nor the aspirational futures method are a strong enough fit for this scenario forecasting.

Uncertainties

There are four major uncertainties within the dairy industry that could drive the disruption resulting in the alternative scenarios. These are the popularity of plant-based alternatives, government action, innovation of methods for replacing dairy products, and the financial positions of the dairy industry's major players.

Plant-based alternatives are the primary substitute for dairy products. Over the next 10 years, the growth of one industry will likely come at the expense of the other. The extent to which American consumers favor plant-based products therefore has a direct impact on their consumption of dairy products. Plant-based diets and lifestyles such as flexitarianism have grown in popularity in recent years. Whether this trend continues, levels off, or fizzles out will have critical implications on resulting scenarios for the dairy industry.

Government action helped propel the dairy industry to near universality in American life by the end of the 20th century. Several policy measures have promoted dairy milk through marketing campaigns and dietary guidelines, financially supported dairy producers, and required milk to be served in school lunches. Whether government action continues to support the dairy industry, pulls back with a more hands-off approach, or even turns against it will determine the industry's profitability and therefore its ability to continue operating through the next decade.

The deep pockets of the dairy industry's largest companies and lobbying groups have been a driving force behind these favorable policies. The financial positions of these major players thus constitute an uncertainty that will affect which scenario dairy moves towards. In this section, the possibility of bankruptcy for dairy companies is considered. If dairy's biggest companies are unable to meet their debt obligations, not only will their influence over policy shrink but so will their likelihood of survival. Widespread bankruptcies across the dairy industry would bring the industry as a whole closer to collapse.

Innovation is a driving force for disruption in any industry. The dairy industry has experienced little to no innovation over the past several decades, so the level of innovation in both dairy and dairy's competitors serves as an uncertainty with significant implications for future scenarios. A new technology that stands poised to disrupt the status quo is lab-grown dairy. Lab-grown dairy products, grown in tanks from microbes, are nutritionally and chemically identical to their cow-sourced counterparts. The key difference is that lab milk requires no cows, no land, and no feed, making it much more sustainable. An innovation on the plant-based alternatives side is nut milk concentrate in the form of a paste. This product is also relatively new and is a more sustainable, convenient, and perhaps less expensive alternative to nut milk in cartons.

Analysis of these four uncertainties and the ways in which each of them could play out informed the scenario narratives in the next section.

Scenarios

**Constraint: "Condensed Milk"** (Expected)

Consumers' increasing purchases of alternative dairy products signal a decline in the traditional dairy market.

**Transformation: "Milkshake"** (Preferred)

Transformation of the dairy industry has primarily been driven by innovation of more sustainable, efficient, and transparent methods of production.

**Growth: "Whole Milk"**

The growth of the dairy industry is primarily due to efforts to meet consumer demands for increased sustainability and health.

**Collapse: "Spoiled Milk"**

The dairy industry collapses due to the rise of plant-based and lab-grown alternatives, failure to innovate, and concerns around sustainability and nutrition.

Condensed Milk (Constraint, Expected)

In 2030, the dairy industry has seen growing competition from alternative dairy companies that epitomize the sustainable and health benefits of their products. The growth of the alternative dairy industry throughout the 2020's was largely attributed to shifting consumer preferences for more sustainable and healthier options. Millennials and Gen Z consumers drove much of this growth, largely in the plant-based milk category. With many consumers wanting to minimize their environmental impact, the past decade has been favorable for more sustainable dairy alternatives since these brands marketed themselves as the "better for the planet" option.

The 2020's was an impactful decade for shifting consumer habits as environmental concerns and consequences of global warming continued to accelerate. Throughout the past decade, increasing natural disasters and a rising global temperature alerted more people to the urgency of climate change. Thus, consumers wanted to make a change in their own lives to feel like they were helping the planet in some way, which aided the rise of plant-based dairy alternatives at the expense of dairy.

The dairy industry was credited with contributing to a substantial part of agricultural emissions with cattle emitting large amounts of methane. With an increased sense of urgency resulting from growing climate disasters, people were looking for ways to quickly limit global warming. Since methane warms the planet much quicker than carbon dioxide, limiting methane emissions from cows became a greater priority. By the mid 2020's, consumers were beginning to increasingly shift preferences from dairy products to plant-based alternatives. This was aided by newly released independent research studies in 2025 that demonstrated the disastrous impacts of the agricultural industry on the environment. Dairy played a large role in both methane emissions and water contamination, which further diminished public perception. Linked with growing consumer preferences for sustainable and healthy products, dairy could not keep up with plant-based alternatives. Sales for dairy slowly and steadily declined in the past decade as plant-based sales soared.

