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Farmers in Vermont's Artisanal Cheese Industry: Examining what Influences Dairy Farm Management

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Special Thanks to:

Dr. John Barlow, Dr. Amy Trubek, Amanda Carmellini, Quinn Jenkins,

Tom Bivins, Alan Howard, Dan Scruton, Maria Carabello, and Rachel DiStefano

Introduction

Vermont is home to approximately 61 licensed cheese producers, who create over 150 varieties of cheese using the milk from cows, goats, and sheep (Vermont Agency of Agriculture Food & Markets 2013).[1] Vermont cheese production ranges in size from a four cattle "farmstead operation" that creates a traditionally produced "artisan" cheese to a large dairy company that creates industrially produced cheese for a domestic and international market.

Artisan or artisanal designation signifies that the cheese is produced in part by hand, in small batches, and made using traditional forms of craftsmanship and technique. Farmstead cheese means the cheese is made on the same farm where the animals that supply the milk are raised and milked (American Cheese Society 2011).[2] The opposite of artisanal cheese is "industrial cheese," which is the mechanized cheesemaking process that happens in a cheese plant or creamery to produce cheese in mass quantities. Unlike artisanal cheese, industrially produced cheese is always pasteurized (Robinson and Wilbey 1998).

This study aims to explain how cow and goat dairy farmers (both farmstead and off-site producers) supplying milk to artisan cheesemakers in Vermont make decisions about farm management. Through personal narratives, perceptions and practices of herd and farm management procedures and protocols are explored.

I argue that the dairy farmers in this study are influenced to adopt certain farm management procedures based on two main reasons defined here as "factors" and "actors." Factors are the farmers' operational constraints and parameters. Actors are the individuals and organizations that directly influence farm and herd management practices. In this report, the

[1] The Vermont Agency of Agriculture, Food, & Markets provides a list of licensed "milk handlers," most
[2] Farmstead designation does not specify size of the farm nor the quality of the cheese or milk (Paxson 2013).

factor and actor themes are broken into eight sub-themes to frame farmers' narratives and provide valuable information about what people, organizations, and constraints shape their farm management decisions.

Context of Study

This study is part of a larger transdisciplinary research project titled, "Food Safety from Milking to Marketing for Vermont's Artisanal Cheese Makers," and funded under the University of Vermont's Transdisciplinary Research Initiative in Food Systems. This project was designed to address food safety research and extension gaps for Vermont's artisanal cheesemakers.

This study in which this data was collected was conducted under the lens of animal health and disease prevention. The larger project focused on evaluating potential problems associated with *Staphylococcus aureus*, which is a potential food-borne human pathogen. Controlling *S. aureus* on dairy farms that supply milk for artisan cheese is a food safety priority, and potentially significant for farms that supply unpasteurized milk or products made from raw milk (Cullor 1997). The purpose of the larger research project is to explore potential associations between the presence of *S. aureus* in milk or cattle, and milking hygiene and mastitis control practices. In cattle, *S. aureus* is a major cause of chronic mastitis (i.e. inflammation of the mammary gland) and mastitis is associated with decrease milk yields and reduced cow well-being; making mastitis both a problem of both animal welfare and farm economics.

Understanding and mitigating S.*aureus* is important, and yet, little is known about the implementation of milking hygiene and mastitis control practices on Vermont artisan cheese farms, and how these practices are being adopted and why. In a survey conducted in 2008, 14 (67%) of 21 herds making artisan cheese in Vermont were positive for *S. aureus* in raw bulk tank milk used for cheese production (D'Amico and Donnelly 2010). In that research, even though the

sample size was a relatively small (12 cow-herds), the researchers were able to demonstrate associations between farm characteristics, management practices, and raw bulk tank milk quality. This initial research shows how farm management practices, and attention to animal health, are important in improving milk quality and potentially reducing food safety outbreaks.

Many artisan cheesemakers require specific standards for their milk, ranging from herd diet, to specific bacteria counts and fat content. Additionally, many artisan cheesemakers in Vermont create cheeses made from unpasteurized milk, which requires additional food safety and quality considerations. These specific needs are leading cheesemakers to create personalized relationships with farmers instead of relying on larger milk distribution companies when sourcing milk from other farms.

The success and viability of the artisan cheese industry is intrinsically linked to the success and viability of these individual dairies that supply the milk. According to researchers Barkema et al. (1999) and Barnouin et al (2004), farm management practices are directly correlated to milk quality. For farmers, higher quality milk (lower SCC) often leads to garnering a higher price for their product (National Dairy Herd Association 2012)**.** Furthermore, it my understanding that knowing *how* and *why* information about farm management practices are currently being understood and adopted is imperative to being able better support farmers in the future.

Previous studies have focused on the role communication plays in improving herd health and milk quality. Jolanda Jansen and her colleagues specialize on communication practices that are shown to improve management protocols, animal health, and milk quality in the Netherlands (2009, 2010, 2012). Jansen's study (2009) focused on farmers' attitudes about specific farm management practices and this related to incidences of mastitis. She theorized that cooperation in management protocols and belief in these practices reduced mastitis. Johanne Ellis-Iversen et al. (2010) also examined motivators for implementing new practices and protocols and focused

their research efforts on perceptions, circumstances and motivators for program implementation. These researchers took a mostly quantitative approach to investigating their research objectives.

Research Objectives

The goal of this research is to provide information to extension staff, educators, veterinarians, and other agricultural support staff to better understand why farmers adopt certain management practices and where they receive support and information. Furthermore, it can provide insight to ways to disseminate and communicate farm management advice and applicable research. A secondary goal of this study is to focus on the farmers involved in this industry and show how their decisions about farm management is connected to artisan cheesemakers being able to create high-quality cheese. Currently there is a deficit of research focused specifically on farm management in the artisanal cheese industry.

My analysis utilized quantitative and qualitative methodologies. The findings are presented using narrative-driven approach to explore what influences these dairy farmers to implement management practices. During the interviews, questions were asked about perceptions of management procedures. Direct observation of milking allowed the researcher to record these practices in action. Additional information was collected about where farmers were currently receiving support and information, whether they believed this information to be true and how well they were following these recommendations. For dairy farmers who transitioned to supplying milk for artisanal cheese, questions were asked to understand how management practices had evolved from their previous situation.

My hypothesis is that as the artisanal cheese industry continues to grow - the demand for milk from off-site farms will also grow. Additionally, I suspect that there will continue to be specific modifications of farm management practices requested by artisan cheesemakers to create

a high-quality finished product. If this is true, then understanding what types of farm management adaptations need to occur and what are the best practices to disseminate this information will become increasingly significant.

Methodology

Study Population

The original sample population was Vermont cow-dairies providing milk for artisanal cheese, but was later expanded to include goat-dairies. Farmers in this study worked on farms producing artisanal cheese on-site as well as on farms that supplied milk to artisan cheesemakers off-site. The parameters for participation were that the cheesemaker acquiring the milk must make a product defined as "cheese" by the federal department of agriculture regulations and that the cheese must be artisanal. We utilized the definitions of "farmstead cheese," and "artisan" or "artisanal" provided by the American Cheese Society (ACS)(2011), and defined "cheese" using the Code of Federal Regulations (2006) created by U.S. dept. of Agriculture, which determines if a dairy product is a cheese by how the milk coagulates and if it is natural or processed.

Additionally, to qualify for this study, a cheesemaker could acquire milk from a maximum of three off-site farms. This means that cheesemakers who purchased milk from a dairy cooperative or creamery did not qualify. The original sample population was a list of licensed milk handlers created by the Vermont of Agency of Agriculture, Food, & Markets (2013). We contacted every cheesemaker on the list that met the prerequisite criteria for initial permission and then contacted the farm owner/manager of the dairy that supplied the milk. Of the 61 licensed milk handlers, 33 cow dairies were eligible, and 22 (67%) agreed to participate. Later in the study we added 5 goat dairies (25% of eligible farms), as they are a growing part of Vermont's artisanal cheese landscape. This decision was made in order to offer a small representative sample and highlight that the goat cheese and goat dairy industry is rapidly growing in Vermont. In 1994, there were 9 goat dairies in the state now there are 27 licensed with the Vermont of Agency of Agriculture Food & Markets (2013). This is a growing sector, and could be a potential future research opportunity.

Data Collection

27 dairy farms (22 cow, 5 goat) were visited between February and August 2014. During the farm visit a survey was administered, milking procedures and farm practices observed, and a bulk tank milk sample was collected. A set of IRB-approved quantitative and qualitative interview questions were asked combined with direct observation. This mixed-methods approach was selected to best collect information on farmer's knowledge and attitudes regarding animal health and farm management protocols and to build on established literature about farm management and communications.

The variables addressed in the questionnaire and observations were identified using the National Mastitis Council's (NMC) 10-point program for mastitis control. The NMC 10 Point Mastitis control program guidance document was established by a team of experts in the field and is considered a comprehensive overview of recommended mastitis control practices. It is freely available to the public and can be accessed on-line.[3] Recent peer-reviewed publications (discussed in the introduction) were also used to inform survey tool development, as well as peer-feedback from a qualitative research methods seminar (2014).

After conducting farm visits, milk samples were analyzed and each farm was given a number to assure anonymity. For their efforts, farmers received their milk quality analysis report in the mail. The report was accompanied by a detailed explanation of the milk analysis and a chance to discuss the results further with an animal health advisor. [4]

For the analysis recorded interviews were transcribed and coded using a qualitative open coding technique to identify key themes and patterns. The themes were coded by how they

[3] The NMC Recommended 10-point program for mastitis control is available at (www.nmconline.org/docs/NMCchecklistNA.pdf).
[4] Milk analysis information was not used in this report, as it was not relevant to the analysis of this specific subject matter.

influenced farmers' management decisions. If the variable was a person or an organization they were coded as being an "actor." If on the other hand, the variable was structural or institutional it was coded as being a "factor." These two main groups were then divided into eight sub-themes and investigated further.

