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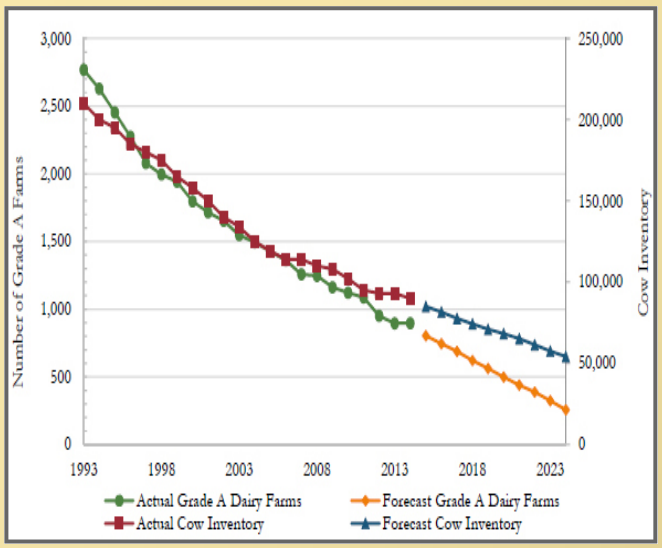

Missouri Dairy Industry Revitalization Study

Section 5:

Comparative Analysis to Identify Gaps

UNIVERSITY OF MISSOURI
Extension
Commercial Agriculture Program

Missouri Dairy Industry Revitalization Study –
Section 5: Comparative Analysis to Identify Gaps

The following authors contributed content to this section:

Joe Horner	Agricultural Economist, Commercial Ag Program, MU Extension
Ryan Milhollin	Agricultural Economist, Commercial Ag Program, MU Extension
Scott Brown	Agricultural Economist, University of Missouri
John Lory	Nutrient Mgt. Specialist, Commercial Ag Program, MU Extension
Alice Roach	Agribusiness and Agrimarketing Consultant
Joseph Zulovich	Agricultural Engineer, Commercial Ag Program, MU Extension
Scott Poock	Dairy Veterinarian, Commercial Ag Program, MU Extension

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Teng Lim	Agricultural Engineer, Commercial Ag Program, MU Extension
Gene Schmitz	Regional Livestock Specialist, MU Extension

Other publications from this study include:

Executive Summary
A comprehensive overview of the overall Missouri Dairy Industry Revitalization study.

Section 1: Historical Perspective
Section 1 provides an in-depth discussion about Missouri's dairy industry historical trends concerning its dairy cow inventory, farms, production, prices, production economics and processing industry.

Section 2: Economic Contribution
Section 2 discusses what the economic contributions such as jobs, value-added and industry sales are from Missouri dairy farms and the Missouri dairy product manufacturing industry.

Section 3: Needs Assessment
A survey was conducted in fall 2014 to Missouri Grade A dairy farms and industry stakeholders. This survey was intended to gather their perspectives on producers' needs and characteristics of Missouri dairy farms. Section 3 provides a summary of all survey responses received.

Section 4: Value Chain, Marketing and Processing
Section 4 provides a discussion about dairy product demand and current opportunities to enhance the farmer's position in the value chain. Further processing opportunities and dairy niche marketing are discussed in this section.

Complete copies of all publications can be found at http://dairy.missouri.edu/revitalization/.

For further information about this report, please contact:
Joe Horner - (573) 882-9339 (phone) or HornerJ@missouri.edu (email)

Missouri Dairy Industry Revitalization Study
Section 5: Comparative Analysis to Identify Gaps

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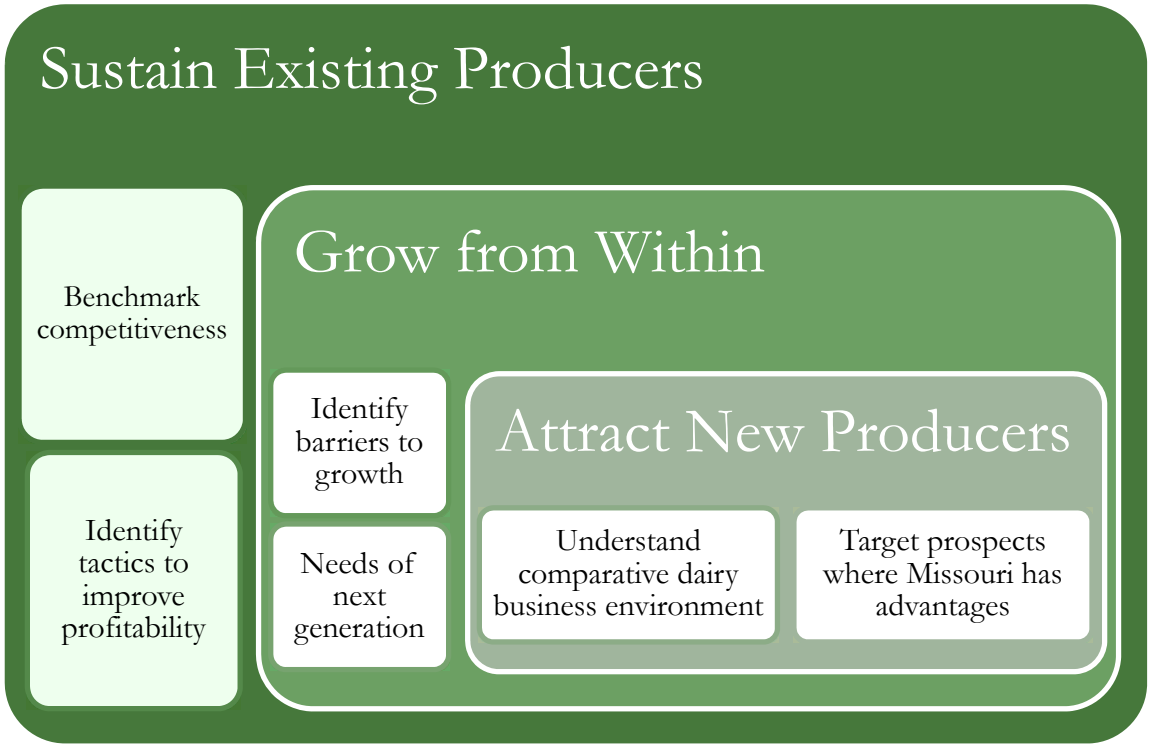
1. Competitiveness of Missouri's Dairy Industry

This purpose of this report is to help create a common understanding of the Missouri dairy industry's competitive position, benchmark Missouri's dairy industry and environment against other states and look at ways that other states have attempted to revitalize their dairy industries. Thousands of jobs and hundreds of millions of dollars of economic impact in the dairy production and processing industries depend on profitable milk production.

Improving Missouri's dairy industry competiveness is important to all stakeholders. For existing producers, benchmarking against other producers helps to identify areas needing improvement, as shown in Exhibit 1.1. For producers who would like to expand or for next-generation producers, understanding growth barriers in Missouri is important. For all the stakeholders allied to the dairy industry, understanding how Missouri compares to other states trying to attract new dairies is important. For Missouri to sustain a dairy industry, all producers will be needed: existing producers, next-generation producers and new dairy farmers recruited from outside of the state.

Exhibit 1.1 – Roadmap to Improve Missouri's Dairy Industry



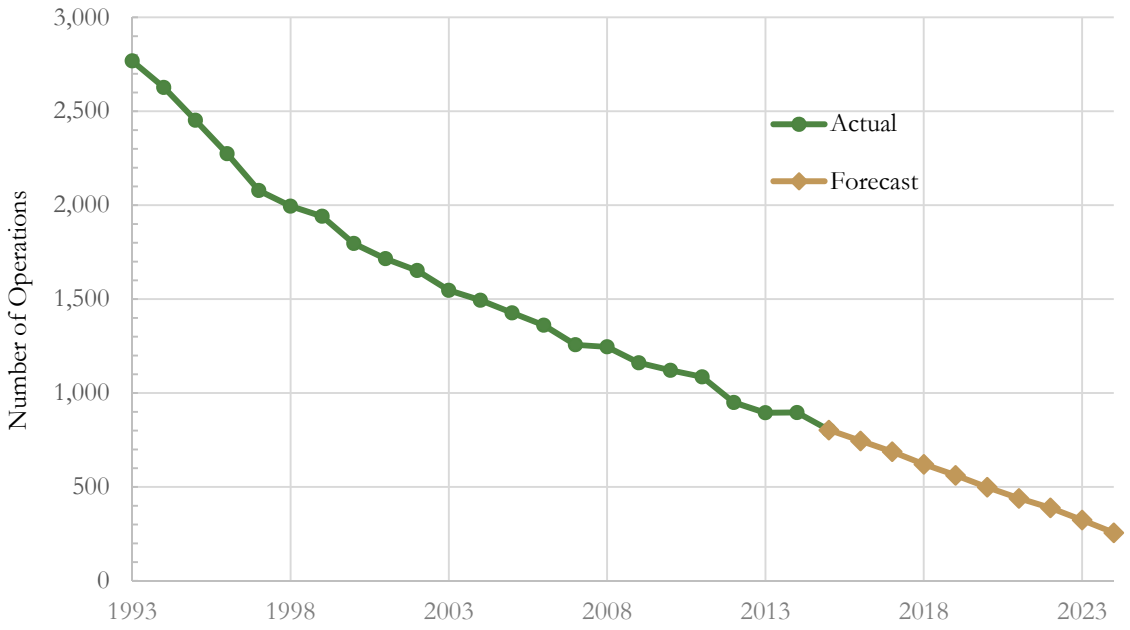
1.1 Missouri Dairy Trends and Forecast through 2024

This examination of the Missouri dairy industry's relative competitiveness begins with the simplest of measures, an examination of farm numbers and cow numbers from the past 22 years. Since 1993, the number of Grade A dairy farms in Missouri has dropped at a 5.3 percent annual compound rate. Exhibit 1.1.1 depicts the number of Grade A dairy operations in Missouri since 1993, and based on past data, it forecasts the number of dairy operations in Missouri through 2024.

Assuming that this trend continues, Missouri is forecasted to drop from 896 Grade A dairies in 2014 to 257 Grade A dairies at the end of 2024. To maintain the state's current cow numbers and, thus, continue to support the current dairy processing industry with the same amount of milk, the average dairy farm in 2024 would need to milk approximately 350 cows, assuming the same milk production per cow as of today.

Consolidation in agriculture is familiar to industry observers. Fewer, larger farms have been the trend in the U.S. for decades across most commodity sectors. Still, the stark and steady nature of long-term trends adds perspective to the competitive challenge faced by Missouri's dairy industry.

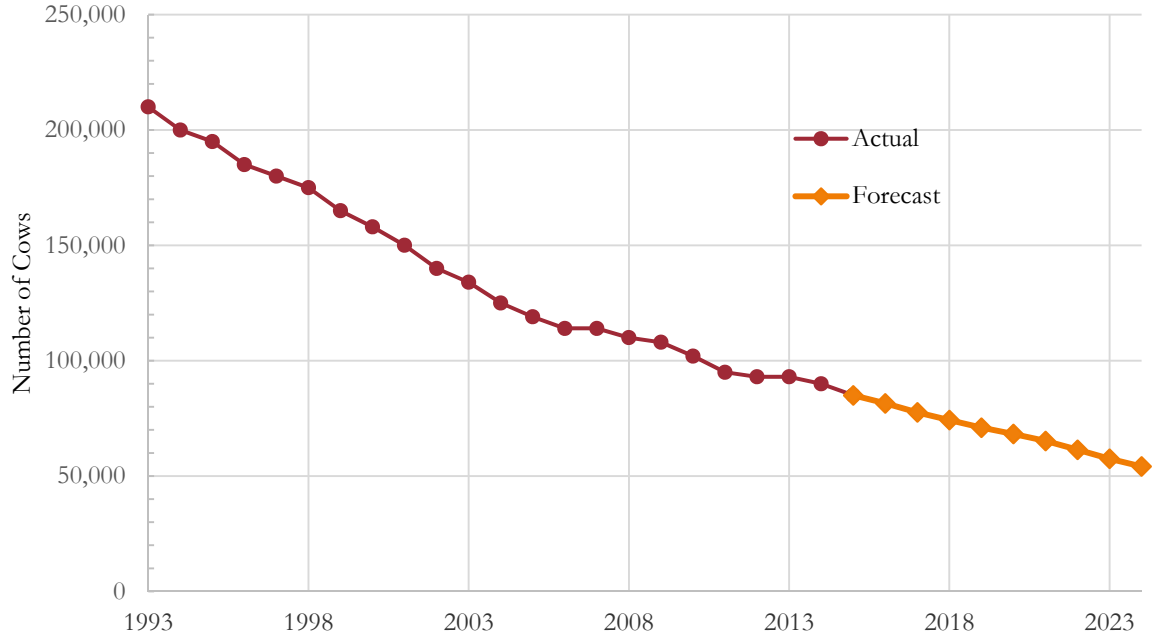
Exhibit 1.1.1 – Missouri's Grade A Dairy Operations, 1993 to 2014 and Forecast through 2024



Source: Derived from USDA National Agricultural Statistics Service Data

The number of dairy cows in Missouri also has trended downward, but at a slower trajectory. Since 1993, the number of dairy cows in the state declined at a 3.8 percent annual compound rate, as shown in Exhibit 1.1.2. If the trend of the past 22 years continues for the next 10 years, then Missouri's 2024 dairy industry will involve 257 Grade A dairies that milk 54,166 cows, and herd size would average 195 cows. In 2014, Missouri's dairy cow inventory totaled 90,000 cows.

Exhibit 1.1.2 – Missouri's Dairy Cow Numbers, 1993 to 2014 and Forecast through 2024

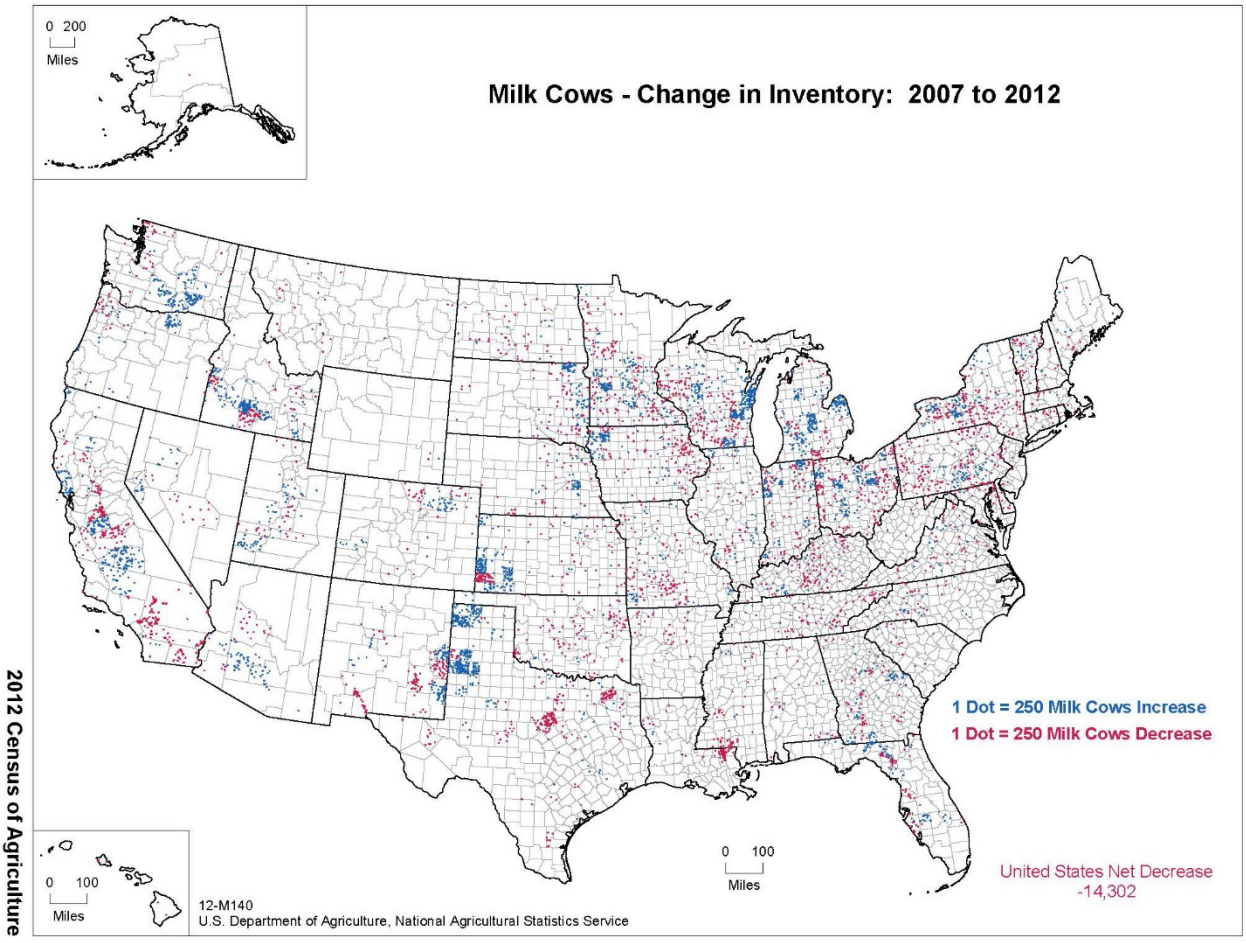


Source: Derived from USDA National Agricultural Statistics Service Data

1.2 Geographic Expansion and Decline in U.S. Dairy Cow Inventory

Exhibit 1.2.1 depicts a map of the growth and decline of dairy cow inventories between the 2007 USDA Census of Agriculture and the 2012 USDA Census of Agriculture. Two obvious questions are where is the industry growing, and what contributes to growth in those areas? Blue dots represent growth in 250-cow increments, and red dots represent decline in 250-cow increments. Areas of strong growth can be seen in pockets across western Texas; southwestern Kansas; and then north through northwestern Iowa, Minnesota, Wisconsin, Idaho, Washington, California and Michigan. In the southeast, pockets of growth appear predominantly in Georgia and Florida.