Limited innovations and a lack of transparency in the dairy industry also contributed to its steady decline. Stagnant developments in technology and collection processes of dairy coupled with increasing innovations from plant-based dairy companies like the utilization of lab-grown dairy in 2022, significantly decreasing traditional dairy's consumption. Consumers were able to enjoy the taste of cow's milk with all the beneficial nutrients but without as big of an impact on the environment. Currently, lab-grown dairy is still only a constraining factor to dairy, but it looms large over the whole industry with the potential to overtake the market. Additionally, dairy companies were generally not as transparent in their processes and food supply chain as plant-based dairy alternatives, which continued to hurt dairy.



Government regulations and tighter emissions policies put pressure on the dairy industry which furthered its decline. During the Biden administration, rejoining the Paris Climate Agreement began a string of regulations on the agricultural industry that directly impacted dairy.

The U.S. presidential election of 2024 and 2028 created highly politicized situations around climate change and how much the government should be regulating industries like agriculture. Ultimately, with increasing climate disasters and extreme events from global warming, the general sentiment favored increased regulations. Large dairy lobbyists no longer had as much influence over climate policies given growing public demand for government action against polluting parties, including dairy.

Several signposts strongly indicate the decline of dairy, including increasing consumer preferences and awareness for sustainable and healthy products, a growing concern for climate change and the impacts dairy has on the environment, limited innovation, and increased government regulations. Consumers increasingly purchasing plant-based and lab-grown dairy products signal a decline in traditional dairy due to shifting preferences towards products that minimize environmental impacts. The early indicators that most strongly represent this scenario are the consumer preferences that are already beginning to shift toward sustainable products coupled with increasing climate-induced events that will likely accelerate this change. Plant-based dairy alternatives marketing the sustainability of products compared to that of dairy further signals early constraints on the dairy industry.

Milkshake (Transformation, Preferred)

After several decades of technological stagnation, the dairy industry underwent unprecedented transformation between 2020 and 2030. Waste is being repurposed in a new circular economy, more sustainable farming practices are being employed, and there is more transparency than ever.

As a result, the decline in demand for dairy products that led into the early 2020s has slowed down, alleviating some financial pressure on the dairy industry, which has adapted well to trends that would have otherwise resulted in its downfall. The type of demand has changed, however, in that consumers generally no longer drink milk on its own, but use it in coffee and tea drinks, yogurt, cheese, and cereal.



By the early 2020s, consumers, the government, and dairy farms could no longer ignore the wastefulness of the existing system for dairy production. The Biden administration began working with environmental advocacy groups and dairy farmers across the country to implement a “circular economy” driven by policy and innovation. Agricultural waste, mainly cow manure, is now being repurposed, opening up opportunities for new revenue streams (Driscoll). Currently, most repurposed waste is directed towards more efficient use of increasingly scarce farmland. But producers of lab-grown milk are starting to use agricultural waste to feed microbes and produce lab milk and cheese identical to the real thing.

In response to widespread consumer demand for more sustainable dairy, and facing pressure from a thriving plant-based dairy alternative industry, dairy farms have transformed their processes. An easily identifiable change is that farms have become much smaller. This is made possible by innovation of methods for getting more milk out of each cow while requiring less land and emitting less pollution.

Dairy farms in 2030 also look much different than they did 10 years ago in terms of their use of digital technology for transparency. Consumers and governmental bodies alike have called for increased transparency out of all food and beverage industries, but especially one as ubiquitous as dairy. Advanced technologies allow for better supply chain traceability, logistical efficiency, and visibility of supply chain risks (Driscoll). This increase in transparency not only allows all parts of the dairy supply chain to operate more efficiently, but is well-received by consumers that now expect it more than ever from what they eat and drink.

With regard to signposts, an indicator is a reduction in dairy farm area and number of cows relative to milk output. This shows a more efficient use of land and livestock indicative of technological change in farming practices. Another signpost for transformation is the Government's legislation called the Circular Economy in Agricultural Act. Built into the act are monetary incentives for farmers to direct waste for repurposing. A third signpost is implementation of digital technology (e.g. AI), in the dairy supply chain. These technologies provide real-time insights to farmers, consumers, and manufacturers and show a shift towards transparency in the industry.