Results & Discussion

Eight Sub-Themes

Qualitative analysis, specifically thematic coding, was used to determine what influenced farmers to create and adapt specific management practices. From the coding process, two main themes emerged to explain what influences farmers to enact specific farm practices. Farmers identified making decisions about management procedures and protocols based on "factors" – operational constraints within a fixed system, as well as based on the recommendations from "actors" - individuals and organizations involved in an evolving farm practice. Based on these two thematic categories, eight sub-themes were identified that provide further insight into farmers' practices.

Factor Sub-Themes:
1. Experience & Practice
2. Location
3. Policy & Regulation
4. Value

Actor Sub-Themes:
1.Community
2 Non-Profit Organizations
3. Service Providers
4. Buyers

Factors

In this study, four main factors (Experience & Practice, Location, Policy & Regulation, and Value) were identified as the dominant fixed influencers that shape farmers' practices as well as their involvement in Vermont's artisan cheese industry. Factors impact what farm management practices are utilized and what resources are available to them. Factors can be defined as being structural constraints as they are seemingly fixed or slow to change. For example, in the case of location, or policy & regulation, these factors have the capacity to change – the farmer *can* move and policies *do* change, but these changes take more time and are more institutional compared to the more immediate and personalized influence from Actors. It appears

that farmers elect to enact certain management practices originally based on these operational constraints and later adapt practices based on the influence of specific people and organizations. In this regard, factors shape the potential influence of actors.

1. Experience & Practice

Farmer's experience and farming practices encompass farmer demographics (age, gender, education etc.) as well as the demographics of the farm (herd size, animal milked etc.). Some of these variables cannot be voluntarily changed (e.g. age, family history, whether or not they were born in Vermont). However, the majority of the variables (e.g. education, specialty certification, raw milk consumption) are all decisions that the farmer made at one time and could potentially change. These decisions encompass everything from choosing to farm, to deciding which animals to raise, and what certifications to pursue. These past decisions may likely influence current behavior and farm management decisions.

Many initial herd management decisions are made when a person decides to be a dairy farmer. These decisions are multiple and range from deciding how many times to milk per day, whether or not to wear gloves, and how to treat animals with mastitis. These decisions can be changed and adapted over time based on personal advice (actor influence) or changing the structure and make-up of the farm (factor influence.) For example, if a farmer elected to become certified organic (factor) there are practices that they must now adhere to, such as refraining from antibiotics use, and changing to organic feed. For this reason, it is important to look at factors such as farming experience as parameters or a frame, in which to understand other management decision variables, and how actor influence can be maximized.

In this study, 8 farm managers and 19 farm owner-managers were interviewed. Table 1 demonstrates the range of experiences of the individuals. Farmers working in the artisanal cheese

industry ranged in education level, gender, age, whether they were born in Vermont, and if they were first of multi-generation farmers. Interestingly, the majority of suppliers for artisan cheese (those not making cheese themselves) were multi-generation farmers, and the majority of the first generation farmers held bachelor degrees or higher.

Table1
Farmer Demographics

Variable	Frequency	Percent
Age		
24 to 50	12	44%
51 to 76	15	56%
Formal Education		
High school or less	5	19%
Associate degree or less	9	33%
Bachelor degree	6	22%
Graduate degree	7	26%
Farming Experience		
First generation farmer	13	48%
Multiple Generational	14	52%
Farming < 10 years	3	11%
Gender		
Male	16	59%
Female	11	41%
Percentage of life in VT		
0-99.99	13	48%
100	14	52%

Table 2
Farm Demographics

Variable	Frequency	Percent
Animal milked		
Cow	22	81%
Goat	5	19%
Herd size (Lactating)		
Under 25	5	19%
25 to 49	10	37%
50 to 74	7	26%
75 to 225	5	19%
Designation		
Organic	5	19%
Humane Certified	2	7%
Relationship to cheese		
Farmstead	12	44%
Supplier	9	33%
Farmstead & Buyer	6	22%
Relationship to Raw Milk		
Sell to Consumer	9	33%
Drink at home	27	100%

Table 2 presents the specifics of the farm including: scale of the farm, specialization, and herd demographics.[5] 66% of farmers interviewed were farming in the same location that cheese was being made - the remaining farmers were directly supplying milk to cheesemakers (the majority of whom lived within a 15 mile radius of the farm). Organic farms were included in this study and the farms ranged in size from 3 cows being milked to the largest farm milking 212 cows at the time of the site-visit.

For questions concerning raw milk, 33% of farmers reported to sell unpasteurized milk directly to the consumer. This includes sales within and outside Vermont's tier system.

[5] These demographics are important to note for context, although association between these and specific farm practices will not be addressed in this study.

Significantly, all 27 farmers reported to drink raw milk from their respective farm. This is an important variable to consider when addressing public policy and regulations concerning raw milk, as well as farmers' relationship to inspectors, which will be addressed in the actor section.

2. Location

Farms that qualified for this study were located in 13 of Vermont's 14 counties.[6] This study did not address the reasons behind site location chosen by farmers and/or cheesemakers. However, in the semi-structured interviews, location anecdotes were shared about land quality and cost, family history, road infrastructure, population density, zoning and proximity to markets. Farm location matters because it can limit or improve farmers' relationships to specific actors including cheesemakers, veterinarians and other support service providers.

Location can be a constraint for dairy farmers (not making cheese) to find milk buyers and transporters. In the case of commodity milk, farmers have contracts with milk processing and distribution companies such as companies like St. Albans Cooperative, Agri-Mark, or Horizon. These companies dispatch large refrigerated trucks to pick-up milk for a price negotiated in their formal agreement and influenced by national dairy pricing systems. According to Dr. Barlow, an Animal Scientist at UVM, during periods of emergence of other niche dairy trends, such as organic milk in the 1980s and 1990s and more recently 'grass milk' (i.e. milk from only grass-fed cattle); location can be a constraint on access to markets.[7]

Small-scale buyers, those purchasing less than 2 millions lbs. (2000cwt) fluid milk per year, such as a local cheesemaker may have a more nuanced set of agreements, as the relationship is more personalized. 100% of the supplier farms surveyed either used to supply for the commodity

[6] According to the Vermont Department of Agriculture, Food, & Markets (2014) the county with the highest density of cheesemakers is Windsor County; there were no licensed cheesemakers in Essex County.
[7] Email correspondence with Dr. Barlow 11/30/14.

milk market before becoming involved in artisanal cheese production, or continue to be in contract with a fluid milk distributor. In some cases, a supplier-farmer will seek out a new milk buyer based on location. However, more often a supplier-farmer will elect to work with a cheesemaker based on value, a factor sub-theme that will be addressed.

In the case of a farmstead operation, where the milk is being used for cheese production on-site, location is not an initial issue because the farm to cheese plant process occurs in a closed system. However, if the cheesemaker wishes to expand their business, then finding additional milk suppliers in close proximity may become an issue. On the other hand, if a farmstead farmer produces more milk than their on-farm cheesemaker can handle then they must sell to another market.

One supplier farmer had a seasonal over-supply of milk during the winter months when cheese production slowed, and apparently the milk truck for a large company could not make it up their unpaved driveway in order to pick up the excess product. Another farmer, who worked on a farmstead operation, claimed that the price for truck pick-up was too exorbitant because of their remote location. During the months they did not make cheese, they fed the excess milk to their pigs. The remaining farmers either had established outlets for fluid milks sales or balanced milk and cheese production and experienced no fluid milk oversupply.

Another constraint connected to location is the physical proximity to service providers. Generally veterinarians in Vermont travel to dairy farms to provide services and appear to limit the geographic range of clients they serve. Therefore, in some regions of the state, dairy farmers may have limited choices of veterinarians providing on-farm services. Two farmers mentioned that having a small herd and milking goats exacerbated their problem of finding a veterinarian in their area.

In other geographic areas, farmers may have excellent choices in service providers. In one county, all of the farmers interviewed used the same veterinarian and this appeared to significantly impact the farmers' protocols. This particular veterinarian was very focused on mastitis prevention and provides his clients with step-by-step protocols on treatment and culling procedures. The majority of farmers in other regions of the state did not report receiving the same types of services from their respective veterinarians showing that location appears to be a variable that can limit actor relationships.

3. Policy & Regulation

Understanding current milk and cheese related agricultural policy is not only important to farmers and cheesemakers, but to "actors" as well, who can benefit by understanding repercussions of impending policy changes in order to provide better information and services. A wide range of federal and state policies and regulations affect how farmers farm, what they farm and how they sell their products. For dairy farmers and cheesemakers working in Vermont's artisanal cheese industry, it appears that failing to adhere to certain policies can "make or break" their respective businesses.

In the interviews, and as a result in the analysis, specific emphasis is placed on how the U.S. government regulates and understands raw milk. In addition, many farmers expressed concern that not enough distinction is made between raw milk sales regulations and regulations concerning raw milk cheese. This section will cover regulatory standards, current milk and cheese policies in Vermont, raw milk sales, the difference between raw milk and raw milk cheese, and finally will illustrate through a farmstead cheesemaker's personal experience how regulations and policies affected what she chose to sell and produce.

