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Feasibility of On-farm Milk Processing, Packaging, and Marketing for Tennessee Dairy Farmers

Jonathan Joel Moss
jmoss14@utk.edu

To the Graduate Council:

I am submitting herewith a thesis written by Jonathan Joel Moss entitled "Feasibility of On-farm Milk Processing, Packaging, and Marketing for Tennessee Dairy Farmers." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

Kimberly L. Jensen, Major Professor

We have read this thesis and recommend its acceptance:

Margarita M. Velandia, Burton C. English, P. Michael Davidson

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

Feasibility of On-farm Milk Processing, Packaging, and Marketing for Tennessee Dairy Farmers

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Abstract

The Tennessee dairy industry has experienced a milk price and feed cost squeeze over the past several years, resulting in declining dairy farm numbers. Many dairy farmers are looking for ways to capture more of the food dollar. One alternative is employing a value-added enterprise. With added managerial and financial responsibilities, it is important that a market and financial feasibility be examined prior to entering into such an undertaking. This study focused on the feasibility of on-farm processed milk, cheese, and yogurt. The feasibility analysis consisted of two major components: market potential and financial feasibility. Market potential was examined for five major metropolitan areas (Memphis, Nashville, Knoxville, Chattanooga, and the Tri-Cities). The financial feasibility for these value-added activities was projected for a representative dairy farm for the state of Tennessee.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 INTRODUCTION

1.1 Introduction

Overall milk production in the state of Tennessee, like much of the Southeastern United States, has been on the decline (USDA-NASS 2010a; USDA-NASS 2010b). From 1990 to the present, milk production has declined by an average of 4.1% per year (Figure 1; USDA-NASS 2010a; USDA-NASS 2010b). A key contributing factor to this trend is the decline in the number of dairy farms, with a nearly 50 percent decrease in the number of Grade A dairies in the nine-year span between 2002-2010 (Sanford 2010; USDA-NASS 2010a; USDA-NASS 2010b).

Many producers are now looking for niche markets where they can obtain higher prices for their products and increase revenues. One potential means for smaller producers to develop niche markets is through product differentiation. Opportunities may exist for dairy farmers to directly market pasteurized fluid milk or further processed dairy products. Examples of such products are farm-bottled milk, organic farm-bottled milk, artisanal cheeses, yogurt, butter, or ice cream. The objective of this study was to examine the feasibility for Tennessee dairy farms to produce and market three products: milk, cheese, and yogurt.

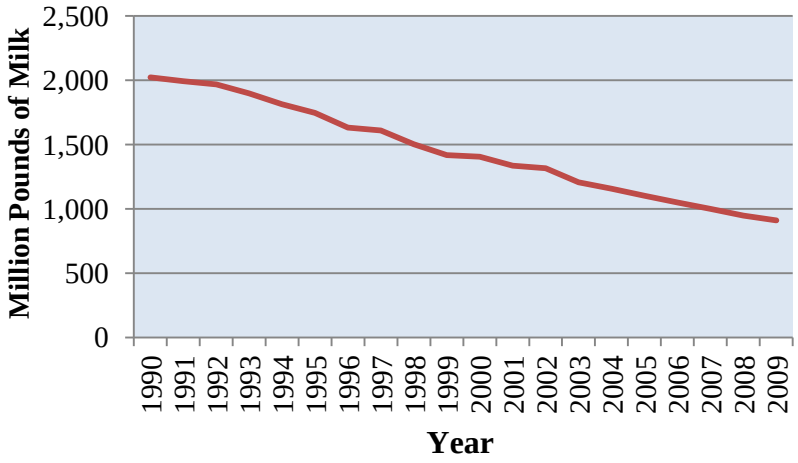

Figure 1. Tennessee Milk Production, 1990-2009 (USDA-NASS 2010b)

In some cases, on-farm bottled milk and processed cheese and yogurt may receive a premium price because the milk is locally-produced, locally processed, or because the product may be organic. These products can allow the producer the opportunity to capture more of the value of the food dollar. In addition to direct on-farm marketing, potential off-farm market outlets for these products may include specialty or gourmet stores in larger metropolitan regions, such as Nashville, Memphis, Knoxville, Chattanooga, or the Tri-Cities. These products may also be sold through farmers' markets or food cooperatives.