Whole Milk (Growth)



Though the dairy industry saw a slow decline in the early part of the 2020s with plant-based alternatives growing, dairy rebounded the rest of the decade because the alternative dairy industry leveled off. Dairy has been able to continue growing as a result of several factors,

including an increased focus on meeting consumer demands of sustainability and health, shifting public perceptions, reducing its impact on the environment, and an overall growth of consumer's disposable income.

With growing public concerns for climate change, consumers began to increasingly shift their buying habits toward more sustainable products. Since plant-based dairy products were marketed as the more sustainable option, this industry saw rapid growth for several years. However, the dairy industry was able to capitalize on the same trend of consumers shifting to eco-conscious buying by creating and marketing products as better for the environment. Improved farming practices and more sustainable packaging helped the dairy industry reduce its carbon footprint, ultimately boosting public perception. Also, big dairy gained a major win in the mid 2020's when new research studies began exposing several large plant-based dairy companies for false claims of being better for the planet. Almond milk producers and other similar companies took a beating when independent researchers demonstrated how much CO₂ was emitted and how much water was used in their processes. For a long time, the dairy industry was criticized for its impact on the environment which gave rise to more "sustainable" alternatives. But these new studies crippled the alternative dairy industry and coupled with dairy's strides in reducing its environmental impact, consumers began to shift back to traditional dairy as their first choice. More dairy farmers and companies pledged to reduce their emissions and become carbon neutral by 2050. Part of how the dairy industry began to take steps against climate change was to tackle methane emissions by implementing methane digesters which transformed manure into energy. This not only provided dairy with an additional revenue source, but greatly improved public views on the industry since it was becoming more green.

Also, dairy responded positively to increasing regulations on agriculture from the Biden administration to reduce emissions and improve water usage efficiencies.

Increasing the nutritional value and health components of dairy products was another key development of the 2020's that led to major growth. To meet consumer preferences for healthier products, many dairy companies began adding healthier varieties to their product mix at a higher price point. The dairy industry spent millions of dollars throughout the 2020's on a marketing campaign centered around milk and other dairy products being a crucial part of the American diet. This campaign was meant to improve public perception of dairy products and epitomize the added healthy qualities like probiotics, low-fat, calcium, and protein. Since many American consumers desire healthier products, the healthy dairy campaign was an incredible success. Dairy sales in 2030 tower over plant-based alternative sales as the traditional dairy staples have become just as healthy or even healthier than its plant-based counterparts. Consumers generally prefer dairy over alternatives because of the health benefits and the strides the dairy industry has taken to reduce its emissions.

Rising disposable income in the U.S. was another crucial factor involved in the growth of the dairy industry over the past decade. In 2030, the average American consumer is able to buy more or at higher prices, which the dairy industry has reaped several of the benefits. By creating healthier and more sustainable dairy products, dairy companies are able to now charge premium prices to a consumer base that is more willing and able to purchase these products.

The major signposts driving this scenario towards reality are dairy's attempts to reduce its environmental impact, improving the health benefits of dairy products, and increasing consumer concern for climate change. Increased attention to sustainability practices throughout dairy's production and supply chain signal how the industry is meeting shifting consumer demands for products that have a minimal impact on the environment. Another early indicator of dairy's growth is the development of new innovations to reduce its impact on the environment and adaptation to changing consumer preferences for healthier products.

Quick responses to government regulations on emissions by implementing methane digesters to turn fertilizer into energy signal dairy's willingness to minimize its carbon footprint and bolster its public image. Also, increased options of healthier milk products to compete with plant-based alternatives reveals how big dairy responds to consumer demands, ultimately contributing to growth in the industry.

Spolied Milk (Collapse)

Americans in 2030 almost exclusively consume plant-based and lab-grown dairy alternatives to the point where they are no longer considered alternatives but the norm. Dairy products are consumed mainly by the baby boomer generation, which is reaching life expectancy. Over the past decade, public sentiment around dairy products followed a similar trajectory to that of fast food and cigarettes when they went from unquestioned staple to almost universally regarded as harmful. This negative outlook is mainly focused on sustainability concerns, but there is ample evidence that dairy products carry health risks as well.