Exhibit 1.2.1 – Map of Changes in Dairy Cow Population between 2007 and 2012



Source: USDA Census of Agriculture

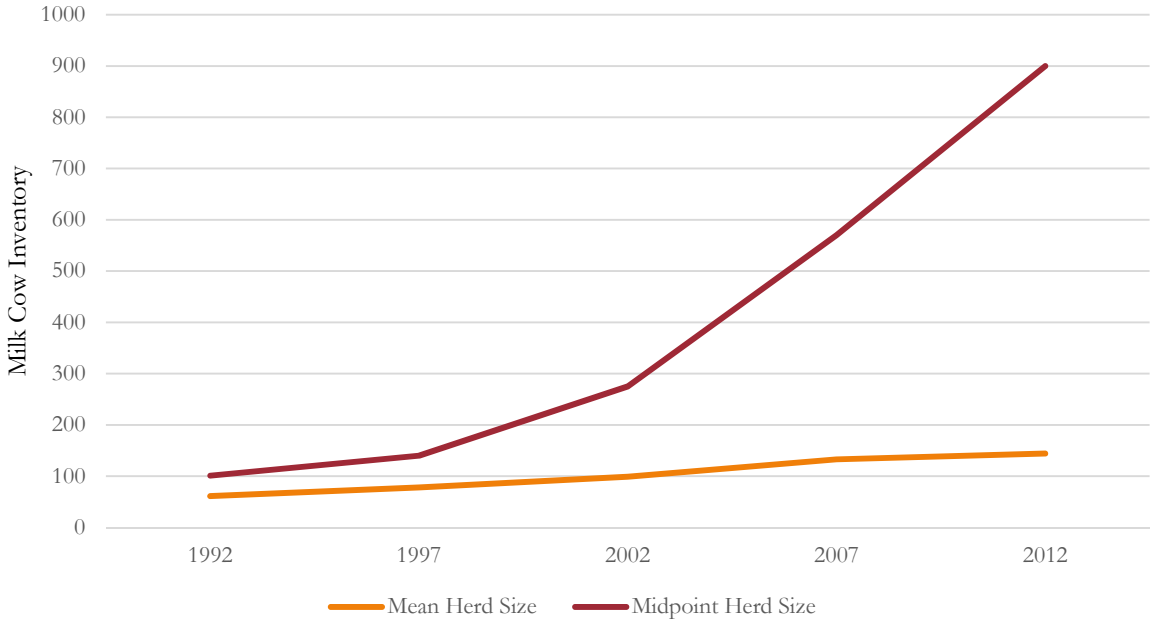
Within Missouri, a careful examination of the map for growth pockets reveals blue dots attributable to the New Zealand grazing dairies in southern Missouri as well as pockets of growth in Mennonite communities near Versailles and Memphis, Mo. A sprinkling of additional dairy growth was recorded in west central Missouri and north central Missouri. Declining dairy pockets in Missouri are centered mostly in the Ozarks, predominantly in the south central portion of the state. These areas have traditionally been the most dairy-dense areas of Missouri.

1.3 Changing Economies of Scale in the U.S. Dairy Industry

According to the USDA Economic Research Service, as shown in Exhibit 1.3.1, "The mean herd size of dairy operations rose from 61 cows in 1992 to 144 in 2012, but that shift understates the nature of the change in dairy production; most cows are now on farms that are much larger than the mean. The midpoint farm size is used to track cows; the midpoint shows the herd size at which half of all cows are in larger herds and half are in smaller herds. In 1992, the midpoint of 101 cows was not much larger than the mean, reflecting the fact that most cows were on small and mid-size dairy farms. However, the midpoint rose sharply over the next two decades, to 900 cows by 2012, over 6 times larger than the mean herd size" (MacDonald and Newton 2014).

"The shift to larger dairy farms is driven largely by the economics of dairy farming. Average costs of production, per hundredweight of milk produced, are lower in larger herds, and the differences are substantial. These costs include the estimated costs of the farm family's labor as well as capital costs, in addition to the cash expenses that are included under operating costs" (MacDonald and Newton 2014).

Exhibit 1.3.1 – U.S. Milk Production Shifting to Larger Herds



Source: USDA Economic Research Service

1.4 Emerging Consumer-Driven Expectations

Dairy producers traditionally have considered milk quality to be determined by somatic cell counts (SCC) and bacteria counts. In recent years, however, consumer expectations have started to drive additional changes. Consumers want to know that dairy products are safe, wholesome and nutritious and that animals receive the highest level of care.

Increasingly, consumers and branded food companies are requiring third-party verification that the milk they are buying is produced in a suitable manner. Because of deferred maintenance and labor scarcity, some Missouri dairy farms find it challenging to meet these increasingly stringent standards.

Milk cooperatives through the National Milk Producers Federation created the FARM Program (Farmers Assuring Responsible Management) to begin the audit process with producers to identify problem areas. As standards become more mandatory and stringent, some producers may lose their existing marketing channels unless they can adapt. Further information about this program can be found on the web at http://nationaldairyfarm.com/.

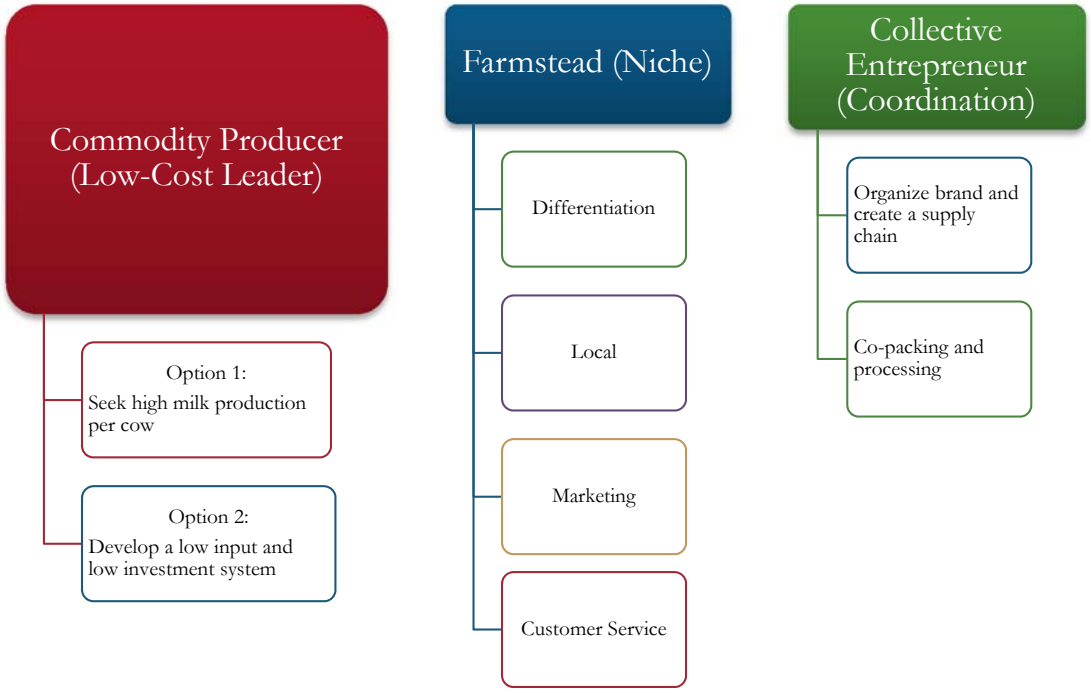
1.5 Missouri Dairy Industry Environment

It is important to understand the current environment for the Missouri dairy industry. The first step is to examine threats and opportunities within the external environment that influence the Missouri dairy industry. The second step is to understand strengths and weaknesses within the internal environment that affect the Missouri dairy industry. By analyzing these characteristics, dairy industry stakeholders and producers can look at ways to take advantage of opportunities and minimize threats by utilizing strengths and overcoming weaknesses. Threats, opportunities, weaknesses and strengths are examined for the Missouri dairy industry in Exhibit 1.5.1.

Exhibit 1.5.1 – Missouri's Dairy Industry Environment

After examining the Missouri dairy industry environment, it is important for Missouri dairy producers to choose the way they position their operations in the future. Strategic positioning is a way to determine strategic options that have potential to lead to long-term success (Boehlje et al. 2004). It seeks to provide fundamental direction and can shape farmers' ability to create value for customers and develop a long-term competitive advantage. Exhibit 1.4.2 identifies three general strategies that dairy producers can pursue. Each option must be examined by producers to align with their core competencies. Typically, dairy farmers will seek to emphasize one position that offers them a firm competitive advantage relative to other producers operating in the same industry.

Exhibit 1.4.2 – Missouri Dairy Producer Strategic Positions



Commodity dairy producers seek to use the "low-cost leader" strategic position. A majority of the existing dairy industry has this position. Dairy farms in the commodity producer category can seek to spread their investment costs over an appropriate volume of milk either by achieving high milk production per cow or milking more cows. Option one is to seek high milk production per cow, consistent with the long term evolution of the U.S. dairy industry. Option two is to develop a low-input system epitomized by the emerging seasonal grazing dairies in Missouri.

Some dairy producers could position or differentiate themselves in a farmstead niche market. Producers could seek to capture extra value by processing their milk into various dairy products and selling their dairy products to a targeted consumer base. This is a small market, but it provides opportunities to capture considerable value by offering attributes such as differentiated/innovative products, high quality, local foods, innovative marketing and/or great customer service. Other dairy producers could become collective entrepreneurs and coordinate by developing unique marketing channels. Developing a new brand and supply chain is an opportunity to participate in the marketplace and can offer a competitive advantage compared with others in the industry.

1.6 Tactics to Improve Profitability on Existing Missouri Dairy Farms

Improving profitability for Missouri's dairy farmers is a key to sustaining the industry. When asked what dairy producers needed to be more successful in a fall 2014 survey of all Grade A dairy producers in the state, the top need identified among 276 responding producers was higher milk prices and profit margins. In a commodity business where producers are price takers, there are two basic strategies for improving profitability: **1) increasing production efficiencies** and **2) increasing the scale of new or existing dairy production operations.**

The first strategy is for the Missouri dairy industry to retool and reinvest in the existing on-farm infrastructure. This reinvestment must incorporate modern dairy production facilities and concepts with technologies that complement dairy operation management. When investments in technology complement management objectives, viable opportunities to improve operational profitability result. The second strategy is to gain the benefits of efficient management of scale. Both strategies can lead to higher labor efficiency. Labor was the No. 1 challenge expressed in the 2014 Missouri survey when dairy farmers answered the question, "What is the greatest challenge on your dairy farm?"

Existing dairy production operations must invest in appropriate production technologies and implement management techniques that complement these technologies. Investing in appropriate technologies and implementing the complementary management techniques that match the particular dairy production system allow producers to improve their competitive position, increase milk production per cow regardless of the system, lower feed costs and increase profit margins.

New dairy production operations must incorporate the appropriate technologies during facility design and construction. The new operation will need to implement management techniques that complement the adopted production technologies. The following eight tactics identify specific methods for Missouri dairy producers to determine the technology areas and complementary management techniques needed to be incorporated into existing operations to accommodate the benefits of the two strategies mentioned above.

Tactic 1: Reduce summer heat stress.
Tactic 2: Address better care for replacement heifers.
Tactic 3: Focus on forage quality.
Tactic 4: Improve milk quality.
Tactic 5: Strive for better cow comfort in housing.
Tactic 6: Improve dry matter intake.
Tactic 7: Focus on better reproductive management.
Tactic 8: Develop economies of scale.

Following is an explanation of each tactic. The explanation includes a brief description, improvement possibilities and action steps to overcome the problem.

Tactic 1: Reduce Summer Heat Stress.

Milk production, due to summer heat stress in lactating cows, declines when systems to cool cows are not installed or operated effectively. Milk production reductions due to heat stress are expected in dairy herds with averages of 40 or more pounds of milk per cow per day. Dairy herds that experience decreased milk production during hot weather have a heat stress problem and will benefit from heat-reduction strategies. Heat stress can reduce milk production by 20 to 25 pounds per cow per day depending on the herd's cool weather production level. High-producing herds will normally experience the greatest production declines if heat-reduction strategies are not implemented.

Improvement Possible:
Milk production losses from heat stress can easily reach 25 pounds of milk per cow per day (or more in severe circumstances on very high producing farms). During a 120-day hot weather period, lost milk production of 3,000 pounds per cow may be realized. This calculates an income loss of $570 per cow when the milk price is $19 per cwt. Heat stress will also contribute to depressed cow health and poor reproductive performance. Heat stress is common in Missouri. Based on hourly data from 2009 to 2013 for Joplin, Missouri, 6 percent of the time dairy cows would experience moderate/severe stress (80 to 90 temperature humidity index (THI)) and 17 percent of the year they would experience mild/moderate stress (72 to 79 THI).

Action Steps to Fix the Problem:
Heat stress reduction will not increase milk production above cool weather production levels. Heat stress reduction allows a herd to maintain production during hot weather. Milk production inputs such as forage quality, dry matter intake and access to a quality ration must be properly managed to realize the benefits from heat stress reduction. Actions steps include:

Drinking Water Access
Inadequate drinking water access will depress water consumption and result in depressed milk production. Drinking water should always be available in cow feeding and resting areas. Waterer space should allow up to one-third of a cow group to drink at one time. Drinking water access should be located near the exit of the milking parlor and be large enough to allow one parlor exit group to drink at one time. Providing drinking water near a milking parlor's exit can increase milk production per cow up to 4 pounds per day.

Shade
Shade should be provided over the feed bunk, holding pen and cow resting areas. Shade blocks the sun's rays and reduces cow heat stress. Without access to shade, cows are hot and experience greater milk production declines than those recorded in cows with shade access.

Installation of Fans and Sprinklers
When outside temperatures exceed 80°F to 90°F, fans that provide supplemental air movement and sprinklers that enable increased evaporative cooling should be operated. Fans and sprinklers should first be installed in the holding pen area followed by the feeding and resting areas. An increase of 5 pounds of milk production per cow per day during the summer heat period will quickly pay the cost of purchase, installation and operation of good fans and sprinklers. Dairy operations that effectively incorporate heat stress reduction strategies,

provide quality feed rations, and ensure water access should experience only minimal milk production declines due to heat stress.

Tactic 2: Address Better Care of Replacement Heifers.

The Missouri Dairy Herd Improvement Association (DHIA) reports that the average age at first calving for Missouri dairy herds is 26.8 months. The primary factor contributing to inadequate heifer growth was a failure to provide sufficient high-quality forage rations to maintain the heifer's desired growth.

Improvement Possible:
Life-time milk yield, 305-day lactation yields and life-time profit of replacement heifers are maximized when heifers calve for the first time at 22 months to 24 months.

Heifers that calve at ages older than an average of 24 months cause the following:

- Decreased heifer productive life, which delays returns of income from milk sales.
- An increased inventory of replacements needed to maintain herd size. As age at first calving and/or cow cull rate and/or calf mortality decrease, fewer animals are required to maintain herd size. Surplus replacements can be used for herd expansion or sold for added revenue. Assuming a given cull rate and a 0 percent calf mortality rate, each month added to the 24 months for first calving of replacement heifers will increase required heifer inventory by approximately one heifer per 100 cows to maintain herd size.
- Greatest increases in 305-day lactation yields are seen in replacement heifers calving for the first time between 20 months to 26 months of age.
- Heifers ideally calve at 22 months to 24 months of age, and they should be at least 85 percent of their mature weight and the correct height for their breed.

Action Steps to Fix the Problem:

- Provide adequate bunk space and bunk management to provide access to quality feed.
- Provide adequate access to good quality drinking water.
- Group heifers according to size to avoid disparity in the size of heifers within the group.
- Provide facilities for stress free handling of heifers at critical intervention points.
- Develop and implement a planned breeding program.

Tactic 3: Focus on Forage Quality.

Many Missouri dairy operations do not have a focus on forage quality. They feed the feedstuffs that are "on hand" or buy feed as inexpensively as possible. Harvested forage is not well-preserved. Covers are not installed on bunker silos. Rations often contain moldy forages because of a failure to separate moldy silage from good silage. Low-quality forage reduces dry matter intake due to a gut-fill factor. Milk production is reduced due to the lower dry matter intake and reduced energy available in the feed consumed by the cow.

Improvement Possible:
Feeding 10 pounds of early bloom alfalfa hay with a relative feed value of 150 versus 10 pounds of full bloom alfalfa hay with a relative feed value of 100 would provide an additional 0.5 Mcal of net

energy for lactation. This is enough energy to produce an additional 1.6 pounds of milk worth about $0.30 per cow per day without consideration of any additional results from feeding the better quality alfalfa hay, which would increase dry matter intake. The higher quality alfalfa hay would also be about 4 percent higher in crude protein. The additional 0.4 pounds of protein could replace about 0.8 pounds of soybean meal in the ration at a cost savings of $0.18 per cow per day.

Feeding moldy silage from the top 6 inches to 12 inches of an uncovered bunker or pit silo has been shown to reduce the digestibility of good silage in dairy cow rations. In addition, feeding moldy silage has the potential to introduce mycotoxins and molds. Mycotoxins can create cow health problems and milk rejection resulting in significant financial losses.

Action Steps to Fix the Problem:
Understand the value of producing or purchasing higher quality forage for dairy production rations. Specifically:

- Plant more alfalfa.
- Harvest alfalfa as haylage or baleage in order to avoid the problems associated with drying alfalfa for hay. Harvest alfalfa when the first blooms appear.
- Prioritize corn silage harvest at optimal time, and properly pack and seal bunkers.
- Sample all forages prior to feeding so that rations can be balanced.

Tactic 4: Improve Milk Quality.

Value available in milk through quality is primarily associated with bacteria and somatic cell count (SCC) levels. Bacteria and SCC levels significantly less than the legal maximum are demanded by dairy buyers because they are associated with a high-quality product that has an extended shelf life. Low SCC milk is also associated with higher solids and a greater cheese yield. Improved taste and desired texture of the manufactured product also add value to the milk.