Because adding value at the farm level also entails additional costs and some business risk, it requires careful business planning and evaluation of market potential, including a feasibility assessment. Market feasibility and financial feasibility should be examined prior to entering into a value-added enterprise. The purpose of this study was to examine both market and financial feasibility of value-added enterprises for dairy in Tennessee. The specific objectives are to 1) ascertain the current market potential for on-farm value-added opportunities (milk, cheese, and yogurt) around five major metropolitan regions (Memphis, Nashville, Knoxville, Chattanooga, and the Tri-Cities), and 2) project the financial feasibility of these on-farm value-added activities for Tennessee dairies.

Significant gains in milk production per dairy cow have been made over the years through technology and improved management practices. While gains have been made in milk production per cow, progressing from 11,825 pounds per year in 1990 to 16,232 in 2009 (Figure 2), Tennessee's milk production per cow still falls below the U.S. average of 20,576 pounds per cow per year. The increase in production per cow has not been able to offset the declines in numbers of dairy cows in Tennessee (Figure 3).

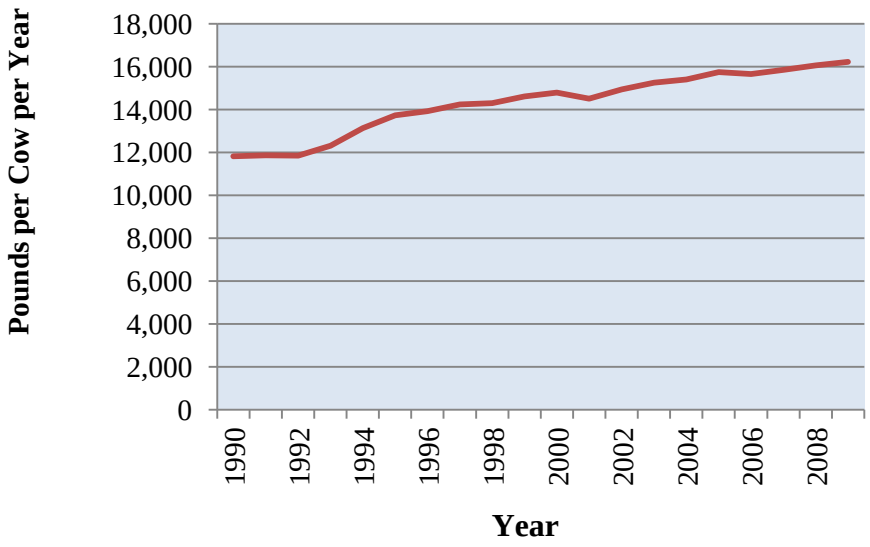

Figure 2. Tennessee Average Milk Production per Cow, 1990-2009 (USDA-NASS 2010b)

The reason for the decrease in dairy cows in Tennessee is…. For example, rising energy costs have caused an increase in the price of fuel and feed. In 2009, the total operating costs per hundredweight (cwt) of milk in the U.S. was $14.14. In Tennessee, these total operating costs averaged about $19.69, or about 1.4 times higher than the national average (USDA-ERS 2010a).