What used to be the largest dairy conglomerates have mostly declared bankruptcy. Those with the balance sheets and foresight to do so transitioned over to plant-based products. Lobbying groups that, with the former industry leaders, made up "big dairy" have lost their once deep pockets and in turn, their influence over policy.



As a result, government action has pulled back on their support of the dairy industry. The National School Program has been amended so that milk is no longer a requirement for school lunches. The government no longer subsidizes the dairy industry by buying billions of dollars of excess milk (USDA).

No longer propped up by the government and with little demand left for their products, dairy milk farmers have had their livelihoods ruined. Other kinds of farmers of corn, wheat, and oats have suffered since they produce what is fed to milking cows, but not nearly to the extent that dairy farmers have. The plight of dairy farmers and the farming communities they belong to has been made visible by protests across the United States demanding government help.

With the collapse of the dairy industry has come the rapid ascension of the plant-based milk and lab-grown milk industries. Plant-based products such as almond milk, soy milk, and oat milk are significantly cheaper than they were a decade ago. However, they are facing increasing competition from lab-grown milk, which has benefited from economies of scale and good publicity and is currently cheaper than plant-based products.

There are, however, growing concerns over the health impacts of diminished consumption of dairy products. Though most American consumers believe plant-based alternatives are healthier than dairy products, there are worries about how the transition away from dairy will impact children who are no longer growing up on a government-recommended steady supply of milk.

A signpost that indicates the collapse of the dairy industry is a steep decline over the last decade in dairy consumption per capita. The decline is more extreme with younger generations, but there has been a clear downward trend across all demographics. This is matched with an equally steep rise in per capita consumption of plant-based and lab-grown dairy alternatives. A signpost indicative of a change in consumer preferences and spending power of dairy advocacy groups is the transition of overall marketing efforts away from pro-dairy and towards pro-plant-based. The plant and nut based industries read the blueprint that made dairy successful and are spending significant amounts on marketing campaigns. A signpost that reveals the impact of dairy's collapse on dairy farmers are nationwide protests from farmers who travelled from their farming communities to major U.S cities to demand assistance from federal and state governments, mainly for the continuation of subsidies.

INSIGHTS

Emerging Threats to Potential Outcomes

When business planning, developing forecasts, and concocting insights, it is always important to factor in and prepare for complications and obstacles. With regard to the dairy industry, one or more emerging threats could be an issue whether the industry is facing a trajectory of growth, constraint, transformation or decline.

Emerging threats that are notable include adverse movements in feed and milk prices: this reflects and amplifies the archaic pricing structure prevalent within the industry. Adverse movements in feed and milk prices mean that costs are rising and revenue is declining. This is indicative of the declining demand for milk and these elements combined result in farm consolidation. The declining revenue could be further impacted by current and future trade wars. Of late, the U.S. dairy industry has heavily relied on exports to Asia as a means of revenue. This reliance is problematic, however, as tensions are rising between the U.S. and specific countries in Asia, such as China, that have a huge market the U.S. dairy industry needs to hold its position in so that the industry can stay afloat (Newburger).

Insights and Implications: Constraint

Emerging Opportunities

In the event of the constraint scenario, the popularity of plant-based alternatives are expected to increase considerably. This future allows for more competitors to enter the market and introduce their own lines of milks and plant-based alternatives.

As for current dairy farmers, the constraint scenario will urge dairy farmers to shift its production or go out of business entirely. Given the expected increase and sustained popularity of alternative milk products, dairy farmers might be more inclined to start producing these products with their current land and resources. Even if current farmers decide to halt milk production, farmland used to produce cows' milk could be repurposed into a more sustainable production, which would be another positive outcome.

Another opportunity is the increased exploration and adoption of lab-grown milk. While many consumers presently have embraced the textural and flavor differences of dairy-free milks, these products do not truly replicate dairy milk in taste or nutritional profile because they lack the proteins that are intrinsic to dairy. Conversely, lab-grown dairy better mimics the consistency of traditional dairy. Given that the declining demand of dairy milk is projected to continue, lab-grown milk could increase its dominance in the future if produced and marketed appropriately. Not only does this present an opportunity for lab-grown milk producers specifically, it also opens an opportunity for the technology producers to collaborate with lab-grown milk producers and existing farmers.