Regulatory Standards

The inspection requirements for dairy farms and cheese plants differ. The Vermont Agency of Agriculture, Food, & Markets is responsible for inspection of both dairy farms and cheese manufacturers. For farmstead operations, the farm and the cheesemaking facility are inspected separately and inspections often occur at different times and by different inspectors. Inspections can also vary based on whether the milk and/or cheese are being sold across state lines (U.S. Department of Agriculture 2011). According to Dan Scruton, Vermont's Dairy Programs Section Chief, state inspectors review dairy farms at least every six months, and federally certified inspectors conduct additional inspections of randomly selected farms every 18 months. Cheese facilities are inspected at least four times a year by an inspector trained in food-safety.[8]

Farmers' opinions on the stringency of regulations differ. Farmer 6 believes "Inspections are random and subjective," where as Farmer 15 states that current regulations "make sense." For farmstead operations being inspected twice (farm and cheese plant), the vast majority believed that the standards were stricter for the farm-side of the business even though cheese inspections occurred more frequently.

> There is not the same level of enforcement. We could really benefit from more testing for cheese production, and inspectors should look at each plant individually based on scale. Cheese needs different standards where milk does not. As it stands, the inspectors were more concerned with facility requirements …the distance from the cheese room to a bathroom, rather than quality of product. -Farmer 5

Milk and cheese regulations are based on setting rules and standards to which all cheesemakers and farmers must comply. If you fail to meet the majority of the requirements, the operation can be penalized or shut down. On the other hand, policies are created to carry out a

[8] Dan Scruton, email correspondence, October 12, 2014.

specific group's goals and political agenda, and may have future unintended consequences or (in some cases) benefits. Policies come with the opportunity for citizens to express their opinion and vote, whereas regulations can be enacted without popular consent, harder to change and impose stricter sanctions for non-compliance.

Impending Milk & Cheese Policies in Vermont

In 2014, two bills and one regulation were introduced in Vermont that could affect cheesemakers and connected dairy farmers. The first was Vermont's GMO-labeling bill, signed into law by Governor Shumlin in May 2014. As it stands, section 6 creates an exemption for requiring labeling of meat, milk and cheese, implying that animals may consume genetically modified (GM) soy or corn without making the animal itself or products derived from the animal genetically-modified (Leschin-Hoar 2014). Therefore, these items do not have to be labeled as a GM product because the logic is that the animals process out the GMOs in their feed.

Another concern with the GMO-labeling law, specifically for Vermont's cheesemakers, is whether rennet will be included in the cheese exemption. Rennet is a substance used to coagulate milk and is used in initial stage of the cheesemaking process. There are animal and plant sources of rennet, however the Dairy Research Institute (2011) estimates that 90% of cheesemakers use a rennet called FPC (fermentation produced chymosin), which is genetically modified and produces more consistent results then other coagulating agents (McCoy).

In an interview with the on-line journal, *TakePart,* Tom Bivins, Director of the Vermont Cheese Counsel stated: "We're waiting to see what the attorney general's findings will be, and that will give us roughly one year to formulate a plan if the law is going to change substantially for dairy" (Leschin-Hoar 2014). If dairy is deemed not exempt in the future and if cheesemakers

want to have their product remain unlabeled this would mean significant change and increased costs to farmers that are not currently certified organic.[9]

The second proposed regulatory change, which would alter artisanal cheesemaking, came this summer when someone in the FDA made a motion to ban wooden boards in the aging of cheese, a practice very rooted in artisanal cheese production. After an outcry from cheesemakers, farmers, and support staff, this idea was quickly revoked. On Wednesday, June 11, the FDA issued the following "constituent update":

> At issue is a January 2014 communication ... which was sent in response to questions from New York State. The FDA recognizes that this communication has prompted concerns in the artisanal cheesemaking community. The communication was not intended as an official policy statement, but was provided as background information on the use of wooden shelving for aging cheeses and as an analysis of related scientific publications. Further, we recognize that the language used in this communication may have appeared more definitive than it should have, in light of the agency's actual practices on this issue (FDA 2014)."

Although regulations don't require a popular vote, this is a case where the FDA responded directly to the public's concern and reassured its' constituents that it was an unintended miscommunication.

Raw Milk Sales

The third policy shift was a slight one, but one that is very indicative of a larger and on-going issue for farmers that sell raw milk both for cheese or for direct consumption. On July 1, 2014, the Vermont House Committee on Agriculture and Forest Products passed bill S.70, which was signed into law as Act 149, which allows Tier 2 raw milk producers to expand their market. Before they could only sell directly to customers on-farm (among other requirements), now they can deliver their milk to pre-existing, prepaid customers at local farmers' markets.

[9] Organic certification requires that animals eat organic grain and feed, which is GMO-free.

The regulation of unpasteurized or "raw" milk is a complex issue because people choose to drink raw milk for a variety of reasons including: perceived nutritional benefits, sensory experience (taste), and cultural and political motivators. The Center for Disease Control (CDC) (2014) estimates that less than 3% of the U.S. population consumes raw milk on a regular basis, and about 25% of this population are farmers and farm workers, this number includes the farmers in this study as 100% reported to drink raw milk.

Currently, the FDA mandates the aging process for unpasteurized cheese and individual states decide on the legality and parameters of raw milk sales. This was a result of a health-scare and led to the introduction of pasteurization. The U.S. Public Health Service (PHS) considered milk quality to be a high priority after the 1920s Tuberculosis and Brucellosis epidemic was linked to contaminated milk. As a result the PHS drafted the Model Milk Health Ordinance (1939) and promoted it actively for adoption at the local level. This ordinance promoted mainstream pasteurization of dairy products, which led to a series of milk regulations and policies on the state and federal level (Wisconsin Legislative Reference Bureau 2010).

Anthropologist Heather Paxson in her book, *The Life of Cheese* (2012*)* breaks down the public's understanding of pasteurized versus unpasteurized dairy, and highlights the assumption that raw is unsafe and pasteurized products are safe. What is interesting about this dichotomy is that each state has different laws and restrictions concerning the sale of raw milk, and yet the aging and bacteria requirements of raw-milk cheese are a federal concern.

Connection between raw milk and raw milk cheese

Making cheese was originally created as a method to preserve milk, just as one might make pickles to preserve cucumbers, and inadvertently created a new taste profile. However, when one examines the FDA's rules on the aging of cheese or talks to an artisan cheese producer about

their current policy frustrations - it is the lack of understanding of the cheesemaking process and fermentation science behind the laws that becomes apparent (2006).

Paxson (2012*)* illustrates this policy crux appropriately when stating:

> The microbiopolitical sentiments of raw-milk spill into regulatory debates about raw-milk cheese. Consequently, the FDA treats raw milk cheese as inherently different from pasteurized-milk cheese, to the point that this distinction overshadows any other meaningful classificatory scheme that could differentiate cheese types. As is most notably evident in the sixty-day aging rule for raw-milk cheese, cheese safety standards in the United States are defined by a binary distinction (165).

Since the 1990s the FDA has revisited the sixty-day rule, often with the intention of increasing the aging requirements and making the rules more stringent to protect against food-borne illness (Andrews 2011). The fear of increased regulations and rules that would change the fundamentals of their current practice was a common thread in the interviews with farmers. It appears that banning raw milk cheese in the U.S. market would put many artisanal cheese producers out of business, as a result of a loss of market share, notoriety for their product, and (for some) they would leave the business because the economic detriment of having to purchase a pasteurizer.

During interviews, opinions about these and other policies were discussed. Questions were asked about the reasons for choosing pasteurization or non-pasteurization for the milk that will be turned into cheese. In all cases, farmers supplied raw milk and the cheesemaker was then responsible for the choice of whether or not to pasteurize. However, for several farmers knowing that the final product would remain raw was an incentive to produce and even safer, higher quality product then if they were producing for pasteurized milk product. It also was an incentive to pay close attention to animal health. As farmer 12 put it: "really healthy cows make really good milk."

This study showed that policies and regulations impacted some farmers' decision to sell raw milk directly to consumers. However, as noted earlier, these standards did not affect their choice

to drink raw milk from their farm. The reasons for drinking raw milk ranged from taste to convenience to tradition. By consuming it themselves and providing it to their families, this may imply that they did not abstain from sales based on perceived food safety or public health issues, but rather based on potential sanctions and liability. In addition to associated risks, six farmers mentioned that it wasn't profitable to sell raw milk in Vermont.

When asked how current food safety regulations impacted their choice produce milk for raw milk cheese, only two farmers mentioned that regulations played any role in their decision. Farmer 7 believes that pasteurization laws are outdated, and are no longer relevant given the results from current research and established safety protocols. Farmer 8 would like the U.S. to adopt regulations that were more similar to the European Union's approach in regards to milk and cheese.

> They [the E.U.] have a listeria tolerance unlike here [the U.S.]. Greater flexibility would be helpful for producing raw products. Each cheese should be regulated differently—understand risk associated. You can choose path [which cheese to make] based on regulations. – Farmer 8

Many farmers echoed the need for more nuanced regulations for artisanal cheese production rather than just the sixty-day rule.[10] Farmer 12 even encouraged more regulation for raw milk and raw milk cheese as long as the rules were backed up by understanding traditional cheesemaking practices and the food science behind keeping these products safe for consumers.