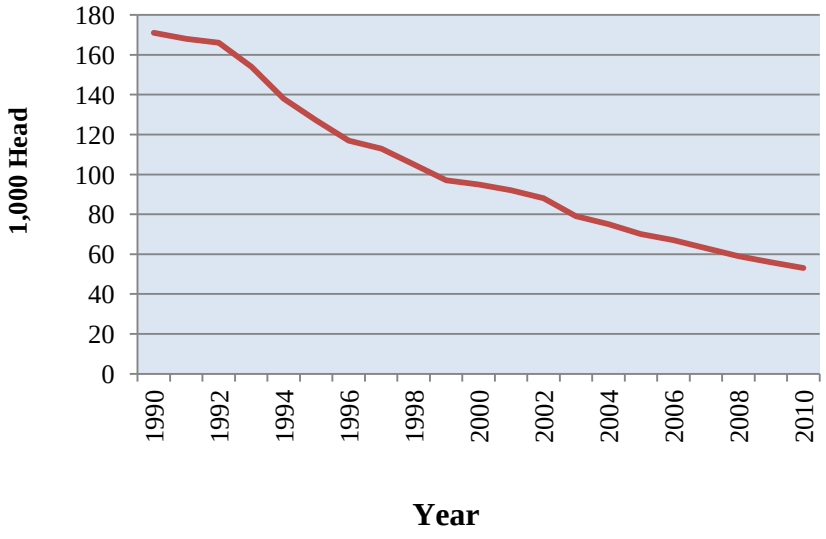

Figure 3. Number of Dairy Cows, Tennessee, 1990-2009 (USDA-NASS 2010b)

The biggest factor contributing to the higher operating costs is the costs associated with homegrown harvested feed. In comparison with costs, the average uniform milk price for 2008 and 2010 in the Appalachian Order was $17.26 per cwt and $17.46 per cwt in the Southeast Order (USDA-AMS 2009). A major component of dairy farm operating costs is feed costs. Tennessee farmers spend about 34 percent of their operating costs on homegrown feed, while the U.S. average is about 23 percent (Figure 4). Also, Tennessee farmers spend about 44 percent of their operating costs on purchased feed, while the U.S. average is 53 percent.