Response Strategy

Constraint is driven by the rise in popularity of plant-based alternatives and their companies that emphasize the sustainable elements and health benefits of their products. Plant-based alternatives are making their way onto shelves in restaurant chains, grocery stores, and personal refrigerators.

The response strategy to the growing competition from alternative product companies involves communicating and promoting the healthy properties milk holds as well as the sustainability efforts in place to combat carbon emissions. While Millennials and Gen Z are driving the rise in popularity of plant based alternatives, it may be wise to market to boomers and an aging population that is living longer due to advances in health and technology. At the same time, it could be worthwhile to reinforce the nutritional benefits of milk for children through an ad campaign similar to “Got Milk?” from the 1990s, early 2000s. Lastly, with constraint, there is enough evident possibility for the survival of the dairy industry that government subsidies could be used as a means to keep the dairy industry afloat.

Moral Ethical Considerations

Constraint in the dairy industry has rather harmful implications for dairy farmers who are struggling to make a profit, especially those family run businesses. In a free capital market, it is important for failing businesses to phase out in order for new businesses to arrive and thrive: a process called creative destruction. However, this has moral implications because as aforementioned, constraint in the dairy industry has real world consequences for dairy farmers: the extreme being to exit from the industry altogether and/or struggling to make ends meet. This ethical consideration is why government subsidies exist and persist today. However, while these funds momentarily save dairy farmers, it allows an archaic system to persist that may be creating more harm than good.

Insights and Implications: Transformation

Emerging Opportunities

The transformation scenario presents a unique opportunity for the dairy industry to establish itself as a leader in the sustainability realm. Given that this scenario is driven by innovation—particularly with regard to technology—there will likely be considerable investment with regard to the research and development of sustainable technologies.

In addition to technological advancements, this scenario also expects to see innovation with regard to the byproducts created by dairy milk production. While some byproducts are currently discarded, the future presents an opportunity to use such resources (e.g. manure in energy production). The advancement of sustainable alternatives will undoubtedly help facilitate this shift.

Another emerging opportunity is the collaboration with the dairy industry and environmental organizations. If these two entities work together to increase the sustainability of the industry, milk could regain its dominance given its more sustainable reputation.

Response Strategy

Transformation is spurred by innovation. While dairy has been a relatively stable consumer staple, new revenue streams are becoming available through repurposed waste. Innovations in sustainable farming practices and technology are also very exciting, resulting in smaller farms that are more efficient by getting more milk out of less cows. This allows for less land to be utilized and results in less greenhouse gas emissions. Aided by advanced technology such as AI and cloud computing, there is more transparency than ever in dairy's supply chain. There is also opportunity in working with legislators and the government. With regards to the new administration, the next few years could possibly be very invigorating for the dairy industry as the Biden administration has begun working with environmental advocacy groups and dairy farmers.

This has been done with the intention of implementing a sustainable “circular economy” across the country.

Moral Ethical Considerations

A majority of the ethical considerations that come to the forefront with transformation involve the failure of late adopters as innovations become the norm. Being able to survive in the dairy industry could come down to having the funds to acquire this expensive technology that decreases long term costs. Transformation has the possibility to further exacerbate the issue of the decline in licensed dairy farmers and bring large conglomerates to the forefront. Also, there are some potential animal rights issues that come to play when forcing cows to produce more milk rather than just milking more cows. This could be seen as abusive if the machinery overworks the cow. The ability to obtain more milk could also be the result of hormones, which could potentially be harmful to the cow, and the usage of hormones would have negative implications for the image that dairy would try to present in the transformative phase. It could be seen as disingenuous to act like the industry is helping the planet by using less land and less cows while potentially mistreating the animals.

Insights and Implications: Growth

Emerging Opportunities

Similar to the transformation scenario, the growth scenario also presents an opportunity with regard to improving the industry's reputation. This scenario encourages increased research and development of healthier milks and production and distribution of milk products in order to meet shifting consumer preferences.

Response Strategy

Advances in sustainability are accomplished through improved farming practices and more sustainable packaging that continue to reduce the industry's carbon footprint and attract eco-conscious customers who have been shying away from dairy products in recent years. As consumer preferences shift to prioritize sustainability, the promotion and communication of the eco-friendly nature of the dairy product helps to actively engage consumers in the market, potentially turning them away from plant-based alternatives. Advances in sustainability promote public perception which in turn positively impacts sales. Continued efforts to amplify the nutritional aspects of dairy products will help to touch into a wider audience who are intrigued by the health benefits of probiotics, low-fat dairy options, calcium, and protein. Rising disposable income helps the growth of dairy by allowing for consumers to afford milk at higher prices, driven up by the creation process being amplified scientifically and accounting for sustainability.