Potential Effects of Policy and Regulation

In this study, raw milk sales and aging raw milk cheese emerged as the top concern among the dairy farmers vis-à-vis policy and regulation. However, these concerns are not the only regulatory arenas where dairy farmers are affected. One of the smaller farms visited had a unique experience with regulations. As a result of certain requirements, she modified the type of cheese

[10] Sixty-day rule is a federal aging regulation for all raw milk cheese.

product she makes. This farmer initially wanted to make butter or yogurt as a value added product for her farm, but found the rules too stringent on a technical regulatory standpoint and could not afford the equipment investment to make her desired product.

Farmer #9 is a first generation dairy farmer operating a small farmstead operation in southwestern Vermont. Her reasons for farming are at the center of her decision-making process around farm management. She loves cows, and for thirty years worked toward owning a small operation that would make enough money to cover costs and provide for a "few extras". She wanted to produce a "fresh product to take to the local market."

After she realized that the hoops were too numerous to make butter or yogurt she settled on a third option. By conducting research on-line she discovered that using vegetable rennet would make whatever dairy product she made be considered a cheese, and she deemed that the regulations would be manageable for an operation of her size. In the end, she decided on a soft unpasteurized cultured dairy product, which resembles a yogurt, but is technically a cheese.

This example shows how policy and regulations shaped her business based on her economic parameters, personal goals and managing external regulations. She is now inspected two times a year as a milk producer and four times a year as a cheese producer. She doesn't consider herself a cheesemaker even if that is how she is categorized by the Vermont Agency of Agriculture, Food, & Markets.

Future Partnerships

Farmers are divided in their reaction to regulation and policy. Some seemed happy with the current system and others spoke about wanting to be engaged in the development of future rules that concerned their business. Farmer 11 spoke of creating partnerships between farmers, cheesemakers and policymakers. He saw potential for lawmakers to work with cheesemakers and

dairy farmers to support their businesses to become increasingly more economically viable and safe. This would mean re-examining potentially outdated regulations and also looking at how more current policies like FSMA and HACCP are affecting dairy farmers and cheesemakers.

3. Value

Farmers in this study fall into one of three groups. The first group consists of farmers working in a farmstead operation; the second group are farmers making artisan cheese on-site, but also purchasing milk from additional farm(s) so they are not defined as farmstead cheesemakers; and the third group are farmers who supply milk to the second group. These three groups vary in their physical proximity and connection to the cheesemaking process; however, when asked why they entered into the artisanal cheese production chain their reasons were similar. Each farmer became involved with artisanal cheese to increase value, whether that value is defined as personal, economic or a combination of the two.

According the USDA Economic Research Service the price farmers get paid for fluid milk can quickly change and is determined by the economic market, and by a wide range of pricing regulations (Blayney and Manchester 2001). For farmers in the third group, supplying milk to cheesemakers can be economically rewarding. The price set between farmer and cheesemaker is created between these two parties, and is typically higher than the prices paid by milk handlers. Furthermore, unlike the commodity milk market, the price set between cheesemaker and farmer remains constant for the length of time specified in their formal or informal contract.

> We decided to do it because of price. They came to us, but we knew them by living close-by. We now make about $2 more a day per cow. –Farmer 20

For farmstead operations, the reason to turn milk into cheese can be economically driven as well. Artisan cheese is considered a "value-added product" and can increase an established farm's income or be the reason for farming in the first place. This division highlights the difference between the farmer who also makes cheese and the artisan who thinks of cheesemaking as the main goal.

> "It is adding value to the milk, with a little more work I can make more money. It's a win-win for us." –Farmer 22

In some cases, the economic value is attached to a personal value. For example, farmer 27 wanted to raise goats and the only economical option was to make and sell cheese. Cheese was the only option she explained, because the demand for goat's milk and meat in this country is currently low.

In other cases, the reasons for supplying milk for cheese seemed purely based on personal values. Farmer 14 supplies milk to a cheesemaker for the same price that his milk distributor pays. When asked his reasons, he replied, "It was the neighborly thing to do." This shows that the value derived from this relationship is about community, rather than trying to make extra money. The idea of creating extra value beyond economics was a sentiment many of the suppliers shared. Paxson (2012) defines this value system as being an "economy of sentiment" and links it to "cultural, emotional, ethical, and political dispositions for making decisions (66)."

Farmer 13 manages a small educational farm at school where students milk the cows and participate in farm responsibilities. The manager identified four main reasons and values to supply milk to a local cheesemaker. The first was the higher price point, which reflects an economic value. The second was for the potential educational opportunities that this partnership might bring, adding cultural value to the community. The third reason was based on the farm manager's friendship with the cheesemaker, who also happened to be an alumnus of the school -

representing both a personal value on the part of the farmer, and a political value for the school. The final reason stated was pure excitement about the idea of creating a product with just the milk from the farm's cows rather than "putting it in the trailer with 50 thousand other pounds of milk from other farms". This reason highlighted both an emotional as well as an ethical sentiment.

Farmers in the second group, those who milk animals, make cheese on-site and buy milk from other farms, purchase additional milk for several reasons. A main reason reported is that a farmer may have a high demand for their cheese products and need to keep up with the supply. Furthermore, they would rather buy additional milk from nearby farms than increase their herd size. This reflects a value of scale by retaining a smaller herd-size on their farm, and also a value of community by sharing the economic opportunities to nearby farmers.

The goat farmers that buy additional milk do so based on a desire to produce cheese year-round and provide additional types of cheese to their consumers. Four out of five of the goat farmers interviewed milk seasonally, which is common for goat dairies. This means that there are between two to four months where the herd is not producing milk. On the other hand, all the cow farmers interviewed milk year-round. Therefore, purchasing cow's milk from a farmer allows the cheesemaker to diversify their product line and be able to make cheese year-round.

> She was looking for an income when her goats were dry in December through March. She pays more for the milk [than the distributor]. I thought it was cool that she is making cheese out of my milk. The blue cheese is from the Holsteins. I initially did it to help her out, and now there is no reason to stop. -Farmer 15

Farmer 15, owns a cow dairy, and sees the relationship with the cheesemaker as economically sensible, neighborly, and "cool." Additionally, the milk distribution company that he sells to formally approved of this buyer/supplier arrangement. All of the formal agreements went through the distributor as to not jeopardize the terms of his contract. Typically, each farmer

who supplies fluid milk has a contract and that contract stipulates an agreement on price and if they can sell to other vendors such as cheesemakers. In all but two cases, the farmers supply cheesemakers without a formal agreement with their fluid milk company.

> At this point it is in everyone's best interest to turn a blind eye. Maybe in the future they'll say something. They obviously know that we have less milk at times, but no one ever asks so we don't talk about it. –Farmer 22

If large companies started regulating this particular rule farmers would have to make tough decisions. On one hand, cheesemakers provide them more money for the product, and there is the economy of sentiment. However, the demand for milk from cheesemakers can be inconsistent. Fluid milk distributors will pick-up all the milk produced, even as the price paid for the product fluctuates.

Value & Changing Market

Farmer 17 chose to exit the fluid milk supply chain and become a farmstead operation in response to the changing market. When the farm was established they were originally part of a small milk distributor called Organic Cow of Vermont. Started in 1990 by Peter Flint, Organic Cow of Vermont was modeled as a cooperative. Farmer 17 describes how the company changed. Organic Cow grew, and H.P. Hood bought it in 1997, which was subsequently purchased by Horizon in 1999. Deane Foods purchased horizon in 2004.[11] The farmer was not pleased with the idea of being a part of the "largest supplier of dairy in the world,"[12] and decided to make a change.

[11] These dates were added by the author and not provided by Farmer 17.
[12] In 2014 Dean Foods is actually number 9 in the world, and is not the largest dairy supplier in the US.

> All of a sudden instead of calling up Peter Flint and saying I got this cow that I am not too happy about and we're going to cull her so you're gonna be down 40lbs tonight and 80lbs by tomorrow, Is that ok? And he would say, yeah that's ok, thank you for calling me. And now you're calling Colorado and what do you get? You get the answer machine. So things changed big time, and we weren't happy.

Farmer 17 was a part Vermont Organic Milk Producers Association (VOMPA), which tried to resist the buy-outs. According to him, when VOMPA could no longer resist the buy-outs and the change many farmers looked for other options. Many VOMPA members either sold their operations or decided to try value-added products instead.

> Bob decided he was going to bottle milk. Everyone decided something and didn't want to get stuck with Deane Foods. And we did always want to make cheese so we started researching cheese. 20 cows can't support a family anymore. Milk trucks go by but won't come up the driveway for the amount of milk we make. Cheese was the solution.

Farmer 17's story of personal and economic value and adapting to a changing market touched on themes that other farmers addressed in this study. A range of values motivate farmers involved in the artisan cheese industry as highlighted by Paxson's theory of the "economy of sentiment" (2013). These values are often very crucial to the relationships established with various actors, especially the relationship between the farmer, cheesemaker and cheesemaking process.

Actors

Actors are the people and organizations that work with farms on a consistent basis and form working relationships with farmers and/or cheesemakers. In this study, the following farmer/actor relationships were identified and grouped into four thematic categories: community, nonprofit organizations, service providers, and buyers. These actors directly influence dairy farmers working in the artisanal cheese industry to change and/or adapt their herd management procedures and protocols.

Unlike the factors discussed previously, actors are more readily accessible and their recommendations can be more immediately adapted to dairy farm management. With this said, not all of the actor relationships are equally valued by farmers, and some management practices get implemented as a result of a combination of actor and factor influence. The power structure and influence of actors will be described and supported by farmers' personal accounts.