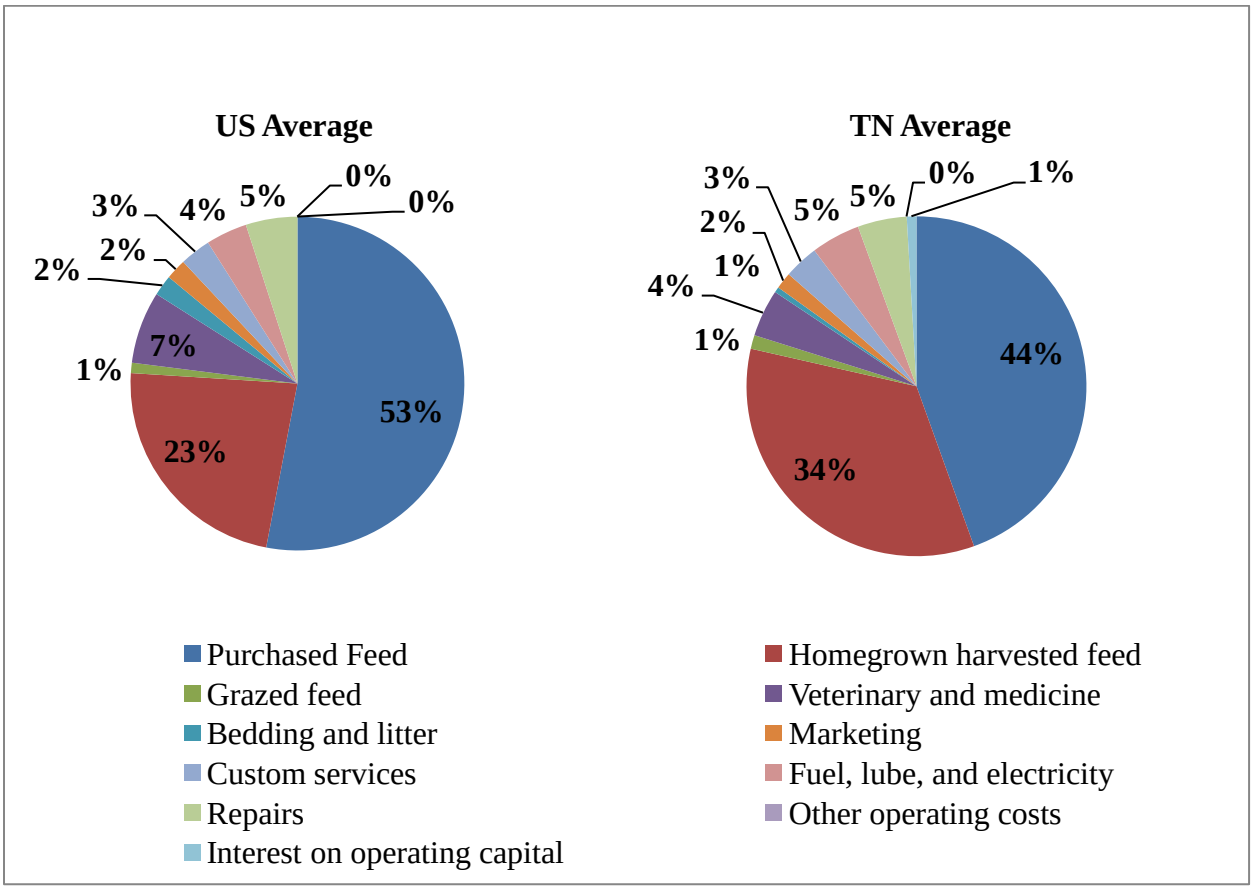

Figure 4. Total Dairy Operating Costs, 2009, the US and TN (USDA-ERS 2010a)

Despite declines in farm numbers, the dairy industry in Tennessee still remains 7th in cash receipts among farm commodities in the state (TDA 2010). Tennessee's dairy farms produce direct economic impacts not only through the milk they sell, but also indirectly through the goods and services these farms use and the incomes that associated industries generate. Displayed in Table 20, the direct economic impacts of farm sales of milk and dairy for 2010 were estimated at $200.2 million with 4,460 jobs (IMPLAN 2010). When multiplier effects are included, the economic impacts of farm level sales are estimated at $278.2 million and 5,113 jobs.

Beyond farm-level sales, the state's fluid milk and dairy products processing industry also generates economic impacts. The direct economic output from the fluid milk and dairy products processing industry is estimated at $1.86 billion with 2,212 jobs. When the multiplier effects are included, the estimated economic impact is $2.89 billion and 7,811 jobs.

As can be seen in Figure 5, there are concentrations of dairy farms near metropolitan areas of Nashville (Davidson Co.), Chattanooga (Hamilton Co.), Knoxville (Knox Co.), and Tri-Cities (Sullivan Co.). With accessible interstate access, there is a potential to sell processed products in these markets. This analysis will evaluate the market potential in these metropolitan areas and determine the financial feasibility of processing, packaging, and marketing the products to sell in these areas.