Moral Ethical Considerations

While the growth of the dairy industry has positive financial implications for farmers and larger institutions, it holds ethical implications as well. The influx of money created from growth adds ethical implications in and of itself. Money creates opportunity for corruption, and this corruption can hinder public reputation, stakeholder trust, and employee satisfaction. The growth also creates potential for the rise of carbon emissions. Growth insinuates more machinery, more animals, more manure, larger farms, and larger transactions that create emissions via production and distribution.

Insights and Implications: Collapse

Emerging Opportunities

The collapse scenario also results in similar opportunities as the constraint scenario with regard the repurposing of existing dairy farms and lab-grown milk. Unlike the constraint scenario, such shifts will occur at a greater degree given the projected decline of the industry. Current dairy farmers have limited options to remain in the industry and, thus, must consider other opportunities to maintain their livelihoods.

Response Strategy

The response strategy to collapse could include exit from the industry entirely or pivoting to produce the plant-based alternatives that most likely will have become the norm in this instance. This response strategy is ultimately one of damage control in which farmers and dairy conglomerates would have to try to mitigate losses. For example, some may have to file for bankruptcy, sell the land for other agricultural endeavors, or repurpose their facilities. More indirectly, other stakeholders will need to pivot into other industries or a different agricultural sector to maintain businesses operations in distribution, for instance.

Moral Ethical Considerations

In terms of ethical considerations, the collapse of the dairy industry would have a ripple effect on a variety of stakeholders, including families of farmers that have worked in the industry for generations. It could be difficult and a financial hardship to transition out of the dairy industry or agriculture altogether if that is all someone is trained for. While collapse presents hardship to the people involved, it provides relief to animals who no longer have to be overworked or exploited for their milk. From a climate perspective, collapse would greatly reduce carbon emissions and water usage and open up hundreds of millions of acres of land for reforestation.

CONCLUSION

Over the last century, the United States has seen dairy, especially fluid milk, emerge as a consumer staple, be entrenched in American life for decades, and begin a steady decline. This report has thoroughly examined where the industry has been, where it is now, and where it is going. A current assessment showed a dairy industry having experienced a history of strong government and societal support. It also revealed a downward trajectory in consumption and the challenges the industry must now face in an attempt to reverse this trajectory. The societal, environmental, economic, and governmental trends that have driven dairy's decline were analyzed and used to forecast out into the next 10 years an expected scenario of *constraint* marked by consumers favoring dairy alternative products at the expense of traditional dairy. Alternative future scenarios were also given based on uncertainties with the potential for disruption. The preferred scenario of *transformation* would be driven by innovation and characterized by a more sustainable, efficient, and transparent production system. A *growth* scenario would be one of rebound due to successful efforts to meet shifting consumer demands. Finally, a scenario of *collapse* represents a total takeover of lab-grown and plant-based alternative products and the abandonment of dairy by American consumers over health and environmental concerns. Each of these futures present opportunities for businesses and governments to innovate sustainable, healthy, and efficient solutions to problems that consumers of dairy and dairy alternatives take seriously.

All stakeholders in the dairy industry and rival alternatives industries must be aware of significant changes in the relationship between consumers and the products they eat and drink. Americans are becoming more cognizant of the environmental and nutritional impact of decisions around their diet.

Rising disposable incomes allow them to spend in accordance with these concerns. Unprecedented access to information provides a limitless bounty of knowledge about the process behind and makeup of foods and beverages and illuminates alternative choices. It also dispels a reliance on government and other heavily-funded sources for information. Americans are therefore less malleable to government-backed marketing campaigns, but farmers are and will increasingly be reliant on government subsidies. With a rapidly-changing, unpredictable political climate, neither this nor anything else is guaranteed. Between consumers and governments, dairy farmers and soy farmers, established companies and innovative start-ups, there will be winners and losers over the next 10 years and beyond. Regardless of whether you want to see dairy retain its longtime status as a valued American foodstuff or fall to more sustainable and healthy alternatives, it is crucial to be open and flexible to positive change that may advance the flourishing of humans and the planet.