Improvement Possible:
Current 2014 DHIA SCC levels = 338,000 for Missouri versus 263,000 for the U.S.

Action Steps to Fix the Problem:

- Provide a clean dry resting environment for lactating cows. The tactics and/or investments needed for a specific operation depend on current milk quality status and the desired dairy production system.
- Maintain, service, and test milking machines.
- Maintain clean outdoor environments, especially high traffic areas, to promote cleanliness of the cows, particularly during wet conditions.
- Perform good milking hygiene; present clean cows for milking; follow consistent standard procedures, effective milking technique, and effective teat disinfection.

Tactic 5: Strive for Better Cow Comfort in Housing.

For confinement dairies in Missouri, many use freestalls of older design with inadequate dimensions and less than ideal ventilation and bedding.

Improvement Possible:
Increased cow comfort removes the facilities' constraint on expressing the cow's genetic potential.

Action Steps to Fix the Problem:

- Open ridge caps to improve ventilation during all seasons.
- Raise natural ventilation capability in warm and hot weather by opening up all sides of barns.
- Remodel/refurbish freestalls to allow for adequate lying and lunge space by replacing loops with modern, cow friendly designs and/or removing center dividers between rows of stalls.
- Lengthen/adjust stall to fit current cows by removing/relocating brisket board and neck rail.
- Move to deep sand bedding, comfort mattresses or compost bedded pack barns.
- Groom (brush or rake) stalls with bedding.

Tactic 6: Improve Dry Matter Intake.

Cows are often fed feedstuffs that are "on-hand." Feed is rated as good by many producers if the cows eat it, and feed that cows don't eat is rated bad. Consider these feed management mistakes:

- Feed bunks may be rarely checked or cleaned out, and old feed is allowed to accumulate and spoil. Spoiled feed in the bunk lowers feed intake.
- Dry matter intakes may rarely be calculated, so many producers do not really know how much feed cows are consuming.
- Many feed bunks are not covered, which exposes the feed to weather elements and allows feed to deteriorate faster in the summer. Feed exposed to the elements will quickly lower in quality and palatability, so cows reduce feed intake.
- Cows fed in open areas exposed to the weather will eat less because cow comfort is lacking.

Improvement Possible
Dry matter intake drives milk production. One additional pound of dry matter intake will result in an increase of 2 pounds to 2.5 pounds of milk produced. One pound of feed dry matter costs about $0.10, and milk price is about $0.19 per pound. Consuming one additional pound of dry matter per day would return about $0.19 to $0.25 per day of added income above feed cost per cow. On a 1,000-cow dairy, reducing shrink by 3 percent could amount to $65,700 a year, based on today's feed prices (Quaife 2011).

Action Steps to Fix the Problem
The following are strategies to increase dry matter intake:

- Provide covered feeding areas.
- Check feed bunks and clean feed not eaten from the feed bunks daily.
- Do not feed moldy feed because it reduces feed consumption and feed digestibility.
- Provide cow comfort facilities and equipment in the feeding area to encourage cows to increase feed intake.

Tactic 7: Focus on Better Reproductive Management.

The estimated average calving interval for Missouri dairy herds exceeds 15.1 months. However, the U.S. national DHIA average is 14.3 months, and many Missouri herds achieve 13.5-month calving intervals. Reproductive management requires basic knowledge about reproduction, heat detection skills, breeding expertise and a plan to ensure that techniques are implemented in a timely manner. Many Missouri dairy production units fail to consistently implement a sound reproductive plan.

Improvement Possible
A direct relationship exists between the calving interval length and the average number of days in milk for dairy herds. Average number of days in milk directly influences the milk volume produced. A 30-day increase in the calving interval results in a 5-pound decrease in the herd tank average or the daily milk production per cow per day. Extended calving intervals also reduce the number of calves produced each year.

Action Steps to Fix the Problem
The goal is to maintain the average number of days in milk for the herd at 180 days. This requires good reproductive management. To achieve this goal, the herd manager and/or herdsman must be skilled in heat detection and breeding and consistently implement his or her chosen reproductive protocol. Sound nutritional management, installation and proper operation of environmental systems that maintain cow comfort and heat stress reduction implementation are essential.

Tactic 8: Develop Economies of Scale.

There are substantial benefits to operational scale. Increasing scale is a major driver to lower costs and increase profitability in the U.S. dairy industry. Dairy operators that learn to manage cattle, technology, labor and risks effectively attract capital and grow.

Financial indicators like "return on assets" and "net farm income per cow" clearly support scale as a method to add profitability to the dairy production industry. Of course, smaller operations efficiently managed with appropriate debt loads and realistic family living expectations can be profitable as well. These smaller operations have traditionally been the mainstay of Missouri's dairy industry and can remain so well into the future.

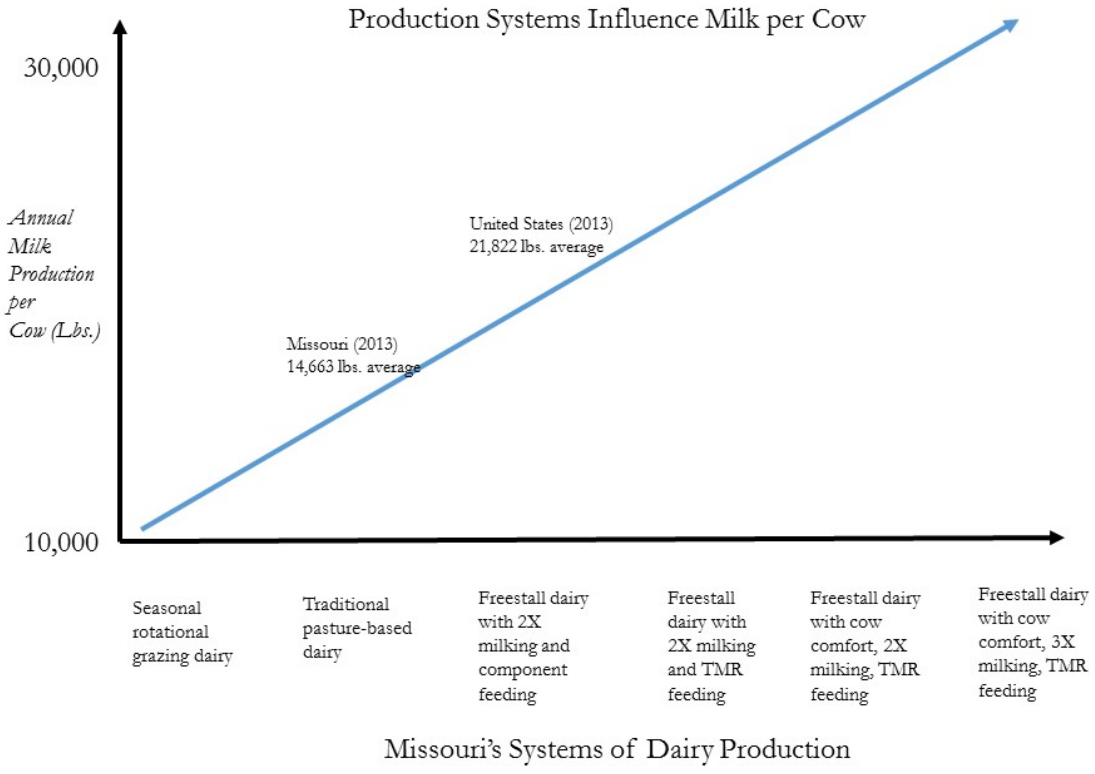
2. Benchmarking Missouri's Dairy Industry

Missouri's dairy industry is an amalgamation of several distinct types of dairy farming. Traditionally, the Ozark region of southwest and south central Missouri, where most of the state's dairies were located, was home to pasture-based dairies. In northern Missouri and counties that bordered the Missouri and Mississippi rivers, confinement or partial confinement dairies evolved. Soil types and cropping potential influenced the systems that dairy producers chose as they developed their operations over decades. In the past two decades, larger confinement farms have begun to appear throughout Missouri, and larger intensive rotational grazing dairies have also developed, mostly in the southern half of Missouri.

2.1 Missouri Production Systems

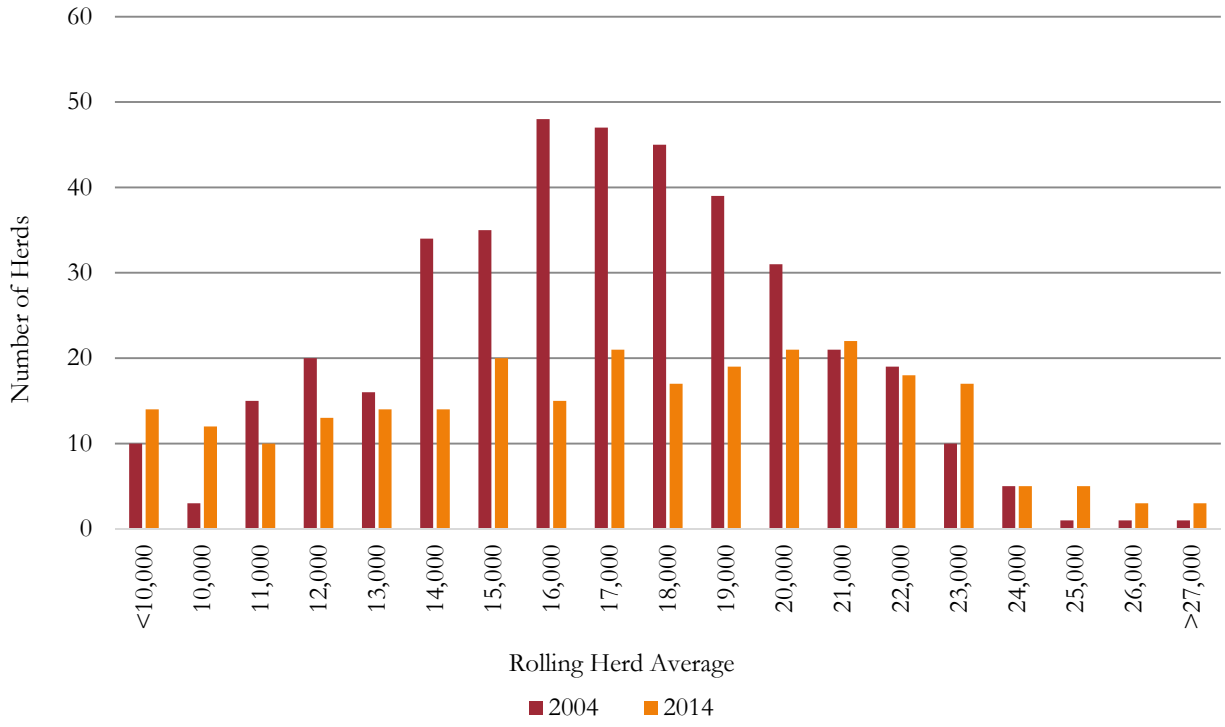
Production system choices impose different limits on milk production per cow. This diversity of systems makes benchmarking Missouri's dairy industry more challenging than simply comparing milk production per cow. However, a careful examination of different benchmarks may be used to reveal Missouri's relative strengths and weaknesses. Exhibit 2.1.1 depicts the annual milk production per cow commonly seen in Missouri and the system of production associated with it, as well as the average production in Missouri and the U.S.

Exhibit 2.1.1 – Common Production Systems in Missouri and Relative Milk Production



Comparing the 2004 and 2014 rolling averages of herds enrolled in DHIA in Exhibit 2.1.2 serves as a proxy indicator of production system changes in Missouri during the past decade. Expressed by an industry observer, one possible explanation of the Exhibit 2.1.2 trend is that Missouri has experienced an industry dividing into two dairy models. During the past decade, the number of rotational grazing dairy producers with rolling herd averages below 14,000 pounds grew. Meanwhile, the number of the state's higher producing confinement herds progressed beyond 20,000-pound rolling herd averages. Between those two production levels, as many as half of the DHIA herds disappeared.

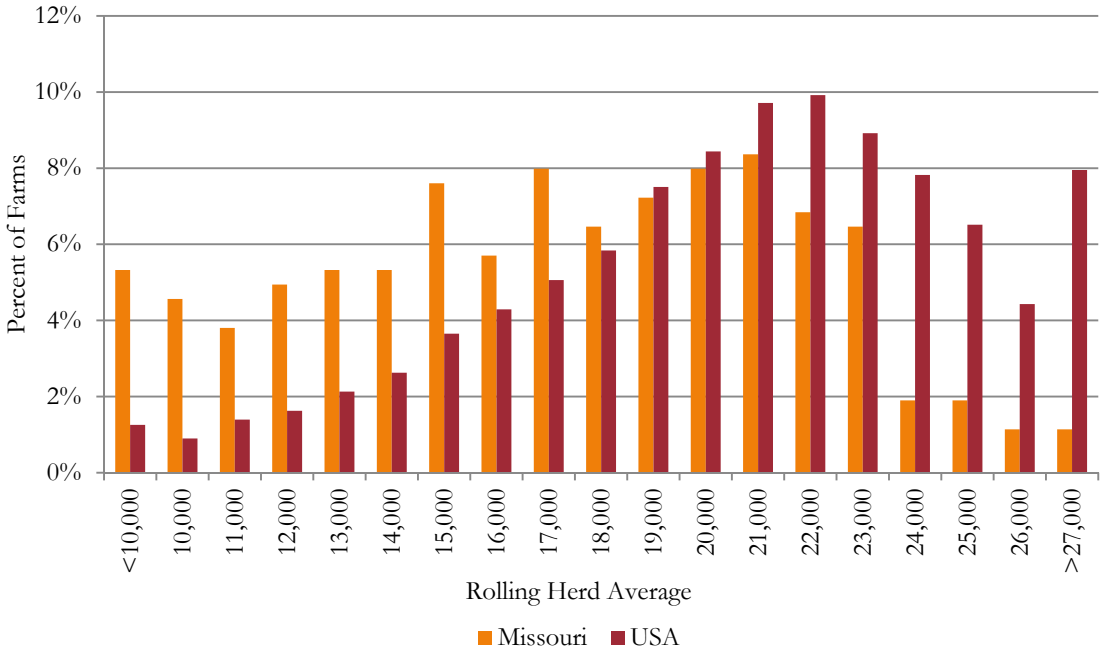
Exhibit 2.1.2 – Missouri DHIA Rolling Herd Averages, 2004 and October 2014



Source: Dairy Herd Information Association (DHIA), Dairy Records Management Systems (DRMS)

Exhibit 2.1.3 compares the percentage of Missouri DHIA-enrolled and U.S. DHIA-enrolled dairy farms using October 2014 rolling herd averages. Missouri had a different distribution of production levels than the U.S.

Exhibit 2.1.3 – Missouri and U.S. DHIA Rolling Herd Averages, October 2014



Source: Dairy Herd Information Association (DHIA), Dairy Records Management Systems (DRMS)

Further explanations and an analysis of strengths, weaknesses, opportunities and threats (SWOT) of each production system can be found in the following exhibits.

Exhibit 2.1.4 – Seasonal Rotational Grazing Dairy, SWOT Analysis

Operation Description: Lowest milk production per cow typically is seen by the low-input style rotational grazing dairies with at least 50 percent of the cows' annual dry matter intake provided by grazing. These systems depend on labor-efficient parlors milking large numbers of relatively low-producing but fertile cows that calve seasonally with the arrival of the grazing season to achieve profitability.	
Strengths: The focus on micro-managing high-quality pastures results in lower input costs. Emphasis on minimal facilities results in lower investment costs per cow and allows profitability even with lower production levels. Majority of investment is in reproducing cows and appreciating land leads to growth in wealth over time if only minimal profitability is maintained.	**Opportunities:** Missouri has emerged as a national leader in this style of dairying. This clustering effect has attracted new dairy producers from other states and countries. Innovations in forages, crossbreeding, irrigation, and system refinements are widely shared. Opportunity exists to potentially develop value-added markets for "grass-based milk."
Weaknesses: Weather risk, especially drought, can greatly impact the profitability of these dairies. Lack of cow housing limits milk production per cow potential.	**Threats:** U.S. dairy industry continues to evolve toward a higher production per cow model. Rotational grazing dairies do not buy as many inputs and, thus, have less industry interest and vendor technical support. As rotational grazing dairies add inputs to overcome weather risks, they creep toward the cost structures of traditional dairying but with limited upside production potential.

Exhibit 2.1.5 – Traditional Pasture-Based Dairy, SWOT Analysis

Operation Description: This style of dairying predominates in much of southern Missouri in some form. Production per cow is capped by heat stress in the summer, forage quality on set-stocked pastures, component feeding with concentrate in the barn and lack of cow comfort during severe weather conditions.	
Strengths: Traditionally, this has been the most widely used and understood system in Missouri. Existing sunk investments in facilities mean producers continue dairying as long as an operating margin exists. This system has one of the lowest barriers to entry due to existing dairies available to buy or lease.	**Opportunities:** Move toward either rotational grazing systems to lower input costs or toward new generation of confinement facilities to raise production and lower costs per unit.
Weaknesses: With milk production per cow capped by physical limitations, margins have narrowed over time and reduce the capacity to replace capital and make next-generation investments.	**Threats:** Dairies tend to be final-generation businesses in that the smartest business decision for existing middle-aged producers is to not reinvest but instead run the facility until the end of its useful life and then retire and sell farm or switch to beef production.

Exhibit 2.1.6 – Freestall Dairy with 2X Milking and Component Feeding, SWOT Analysis

Operation Description: This style of dairying exists mostly outside of the Ozarks on dairies with less than 100 cows. Production per cow is limited by a lack of cow comfort in older style freestall barns and the use of component feeding.	
Strengths: Widely used and understood system in Missouri outside of the Ozarks. Existing sunk investments in facilities mean producers continue dairying as long as an operating margin exists. Established confinement dairy skill sets allow easier move to higher production systems.	**Opportunities:** Many facilities allow incremental investments into existing facilities and equipment that improve labor efficiency and cow comfort.
Weaknesses: Herd size limits affordability of TMR feeding system and parlor investments necessary to achieve higher milk per cow and labor efficiency.	**Threats:** Existing facilities may be locked into an area that cannot grow herd size due to urban encroachment, rising land prices or county and local restrictions. Producers may prefer to stay with smaller herds so they don't have to hire employees, and this limits the capacity to pay for new investments.