1. Community

The first actor group is defined as the farmer's community, specifically those that play a role in farm decisions and participate in farm life. This group includes family members, farm employees, students or volunteers if the farm is part of a school or foundation and also includes other farmers and other cheesemakers (not those that they directly work with). The relationships in this group are voluntary and the relationship between farmer and actor is peer-focused or hierarchical where the farmer is in the position of power to accept or reject suggestions. To a lesser extent, popular media sources such as books, and magazines to which the farmer subscribes can also fall into this category, as it remains up to the farmer what information to explore further and what to ignore.

For multi-generational farms, the family dynamic appeared to play a key role in what farm management protocols have been established over time. The role individual family members play in influencing management practices builds upon the Experience & Practice factor previously discussed. Farmer 20 is a fourth generation dairy farmer and serves as an example on how the influence of factors and actors coincide.

Farmer 20 elects not to wear gloves during milking because neither he nor his father nor his grandfather nor is great-father ever had. However, he is retiring this year and his two sons are taking over the family's dairy business. Both sons wear gloves based on the influence of the younger generation. Farmer 20 has a grandson that recently returned from a two-year agricultural technical college and convinced his father and uncle that wearing gloves would help to keep the somatic cell count (SCC) low and help reduce infection between cows.[13] Furthermore, a low SCC earns this farm a price premium with their milk distributor and is a standard that the cheesemaker also has requested. In addition to gloves, the grandson has also convinced his father to use pre-dip on cows teats to disinfect them before milking. His uncle was not been convinced that this makes a difference for herd health and so (for now) half of the cows are subject to different milking procedures.

Multigenerational farms can change management decisions when ownership is passed down or another family member wants to have a more active role in farm life. Farmer 14 took over the family business about twenty years ago from his father. When the shift in management occurred, farmer 14 decided it was a good opportunity to switch the farm from conventional to organic. This change occurred at the recommendation of his wife and daughter, and to make the

[13] SCC is indicative of the white blood cell count. When this number is high it is an indicator of illness or infection; e.g., it could mean a cow has mastitis. Low SCC are usually indicative of a healthy herd, even though some farmers believe that too low of a SCC number can mean the herd may be prone to a sickness.

farm "his own", and to "adapt to the times." Farmer 8 changed a lot of her management practices when her son came back from college and wanted to begin to make cheese. He would take classes and read books and make suggestions how to make the ideal milk for the types of cheeses he wanted to create.

Books, videos, magazines and newsletters were commonly cited as sources of information that influenced farmer's management decisions, especially for those farmers that did not have regular interaction with their veterinarians. Farmer 8 uses literature to make most of her decisions and only calls the veterinarian in emergencies and for mandatory check-ups. Farmer 27 and 24, both rely on goat-specific information from magazines and books as they both find most of their local service providers do not specialize in goats.

Many farmers also have working-relationships with one another, and utilize the experience of their colleagues to influence their own operations. Farmer 12, who is first generation, and at the beginning of his career, often calls his neighbor (farmer 2) for advice. Farmer 12 believes that farmer 2 is more experienced and can afford the best products, and has tried a lot of testing that is out on the market.

> We call [farmer 2] and ask - What are the newest most expensive things that you're using? And then we go out and buy the ones we can afford. –Farmer 12

This comment was delivered in a jokingly manner, but farmer 12 does consider his neighbor to be a close friend and advisor. If there is a problem on the farm he usually reaches out to farmer 2 before calling a veterinarian.

Farmers and cheesemakers influence one another. A reputable cheesemaker can shape the practices and herd management of a farmer just starting out in the cheese business. Farmer 22 and Farmer 8 both added Ayrshire cows to their herd once they entered into the cheese market because a well-established Vermont cheesemaker was doing well and gaining popularity

with Ayrshire milk. This particular farmer/cheesemaker influenced other farmers based on reputation and popularity.

Farm 13 is part of a high school, where students' impact farming practices and decision-making; e.g. they influenced the decision to supply milk to a local cheesemaker and no longer work with a large milk distribution company. Farms 16, 17 and 18 are each owned by a collective (multiple owners) or set-up as a foundation. They all reported to receive a lot of support and guidance about their management procedures from their community and respective constituents. For example, a farm may be encouraged to choose farming practices such as pasture-based grazing because it contributes to the "working landscape" and other aesthetic values expressed by their students, neighbors, board members, and donors. In this way, the perceived interests of the community are considered when making management decisions about the farm.

2. Non-Profit Organizations

Each farmer was questioned about their level of involvement with the National Mastitis Council (NMC), the International Dairy Federation (IDF) and the Vermont Cheese Council (VCC). These organizations are structured as non-profits with a focus on (some part of) the dairy industry and were created to provide support and information to farmers and/or cheesemakers. These are not regulatory organizations and membership is voluntary, although there are membership fees for certain services.

There were three reasons for asking about involvement in these organizations. The first was to assess how well these organizations were getting their names and missions out to this section of the dairy industry. The second was to see if dairy farmers involved in artisanal cheese production in Vermont were directly obtaining any of the suggestions and recommendations

provided by these groups. The final reason was to understand reasons why farmers chose to participate or to abstain from these groups. Follow-up questions investigated whether or not farmers would be interested in materials, workshops or services provided by these groups.

NMC Mission:
Provide a forum for education and global exchange of information on milk quality, mastitis and relevant research. Communicate that information to the dairy industry enabling it to control mastitis and improve milk quality (2014).

The National Mastitis Council (NMC) was founded in 1961 as a not-for-profit organization focused on improving milk quality, and dairy herd health through mastitis prevention. The NMC provides information based on peer-reviewed research such as the 5 and 10 point plans for mastitis prevention. The NMC also provides workshops and conferences focused on udder health, milk safety, and farm management. There are publications and free resources available on their website[14] to members and non-members.

None of the 27 farmers were NMC members, however 17 farmers had heard of the NMC, 5 had looked at their website, but only 2 had ever looked at or used their resources for mastitis control. These two farmers both stated that they chose certain products and implemented procedures based on NMC recommendations and made sure both their teat dips were NMC certified.

IDF Mission:
Representing the dairy sector as a whole at international level, by providing the best global source of expertise and scientific knowledge in support of the development and promotion of quality milk and milk products, to offer consumers nutrition, health and well-being (2014).

The International Dairy Federation (IDF) is a non-profit operating on an international level in the private sector. Like the NMC, the IDF is focused on disseminating scientific

[14] The NMC website can be accessed at: (www.nmconline.org)

knowledge to support practices that produce quality milk. However, unlike the NMC, the IDF casts a wider net focusing on key players across the dairy chain and works with producers, processors, suppliers, governments and customers. According to the information gathered in this study, it does not appear that the IDF is influencing farmers working in the artisan cheese industry in Vermont. Nine farmers had heard of the IDF, but only one knew the purpose of the organization. None of the farmers had ever accessed the IDF website, and one farmer reported to accessing any of their resources, which happened to be a brochure at a NMC training course.

VCC Mission:
The Vermont Cheese Council represents cheesemakers throughout Vermont who are dedicated to the production and image of premier cheese. Our mission includes hosting educational events for the public and food professionals in order to learn more about the art and science of artisan and farmstead cheeses made in Vermont (2014).

Many of the farmstead cheesemakers included in the study were members of the Vermont Cheese Council (VCC). VCC is a member association of cheesemakers who are dedicated to the production and advancement of artisanal and farmstead cheese. The VCC, at this time, is only open to cheesemakers and not to the farmers that supply milk to cheesemakers. Farmer 25 supports the efforts of the VCC but also state, "cheesemakers have more support than farmers." Farmer 5 liked that the VCC was just for folks making cheese.

We are [VCC] members because they have done a lot of legwork. They help with marketing and fight for good legislation. It's the same as having a co-op or network for farmers, but instead, just for cheesemakers. - Farmer 5

Farmers were asked about their personal experience or to speak to the experience of the cheesemaker they worked with, and their working relationship with the VCC if applicable. In Vermont, about 75% of cheesemakers who register with the Vermont Agency of Agriculture Food & Markets (2013) also elect to become VCC members. The members surveyed in this study listed the benefits as being able to access support for marketing, networking,

sharing/accessing information and collaborating. Farmer 8 enjoyed seeing the work of VCC promoting different scales of farming and cheesemaking in a non-competitive environment.

> The Cheese Council is working toward getting Vermont to be known for its cheese and cheesemakers. We're working together instead of working against each other. –Farmer #8

Only four participant farmstead operations were not VCC members. Out of the four, two expressed that the small size of their operation was a main reason why they abstained. The other two had established markets and did not see how VCC could benefit them personally. One stated they were not interested in having visitors, and the other claimed to not need marketing support. One farm that abstained said that he was often encouraged to join and that the benefit would be increased exposure and opportunities for collaboration; however at the moment he was more interested in staying local and remaining a member of a farmer cooperative board instead of the VCC.

Other non-profit organizations and associations came up in interviews, although they were not asked about directly. Organic farmers mentioned the influence from the Northeast Organic Farming Association of Vermont (NOFA VT) and the former, Vermont Organic Milk Producers Association (VOMPA). Three goat farmers mentioned the American Dairy Goat Association (DGA) as being a source of information on farm practices specifically for goat dairies. The Vermont Institute for Artisanal Cheese (VIAC) was also cited as a source of information (although it too is no longer in operation.) Rural Vermont, an organization working on raw milk policy was mentioned in several interviews. Some lauded the organization for expanding the legality of sales and others expressed criticism of the organization for influencing the policy and making it more difficult to sell raw milk to neighbors without proper certification.