WORKS CITED

Acharya, Pramod. "There Are Half as Many Dairy Farms as There Were in 2003." *The Counter*, 25 Sept. 2020, thecounter.org/dairy-farms-decline-half-since-2003-usda/#:~:text=There%20are%20less%20than%20half,just%20over%2070%2C000%20in%202003.

Amadeo, Kimberly, and Brian Barnier. "Why Recessions Happen in the U.S." *The Balance*, 29 May 2020, www.thebalance.com/the-history-of-recessions-in-the-united-states-3306011.

"American Dairy Farmers Depend on Government Subsidies." *Business Insider*, Business Insider, 8 Feb. 2018, markets.businessinsider.com/news/stocks/american-dairy-farmers-depend-on-government-subsidies-1015126442#:~:text=The%20study%2C%20w%20high%20focuses%20on,to%20the%20U.S.%20dairy%20sector.

"Animal Products." *USDA Economic Research Service*, USDA, www.ers.usda.gov/topics/animal-products/dairy/policy.aspx.

"Archived: Food Guide Pyramid." *U.S. Department of Agriculture*, www.fns.usda.gov/FGP.

Baur, Gene. "The Best Way to Help Dairy Farmers Is to Get Them out of Dairy Farming." *The Washington Post*, WP Company, 12 June 2019, www.washingtonpost.com/opinions/2019/06/12/best-way-help-dairy-farmers-is-get-them-out-dairy-farming/.

Bertrand, Natasha. "Here's Why People Don't Believe In Climate Change." *Business Insider*, 25 Nov. 2014, www.businessinsider.com/public-religion-report-climate-change-2014-11.

Boisseau, Anna. "2020 State of the Industry: Cheese Is Flying High." *Dairy Foods RSS*, Dairy Foods, 17 Nov. 2020, www.dairyfoods.com/articles/94649-state-of-the-industry-cheese-is-flying-high.

WORKS CITED

"Bovine Somatotropin (BST)." U.S. Food and Drug Administration, FDA, 2021, www.fda.gov/animal-veterinary/product-safety-information/bovine-somatotropin-bst.

Bowden, Bridget, "How We Produce More Milk With Fewer Cows." Wisconsin Public Radio, National Public Radio, 14 Dec. 2017

Bryner, Sarah. "Influence & Lobbying - Dairy." OpenSecrets.org, www.opensecrets.org/industries/indus.php?ind=a04&cycle=All.

Burke, Niamh. "The Dairy Industry: Process, Monitoring, Standards, and Quality." IntechOpen, IntechOpen, 5 Nov. 2018, www.intechopen.com/books/descriptive-food-science/the-dairy-industry-process-monitoring-standards-and-quality.

Capper, Judith L, and Roger A Cady. "The Effects of Improved Performance in the U.S. Dairy Cattle Industry on Environmental Impacts between 2007 and 2017." Journal of Animal Science, Oxford University Press, 1 Jan. 2020, www.ncbi.nlm.nih.gov/pmc/articles/PMC6978902/.

"Climate Change History." History.com, A&E Television Networks, 6 Oct. 2017, www.history.com/topics/natural-disasters-and-environment/history-of-climate-change.

"Cooperatives In the Dairy Industry." United States Department of Agriculture, 2005, www.rd.usda.gov/sites/default/files/cir1-16.pdf.

Curtin, Melanie. "73 Percent of Millennials Are Willing to Spend More Money on This 1 Type of Product." Inc., 30 Mar. 2018, www.inc.com/melanie-curtin/73-percent-of-millennials-are-willing-to-spend-more-money-on-this-1-type-of-product.html.