Exhibit 2.1.7 – Freestall Dairy with Cow Comfort, 2X Milking, TMR Feeding, SWOT Analysis

Operation Description: This style of dairying is represented by producers who have reinvested in newer freestalls, fan and sprinkler cooling with adequate ventilation during all weather conditions. Freestalls are large enough for cows to comfortably use (adequate width, length and lunge space) and have bases (beds) that provide adequate cow comfort. Milk production per cow is often limited simply by udder stress caused by only milking two times per day.	
Strengths: All the pieces are in place for high milk production per cow.	**Opportunities:** Move to three times per day milking when labor pool allows.
Weaknesses: Milk production per cow may be limited by udder stress caused by only milking two times per day.	**Threats:** Managing a high-producing herd requires constant attention to detail.

Exhibit 2.1.8 – Freestall Dairy with Cow Comfort, 3X Milking, TMR Feeding, SWOT Analysis

Operation Description: These dairies typically achieve the highest milk production per cow because all efforts are made to maximize cow comfort during all weather conditions.	
Strengths: All the pieces are in place for high milk production per cow.	**Opportunities:** Micromanaging cows with attention to detail and adoption of the latest technologies can unlock the herd's genetic potential.
Weaknesses: Milking three times per day requires another shift of workers for milking to be managed or robotic milking systems can be installed and managed.	**Threats:** Managing a very high-producing herd requires attention to detail, skill sets to solve problems quickly and a continual commitment to learning as new innovations appear.

2.2 Key Production Benchmarks of Missouri Dairy Farms

Rolling herd average, SCC and pregnancy rate are benchmarks that can be used to analyze production productivity. An analysis of these Missouri benchmarks, gaps and tactics that can improve each respective production measure are identified in Exhibit 2.2.1.

Exhibit 2.2.1 – Gap Analysis on Missouri Production Benchmarks

Measure	Source	Benchmark			Tactics to Improve
		MO	U.S.	Gap	
Rolling herd average *(lbs./cow)*	DHIA DRMS 2014 USDA-NASS 2013	17,105 14,663	21,116 21,822	4,011 7,159	• Improve dry matter intake and forage quality • Heat stress abatement • Cow comfort in stalls • Lower number of days in milk via better reproduction • Systems that lead to proper attention to detail • Genetic improvement
Somatic cell count (SCC) *(thousands)*	DHIA DRMS 2014	338.4	262.9	75.5	• Clean resting and high traffic areas • Use correct milking procedures, and maintain equipment • Systems that lead to proper attention to detail
Pregnancy rate as indicated by calving interval *(months)*	DHIA DRMS 2014	15.1	14.3	0.8	• Improved heat detection/breeding • Heat stress reduction • Estrus synchronization protocols • Cow comfort systems • Improved nutrition

2.3 Key Financial Benchmarks of Missouri Dairy Farms

An analysis of Missouri dairy producer financial benchmarks, gaps and tactics that can improve each respective financial measure are identified in Exhibit 2.3.1. Benchmarks are derived from USDA-reported data for Missouri and the U.S.

Exhibit 2.3.1 – Missouri Financial Benchmarks Gap Analysis and Tactics

Measure	Source	Benchmark			Tactics to Improve
		MO	U.S.	Gap	
Milk price *(per cwt.)*	USDA-NASS (2009-2013 avg.)	$17.92	$17.64	$0.28	• Need to maintain slight price edge by at least maintaining farm performance to U.S. average • Quality, volume and component premiums • Niche or collective processing • Organic production
Feed cost *(per cwt.)*	USDA-ERS Cost of Production Survey 2013	$16.46	$15.91	$0.55	• Raise milk production per cow • Improve forage quality and yields • Graze to remove harvest and storage costs • Reduce waste in storage and feeding • Volume buying of feedstuffs individually or in purchasing groups • Use of nutrition consultants or dairy nutrition training programs to optimize rations • Improve reproduction to decrease herd's number of days in milk
Hired/unpaid labor cost *(per cwt.)*	USDA-ERS Cost of Production Survey 2013	$10.33	$3.80	$6.53	• Increase herd size to achieve economies of scale • Build contractor network to outsource feed production, manure handling, heifers raising • Improve productivity through labor training programs • Design and implement labor-efficient holding areas and parlors
Machinery and equipment cost *(per cwt.)*	USDA-ERS Cost of Production Survey 2013	$5.63	$3.57	$2.06	• Custom hire operators or collective ownership groups for forage harvesting • Increase herd size to achieve economies of scale
Net cash farm income *(avg. per farm)* *(avg. per cow)*	USDA-NASS Census of Agriculture 2012	$48,569 $602	$201,930 $1,004	$153,361 $402	• Increase herd size to achieve economies of scale • Decrease variable and fixed costs by spreading over other enterprises • Move to value-added production
Return on assets *(percent)*	USDA-ERS ARMS Survey 2012	-2.1	4	6.1	• Decrease asset allocation • Improve net farm income • Build contractor network to outsource feed production, manure handling, heifers raising to lower capital investment per cwt. and mimic scale in smaller herds • Increase gross farm income with other enterprises

Exhibit 2.3.2 details the USDA cost of production estimates by herd size for the U.S. and an average herd in Missouri. Most of the operating costs data for Missouri is very similar to what has been estimated by different herd sizes in the U.S. However, allocated overhead is the category where Missouri is noticeably higher than the U.S., as shown in the capital recovery of machinery, and equipment and opportunity cost of labor categories. Most of this can be attributed to Missouri's smaller herd sizes that result in unpaid family labor and machinery/equipment split across smaller milk production levels.

Exhibit 2.3.2 – USDA Cost of Production U.S. Estimates by Herd Size versus Missouri, 2013

Item	Estimated Cost by Herd Size in the United States					Missouri
	50-99 Cows	100-199 Cows	200-499 Cows	500-999 Cows	>1,000 Cows	Average Herd
	$/Cwt	*$/Cwt*	*$/Cwt*	*$/Cwt*	*$/cwt*	*$/Cwt*
Gross value of production:						
Milk sold	21.15	20.76	20.64	20.02	18.86	19.78
Cattle	1.97	1.70	1.49	1.55	1.45	2.04
Other income	1.08	0.95	0.94	0.87	0.82	1.34
Total, gross value of production	24.20	23.41	23.07	22.44	21.13	23.16
Operating costs:						
Feed--						
Purchased feed	7.85	8.22	9.65	10.00	10.12	10.27
Homegrown harvested feed	11.25	9.84	7.96	5.56	3.26	5.51
Grazed feed	0.25	0.15	0.12	0.02	0.02	0.68
Total, feed costs	19.35	18.21	17.73	15.58	13.40	16.46
Other--						
Veterinary and medicine	0.92	0.82	0.96	0.94	0.67	0.70
Bedding and litter	0.39	0.34	0.32	0.30	0.12	0.11
Marketing	0.22	0.23	0.24	0.29	0.22	0.15
Custom services	0.62	0.65	0.71	0.70	0.41	0.55
Fuel, lube, and electricity	1.22	1.01	0.99	0.74	0.58	1.29
Repairs	1.02	0.72	0.71	0.42	0.43	0.83
Other operating costs	0.01	0.00	0.00	0.00	0.00	0.00
Interest on operating capital	0.01	0.01	0.01	0.01	0.01	0.01
Total, operating cost	23.76	21.99	21.67	18.98	15.84	20.10
Allocated overhead:						
Hired labor	0.93	1.35	2.02	2.02	1.60	0.93
Opportunity cost of unpaid labor	7.38	3.66	1.55	0.54	0.17	9.40
Capital recovery of machinery and equip.	6.88	4.87	3.88	2.69	2.12	5.63
Opportunity cost of land (rental rate)	0.06	0.04	0.02	0.01	0.00	0.22
Taxes and insurance	0.33	0.26	0.24	0.17	0.10	0.46
General farm overhead	0.97	0.78	0.73	0.46	0.44	0.63
Total, allocated overhead	16.55	10.96	8.44	5.89	4.43	17.27
Total costs listed	40.31	32.95	30.11	24.87	20.27	37.37
Value of production less total costs listed	-16.11	-9.54	-7.04	-2.43	0.86	-14.21
Value of production less operating costs	0.44	1.42	1.40	3.46	5.29	3.06

Source: USDA-Economic Research Service

2.4 Regulatory Environment for Water Quality

The purpose of this section on water quality requirements is to compare regulatory requirements in selected states versus Missouri. States included in the review are Missouri, Iowa, Kansas, South Dakota and Wisconsin. Information in this section should be confirmed with local state regulatory agencies before using information for planning or managing an existing facility. This review did not consider air quality standards. A brief review of each state's approach follows. States are listed in order of decreasing regulation complexity:

Iowa:
The rules applying to working dairies will be for confined feedlot operations (CFOs). Iowa has a unique approach to CFOs, and it requires a construction permit but does not issue operating permits. Because there is no operation permit (but nutrient management plan is required), a CFO cannot discharge for any reason. Iowa CFO regulations are complex to understand and highly detailed. They have many exceptions and nuances dealing with everything from storage design to implementation of facility and manure application setbacks. Iowa has extensive additional requirements that are not apparent in the tables beyond any other state. Iowa requires all CFO information, including the required annual updates to the nutrient management plan, to be submitted to the local county board of supervisors. Iowa uniquely does not allow liquid manure application to soybean fields by permitted operations. It also has many additional fees including an annual nutrient management plan submission fee, indemnity fund fee and construction permit fee. Finally, Iowa has another set of rules for open feedlots that allow discharges under certain situations. These rules are rarely applied to milking cows, but dairy operators may fall under them if they raise young stock or maintain dry cows on open feedlots. It was impossible to fully understand Iowa rules without calling a state resource.

Wisconsin:
Wisconsin has three separate permits covering all dairy sizes. It is the one state that explicitly states that all operations are expected to follow appropriate rules and standards. This statement is particularly relevant for nutrient management plan requirements. Wisconsin has detailed rules mostly by incorporating many technical standards from organizations like the Natural Resource Conservation Service (NRCS), American Society of Civil Engineers (ASCE) and American Society of Agricultural Engineers (ASAE) for storage design and nutrient management criteria. In addition to incorporating the NRCS 590 Nutrient Management Standard by reference, Wisconsin rules also have detailed, complex requirements about setbacks, winter manure applications (governed by manure type; method of application; and within irrigated systems, nozzle pressure) and edge-of-field manure stacking. Wisconsin has the longest storage period requirements consistent for its long winters. It was impossible to fully understand Wisconsin rules without calling a state contact.

Kansas:
Kansas is unique in that all dairies require a permit, and it has no exception for size. Smaller operations can use the state permit, but large operations must use the more stringent site specific permit. The state permit is similar to Missouri's state permit in that it eliminates much of the public comment and reporting needed for larger operations. Kansas only extends those benefits to operations with less than 700 cows because its site-specific permits allow discharges under certain conditions. More operations are covered by regulations in Kansas. However, the rules largely follow federal requirements and are fairly easy to find and follow.

Missouri:
Missouri rules are more complex than rules in Kansas, but Kansas rules affect all operations directly, which makes them more complicated to implement. Missouri is unique in providing farmers the choice of degree of regulation except for the largest operations. The options include either a state permit or a National Pollutant Discharge Elimination System (NPDES) permit. Having two parallel permit options is more complex, but that complexity offers flexibility for producers. An operation that agrees to never discharge eliminates permit requirements for public notice and submission of records. Missouri has worked to consolidate key information for regulating operations.

South Dakota:
South Dakota contains all of its requirements within the one general permit that covers all CAFOs in the state. The permit was approved in 2003 and expired in 2008, but it is still the effective basis of regulation of CAFOs in the state. The state website implies the permit will be updated soon. The rules in South Dakota are closely related to federal requirements, and there are few specific requirements for design criteria common in the other states.

Exhibits 2.4.1 through 2.4.11 compare key regulatory attributes for Missouri, Iowa, Kansas, South Dakota and Wisconsin. The exhibits define the dairies that are regulated in each state and characteristics of the rules that they are expected to follow. Note that in all states, unregulated operations are expected to protect water quality. In some cases, they are expected to implement water quality rules even when not getting a permit. For example, the Wisconsin Department of Natural Resources states that "Compliance with Wisconsin's agricultural standards and prohibitions is required of all cropland and livestock operations in the state regardless of size." In other states, the requirements to specifically follow water quality rules are less clearly stated, but if a spill occurs during land application, having followed the rules may mitigate/eliminate a regulatory penalty.

Exhibit 2.4.1 – Regulatory Summary: Missouri, Iowa, Kansas, South Dakota and Wisconsin

Category	Comparison Summary
Permit types	MO has the most flexibility in permit types. It is the only state offering producers the choice between a permit requiring never to discharge and a higher degree of regulatory requirements for a permit that allows emergency discharges under specific conditions.
Permit types and costs	Missouri's largest operations (Class IA) have the highest permit fee among the selected states. Costs of other permits are similar to those in other states except Kansas, which has the lowest costs.
Who is covered	Missouri is like Kansas and Wisconsin in permitting operations and explicitly requiring nutrient management plans of operations starting at 700 mature cows. Iowa and Kansas requirements apply at lower animal numbers.
Facility setbacks	Iowa has the most extensive requirements. Wisconsin has the lowest. Missouri requirements are similar to those in Kansas and South Dakota.
Storage design period	States farther north had longer storage design periods consistent with their longer over-winter periods, which are unsuitable for manure application.
Manure application setbacks	Wisconsin and Iowa have complex and extensive setback requirements. Kansas requirements are the most limited. Missouri requirements are intermediate in range and complexity. Some of the complexity in Missouri requirements leads to lower setback requirements.
Nutrient management	Wisconsin and Iowa have the most detailed nutrient management requirements requiring the plan be submitted annually. South Dakota requires annual plans, but those plans are maintained on-site (not required to submit to agency).

Exhibit 2.4.2 – Key Permits: Missouri, Iowa, Kansas, South Dakota and Wisconsin

State	Permit Designation	Permit Type	Discharges Ever Allowed?	Authority	Public Notice	Cost
MO	State	General	No	Missouri Department of Natural Resources	No	$150-$300/year
MO	1B/C-NPDES	General	Yes	Missouri Department of Natural Resources	Yes	$350-$450/year
MO	IA-NPDES	Site-specific	Yes	Missouri Department of Natural Resources	Yes	$5,000/year
IA	CFO	Construction only	No	Iowa Department of Natural Resources	Yes	$350
IA	Small CFO	Construction only	No	Iowa Department of Natural Resources	No	$350
KS	State	Site-specific	Yes	Kansas Department of Health and Environment	Yes	$25 + $25/year
KS	Large CAFO	Site-specific	Yes	Kansas Department of Health and Environment	Yes	$100-$400/year
SD	CAFO	General	Yes	Department of Environment and Natural Resources	Yes	$175-$250
WI	Large Dairy	General	Yes	Wisconsin Department of Natural Resources	Yes	Not available
WI	Large CAFO	Site-specific	Yes	Wisconsin Department of Natural Resources	Yes	Not available
WI	Small CAFO	General	No	Wisconsin Department of Natural Resources	Yes	Not available

Exhibit 2.4.3 – Key Permit Size Thresholds: Missouri, Iowa, Kansas, South Dakota and Wisconsin

State	Permit	Regulatory Threshold	Notes
MO	State	≥700 and ≤4,900 mature cows	Regulatory threshold based on single animal type inventory.
MO	1B/C-NPDES	Required ≥700 and ≤4,900 mature cows if you propose to discharge	Regulatory threshold based on single animal type inventory.
MO	IA-NPDES	Required, >4,900 mature cows	Regulatory threshold based on single animal type inventory.
IA	CFO	≥700 mature cows	Sum animals confined under cover and open lots separately.
IA	Small CFO	200-700 mature cows	Sum animals confined under cover and open lots separately. Most rules and fees related to Small CFOs only apply to those required to have a manure management plan (≥500 animal units (350 mature cows)).
KS	State	All dairies <700 mature cows	All dairies will need to have a permit independent of size in KS.
KS	Large CAFO	≥700 mature cows	Regulatory threshold based on sum of all animal types.
SD	CAFO	Required ≥ 700 mature cows	Regulatory threshold based on sum of all animal types.
WI	Large Dairy	Required ≥ 715 and ≤4086 mature cows	Regulatory threshold based on sum of all animal types. Must have at least 80% animal units as dairy.
WI	Large CAFO	Required >4085 mature cows	Regulatory threshold based on sum of all animal types. All large CAFOs except dairy must always use this permit.
WI	Small CAFO	<715 mature cows	Only operations designated as needing a permit.