Out of the three non-profit organizations highlighted in this study, the VCC was the most well known, and many affiliated cheesemakers in this study were members. However, the support the VCC provides is mainly focused on the cheesemaking and marketing side of the operation and not as focused on farm management and how that connects to creating quality cheese. Perhaps, the VCC might consider extending its mission to include this emerging group of farmers. Or possibly, the NMC and the IDF may wish to extend efforts and support services to include farmers involved in the artisanal cheese industry.

3. **Service Providers**

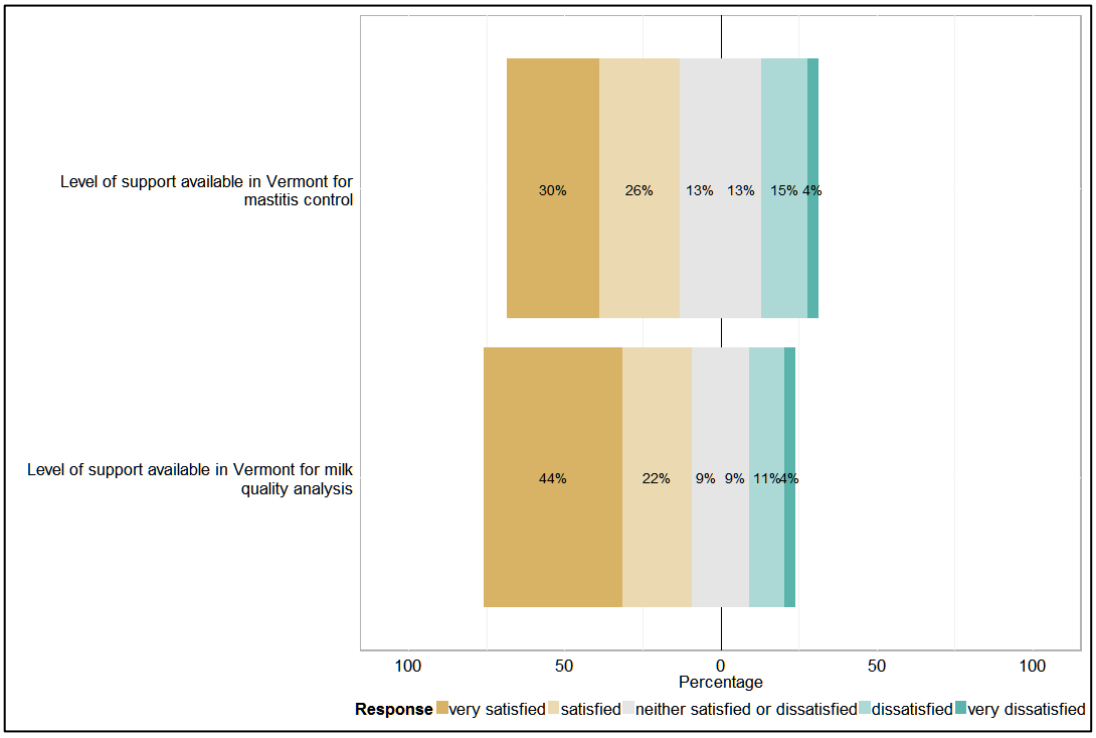
The third actor group encompasses individual service providers. This includes both required services like state and federal inspections as well as elective services such as veterinarian visits, additional milk testing, and farm sales calls. Depending on the quality of the relationship, this actor-group appears to be very influential in impacting farm management decisions and long-term practices.

The relationship between service providers and farmers is hierarchical in the sense that some service providers are in a position of power. Government inspectors have the power to enforce regulations and penalize the farmer if they fail to comply. On the other hand, veterinarians and other elective service providers are brought into farm operations based on their expertise and then paid for their services. Although different in their capacity to be hired and fired, both mandated and elective service providers are expected to be experts in their respective fields.

Each farmer was asked to rate their satisfaction (on a 1 to 5 scale) with the level of support services available in Vermont for mastitis control and for milk quality analysis. This was a broad question to gauge the overall approval rating of service providers. Figure 1 shows that the majority of farmers are either satisfied or very satisfied with current support services. The

following breakdown of service providers (Inspectors, Salespeople, Milk Testers, Researchers/Extension Agents/Government Service Providers, Veterinarians) seeks to provide more insight into these relationships and how they impact farm management decisions and practices.

Figure 1.
Farmer Satisfaction with Support Services in Vermont



a. Inspectors

As of October 2014, there were four farm inspectors, and three and a half plant inspectors[15] serving approximately 900 dairy farms, 116 milk-processing plants (including cheese plants), and about 85 dairy transportation companies and distributors in Vermont.[16] Perhaps as a result of there being so few inspectors, personalized working relationships between the farmer/cheesemaker and their local inspector appear to be common.

[15] Three inspectors are full-time and one is part-time the part-time plant inspector is a milk quality specialist that is about to start inspecting some cheese plants as well as farms.
[16] Dan Scruton, email correspondence, October 12, 2014.

As discussed previously, farm policies and regulations are difficult to change quickly. Inspectors come to farms and plants to make sure the mandated rules are being followed. However, in some cases, inspectors have the opportunity to work with farmers beyond enforcing regulatory compliance. They can be assets in herd management improvements and trouble shoot around potential problem areas. If a positive working relationship is established, efforts can be made to adapt protocols to go above industry standards.

> Regulations really depend on who your inspector is … working *with* inspectors really helps the process." –Farmer 23

On farmstead operations, the farm and cheese plant are inspected separately and often by different inspectors. This is interesting because these two operations are intrinsically linked, both by physical proximity and by function. Dairy farms are typically inspected two times a year, with a special rating visit every 18 months. Cheese facilities are typically inspected four times a year.[17] Therefore, farmstead operations are interacting with inspectors about six times a year. The majority of farmstead producers mentioned that they typically worked with the same farm inspector, but that the cheese plant inspectors varied.

When asked which inspection was more stringent (farm or cheese plant) the responses were divided. Farmer 7 called the cheese plant inspector more of a "stickler," than the fluid milk inspector. She was glad he was more meticulous because it showed that he took his time to make sure the equipment was working properly. Farmer 7 often worries about working with raw milk and food safety. By having a thorough inspection, she is assured that her customers are safe consuming her product. Admittedly, she doesn't worry as much about the fluid milk that gets picked up by the milk distribution company because it gets pasteurized, and stated: "there is less room for error."

[17] Dan Scruton, email correspondence, October 12, 2014.

When the milk inspector comes - on the one hand it's a pain in the ass and on the other hand you clean up everything that needs to get cleaned up for the last month and half. It keeps you on your toes…We're inspected by the same guys who inspects the milk plants. His attitude is that he wants us to process milk, but it has got to be done his way. He doesn't want to come in and be a jerk and shut us down, but it better be done his way. I like his attitude. He's on my team. – Farmer 13

Farmer 12 had a different experience, and believed that the cheese inspectors knew enough about the cheesemaking process to keep it safe but were "pretty lax" overall. He believed that inspectors better understood the nuances of farm management and fluid milk production. Four farmstead operators echoed this sentiment and noted that they have had quite a few FDA cheese inspectors and some did not appear to fully understand the cheesemaking process. Farmer 19 believed that cheese regulation is getting tighter for artisan producers, but believes that inspectors understand fluid milk and other food systems more than cheese production. He claimed that last year an inspector came that usually inspects fish and seafood facilities, and had never been in a cheese room before, but was called in because the department was "short-staffed."

The experience reported by farmer 19 is unfortunate because it undermines the potential for partnerships and the transference of useful knowledge and collaborative problem solving. Farmer 9 mentioned that a lot of information about farm management and procedures was coming from their milk and cheese plant inspectors. Six farmers chose their post-dip based on inspector recommendations. Farmer 27, changed parts of her milking system based on an inspector recommendation. One of the smaller operators stated that she gets almost all of her herd management advice from her farm inspector. Inspectors can play an important role in farm management, but consistency, rapport, and expertise are important factors in creating this type of positive working relationship.

b. Salespeople

Farmers were asked about their milking procedures. Specifically they were asked if they use pre-dip and/or post-dip, which are shown to decrease the chances of spreading infections between animals (Bandouin 2004). All the farmers interviewed used post-dip and most used pre-dip as well. There are many types and brands of dips available for purchase, leaving farmers with many choices. We asked farmers what the most important factor was in selecting their current teat dip. Some answered cost, or effectiveness based on research or a recommendation. However, the majority of the farmers responded that they selected a dip based on availability and/or promotion from their local salesperson.

> We don't have a lot of choice here. We use the teat dip that the IBA guy has. We're at his mercy. –Farmer 19
>
> I use an IBA backstop because it was recommended my salesperson and available. If you use something more obscure it might not be available next month. –Farmer 20
>
> We were given a free dip system if we used the promoted product… IBA checked it out. It's a good product. –Farmer 21

Most farmers reported using an IBA dealer as their primary dairy product provider. IBA is a national dairy farm supply company whose products are sold through independent affiliated dealers and technicians. However the options for sales calls seemed contingent upon farm location. Farmers in southwest Vermont had fewer supply company options than farmers located in more densely populated areas or counties with many dairy farms. Many farmers expressed their desire for more options for buying farm supplies, and farmers 6 & 12 mentioned that there used to be more local supply companies, but they have since gone out of business. It is possible that limitations in product suppliers and product availability create a strain on adaptive management practices.

c. Milk Testers

Service providers such as the Dairy Herd Improvement Association (DHIA), Cornell University and St. Albans Cooperative provide elective milk testing. DHIA organizations provide dairy record management support. Milk testing provides the farmer with milk quality measures including a breakdown of milk components and SCC. According to the national DHIA (2008) this information can be important for a variety of management factors including: reproduction, benchmarking, metabolic and disease information, and culling considerations.