WORKS CITED

- "Dairy: Family Farmers in Crisis." Farm Aid, 6 Feb. 2019, www.farmaid.org/blog/fact-sheet/dairy-family-farmers-in-crisis/.
- "Dairy Management Inc." Dairy Management Inc. (DMI) | U.S. Dairy, 2021, www.usdairy.com/about-us/dmi.
- "Dairy." OpenSecrets.org, The Center for Responsive Politics, 2020, www.opensecrets.org/industries/indus.php?ind=a04.
- Dairy Production Stabilization Act of 1983, 2010.
- Danovich, Tove. "Why You're So Obsessed With Almond Milk: An Investigation." Why Almond Milk Is America's Favorite Milk Substitute, 17 May 2018, www.refinery29.com/en-us/almond-milk.
- "Do Scientists Agree on Climate Change?" NASA, 2021, climate.nasa.gov/faq/17/do-scientists-agree-on-climate-change/.
- "Farm Sanctuary: About Us." Farm Sanctuary, 21 Jan. 2021, www.farmsanctuary.org/about-us/.
- Fluid Milk Promotion Act of 1990, 2010.
- Ganzel, Bill. "Agricultural Groups Lobby Washington during the 1950s and 60s." Wessels Living History Farm, 2007, livinghistoryfarm.org/farminginthe50s/money_10.html.
- Glenza, Jessica. "Revealed: How Big Dairy Pushed Fattier Milks into US Schools." The Guardian, Guardian News and Media, 4 Feb. 2019, www.theguardian.com/us-news/2019/feb/03/revealed-dairy-lobby-fat-milk-trump-sonny-perdue#:~:text=Lobbyists%20for%20the%20milk%20industry,on%20issues%20including%20school%20lunches.

WORKS CITED

"Greenwood, Veronique. "How Did Milk Become a Staple Food?" BBC Future, BBC, 6 July 2015, www.bbc.com/future/article/20150706-how-did-milk-become-a-staple-food.

"Historical Timeline - Milk - ProCon.org." Milk, 15 Apr. 2020, milk.procon.org/historical-timeline/.

"History of the Clean Water Act." EPA, Environmental Protection Agency, 15 June 2020, www.epa.gov/laws-regulations/history-clean-water-act.

Lucas, Amelia. "5 Charts That Show How Milk Sales Changed and Made It Tough for Dean Foods to Avert Bankruptcy." CNBC, CNBC, 13 Nov. 2019, www.cnbc.com/2019/11/13/5-charts-that-show-how-milk-sales-have-changed.html.

MacDonald, James M. "Changing Structure, Financial Risks, and Government Policy for the U.S. Dairy Industry." Economic Research Service, USDA, Mar. 2016, www.ers.usda.gov/webdocs/publications/45519/56833_err205_errata.pdf?v=2398.8.

MacDonald, James M. "Consolidation in U.S. Dairy Farming." United States Department of Agriculture, July 2020, www.ers.usda.gov/webdocs/publications/98901/err%20274_summary.pdf?v=5060.2.

"Milk Market in the U.S." Statista, 2020, www-statista-com.proxy.library.nd.edu/study/13095/milk-market-in-the-us-statista-dossier/.

Moon, Emily. "Our Government's Dairy Conundrum." The Week - All You Need to Know about Everything That Matters, The Week, 27 Jan. 2019, theweek.com/articles/819258/governments-dairy-conundrum.

WORKS CITED

Newburger, Emma. "'It Crushes Me': Dairy Farmers Struggle to Survive Trump's Trade Wars and Declining Milk Demand." CNBC, 4 Jan. 2020, www.cnbc.com/2020/01/04/us-dairy-farmers-battle-extinction-trump-trade-wars-lower-milk-prices.html.

Nyman, Patti. "Methane vs. Carbon Dioxide: A Greenhouse Gas Showdown." One Green Planet, One Green Planet, 20 Oct. 2020, www.onegreenplanet.org/animalsandnature/methane-vs-carbon-dioxide-a-greenhouse-gas-showdown/.

"Our Mission and What We Do." EPA, Environmental Protection Agency, 23 Sept. 2020, www.epa.gov/aboutepa/our-mission-and-what-we-do.

"Per Capita Disposable Income." IBISWorld, 10 Dec. 2020

Poinski, Megan. "4 Reasons Plant-Based Milk Will Keep Growing after the Pandemic." Food Dive, 24 Nov. 2020, www.fooddive.com/news/4-reasons-plant-based-milk-will-keep-growing-after-the-pandemic/589553/#:~:text=In%202019%2C%20according%20to%20statistics,dairy%20milk's%20essentially%20flat%20growth.

"Real Disposable Personal Income." FRED, 19 Mar. 2021, fred.stlouisfed.org/series/DSPIC96.

Samuels, Alana. "Milk Was an American Staple. Now, the Industry Is in Trouble." Time, 9 Jan. 2020, time.com/5762011/america-milk-industry-failing/.

Wunsch, Nils-Gerrit. "U.S. Plant-Based Milks." Statista, 1 Dec. 2020, www.statista.com/topics/3072/us-plant-based-milks/.