Exhibit 2.4.4 – Key Facility Setback Requirements and Site Restrictions: Missouri, Iowa, Kansas, South Dakota and Wisconsin

State	Permit Designation	Feature	Setback Criteria	Restriction	Setback
MO	All	Occupied residence, non-owned	700 to 2,099 mature cows	Facility setback	1,000 ft.
MO	All	Occupied residence, non-owned	2,100 to 4,899 mature cows	Facility setback	2,000 ft.
MO	All	Occupied residence, non-owned	≥4,900 mature cows	Facility setback	3,000 ft.
MO	All	100-year Flood plain	≥4,900 mature cows	Manure storage	Restricted
MO	All	Listed watersheds	≥4,900 mature cows	Facility	Prohibited
IA	All	Public use areas and buildings	< 350 mature cows	Manure storage	0-1,875 ft.
IA	All	Public use areas and buildings	350-699 mature cows	Manure storage	1,275-1,875 ft.
IA	All	Public use areas and buildings	700-2,099 mature cows	Manure storage	1,875-2,500 ft.
IA	All	Public use areas and buildings	≥2100 mature cows	Manure storage	2,375-3,000 ft.
IA	All	Other CAFO	<700 mature cows	Facility	1,250 ft.
IA	All	Other CAFO	≥700 mature cows	Facility	2,500 ft.
IA	All	Drinking water well	All CFOs	Facility	100-1,000 ft.
IA	CFO	100-year flood plain	All CFOs	Facility	Restricted
IA	CFO	Designated wetland	All CFOs	Facility	2,500 ft.
IA	CFO	Wellhead, sinkhole, water source	All CFOs	Facility	200-1,000 ft.
IA	CFO	Right-of-way of a thoroughfare	All CFOs	Facility	100 ft.
KS	All	Occupied residence, non-owned	<200 mature cows	Facility	None
KS	All	Occupied residence, non-owned	200-699 mature cows	Facility	1,320 ft.
KS	All	Occupied residence, non-owned	≥ 700 mature cows	Facility	4,000 ft.
KS	All	Groundwater	All permitted operations	Facility	>10 ft. depth
SD	CAFO	100-year flood plain	≥ 700 mature cows	Facility	Restricted
SD	CAFO	Public drinking water well or source	≥ 700 mature cows	Facility	1,000 ft.
SD	CAFO	Private well or source	≥ 700 mature cows	Facility	250 ft.
SD	CAFO	On-site well	≥ 700 mature cows	Facility	150 ft.
SD	CAFO	Shallow aquifer	≥ 700 mature cows	Facility	Restricted
WI	All	Wells	Barnyards, feedlots and reviewable facilities	Facility	250-1,000 ft.

Note: Most setback restrictions for residential buildings only apply when the building is not owned by the dairy.

Exhibit 2.4.5 – Key Storage Design Requirements: Missouri, Iowa, Kansas, South Dakota and Wisconsin

State	Permit Designation	Storage Type	Minimum Storage Period	Notes
MO	All	All but anaerobic lagoon.	180 days	
MO	All	Anaerobic lagoon	365	Design plans for all earthen basins to be submitted with permit application
IA	CFO	All	None	Must be able to meet over-winter non-application period requirements for liquid manure in new rules. Must locate and decommission any tile lines within 50 feet of the storage.
IA	Small CFO	All	None	
KS	All	All	120 days	Dairies typically designed for 180-day storage.
SD	CAFO	For lots under cover	270 days	
SD	CAFO	For open lots	365 days	
WI	Large Dairy	Liquid storages	180 days	
WI	Large CAFO	Liquid storages	180 days	
WI	Small CAFO	Liquid storages	180 days	

Exhibit 2.4.6 – Key Manure Land Application Setback Requirements Ranges for Dairy: Missouri, Iowa, Kansas, South Dakota and Wisconsin, Feet

State	Permit Designation	Drinking Water Well	Intermittent Stream	Perennial Stream/River /Canal	Lakes and Impoundments	Occupied Residence, non-owned	Property Boundary
MO	All	300	0-100	0-100	0-100	0-150	50
IA	CFO	0-800	0-800	0-800	0-800	0-750	0-100
IA	Small CFO	0-800	0-800	0-800	0-800	N/A	0-100
KS	All	N/A	0-100	0-100	0-100	N/A	N/A
SD	CAFO	150-1000	35-100	35-100	35-100	N/A	N/A
WI	All	100-1000	21-600	21-600	21-600	0-500	N/A

Exhibit 2.4.7 – Key Factors Affecting Manure Land Application Setback Distances: Missouri, Iowa, Kansas, South Dakota and Wisconsin

State	Permit Type	Vegetation in Setback	Vegetation in Field	Application Down-Slope	Method of Application	Type of Animal	Form of Manure	Type of Storage	Soil Test Phosphorus	Sensitive Water Resource
MO	All	Yes	No	Yes	Yes	No	Yes	No	No	No
IA	CFO	Yes	No	No	Yes	No	Yes	No	No	Yes
IA	Small CFO	Yes	No	No	Yes	No	No	No	No	Yes
KS	All	Yes	No	Yes	No	Yes	No	No	No	No
SD	CAFO	Yes	No	No	No	No	No	No	Yes	No
WI	All	Yes	Yes	No	Yes	No	Yes	No	No	Yes

Exhibit 2.4.8 – Other Manure Land Application Restrictions: Missouri, Iowa, Kansas, South Dakota and Wisconsin

State	Permit Designation	Applications, frozen and/or snow-covered ground	Slope prohibition
MO	All	Surface application prohibited.	Prohibited, slope >20%.
IA	CFO Small CFO	No application of liquid manure 12/21-4/1 for snow-covered ground and 2/1-4/1 for frozen ground. Only applies to operations required to have a manure management plan.	Limited on ground with >10% slope. Injection preferred on these slopes. Only applies to operations required to have a manure management plan.
KS	All	Liquid applications prohibited.	None, must meet P Index.
SD	CAFO	Application of liquid manure prohibited; application of solid manure to be avoided, setback must be 100 feet.	Irrigation prohibited, slope $\geq$6%. Winter application, prohibited slope $\geq$4%.
WI	Large Dairy and Large CAFO	<12% solids, surface application prohibited. $\geq$12% solids, surface applications prohibited in 2/1 to 3/31. Extensive rules in this area.	Slope >9%, solid manure.
WI	Small CAFO	<12% solids, surface application prohibited. $\geq$12% solids, surface applications prohibited in 2/1 to 3/31.	

Note: These restrictions are often bypassed under "emergency" conditions defined in the rules.

Exhibit 2.4.9 – Selected Nutrient Management Plan Requirements: Missouri, Iowa, Kansas, South Dakota and Wisconsin

State	Permit Type		New Plan		Modifications		Record Keeping
		Plan Duration	Submission Requirements	Public Notice	Submission Requirements	Public Notice	
MO	General	Five years	Maintain on-site	No	Maintain on-site	No	Maintain on-site
MO	All NPDES	Five years	Submit for approval	Yes	Submit for approval	Yes	Submit annually
IA	CFO[1]	Annually	Submit for approval	Yes	Submit for approval	No	Maintain on-site
IA	Small CFO[1]	Annually	Submit for approval	Yes	Submit for approval	No	Maintain on-site
KS	State	Five years or by permit cycle if less	Maintain on-site	No	Maintain on-site	No	Maintain on-site
KS	Large CAFO	Five years or by permit cycle if less	Submit for approval	Yes	Submit for approval	Yes	Annually
SD	CAFO	Annual	Submit for approval	No	Maintain on site, submit changes in land base for approval	No	Submit annually
WI	Large Dairy	Annual	Submit for approval	Yes	Submit for approval	Typically No	Submit annually
WI	Large CAFO	Annual	Submit for approval	Yes	Submit for approval	Yes	Submit annually
WI	Small CAFO	Annual	Submit for approval	No	Not stated	No	Submit annually

[1] Plans for these operation are called Manure Management Plans and are only required for CFOs with $\geq$350 mature cattle.

Exhibit 2.4.10 – Nutrient Management Plan Testing and Training Requirements: Missouri, Iowa, Kansas, South Dakota and Wisconsin

State	Permit Type	Soil Test P Limit?	Soil Testing	Manure Sampling	Specialized Training
MO	General	No	Every five years.	Annually	No
MO	1B/C-NPDES	No	Every five years.	Annually	No
MO	IA-NPDES	No	Every five years.	Annually	Yes
IA	CFO, Small CFO		Every four years on operations with ≥350 mature cows.	Not required	For applicators
KS	State	Yes	Required before applications if sensitive ground water area and manure has been applied within five years; otherwise, every three years or annually if manure is applied two or more consecutive years; includes residual soil nitrate.	Annually	No
KS	Large CAFO	Yes	Every three years or annually if manure is applied two or more consecutive years; includes residual soil nitrate.	Annually	No
SD	CAFO	Yes	Annually, including residual soil nitrate.	Annually	Yes
WI	All	Yes	Every four years.	Solids quarterly, liquid twice per month; only when applying manure	Yes

Exhibit 2.4.11 – Nutrient Management Plan Testing and Training Requirements: Missouri, Iowa, Kansas, South Dakota and Wisconsin

State	Core Website	Web Address
MO	Missouri DNR Water Protection Program Concentrated Animal Feeding Operation website	http://www.dnr.mo.gov/env/wpp/cafo/
IA	Iowa DNR Animal Feeding Operations website	http://www.iowadnr.gov/Environment/LandStewardship/AnimalFeedingOperations.aspx
KS	Kansas DHE Livestock Waste Management Section website	http://www.kdheks.gov/feedlots/index.html
SD	South Dakota DENR Feedlot Permit Program website	http://denr.sd.gov/des/fp/fphome.aspx
WI	Wisconsin DNR CAFOs, water permits and NR 243 website	http://dnr.wi.gov/topic/AgBusiness/CAFO/WPDESNR243.html

2.5 Local Restrictions on Animal Feeding Operations

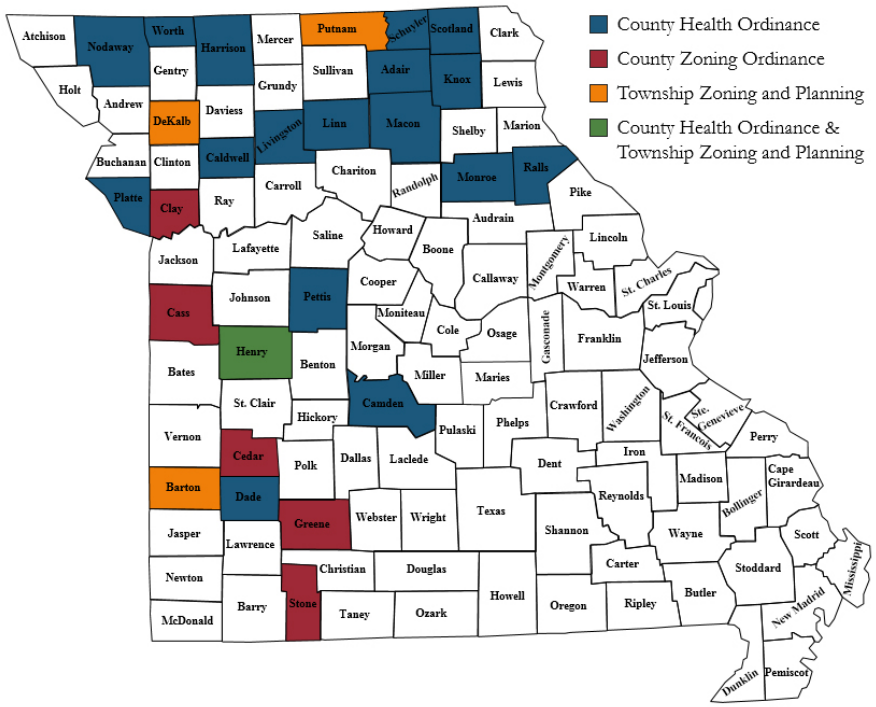
Missouri and other states have allowed local powers to create restrictions that impact livestock agriculture. Often, these restrictions have limited the ability of existing operations to expand and deterred new operations from relocating. Exhibit 2.5.1 shows a comparison between Missouri, Iowa and Indiana concerning local restrictions in their respective states. All three states have local control mechanisms that can impact dairy operations, but they vary in the degree of impact.

Exhibit 2.5.1 – Local Restrictions on Animal Feeding Operations, Select States

State	State law(s) specifically limiting county AFO rules?	Significant local limits on AFOs that exceed state standards?	Local control mechanism
Missouri	No	Yes	• County health ordinance • County or township zoning
Iowa	Yes	Yes	• Master matrix system
Indiana	No	Yes	• County zoning

Local governments in Missouri have imposed additional requirements and fees on animal feeding operations beyond what is required in regulations by the Missouri Department of Natural Resources. Two strategies have been used by these local governments to add requirements: county health ordinances and zoning ordinances (county and township). Exhibit 2.5.2 shows a map for Missouri that identifies all known local restrictions that impact animal feeding operations.

Exhibit 2.5.2 – Missouri Counties Known to Have Local Restrictions on Animal Feeding Operations



Source: University of Missouri

The scope of the ordinances and zoning restrictions can be quite broad. Exhibit 2.5.3 summarizes counties where health ordinances impose local requirements or fees that exceed state requirements. Typically, there is a lot of similarity among many of the county health ordinances. For example, the health ordinances in Harrison and Livingston counties have identical wording.

Exhibit 2.5.3 – Summary of County Health Ordinances, Selected Missouri Counties

County	Classification of CAFO	Air Quality Restrictions	Facility Setbacks	Lagoon or Feedlot Setbacks	County Fees	Financial Security
Caldwell	≥ 300 AU	Yes	¼ - 1 mile from another CAFO	2,000 feet from an existing residence	$1,000-10,000	$30,000-$70,000 cash or surety bond; Extra $20,000 per 500 AU over 2000
Camden	≥ 250 AU	Yes	½ - 2 miles from another CAFO	1-5 miles from dwellings, public areas, water supply sources	$1 per AU original and annual renewal for a permit	$100 per AU, cash or surety bond
Harrison	≥ 300 AU	Yes	¼ - 1 mile from another CAFO	1,000-3,000 feet from public building or dwelling	$1000-10,000	$15,000-$100,000 cash or surety bond
Henry	≥ 1000 AU	Yes	None	3,000 feet from occupied dwelling	Original or renewal fee is $0.71 per AU; Permit fees range from $6,000 to $12,500	None
Linn	≥ 300 AU	Yes	¼ - 1 mile from another CAFO	None	$1,000-10,000	$30,000-$70,000 cash or surety bond; Extra $20,000 per 500 AU over 2000
Livingston	≥ 300 AU	Yes	¼ - 1 mile from another CAFO	1,000-3,000 feet for public building or dwelling	$1,000-10,000	$15,000-$100,000 cash or surety bond
Pettis	≥ 300 AU	No	¼ - 1 mile from another CAFO	None	$5 for permit	None
Platte	≥ 300 AU	Yes	¼ - 1 ½ mile from another CAFO, increase ¼ mile each 500 over 7,000 AU	None	$1,000-10,000; $1 per AU over 10,000 AU; Renewal is $100-500	$1,000-$150,000 surety bonds or insurance; $20,000 extra each 500 AU over 7,000 AU

Note: Copies of the ordinances can be downloaded at http://nmplanner.missouri.edu/regulations/mocountyrules/.
Source: University of Missouri

Other states have varied in how they have treated county legislation concerning livestock. Iowa state law includes two measures that limit county-level legislation affecting animal feeding operations.

Iowa Code 331.304A, passed in 1998, limits county powers to regulate livestock operations when it is more restrictive than the state laws and regulations, which provides in part: "A county shall not adopt or enforce county legislation regulating a condition or activity occurring on land used for the production, care, feeding or housing of animals unless the regulation of the production, care, feeding or housing of animals is expressly authorized by state law."

Iowa Code 459.403, passed in 2002, prevents counties from charging fees for construction permits, manure management plans or other areas related to animal agriculture. "A county shall not assess or collect a fee under this chapter for the regulation of animal agriculture, including but not limited to any fee related to the filing, consideration, or evaluation of an application for a construction permit pursuant to section 459.303 or the filing of a manure management plan pursuant to section 459.312."

Additionally, Iowa developed a master matrix program in 2004 that counties can adopt for use. This criterion is used during the evaluation of a construction permit for permitted confinement feeding operations, including dairy operations. The matrix has three subcategories for air, water and community impacts. Producers in counties that have opted into this matrix have higher standards than other permitted operations in counties that have not adopted this program. As of 2014, only 11 counties in Iowa have not passed the use of the master matrix program in their counties.

Indiana allows counties to create local zoning ordinances that could affect a confined feeding operation. Indiana Code 36-7 Planning and Development provides the broad authority to plan and adopt zoning ordinances. Zoning ordinance restrictions usually include residential and public building setbacks. The Indiana Department of Agriculture (2012) developed a guide that recommended three models or approaches to local regulation and that gives local officials some guidance in what could be adopt in a respective county if the given county wishes to have a local zoning ordinance.

2.6 Water Availability

Missouri is a riparian water law state, so landowners have a right to reasonably use water sources that are touching or underneath their land. Under riparian law, a landowner can withdraw as much water as needed as long as the withdrawals do not adversely impact the water use of other individual water users. Exhibit 2.6.1 details water right laws, groundwater permits and usage reporting for Missouri, Kansas, Iowa, South Dakota and Wisconsin. Many western U.S. states, such as Kansas and South Dakota, use prior appropriation water law that are determined by priority of beneficial use. This means that the first person to use water or divert water for a beneficial use can acquire individual rights to the water and the rights can be sold or transferred.

Exhibit 2.6.1 – Groundwater Laws and Permits: Missouri, Iowa, Kansas, South Dakota and Wisconsin

State	Doctrine of Appropriation	Groundwater Permit Required	Groundwater Use Reported
Missouri	Riparian	No	>100,000 gpd
Kansas	Prior appropriation	Yes	
Iowa	Riparian (modified)	Yes, >25,000 gpd	>25,000 gpd
South Dakota	Prior appropriation	Yes	
Wisconsin	Riparian	Yes, >100,000 gpd	Yes

Source: National Conference of State Legislatures (2013)

Missouri water users who withdraw or divert 100,000 gallons per day (gpd), equivalent to 70 gallons per minute all day, from streams, rivers, lakes, wells, springs or other water sources are considered major water users. Missouri Water Law (Section 256.400–430 of the Revised Statutes of Missouri) requires that major water users register their water use annually with the Missouri Department of Natural Resources (DNR). Users may be designated as major even if they only withdraw or divert the 100,000-gallon threshold on one day in a year.

For Missouri, a majority of the water currently used for irrigation comes from groundwater sources. The Missouri DNR Division of Geology and Land Survey/Wellhead Protection Section is the regulatory agency in charge of irrigation wells in Missouri. It is the clearinghouse for all well construction rules. It also maintains a Missouri database of licensed private well drillers and pump installers that should be used when drilling or repairing a well. Groundwater use data for Missouri, Iowa, Kansas, South Dakota and Wisconsin are detailed in Exhibit 2.6.2. Primary groundwater use in Missouri is for irrigation, amounting to 77 percent of the total groundwater.