70% of farmers surveyed utilize testing services offered by DHIA on a monthly basis. This testing provides them with a "hot sheet" which allows farmers to examine SCC for individual cows and to potentially identify which cows have subclinical or clinical mastitis. The 30% of farmers who opted out of DHIA did so for various reasons including: high cost, utilized another testing provider, wasn't offered in their area, or did not see the benefit of additional testing.

For farmers using these tests, they often rely on their results for economic premiums, and use the data as an indicator for animal health and overall milk (and potential cheese) quality.

> We didn't use DHIA before we started making cheese. We cared about having healthy cows before, but with cheesemaking it's a numbers game when it comes to udder health. – Farmer 8

Farmer 21 has two bulk tanks, one for the cheesemaker (milk from the top tier cows- lower SCC) and one for Agri-Mark (from the lower tier cows-higher SCC). The cheesemaker tests the milk five times a week and Agri-Mark is testing two times a month. They are receiving a lot of test results, which means they can make changes quickly and see if the adaptations makes a difference

in the numbers. However, apparently the increased frequency of SCC testing has led one producer to question the accuracy of this test.

> The more quickly we get our bacteria counts the more we can make quick changes. It has led me to question the accuracy of SCC when you're getting it tested all the time. Sometimes it changes so quickly that you think something must be questionable with the test. –Farmer 13

DNA tests are now available through some DHIA testing organizations. Farmer 21 was the only farm in the study currently utilizing DNA tests for individual cows. He sends milk samples to the Lancaster DHIA laboratory in Manheim, Pennsylvania and they send back interpretive results about the bacteria found in the sample by Polymerase Chain Reaction (PCR)-DNA testing. Farmer 21 selects cows that have a high or fluctuating SCC and those he suspects may have contagious mastitis such as *S.aureus* for additional testing. This type of testing is relatively new but is shown to be more effective, accurate, and identifies additional sources of bacterial targets such as *s. aureus, as well as Strep. ag.* and *Mycoplasma bovis* (Caldwell 2012). The other farmers in this study were either not familiar with DNA testing services, or did not participate based on cost.

The large majority of the sample population used and relied on DHIA testing for information about specific cows/goats that shaped herd management practices including which animals to treat, to breed and which to cull. For those that opted out of elective testing their reasons varied. Farmer 9 only participates in mandatory testing done by the state because she does not believe elective testing would improve herd health or her cheese business. In the case of SCC and goats, two farmers expressed skepticism on whether SCC was an accurate indicator for determining mastitis in goats as the tests were designed for cows.

In this study, the organic dairy farmers valued DHIA testing as much as those operating conventional dairies. However, this group's main complaint and frustration about general testing

had to do with antibiotics. Organic farmers cannot use antibiotics in their herd management practices. All milk processors get regularly tested for the presence of antibiotics. These tests are required and can be expensive for the farmer. Farmer 26 believes that this additional expense is "unnecessary" for organic producers. Overall, more farmers appear to consider DHIA testing a useful tool to gather information about milk quality and to be able to tweak herd management practices quickly.

d. Research, Extension & Government Services

The Vermont Agency of Agriculture Food & Markets, and the University of Vermont provide educational and practical services throughout the state. These services range from milk system evaluations, food safety workshops, to rotational grazing consultations. Some services are free and others available for a fee. Furthermore, there are specific research efforts conducted by these parties that may benefit dairy farmers working in artisan cheese production.

Like all of the elective service providers mentioned, certain farmers utilized opportunities to work with extension agents more than others. Four farmers noted that until this study, they had never worked with a university or state extension representative. A few farmers mentioned that they had reached out previously or used a service a few years prior. Many farmers expressed interest in knowing what types of extension services are currently available and the prices associated with each service. Vermont is a small state and is bordered by New Hampshire, New York and Massachusetts. A few farmers have gone to animal health and food safety workshops across state lines and utilized other states' extension services. Currently, there does not appear to be any extension partnerships between states for artisan cheese farmers and producers.

Farmers that have utilized University of Vermont's extension services have received support in different areas ranging from attending a workshop on the FDA's Hazard Analysis &

Critical Control Points (HACCP)[18] to receiving analyzed soil samples of their fields. One farmer described support they received from the Vermont Agency of Agriculture Food & Markets for an individualized problem-solving meeting addressing a consistent high bulk tank SCC. Laurel Junkins, the Dairy Field Specialist for the Agency's Milk Quality Enhancement Program, which focuses on improving milk quality and milking systems. His name came up in several interviews as an industry asset and someone who helped shape current farm management protocols.

> 2 years ago we had a problem with high SCC and mastitis. We called the state and they sent Laurel Junkins who suggested switching to individual cloth towels and a different brand of pre and post dips. It helped. Now he comes to evaluate our milking system every other year.
> -Farmer 26

Farmer 21 has worked on a variety of research projects with UVM research faculty. This farmer reports to have a "strong relationship" with UVM. Farmer 21 credited his new culling protocols and that his herd is now *S. aureus* free based on the results from a recent study. Other farms reported similar breakthroughs in mastitis control based on participation in this study.

Whether through UVM, or the state, they are countless opportunities for partnerships. Farmers repeatedly requested more information about what services/studies are available, what the time/price costs are, and how to get involved if they were interested. This is an opportunity for potential outreach efforts, especially by extension in Vermont, and nearby states and universities.

e. Veterinarians

Some farmers, especially those from farm families, reported to do their own "vet work", and will only utilize a certified veterinarian during an annual mandatory herd check. Some

[18] The FDA (2014) defines HACCP as "a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product."

farmers do some of their own vet work and utilize a veterinarian for emergency situations. The remaining farmers utilize their veterinarians on a more regular basis. For this group, veterinarians are very involved in what is happening on the farm and herd management. Some veterinarians create protocols and flowcharts for farmers to treat mastitis and other problems. They serve as educators for various issues such as different strains of mastitis and treatment options.

> We were lucky when I did buy this herd and we did have a bunch of contagious mastitis that we had a vet that lived up the road, who had a link to Cornell and who was our neighbor. He taught me a lot. We cultured the whole herd. For 50 percent off it cost me barely nothing. He came and did it with me. That was really helpful. –Farmer 19

Farmer 16 keeps records of all cows treated for mastitis because his veterinarian "requires" it. They meet every other week and go over the whole herd. Farmer 16 utilizes protocols established by the veterinarian and honors a "3 strikes policy" for culling cows that have had three major health issues. Farmer 13 uses his veterinarian to understand the different types of mastitis and which types can be treated and how. Each veterinarian has specialties ranging from experience with breed of animal, but also specific interest areas.

> I was talking to my vet the other day about that a lot of clinical mastitis is untreatable. Coliform mastitis is untreatable. More important to support the cow than treat bacteria that is no longer there. My vet is especially concerned with listeria in baleage and how that affects cheese. -Farmer 13

Some producers also indicated that veterinarians provide advice on policy and marketing issues such as whether or not to sell raw milk to the public. It appears that veterinarians can provide a connection between public policy concerns, scientific research and herd management.

My vet advises against selling raw milk. He was on the committee that relaxed the raw milk rules in Vermont. He now thinks that it was a mistake. He thinks the amount of listeria that is prevalent in round bales is being fed to cows and it's just everywhere. Selling raw milk is playing Russian roulette. He is a pretty smart guy. I don't agree with him on everything, but he's not someone who just spouts off at the mouth. He backs up his opinions with science. He's a scientist. – Farmer 13

This personal account demonstrates the important role veterinarians can play in farm management. However, it is not always easy to find a veterinarian that shares ideologies, or specializes in the animal that the farmer works with. Brad Kessler, a Vermont goat farmer, wrote in his book *Goat Song* (2009) about the difficulty finding a veterinarian:

> We've been trying to find a good goat vet for months. I've called around a half dozen places. There are plenty of vets in the area for horses, cattle, dogs, and cats, but vets who specialize in goats are rare (117).

Unlike inspectors, who have to come to your farm even if it is off the beaten path and even if you are only milking two does, paid service providers don't have to come if they don't want to. Furthermore, if they do come they may be like farmer 15's veterinarian and take a more "hands-off" approach. Overall, a close working relationship with a veterinarian seems to be influenced by geographic location, veterinarian preference and personal relationship. This highlights the association between factors and actors. When there is a successful working relationship, a veterinarian appears to be a great to be a great source of information, support and provides innovative solutions to improve herd health and milk quality.

4. Buyers

For the purpose of this report, the following buyers were identified: milk processors/ distributors, cheesemakers, and artisan cheese customers. Buyers can influence milk price, quality requirements, and availability. Certain buyers also create contracts and set requirements for farm management practices and milk components.

a. Milk Processors and Distributors

Milk processors and distributors specialize in transferring milk from the farm to the market. The modern dairy farmer is no longer responsible for selling their product directly to consumers. The exceptions to this are direct farm sales including raw and bottled milk. Of all the farmers in this survey that supply milk to off-site cheesemakers, only one has not retained a relationship with a milk distribution company. Farmers in this study worked with a range of companies including: St. Albans Cooperative, Horizon Organic, Agri-Mark, and Organic Valley.

Farmer 22 sells to three cheesemakers in addition to St. Albans Co-op, which picks-up milk every other day. She supplies to the cheesemakers for a higher price point and to St. Albans for the consistency. She also pays close attention to her bulk tank SCC so she can get the premium offered by the co-op for keeping her numbers low, a feature not offered by the cheesemakers. She pays a fee for pick-up with St. Albans, but is not responsible for transportation to the cheesemakers.