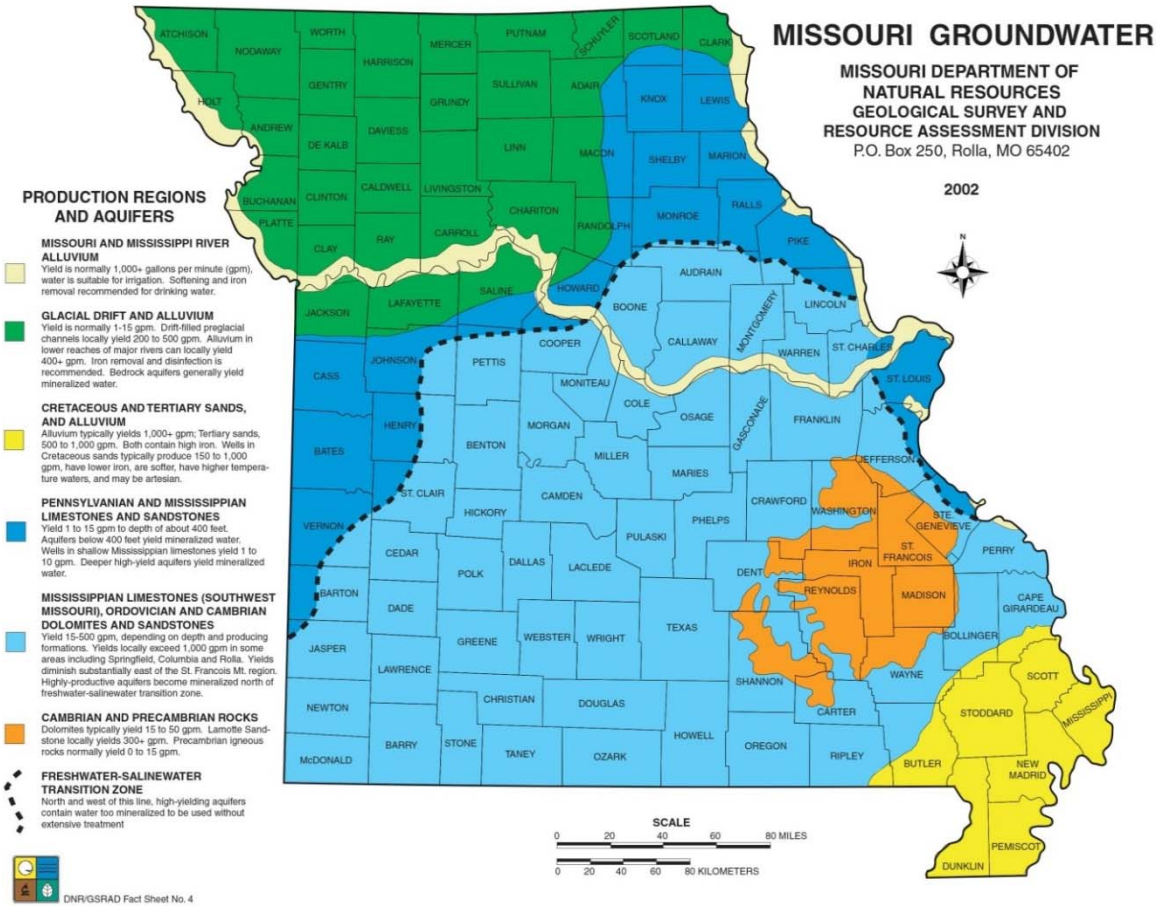
Exhibit 2.6.2 – Groundwater Use: Missouri, Iowa, Kansas, South Dakota and Wisconsin, 2005

	Total Groundwater		Livestock/Aquaculture		Irrigation	
State	Fresh, no saline (mgd)	% of total state water supply	Groundwater (mgd)	% of total groundwater used	Groundwater (mgd)	% of total groundwater used
Missouri	1,750	20%	27	2%	1,340	77%
Kansas	2,950	78%	86	3%	2,620	89%
Iowa	683	20%	99	14%	32	5%
South Dakota	271	54%	38	14%	149	55%
Wisconsin	975	11%	104	11%	104	11%

Source: National Groundwater Association (2012)

It is important to understand the geology of Missouri to have an idea of how much groundwater is typically available in various areas, as shown in Exhibit 2.6.3. Special areas in Missouri may require that dairy producers either case or grout deeper, depending on the area and geologic conditions. Requirements for well construction are based on yield, use of well and the region where the well is located.

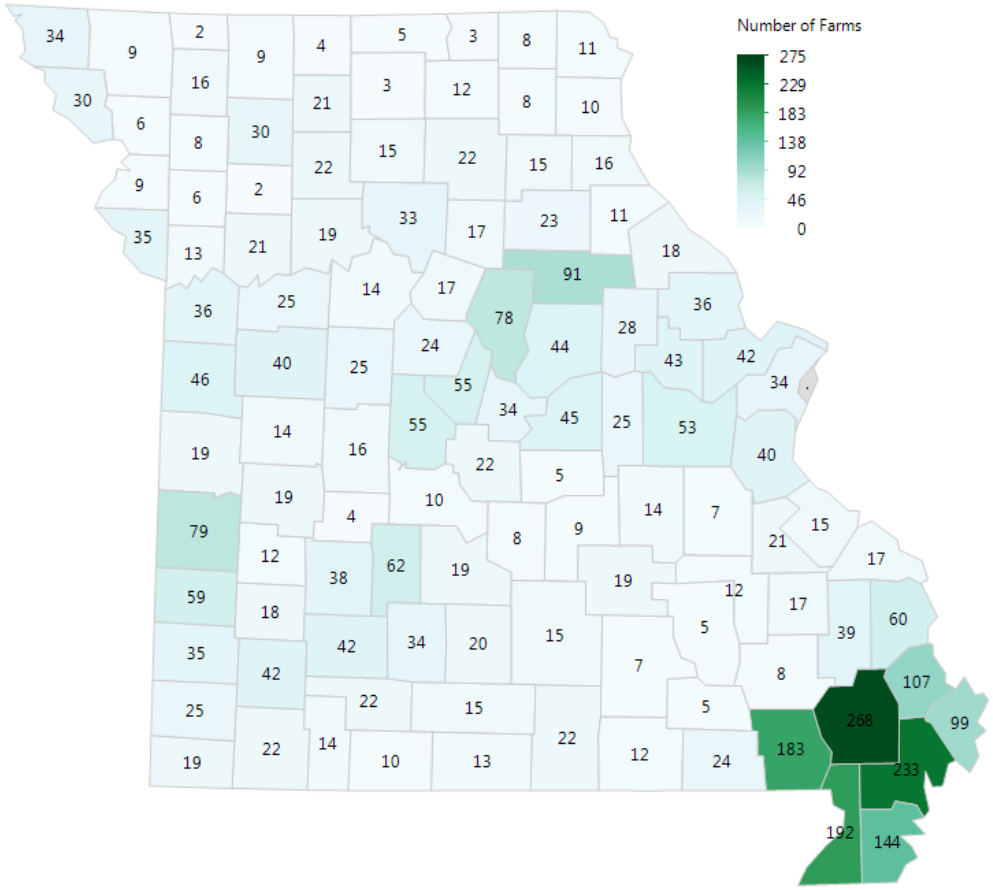
Exhibit 2.6.3 – Missouri Groundwater Production Regions and Aquifers



Source: Missouri Department of Natural Resources

Exhibit 2.6.4 provides a county-level analysis of where irrigation occurs in Missouri. Missouri had 3,727 farms, or 3.8 percent of total farms in the state, that irrigated in 2012. Of the approximately 1.2 million acres that were irrigated, irrigation occurred predominately on cropland. The southeast corner of Missouri has the strongest concentration of irrigation.

Exhibit 2.6.4 – Missouri Farms with Irrigation, 2012



Source: National Agricultural Statistics Service, Census of Agriculture

2.7 Business Climate

Tax rates, utility costs, infrastructure and population demographics are all key indicators of a state's business climate. Exhibit 2.7.1 outlines these key indicators for Missouri, Illinois, Iowa, Kansas, Minnesota, South Dakota and Wisconsin. Missouri has the highest number of interstate miles and persons below poverty level, while the median household income was the lowest among the selected states.

Exhibit 2.7.1 – Business Climate in Missouri and Other States

Category	Unit	MO	IL	IA	KS	MN	SD	WI
Tax Rates								
Corporate	%	6.25%	9.50%	6%-12%	4%-7%	9.80%	None	7.90%
Individual Income Tax Collection	$ per capita	$853	$1,206	$987	$1,005	$1,489	$0	$1,183
State and Local Sales Tax	%	7.58%	8.16%	6.78%	8.15%	7.19%	5.83%	5.43%
Gasoline Tax	¢/gal.	17.0	19.0	21.0	24.0	28.5	22.0	30.9
Diesel Tax	¢/gal.	17.0	21.5	22.5	26.0	28.5	22.0	30.9
Utility Costs								
Avg. Commercial Electric	$/kWh	$0.090	$0.089	$0.092	$0.102	$0.099	$0.089	$0.113
Avg. Residential Electric	$/kWh	$0.110	$0.115	$0.123	$0.124	$0.128	$0.115	$0.146
Avg. Residential Natural Gas	$/1,000 cu ft.	$24.72	N/A	$15.96	$20.05	$12.71	$13.47	$12.41
Infrastructure								
Freight Railroad	miles	3,958	7,027	3,855	4,855	4,449	1,754	3,385
Interstate	miles	1,379	1,239	782	874	914	679	743
Public Road	miles	131,978	144,337	114,438	140,614	138,833	82,536	115,094
Airports	number	359	468	194	330	324	138	421
Income and Population								
Median Household Income	dollars	$47,380	$56,797	$51,843	$51,332	$59,836	$49,495	$52,413
Per Capita Income	dollars	$25,649	$29,666	$27,027	$26,929	$30,913	$25,740	$28,155
Population	number	6,044,171	12,882,135	3,090,416	2,893,957	5,420,380	844,877	5,742,713
Persons below Poverty Level	percent	15.5%	14.1%	12.4%	13.7%	11.5%	14.1%	13.0%
Cost of Living	ranking	16	22	14	13	28	29	24

Source: Missouri Economic Research and Information Center, Tax Foundation, U.S. Department of Transportation, U.S. Energy Information Administration and U.S. Census Bureau.

For selected states, Exhibit 2.7.2 provides a state business tax climate analysis conducted by the Tax Foundation. Missouri is ranked 17th of all U.S. states. The five best states in this year's index were Wyoming, South Dakota, Nevada, Alaska and Florida. Many of these top states have no corporate or individual income tax. Rankings are also displayed by various tax categories such as corporate tax, individual income tax, sales tax, unemployment insurance tax and property tax. Missouri ranked in the top 10 states in corporate tax and property tax.

Exhibit 2.7.2 – 2015 State Business Tax Climate Ranks and Component Tax Ranks

State	Overall Rank	Corporate Tax Rank	Individual Income Tax Rank	Sales Tax Rank	Unemployment Insurance Tax Rank	Property Tax Rank
Missouri	17	4	29	29	12	7
Illinois	31	47	11	34	38	44
Iowa	41	49	32	23	33	38
Kansas	22	38	18	30	9	28
Kentucky	26	29	30	11	45	17
Minnesota	47	44	46	37	29	34
South Dakota	2	1	1	35	41	18
Texas	10	39	6	36	15	36
Wisconsin	43	33	43	14	27	31

Note: 1 is best, and 50 is worst. Rankings do not average to total. States without a tax rank equally as 1 for that component. D.C. score and rank do not affect other states. Report shows tax systems as of July 1, 2014 (the beginning of fiscal year 2015).
Source: Drenkard and Henchman (2014)

3. Dairy Revitalization Efforts and Public Incentives

Several U.S. states have implemented initiatives to strengthen their dairy industries. At the production level, several factors motivate dairy relocation. According to Normand St-Pierre from The Ohio State University, important factors that lead to dairy operations selecting a given area or location include cash flow potential, capital expenditures required and the area's tax structure and incentives (Latzke 2013). From a tax perspective, property taxes tend to be a greater concern than income taxes. Economic incentives have moderate importance. Within different subcategories of relocation factors, several other items are important. Regarding regulation, important factors include CAFO-friendly legislation, the judicial system's position toward agriculture and clear regulatory processes. When selecting a specific site, producers look for fresh water access, land to handle animal waste, average milk price, fresh water quality and waste handling and odor regulations (Latzke 2013).

Public incentives are one approach that states have taken to strengthen their dairy industries. Exhibit 3.1 details a comparison of selected policies and incentive programs that have been developed in other states. The following subsections (3.1 through 3.9) describe a few state-by-state efforts that have sought to address dairy producers' needs, position their states as dairy-friendly and revitalize the dairy industry.

Exhibit 3.1 – Dairy State Policy Comparison, 2014

State	Title	Background	Funding Source
AR	Arkansas Milk Stabilization Act of 2009	The Secretary after each month shall calculate the monthly average blend price of milk received by Arkansas producers and obtain from USDA's ERS the monthly average cost of production in Missouri and Tennessee. The Secretary shall compare the monthly Arkansas average blend price of milk with 70% of the estimated monthly cost of production in Missouri and Tennessee. If the Secretary determines the Arkansas average blend price of milk is lower than the 70% of the estimated cost of production in Missouri and Tennessee, producers will be eligible for a monthly grant, provided funds are available. The Secretary shall consult with the Arkansas Milk Stabilization Board. The monthly grant cannot exceed $5 per cwt. per month, and the annual average grant cannot exceed $2 per cwt. The Secretary will provide quality incentive grants to producers if funds are available, accordingly: (1) 50 cents per cwt. of milk for each cwt. of milk produced above the producer's average annual production during the preceding two years; (2) 50 cents per cwt. for the milk produced during a given year above the average annual production of the preceding two years if the somatic cell count is below 400,000 for milk produced during the given year; (3) Annual incentives to milk producers for milk production and quality shall be limited to not exceed $50,000 per producer.	The program is subject to state appropriations and was funded at $9.1 million for the 2009 and 2010 calendar years. Since that time, the program has not been funded.
KY	Market Incentive Leadership of KY (MILK) Program	Producers participating in the MILK program receive an incentive payment to increase production and improve quality. Producers can qualify for incentive if they increase production by 5% (50 cents/cwt.) or 10% (75 cents/cwt.) in 2015 above the 2013/2014 average base (Calculated Monthly). Additional premiums are rewarded for milk quality improvements (SCC $\leq$ 300,000 average of all pickups for month and PIC $\leq$ 20,000 pre-incubation count – producer's marketing agency requirement). The maximum amount per year for an eligible farm is $15,000. The program does not replace or affect existing incentives paid by marketing agencies in Kentucky. A total of 213 producers across the state participate currently.	MILK was funded through the 2013 and 2014 calendar years with $1.8 million. Kentucky's Master Tobacco Settlement Agreement allocates 50% of the program. The program is managed by the Kentucky Dairy Development Council.
KY	Udderly Kentucky Milk	"Udderly Kentucky" milk is trademarked by the Kentucky Department of Agriculture and processed by Prairie Farms Dairy in Somerset, Kentucky. This facility processes milk from 105 Kentucky producers in the region. Prairie Farms offers "Udderly Kentucky" milk in whole, 2%, 1%, and skim varieties in gallon sizes. In addition, producers participating in the program receive a 7 cent per-gallon premium. The milk is sold in Wal-Mart stores in the state.	Is funded through the Kentucky Proud program, which is administered by the Kentucky Agricultural Development Board and funded at $2.8 million through 2013 and 2014.
NC	NC Dairy Advantage	The program offers several consulting services that help producers to improve milk quality, feeding rations and operational profitability. Some of these services are provided at no cost to the producer. Similar to the Wisconsin program, producers can utilize a farm assessment and on-farm profit program. These programs are offered through NC State University Extension. The program also uses resources through the NC Department of Agriculture and NC Dairy Producers Association.	The program is set up as a 501(c)3 program. It utilizes resources from several areas including the university system, extension services and several state organizations like the NC Ag Foundation, NC Dairy Foundation, NC Dairy Producers Association, Golden Leaf Foundation, and the Agricultural Development and Farmland Preservation Trust Fund.

State	Title	Background	Funding Source
NY	Dairy Acceleration Program	Dairy Acceleration Program funding provides 80% of project cost while farm covers 20% on eligible projects, such as $5,000 to write a business plan and develop a business growth model; $6,000 for a comprehensive nutrient management plan for farms under 300 cows; up to $4,500 to update existing CNMP for farms under 300 cows; and up to $3,600 for an initial evaluation of financial and environmental needs for farms under 300 cows.	The program is being funded at $1 million through the state appropriations process.
VT	Best Management Practice Program	BMP provides state financial assistance to Vermont farmers. Funding through the BMP program is available for the voluntary construction of on-farm improvements designed to abate non-point source agricultural waste discharges into the waters of the state. Such construction must meet standards that are consistent with goals of the federal Water Pollution Control Act and with state water quality standards. BMP funds can be combined with federal cost share to provide a maximum of 85% of an approved project. State cost share is limited to a maximum of 35% when combined with federal cost share and up to 80% without federal cost share. A minimum of 15% of the costs will be covered by the farmer.	The program is funded through the state and works in partnership with USDA funds. In 2013, the Vermont budget included approximately $300,000 for all grant programs including BMP.
WI	Grow Wisconsin Dairy Producer Grant	The program provides grants up to $5,000 to be applied toward business development and expansion needs. These funds can be used toward different business development areas such as business planning, financial analysis, transition planning and farm transfers. Business planning grants assist producers in the early stages of planning dairy start-up or major changes in business structure. Funds are also applicable for dairy farm modernization and expansion efforts to provide assistance with professional services costs related to siting, engineering, design, layout of new barns, parlors or other farm structures. Assistance (up to $5,000) for related professional services and consultant. The producer is required to cover 20% of the grant amount.	Both Wisconsin Dairy Producer Grant and Profit Teams are funded through annual appropriation of $200,000.
WI	Dairy Profit Teams	The program provides up to $5,000 grant for on-farm management team to assist dairy producers in improving management of existing operational systems and identify opportunities to improve profit. The Profit Teams are a successful model in which groups of specialists and advisors work with farmers to evaluate opportunities for their farm, based on the specific needs of their operation. Services include a series of three to four meetings in which the farmer and team members identify issues and opportunities, develop strategies for near and long-term planning. Topics include new or appropriate technology implementation, farm growth, financial success, long-term sustainability and other production-enhancing measures through focuses on herd health, nutrition, milk production, software for operational efficiencies and training, managed grazing planning or transition to organic production. Assistance (up to $5,000) to cover meeting expenses including facilitator's expenses, consultant fees, applicable testing and associated costs. The producer is required to cover 20% of the grant amount.	Both Wisconsin Dairy Producer Grant and Profit Teams are funded through annual appropriation of $200,000.
WI	Dairy and Livestock Farm Investment Tax Credit	The Wisconsin Dairy and Livestock Farm Investment Credit is a nonrefundable credit equal to 10% of the amount a producer spends on dairy and livestock farm modernization or expansion. The maximum credit is $75,000. This credit applies to building or facility construction, improvement or acquisition, or it applies to acquiring equipment for housing, confinement, feeding, milk production or waste management. It relates exclusively to dairy or livestock animals.	This credit is available for taxable years beginning on or after January 1, 2006 and before January 1, 2014.

3.1 Missouri

The Missouri Dairy Growth Council (MDGC) has been one revitalization effort in Missouri. MDGC's mission is to grow a stronger and more viable dairy industry. Formed in January 2003, the council meets regularly to explore opportunities in communication, legislation, education and capital sources for producers. This group consists of dairy producers, allied industry representatives, state government staff and university faculty. The council has participated in trade shows such as the World Dairy Expo in Madison, Wis., and World Ag Expo in Tulare, Calif. Promoting Missouri as a dairy state to producers seeking to relocate or expand existing operations has been the primary goal.

Other programs in Missouri that have benefited dairy producers originate from the Missouri Agricultural and Small Business Development Authority (MASBDA). Housed at the Missouri Department of Agriculture, MASBDA implements financial assistance programs for Missouri livestock and crop producers as one of its roles. These programs include numerous loan programs, loan guarantees, tax credits and grants available to producers. The following is a list of financial assistance programs available to Missouri producers, including dairy, from MASBDA.

Beginning Farmer Loan Program
Beginning farmers can receive loans from commercial lenders on an average of 20 percent to 30 percent below conventional rates through this program. The reduced rates are made possible by tax-exempt bonds issued by MASBDA and sold to commercial lenders. Lenders, in turn, pass the savings derived from the tax-exempt bonds to beginning farmers in the form of lower interest rates. Bonds issued by the authority, including those used to fund beginning farmer loans, do not constitute a debt, liability or obligation of the state or of any political subdivision but are payable solely from the authority's revenues or assets. A qualified beginning farmer can borrow up to $509,600 to buy agricultural land, farm buildings, farm equipment and breeding livestock. For fiscal years 2010 to 2014, 49 beginning farmer loans were approved by MASBDA, and they totaled $9,767,663.

Animal Waste Treatment System Loan Program
Livestock producers are able to secure direct loans from MASBDA for animal waste treatment systems. Loans can be made for up to 10 years at fixed interest rates that are below conventional interest rates (currently at 4.3 percent). Loan proceeds may generally be used for financing waste facilities and equipment as approved by the Department of Natural Resources. For fiscal years 2010 to 2014, eight loans were approved by MASBDA, and they totaled $1,129,565.

Single-Purpose Animal Facilities Loan Guarantee Program
The Single-Purpose Animal Facilities Loan Guarantee Program is designed to provide banks and other lenders with a 50 percent first-loss guarantee on loans of up to $250,000 for up to 10 years. Independent livestock producers may use the loans to finance the acquisition, construction, improvement, rehabilitation or operation of land, buildings, facilities, equipment, machinery and animal waste facilities used to produce poultry, hogs, beef or dairy cattle or other animals in a single-purpose animal facility. Borrowers who qualify for the guaranteed livestock loan may also qualify for a reduced interest loan through the Missouri Linked Deposit Program administered by the state treasurer's office. For fiscal years 2010 to 2014, six guarantees were issued by MASBDA, and they totaled $892,500.

Family Farm Breeding Livestock Loan Program
The program provides Missouri tax credits to lenders in lieu of the first-year interest being paid on breeding livestock loans made to "small farmers" who are Missouri residents and who have less than $250,000 in gross agricultural product sales per year. Maximum eligible loans cannot exceed 90 percent of the cost of purchasing breeding livestock. Each small farmer shall be eligible for only one family farm livestock loan per immediate household family and only one type of livestock. For fiscal years 2010 to 2014, 122 producers took advantage of the program, and the program issued $204,658 in tax credits.

Dairy Business Planning Grant
This program provides Missouri dairies an opportunity to expand by providing business planning grants to aid them in determining the feasibility of the planned expansion. The grants provide up to 90 percent of the cost of the business plan, and the maximum grant is $5,000. This program was funded in fiscal year 2005 through general revenue funding. Eleven grants were funded, and they totaled $29,500. In fiscal year 2009, the program received no general revenue funding, but through contributions to MASBDA from the Missouri Dairy Growth Council and the Missouri Soybean Association, three grants were funded, and they totaled $15,000. In fiscal year 2011, the program received no general revenue funding, but again, through contributions to MASBDA from the Missouri Dairy Growth Council and the Missouri Soybean Association, four grants were funded, and they totaled $12,950.

Dairy Cow Loan Program
The goal of the Dairy Cow Loan Program is to facilitate the expansion of Missouri dairy operations by paying the first year's interest on any Missouri linked deposit loans made for the purchase of dairy cows or other replacement dairy females. This program has not been funded.

Livestock Feed and Crop Input Loan Guarantee Program
This program provides a 50 percent first-loss guarantee on loans made for livestock feed or crop inputs used to produce livestock feed. Thus, it encourages lenders to continue to make loans to farmers for livestock feed and feed crops on competitive terms. This program was authorized by legislation beginning in fiscal year 2012, but it has never been utilized.

3.2 Wisconsin

Beginning in the 1980s, Wisconsin milk production showed potential for decline. From 1988 to 2004, the state's annual milk production dropped from about 25 billion pounds to about 22 billion pounds. However, with intervention, the industry not only reversed this trend, but it also found opportunities to grow. Milk output totaled nearly 28 billion pounds in 2013. Over time, larger dairies have contributed more production by growing and modernizing their operations, and smaller dairies have pursued options like grazing and organic production to improve their viability (Natzke 2014).

Reversing the industry's decline involved several efforts. For producers and processors, the state introduced tax breaks, use-value tax assessments and investment-related tax deductions. The Professional Dairy Producers of Wisconsin (PDPW) and Dairy Business Association formed as groups that supported dairy producers and the dairy industry. The University of Wisconsin-Madison also implemented programs focused on modernizing the state's dairy industry (Natzke 2014).

PDPW is a dairy industry professional organization. In 2013, its membership totaled 1,600 farms in 18 states. The organization hosts several events and programs for its members. For example, PDPW organizes meetings and event focused on topics such as business transition, feed and nutrition, animal health, technology and financial management. It also hosts mentorship and internship programs for students interested in the dairy industry and develops other youth-centered programming. On its website, PDPW provides a virtual trade show that allows for identifying product and service providers. It also supports various initiatives including those that connect dairy producers with community leaders, veterinarians and agriculture service providers (PDPW 2014). The Dairy Business Association's purpose is to benefit the Wisconsin dairy industry by "fostering a positive business and political environment." Memberships include farmers, processors and other industry groups and businesses. Regulatory issues addressed by the group have included those related to water, the environment and waste management (Dairy Business Association 2014).

As the Wisconsin dairy industry positions itself for the future, it considers its specialty cheese business as an opportunity. Its cheese expertise gives the state credibility and the added value (Natzke 2014). Because Wisconsin has a dairy history, young producers have opportunities to assume leadership of their family farms. This is one reason Wisconsin hasn't implemented an aggressive attempt to attract farmers from other states. However, the state's many processors, dairy support services, animal genetics and health care, technologies and dairy education opportunities make it a good choice for dairy operations. These benefits may have contributed to relocation inquiries from producers from places including California, Pennsylvania, Maryland, Pakistan, Turkey, England and Japan during 2011 (Barrett 2012). Despite the opportunities available to Wisconsin's dairy industry, water quality and quantity remain challenges for the industry (Natzke 2014).

Currently, the Wisconsin Department of Agriculture, Trade and Consumer Protection administers the Dairy 30x20 program to support the Wisconsin dairy industry's future. The name stems from the initiative's goal to increase Wisconsin milk production to 30 billion pounds by 2020. The state has a need for more milk production because Wisconsin dairies supply only about 90 percent of the milk that state processors require. The initiative has several objectives. Those include helping producers to boost profitability, address management and operational needs, form business and legal frameworks, foster herd health, optimize milk production and support beginning farmers. Since 2012, the initiative has provided grant funding to Wisconsin dairy farms that need assistance related to business development, modernization, expansion or consulting. Funding may be used for planning purposes or improving profitability. Each farm legal entity that applies may request as much as $5,000, and they must supply at least 20 percent match. Possible eligible expenditures include professional services, equipment rental and supply purchases that are depreciated within a one-year period (Wisconsin Department of Agriculture, Trade and Consumer Protection 2014).

Processors also have grant resources available through the Dairy 30x20 program. They may request as much as $50,000 for eligible expenses such as operating costs, employee training expenses, equipment rental and equipment purchases that may be depreciated within a one-year period. The processor grant program also has at least a 20 percent match requirement. The processor grants are another tool used to improve the Wisconsin dairy industry's long-term sustainability (Wisconsin Department of Agriculture, Trade and Consumer Protection 2014).

3.3 New York

The milk production and dairy processing story in New York illustrates opportunities available when a state can attract manufacturers producing a popular dairy product. In New York, yogurt – and Greek yogurt in particular – has been that popular product. Chobani and Fage both process Greek yogurt in New York. When Fage first selected New York as a processing location, it wanted to be near the large Greek-heritage population in New York City (Neuman 2012). Upstate New York's proximity to numerous markets within a day's drive was another motivation for other companies like Alpina and Muller Quaker to build yogurt facilities in the area (Sommerstein 2013). Dairy farmers have benefited from the Greek yogurt production boom because Greek yogurt requires about three pounds of milk to produce one pound of the yogurt. When making traditional yogurt, a pound of milk yields a pound of yogurt. Greek yogurt production's need for extra milk generates good demand for New York-produced milk. The state economy has experienced positive results because Greek yogurt supports job creation and an economic multiplier effect (Neuman 2012).

State support for New York's dairy industry includes the PRO-DAIRY program. The program has a mission to "increase the competitiveness and sustainability of New York's dairy businesses through industry-applied research and educational programs that enhance farm profitability while advancing dairy professionals' knowledge, skills and enthusiasm." Formed in 1988, PRO-DAIRY has several focus areas: dairy farm business management, field crops and nutrient management, dairy environmental systems and renewable energy, dairy profit discussion groups, dairy management education, dairy youth programs and dairy industry communications and outreach. According to the program's 2013 annual report, PRO-DAIRY has received support from the New York State Department of Agriculture and Markets, New York state government, New York Department of Environmental Conservation, Cornell University College of Agriculture and Life Sciences and New York Farm Viability Institute (PRO-DAIRY 2013).

Several other efforts have targeted strengthening the New York dairy industry. For example, the state has made grants available for modernized milking equipment, business plans and anaerobic digesters (Sommerstein 2013). New York annually hosts a Yogurt and Dairy Summit. At the most recent summit, held during October 2014, the governor's office shared that several items were discussed. Those included a "Made in NY" program that encourages state institutions to purchase more dairy products made in New York. A renewable energy task force would form to identify energy needs of the dairy industry. Producers have access to newly approved funding that would support energy efficiency efforts. To expose students to dairy processing and train processing technicians and managers, the state has allocated as much as $1 million to a dairy processing facility at SUNY Cobleskill. At the summit, the governor also announced that yogurt would be the official snack of New York (Booker 2014).

Advocating for his state, Senator Chuck Schumer suggested a Farm Bill amendment in 2013 that would create a dairy block grant pilot program similar to the program already available for specialty crop producers. The amendment suggested a $5 million pilot program that would fund technical assistance to improve dairy productivity, profitability and environmental stewardship. Funding would have allowed dairies to access experts on topics such as animal nutrition, housing, breeding and nutrient management. Assisting small-scale dairy operations would have been the program's focus. In New York, dairy producers benefiting would have been better equipped to supply milk to buyers such

as Greek yogurt manufacturers. However, in other states, the pilot program would have given latitude in addressing specific needs state by state (Senator Charles E. Schumer 2013).

3.4 South Dakota

South Dakota sought to raise its profile as a dairy state when its dairy numbers began to constrict. During the 1960s, the state was home to about 250,000 cows, but over time, inventories eventually dropped to 79,000 cows in 2004, which was its lowest level. Since then, the industry has slowly rebounded. In 2014, dairy cattle inventory totaled 97,000 cows (Walker 2014b). Much growth has been attributed to increasing dairy size; however, the Midwest Dairy Association assures that operations of all sizes have opportunities (Harriman 2014). In 2012, the state planned to double its dairy herd size during the next five years (Barrett 2012).

Several factors contributed to dairy's growth in South Dakota. Since 2012, state government officials have attempted to encourage dairy farmers in other states, such as those on the West Coast, to move their operations to their state. Even the governor has played a role in these recruitment efforts (Harriman 2014). For example, he made an appearance at the 2014 World Ag Expo hosted in California. Specifically, his visit meant to target California dairy farmers and outline the benefits of operating in South Dakota to them. South Dakota's inexpensive land and feed, processors willing to source milk and less stringent regulatory environment may interest some California producers. Weather, especially the winters and changing seasons, may still be a limitation for California producers migrating to South Dakota (Visalia Times-Delta 2014). Other domestic recruitment efforts have included attending events hosted in Wisconsin and South Dakota (Swenson 2014).

South Dakota hasn't limited its recruitment efforts to the U.S. Officials have traveled to England, Ireland, Northern Ireland, the Netherlands and Canada to share about South Dakota's dairy industry and build interest in possible relocation (Swenson 2014). To attract foreign interest, the state implemented an EB-5 investment program, which provided a loan financing option for foreign dairies, such as those in Europe, relocating to South Dakota (Harriman 2014). By investing $500,000 in an approved rural project that generated at least 10 jobs, foreign investors could access U.S. visas (Walker 2014a). At least 17 dairies took advantage of the EB-5 program (The Associated Press 2014). However, the integrity of the program has been questioned (Walker 2014a).

Despite efforts to attract dairies interested in relocating, expanding South Dakota dairies are thought to lead to "the most sustainable growth in milk production." As dairies grow or move to South Dakota, state and local governments have a goal to ensure that milk cows don't concentrate too much in a given area (Swenson 2014).

South Dakota is accommodating from a tax perspective because it doesn't levy personal income tax, corporate tax, inventory tax or business tax. The state also has good access to cropland that can produce feed for dairy animals, and because the state tends to be more remote than some others, dairy producers don't need to worry as much as urban encroachment and its associated problems (Barrett 2012). Additionally, South Dakota has the water supplies needed for dairy farms (Harker 2014). Moving forward, a key element necessary for growth is ensuring that dairy cow waste is properly handled. As producers seek to grow, they'll also need more equity to qualify for capital that's necessary for expansion (Harriman 2014).

Other stakeholders have participated in promoting the state's dairy industry. For example, two processors located in South Dakota promoted the state's dairy industry using billboards strategically placed in Tulare County, Calif. Before the billboards, an advertising campaign promoted that South Dakota is better for milk production because it lacks milk production quotas (Barrett 2012).

Dairy farms have opportunity in South Dakota because processors are present in the state. For example, Davisco Food International operates a cheese processing facility in the state, but it has had to source milk from Idaho to meet its demand and supply its buyers, including Kraft Foods and importers in foreign countries (Barrett 2012). If it could source adequate milk supplies, then Davisco may be interested in expanding (Swenson 2014). In 2014, Bel Brands USA opened a cheese processing plant in Brookings, S.D. The plant will produce Mini Babybel cheese, which has benefited from increasing sales since 2009. The company picked the Brookings area because it provided milk at good prices; opportunity for further dairy growth; a good business climate; and well-educated students from South Dakota State University, which offers dairy production and processing degrees (Walker 2014b). California Polytechnic State University in San Luis Obispo is one other U.S. university that offers comprehensive programs in both dairy production and dairy manufacturing (Swenson 2014). South Dakota State University has been involved with processors updating their facilities or building new ones (Harker 2014). Cheese production may present an opportunity for the state because as states like Washington and Oregon export cheese, those states may lack access to enough cheese and represent potential markets for South Dakota-produced cheese (Harriman 2014).

In addition to serving South Dakota processors, some South Dakota dairy producers may supply milk to processors in other states. For example, South Dakota producers could ship milk to an Agropur cheese facility in Iowa. The Agropur facility would like to double its production, which could further expand opportunities for nearby South Dakota dairy producers (Swenson 2014).