If she had to choose between only supplying to the cheesemakers or to St. Albans she would choose St. Albans. For her, the relationship with St. Albans is more important than the relationships with the cheesemakers because of the consistency and premiums. Her contract stipulates that farms are not supposed to supply to cheesemakers, but (for now) St. Albans seems to be turning a blind eye. If there did come a time to make a choice, farmer 22 has already made up her mind, and she is not the only one. When farmers were asked if they had to choose between selling to a cheesemaker or to a large milk processor many chose the latter.

> There is something very convenient about a truck that shows up and the stability of it. The milk price stability isn't great, but in terms of always being very reliable… We ship to [farmer 17], but it's hard if they decide one day they don't want the milk. The milk truck is much more reliable." -Farmer18

Farmer 15 supplies a local cheesemaker and a fluid milk processor. They coordinated this arrangement with the milk distribution company to make it transparent. He wanted everything to be legitimate and hopes to continue to supply to both buyers.

> [Farmer 23] had to sign something to allow for the milk to go to her - 50 gallons at a time, 5 ten-gallon milk cans at a time, for a total of 400lbs of milk. They took care of it. -Farmer 15

This arrangement appears to be positive for the farmer and the cheesemaker because the arrangement is legitimized and seemingly more sustainable because of the transparency. Although unproven, one farmer believed that this relationship appears to benefit the milk distribution company by supporting the artisanal cheese industry instead of taking a stand against it, which may lead to unintended consequences.

b. Cheesemakers

More research is needed to solidify the importance of the relationship between dairy farms that supply milk for artisan cheese and cheesemakers. As it stands there is a wealth of material about farm management and artisan cheese production, but a lack of information on how they intersect. It appears that the cheesemaking process influences both on and off-site farm management. More specifically, farmers' management procedures must adapt to create safe, high quality raw milk to meet not only government standards but also the standards of the cheesemakers. Farmer 6 has worked with three cheesemakers and has learned that "the quality of milk, affects quality of the cheese." He believes producing a quality cheese means adapting certain on-farm milk quality management protocols.

Farmer 8 is a second-generation farmer. Her family began making cheese five years ago with the intention of having the farm support more than one family. Their son started the cheese business on the farm and since its inauguration several milking procedures have changed.

Everyone now uses a strip cup, a pre-milking strategy to look for abnormal milk, a sign of clinical mastitis. Additionally, everyone who milks uses pre and post dip and wears gloves. The son really wants the SCC and bacteria counts as low as he can get. They are doing a lot more testing on the farm, and now approach each cow's udder by the quarter instead of as a whole. They have implemented procedures to dry off individual quarters and established that if two quarters are "bad" then the cow is culled. When they started making cheese, they bought 6 Ayrshires cows to add to their established 45-Jersey cowherd. This purchase was intentional to create a product with a specific fat content and desired taste profile for the cheese.

> It's changed everything. Cheesemaking helped establish protocols, which helped milk quality. -Farmer 8

Farmers made a variety of changes to farm management when becoming involved in artisan cheese production. However, the most common change was what they should and should not feed their herd. According to many cheesemakers, fermented feeds such as silage and wrapped round bales causes many cheeses to become "gassy" and unpalatable. One cheesemaker described this as "blowing up the cheese." What this means for farmers is that they can only feed dry hay and grain, and often this is stipulated in the agreement between farmer and cheesemaker.

> [The cheesemaker] makes raw milk low acid cheese. There is to be no fermented feeds whatsoever. No wrapped round bales…What does that mean to me? I buy feed. I buy hay. I spent 50,000 dollars on hay last year. –Farmer 11

The change of feed can be an expensive endeavor, but there are financial trade-offs. In most cases with the supplier-buyer relationship the cheesemaker was paying more for the fluid product, paying or transporting the milk themselves and all the testing was at the cheesemakers

expense. According to farmer 13 these reasons in addition to the satisfaction that comes from the value (factor) of the endeavor makes this considerable shift "worth it."

Each cheesemaker has a different set of standards. Farmer 22, who supplies to three different cheesemakers, compared her buyers. One was very number focused, one very concerned with the treatment of animals as that is a major part of their marketing for their cheese, and the third who just began making cheese did not ask for anything in particular from the farmer.

Farmer 10 was pleased with their relationship supplying milk for artisanal cheese because the cheesemaker tests all of milk, and also interprets the results and works with the farmer to fix any problems, like mastitis, that may arise. This cheesemaker works with two dairy farms, both with all Jersey cows herds. This breed is desired for their milk, which is high in butterfat. Farmer 21 expressed satisfaction with being rewarded for making high quality milk. She stated that she puts a lot of energy in management practices to keep the cows healthy and the milk tasting good. She likes that the cheesemaker cares about the quality of the product as much as she does: "It's good to see more value added to it down the chain."

The relationship between farmer and artisan cheesemaker is a working arrangement that should be explored further, and in greater depth. Additionally, studies that focus on the connection between specific farm practices and cheesemaking would be informative and would help cement the connection between the two fields.

c. Customers/ Market

The customer is an imperative component in the artisanal cheese industry. Ultimately, in order for the artisanal cheese industry to grow in Vermont and elsewhere, the customer base needs to continue to grow. Although the survey did not cover the customer and market

specifically, this group came up frequently in discussion ranging from how certain decisions are made based on customer sensibilities to increasing market pressure.

The artisan cheese consumer has many options now, which increases competition for cheesemakers.

> We got here early with the artisanal cheese thing, and now we feel the squeeze and it's a big f*$%ing hammer…they see you got a good thing and they want it to. They say 90% of sales come from 10% of your customers. It's harder with more competition. – Farmer 19

As the market continues to grow and the industry gets more competitive it will likely become increasingly imperative to connect to consumers and gain their loyalty. According to some of the farmers who are also making cheese, their customers are looking for more than a cheese that tastes good; they are looking for a cheese that represents craftsmanship and additional value. Paxson (2012) discusses this concept extensively and believes that artisanal cheese customers are consuming both the cheese and the story about how the cheese was made. This story includes value associated with agrarian life, the small farm and well-treated animals (Paxson 2012).

While most customers may be oblivious to the importance of SCC in dairy operations, or how fermented feeds affect cheese processing, it appears they do place value on other indicators. It appears that customers are concerned with certain established labels like organic and humane certified. They also like the idea that by buying artisan cheese they are supporting small, family-owned farms (Paxson 2012). Artisan cheesemakers don't usually advertise if they are buying additional milk from other farms as this does not play well into the bucolic farmstead imagery.

The higher price point for artisan cheese allows for farms to remain small and for cheesemakers to make handmade products in a more traditional way. Many of the cheesemakers interviewed sold their products and directly interacted with part of their customer base at a farmers' market or farmstand. The interactions with customers influenced the types of cheese

produced. Farmer 26 only makes cheese that is popular with her customers at the farmers' market; currently Chevre is their bestseller.

According to farmer 7, many customers are concerned with food safety and farm practices, but they are not very knowledgeable about the intricacies of these subjects. Farmer 16 echoed this sentiment wishing to educate consumers about regulations and rules that are already in place, and how they are personally "going above and beyond" the established requirements.

> Dairy is tested more than most other products. [Consumers] are going to almond and soy, because they don't understand that dairy is safe. –Farmer 16

Farmer 12 was very concerned about food safety and especially weary of Listeria and *E.coli*. He stated practices "need to be perfect to make raw cheese". Currently there is no easy way for cheesemakers to communicate to customers about their compliance with regulations, and many farmers say they went above and beyond HACCP regulations, but that those formalities were difficult to articulate to customers. Farmer 16 believes that the customer does not always understand much about farm production, or even much about already established labels like "GMO-free", "organic" or "humane certified".

Farmer 7 wished that consumers would care more about animal welfare and felt that farmers in the artisanal cheese-making industry tend to treat their animals better because farms can remain smaller and more personalized. This farmer also expressed frustration that many decisions are made to increase the desirability of the final product: cheese, and yet many customers are unfamiliar with the farm practices that go into creating the main ingredient: milk. It is my opinion that if research and policy made greater efforts to connect milk and cheese, farmer and cheesemaker then these efforts may better inform customers about the cheesemaking process, food safety concerns, and potentially increase the overall value and popularity of artisan cheese.

Conclusion

This study examined how and why (goat and cow) dairy farmers gain knowledge and implement farm management practices within Vermont's artisanal cheese industry. The purpose of this project was to determine what is influencing farmers' decision-making, and provide insight to service providers, researchers and policymakers.

27 farmers were interviewed and their milking practices observed. Farmers' perceptions, knowledge and behavior were analyzed to determine what influences their management practices. According to this study, farmers are influenced to adopt certain farm management procedures based on "factors" and "actors." Factors are the farmers' operational constraints and parameters, and actors are the individuals and organizations that directly work with farmers.

Factors were presented first and examined further using the following sub-themes: Experience & Practice, Location, Policy & Regulation and Value. Factors shape the ways in which actors can effectively disseminate recommendations and advice. The actor category was broken into the following four sub-themes: Community, Non-Profit Organizations, Service Providers and Buyers. Actors have the capacity to directly work with farmers and create relationships that will immediately impact farm management and cheese production.

There are many benefits to understanding the complex relationship between factors and actors. It is my hope that those involved in the artisanal cheese industry will have gained insight to how information is being disseminated and how and why certain farm management practices are being implemented. Furthermore, by using the personal accounts of farmers, the intention was to share the voice of those working in the industry and to connect dairy farm management to the greater understanding of the artisanal cheese industry.

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