3.5 North Dakota

Motivated by South Dakota's dairy industry improvement, North Dakota itself has committed to revitalization efforts (Knutson 2014). The North Dakota Dairy Coalition leads an effort to strengthen the dairy industry. The coalition, formed in 2004, promotes several North Dakota features that make it conducive to dairy production. Those include reasonable land prices, good communities, simple permitting process, feed ingredient availability, inexpensive feed byproducts nearby, economic development loan access from the state-owned bank and its affiliates, sales tax exemptions on many agricultural products, access to five milk markets and many in neighboring Minnesota and South Dakota, area to raise heifers, economical labor rates, low electric rates and vast space availability. The website maintained by the coalition further explains these features, and it also provides listings for dairy farms available by purchase or lease, hay available from local producers and other resources that would be helpful when evaluating whether to proceed with dairying in North Dakota (North Dakota Dairy Coalition). The state has also had an interest buy-down program as an incentive program, and it doesn't levy personal property taxes (Archwamety 2008).

In the past, North Dakota has attracted dairy families from California, New York, Wisconsin, South Dakota, Pennsylvania and Canada. Although the coalition retains out-of-state recruitment as an element of its approach, it has also had a priority to assist North Dakota dairies that already operate

and would like to expand. To fund the coalition's work, it has received support from state government, agriculture-focused groups, rural electric entities and grants (Archwamety 2008).

Although the coalition formed years ago, efforts haven't sparked the desired turnaround. Challenges affecting the industry have included few milk truck drivers available, distance between farms and processors, need for high labor rates and aging producers. In 2014, the state's dairy farm count fell below 100, and it had just three processing facilities. Coinciding with this drop in dairy farms, the coalition in 2014 was planning a resource network to help improve dairy farmer success (Holdman 2014). These efforts involve groups including dairy producers, the state agriculture department, crop group leaders and other dairy industry representatives (Knutson 2014). To share its message, the coalition has had a presence at farm shows and expos (Holdman 2014). One initiative included in the coalition's plan involves supporting crop producers who would like to diversify their operations and produce milk. Instead of exporting so much feed, the coalition has a goal to retain some of that feed to raise North Dakota cattle (Knutson 2014). Currently, North Dakota supplies feed such as hay and dried distillers grains to farms in other states. With respect to attracting producers considering relocation, dairies in Washington, Oregon, California, Holland and Ireland may like the opportunities and environment available in North Dakota (Holdman 2014).

3.6 Kansas

To attract dairies, neighboring Kansas has its own dairy recruitment program – Dairy in Kansas – that brands the state as "The Premier Dairy Frontier." The effort is a collaboration between the Kansas Department of Agriculture and the western Kansas Rural Economic Development Alliance (Dairy in Kansas 2014). The state's Department of Commerce has also contributed to Kansas state dairy promotion (Greve 2012). The Dairy in Kansas campaign's promotional message emphasizes Kansas' feed availability, including corn products, distiller's grains and alfalfa; desirable climate; water access; spacious rural area; heifer accessibility; and good communities (Dairy in Kansas 2014). The state's cattle feeding industry provides good background infrastructure for dairy expansion. Factors such as water use, environmental impact, labor, and consumer perceptions are still challenges for the state's dairy industry (Latzke 2014). Kansas also has a goal to interest dairies in states such as California and encourage them to relocate to Kansas (The Associated Press 2013).

Kansas has had dairy-related opportunities because it's near four states that haven't produced enough milk to satisfy their demand: Texas, Oklahoma, Missouri and Arkansas. So far, western Kansas has become a growth spot for Kansas dairies (Latzke 2013). In 2012, the western third of the state produced 70 percent of the state's total milk output (Greve 2012). Southwest Kansas has been called the state's "dairy case" (Latzke 2014).

Kansas offers several incentive and tax exemption programs that encourage dairies to operate in the state. Regarding incentives, the state itself has implemented two programs, and local communities may offer additional incentives. The Promoting Employment Across Kansas (PEAK) program allows companies bringing new jobs to Kansas or expanding within Kansas to keep 95 percent of payroll withholding tax for a 10-year period for the eligible jobs that they create. The Rural Opportunity Zone program, available in 73 counties throughout Kansas, provides state income tax exemptions for as long as five years and $3,000 in student loan forgiveness for individuals who meet certain conditions (Dairy in Kansas 2014).

Four tax exemptions may be an option for qualifying dairies. A business income tax exemption is available to partnerships, limited liability corporations, limited liability partnerships, sole proprietorships and subchapter-S corporations. An agricultural projects sales tax program exempts sales tax for capital investment-type projects that total at least $50,000. Kansas will exempt commercial and industrial machinery and equipment property tax if the machinery is meant to build or expand a facility. Several other sales tax exemptions exist for purchasing animals for agriculture and producing food, animal or dairy products or animal offspring (Dairy in Kansas 2014).

To ensure that dairies contemplating a move to Kansas understand the state's benefits, regulations and incentives, the Dairy in Kansas initiative has an easy-to-understand website – dairyinkansas.com – devoted to educating people about those items and providing the necessary contact information if interested parties have questions that they'd like to discuss. For more information about the incentives and benefits included in this section, go to the website. Additionally, the Dairy in Kansas initiative has had representation at events such as the World Dairy Expo, Elite Producer Business Conference and World Ag Expo (Dairy in Kansas 2014).

The state's characteristics and efforts to strengthen its dairy industry have resulted in some successes. Since the mid-1990s, both dairy cattle inventories and milk production measures have improved. Not only would the state like to increase the number of dairy farms and dairy cows, but it would also like to pursue more processing and serve the artisan dairy product market (Latzke 2013).

After several dairies concentrated in western Kansas, processors began to show interest in the area (Greve 2012). For example, since 2013, Kansas Dairy Ingredients in Hugoton, Kan., has removed water from milk that it processes and shipped the concentrated product to Springfield, Mo., where Kraft makes products like Kraft Singles and Velveeta cheese (Latzke 2014). Concentrated milk not only ships more efficiently, but its availability also somewhat simplifies cheese production (The Associated Press 2013). Instead of joining a cooperative, MasCow, a dairy in Moscow, Kan., has liked having the opportunity to directly sell to Kansas Dairy Ingredients and manage its price risk, which can contribute to better financial forecasting (Latzke 2014). In 2013, Kansas Dairy Ingredients received 75,000 gallons of milk each day, and it noted that it may later expand into dry milk and cheese production (The Associated Press 2013).

McCarty Dairies, located in Rexford, Kan., also partnered with a buyer. The arrangement with Dannon allows the dairy to exclusively provide milk to the Dannon facility in Fort Worth, Texas (Greve 2012). The McCarty-Dannon partnership started in 2011, and it drew interest because it was the first such partnership to form in North America. Dannon uses the milk from McCarty Dairies to produce Dannon Cream low-fat yogurt, which is sold in Sam's Club stores (Bowman 2014).

In November 2014, Dairy Farmers of America announced a partnership with China-based Inner Mongolia Yili Industrial Group that would bring a $100 million milk powder plant to Kansas. Although no location details have yet been confirmed, western Kansas is the likely planned area for that facility (Everly 2014).

3.7 Vermont

Based a 2013 report about Vermont's dairy industry, for the past 50 years, annual Vermont milk production has totaled more than 2 billion pounds. Of all Vermont agricultural product sales recorded during 2007, the milk and other dairy products commodity group represented nearly three-quarters of the total. Dairy processing also has a presence in the state as more than 60 processing plants operate, including many farmstead or artisan cheese facilities and a few large-scale processors such as Ben & Jerry's and Cabot Creamery (Sawyer et al. 2013).

Several dairy revitalization ideas were shared in the Vermont food system's 10-year strategic plan issued in 2013. Representatives from Vermont Sustainable Jobs Fund, Everything Agricultural and the Vermont Agency of Agriculture Food and Markets authored the plan's dairy section. In it, the authors categorized industry sustainability strategies into groups: research strategies; natural resource, physical infrastructure and technology strategies; sales and distribution strategies; marketing and public outreach strategies; technical assistance and business planning strategies; financing strategies; network development strategies; education strategies; and regulation and public policy strategies. Within these categories, the dairy sustainability ideas shared include developing best practice case studies about topics such as manure management, animal housing, on-farm energy production and diversification; analyzing the state's artisan cheese sector; encouraging Vermont goat milk production to double; promoting Vermont dairy products to institutional buyers; supporting industry marketing through public relations, farmers markets, community-supported agriculture programs and an annual Dairy Summit; reaching more farmers with technical and business planning assistance; pursuing financing alternatives such as consolidating dairy farm loans into one monthly payment, allowing cooperatives to seek non-producer member equity investments and purchasing equipment to share; addressing education programs that teach future dairy industry professionals; and revising the process for hiring migrant farm workers (Sawyer et al. 2013).

Dairy management teams were a network development strategy mentioned in the plan. The teams include five to eight advisers who collectively address topics such as enhancing profitability; decreasing production costs; promoting diversified operations; addressing nutrient management; and coordinating transitions like farm transfers, organic certification and farm preservation. The advisers may include stakeholders such as family, veterinarians, bankers and feed dealers. Personnel from University of Vermont Extension, the Farm Viability Program, the Vermont Small Business Development Center and the Vermont Agency of Agriculture Food and Markets may assist producers in identifying facilitators to lead the dairy management teams. By arranging for all of a dairy's team members to meet at the same time to discuss farm challenges, the group may collectively brainstorm options to address issues and opportunities (Sawyer et al. 2013).

The Vermont food system strategic plan also highlighted several entities and efforts in the state that provide support to the Vermont dairy industry. For example, the Vermont Pasture Network and Vermont Grass Farmers' Association share resources for producers using grass as a livestock feed. To help dairy farmers to adopt energy-efficient technologies, Efficiency Vermont has historically provided a rebate program for some agricultural equipment. At the University of Vermont, the Vermont Institute for Artisan Cheese conducts research and offers artisan cheese training. As another support mechanism offered by the University of Vermont, the Dairy Center of Excellence encourages producers to participate as research partners. From an advocacy perspective, Rural Vermont helped

an effort that involved the state approving raw milk-supportive policies. Keep Local Farms is a New England effort that requests consumer donations to assist local dairies (Sawyer et al. 2013).

The VT Food Venture Center is another effort that supports innovation in Vermont's dairy industry. The center acts as a shared-used incubator for entrepreneurs. Jasper Hill Creamery is the center's main tenant. At the center, Jasper Hill produces two cheeses (Jasper Hill Farm).

The Vermont Farm & Forest Viability Program provides business, technical and management assistance to Vermont's farm, food and forestry businesses. The program administers a "Dairy Improvement Grants" program for producers who are involved in the St. Albans Co-op (Vermont Farm and Forest Viability Program 2014). The dairy cooperative is Vermont's largest. It processes some member-produced milk into products like cream, skim milk, condensed milk and powdered milk. It also sells product to processors. For example, it provides all domestic milk for Ben & Jerry's (Sawyer et al. 2013). The grants, which may provide as much as $40,000 per applicant, fund infrastructure-related expenses that seek to improve milk production and farm viability. Several groups support the grant program: Commonwealth Dairy, St. Albans Cooperative Creamery, Dairy Farmers of America, Housing Vermont and the Massachusetts Housing Investment Corporation (Vermont Farm and Forest Viability Program 2014). The Massachusetts group may be involved because the St. Albans Co-op supplies milk to some Massachusetts processors (Sawyer et al. 2013).

Commonwealth Dairy, which provides funds for the Dairy Improvement Grants program, received many assistance offers when it began considering a location in Vermont during the late 2000s (Vermont Farm and Forest Viability Program 2014 and Agency of Commerce & Community Development 2014). Commonwealth Dairy wanted to produce private label yogurt, and state and local officials developed several incentives to encourage Commonwealth Dairy to locate its facility within Vermont. Of those, a few include a federal grant facilitated by the Brattleboro Development Credit Corporation to use for a $1.15 million public-private partnership water line, more than $1.2 million in incentives from the Vermont Economic Progress Council and more than $101,000 from the Vermont Training Program to fund on-job training (Agency of Commerce & Community Development 2014).

To educate college-age students about the dairy industry, the University of Vermont offers its CREAM program, Cooperative for Real Education in Agricultural Management. Each year, 13 to 16 students participate in the program, which allows them to earn eight credits combined in their spring and fall semesters and gain first-hand experience in managing a dairy farm and being responsible for the related farm chores. Any student at the university, not necessarily those who have a dairy or livestock background, may apply to participate in CREAM (University of Vermont 2014).

3.8 North Carolina

Like other states evaluated in this section, North Carolina has also experienced a slumping dairy industry. A 2012 presentation shared that the state only produced enough milk to satisfy about half of its fluid milk needs (Davidson 2012). Several processors – seven Grade A milk processing facilities, one large commercial cheese processing facility and more than 40 farmstead processors – operated in the state based on the 2012 presentation. To improve the industry's viability, a state initiative organized an extensive resource network to include the North Carolina Association for Dairy Stabilization & Growth Inc.; NC Dairy Advantage program; and other entities such as processors, input suppliers,

state government agencies, cooperatives, the North Carolina Dairy Producers Association, nonprofits, bankers, real estate agents and retailers (Davidson 2012).

Since 2007, the NC Dairy Advantage program, an effort of the North Carolina Association for Dairy Stabilization & Growth, Inc., has focused on improving the dairy industry's viability (The North Carolina Association for Dairy Stabilization & Growth, Inc. 2013). Several groups have contributed to NC Dairy Advantage: the NC Department of Agriculture and Consumer Services, NC State University Cooperative Extension, NC Farm Bureau and the NC Dairy Producers Association (Lathrop 2012).

NC Dairy Advantage has had four priorities. Those goals have been to create more value for milk and dairy products, improve quality of life for dairy farm families, accelerate milk production output and "support the total number of dairy farms." The effort has seemed to assist in improving the state's dairy industry. Compared with 2011 data, the state has grown its milk cow inventory and milk production (The North Carolina Association for Dairy Stabilization & Growth, Inc. 2013).

On its website, NC Dairy Advantage promotes several North Carolina features that make the state conducive to dairy production. Those include agriculture-focused communities, available infrastructure, adequate water and feed availability, support accessible from professionals and other producers and higher farm milk prices than those in other areas (The North Carolina Association for Dairy Stabilization & Growth, Inc. 2013).

To offer assistance to the state's dairy industry, NC Dairy Advantage includes several programs. The first, Advantage 1-on-1, is a free service that connects dairy producers with a team that can quickly help producers when they have a question, problem or information need. The second is the Farm Assessment initiative. Through this program, dairy producers may work with the NC Dairy Advantage team to develop a SWOT analysis and long-term goals. Before reaching these final deliverables, however, the team assesses a dairy from multiple perspectives, including herd health, nutrition, milk quality, reproduction and management. As the third program, Farm Profit Teams encourage dairy producers to create a stakeholder group that meets to discuss the business and share ideas about improving the dairy business' viability. Stakeholders on these teams may include a veterinarian, nutritionist, accountant and other professionals. The Dairy 20/40 program convenes meetings for younger producers, especially those 20 to 40, who seek assistance. The NC Dairy Advantage group also offers relocation assistance, and it assists dairy farms in start-up business planning (The North Carolina Association for Dairy Stabilization & Growth, Inc. 2013).

At the 2012 Southern Dairy Conference, a presentation from a North Carolina State University extension associate further highlighted efforts to sustain the North Carolina dairy industry. North Carolina personnel engage real estate agents and consultants to identify farms and other production resources; host workshops and programs dedicated to timely, relevant topics; consider value-added and diversification opportunities including grazing, organic production and dairy product production; and attend the World Dairy Expo to learn and promote North Carolina as a good location for dairy production (Davidson 2012).

Also during 2012, NC Dairy Advantage offered as many as 12 scholarships to cheesemakers from state-inspected cheese production facilities who were interested in attending the American Cheese Society annual conference, which was scheduled to convene in state. Recipients could use the $250 to

$375 award to reduce their conference attendance costs. USDA Rural Development and N.C. Market Ready provided the grant funding for scholarships (Lathrop 2012).

3.9 Kentucky

Since 2005, the Kentucky Dairy Development Council has pursued improving Kentucky's state milk production and quality and making the state's dairy producers more competitive. The organization describes that it has several purposes, including improving the state dairy industry's profitability, encouraging dairy industry growth and development and participating in dairy legislation and regulation efforts (Kentucky Dairy Development Council).

The Market Incentive Leadership of Kentucky Program, otherwise known as the MILK Program, pays incentives to dairy producers who increase production output and produce high-quality milk. Relative to the 2013/2014 average base, calculated monthly, a 5 percent production increase would lead to a $0.50 per cwt. incentive in 2015, and a 10 percent production increase would lead to a $0.75 per cwt. incentive. Specified SCCs and pre-incubation counts are quality considerations that the milk must satisfy. To participate, producers must have at least six qualifying DHIA tests during a rolling 12-month time period. At maximum, eligible farms may earn $15,000 per year from the MILK Program incentives. Producers earn incentives monthly, and they're paid quarterly. Participating in the MILK Program doesn't change incentives that Kentucky marketing agencies pay (Kentucky Dairy Development Council).

The MILK Counts program provides technical assistance focused on improving milk quality. Although all Kentucky dairy producers are eligible to participate, those involved in the MILK Program have first priority as MILK Counts can help them to achieve the MILK Program standards and earn MILK Program incentive payments. As a collaboration between the Kentucky Dairy Development Council and the University of Kentucky Dairy Extension program, MILK Counts participation involves DHIA records review and an on-farm visit and milk quality evaluation, which assesses factors including a farm's milking methods, management, animal hygiene and dry cow treatment. Several stakeholders can be involved in the on-farm visit, including the state dairy systems extension specialist, county extension agent, Kentucky Dairy Development Council consultant and veterinarian. Following the on-farm visit, dairy farmers receive a written report that shares improvement recommendations and estimates the possible economic impact associated with milk quality improvements. On-going support like improvement plan development, monitoring and follow-up visits are optional for participating producers (Kentucky Dairy Development Council).

As a state-branded milk, Udderly Milk is trademarked by the Kentucky Department of Agriculture. Sourced from a Kentucky dairy producer, the milk undergoes processing at the Prairie Farms Dairy facility in Somerset, KY (Kentucky Department of Agriculture). Walmart stores in the state distribute Udderly Milk products. For participating as suppliers, dairy producers may earn a $0.07 premium per gallon.

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