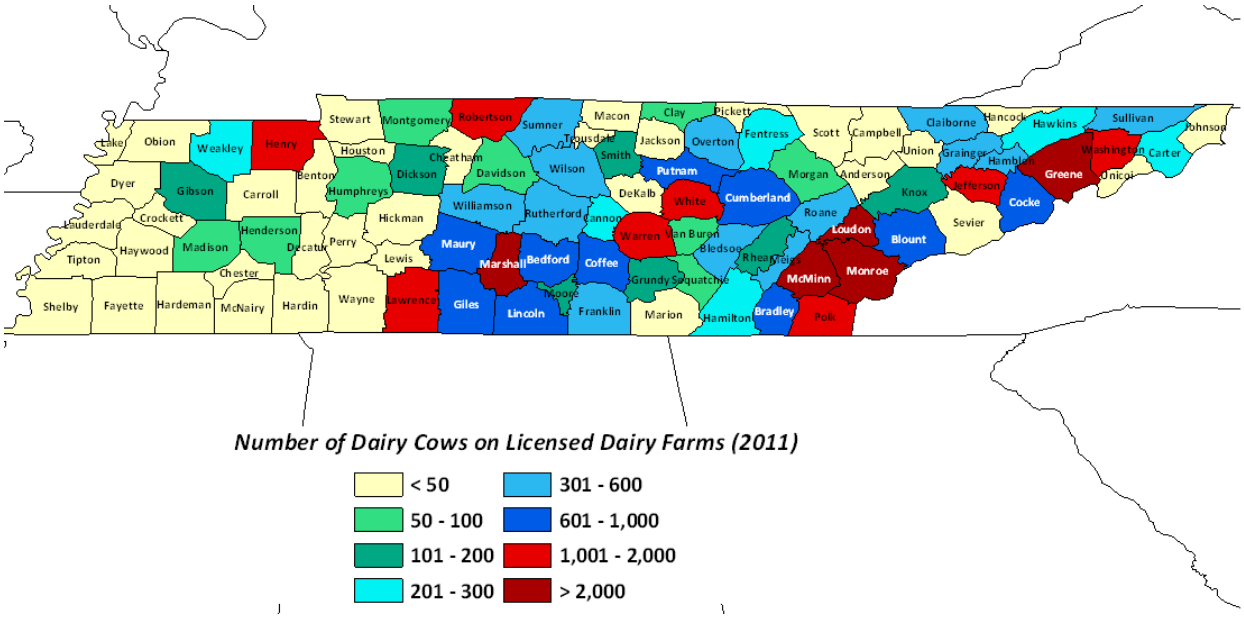

Figure 5. Number of Dairy Cows on Grade A Dairies in Tennessee, by County, 2011 (TDA 2011)

CHAPTER 2 LITERATURE REVIEW

To be able to understand the potential for on-farm and farm associated dairy products processing, it is necessary to examine milk and dairy products feasibility studies, consumer demand and preferences, consumer preferences for type of outlet, and demographic effects on consumption. While there is some information on the costs and market opportunities associated with value-added dairy products for some US states (Hammarlund 2003; Wolfe and Shepherd 2006a; Wolfe and Shepherd 2006b; Wolfe and Best 2005; Glaser and Thompson 2000), little information is known about Tennessee.

Previous research has determined that the best way niche markets are developed is through a combination of a good product and an effective advertising and promotion program (Wolfe and Shepherd 2006a; Wolfe and Shepherd 2006b; Wolfe and Best 2005). It is expensive to develop a new product. In addition, the development and promotion expenses would be incurred before any revenue could be realized. If the product never gains acceptance, investments would be lost (Wolfe and Shepherd 2006a; Wolfe and Shepherd 2006b; Wolfe and Best 2005).

2.1 Milk and Dairy Products Feasibility Studies

Value-added products that are currently gaining market interest include organic/natural, locally-produced, and grass-fed milk and dairy products. Organic milk products are products that met organic standards at the milk producer, handler, and processor levels. Special production systems and methods are used in organic milk products. The USDA has a detailed certification process and guidelines that must be followed to be certified organic. Natural milk products are not specifically defined by the Food and Drug Administration. The agency has not objected to the use of the term if the food does not contain added color, artificial flavors or synthetic substances.

Locally-produced products have no regulations specifying what locally grown means. However, past market research has suggested that consumers associate a locally grown label with products that were produced within 50 miles of the point of sale (Onozaka et al. 2010). Grass-Fed implies that the animal is solely fed a grass and forage diet. These products are inventoried at most major grocery stores. Each group of products will be evaluated in the consumer demand and preferences section (2.2).

2.1.1 Milk

The feasibility of on-farm milk processing must be examined prior to entering into a value-added enterprise. This section examines the feasibility of on-farm milk processing and also examines the feasibility of organic milk production.

Wolfe and Best (2005) in their analysis of the feasibility of a Polk County, Georgia dairy, assessed both the market and financial feasibility for locally-produced milk products. For market feasibility, they examined the overall fresh fluid market, demographics of the area, product consumption, purchase frequency, container preferences, purchase location, milk prices, likelihood to purchase milk, and product feature ratings. For financial feasibility, they examined the following types of costs: raw milk (an opportunity cost to the dairy), labor, supplies and packaging, utilities, and physical plant (building and equipment). They then performed a break-even analysis where they based it on different cost estimates and random price variations for retail milk products. Since there was a very limited amount of information for production available, three different analyses of costs were made (over-estimate, estimate, under-estimate). They first made best estimates in the process design and assignment of costs for the processing equipment. Then after receiving a range of estimates, the high and low were averaged to come up with the estimate. The high was used as the over-estimate and the low was used as the under-

estimate. An estimation was made for the processing and retail facilities' cost and a twenty-percent cushion was added to the over-estimate and subtracted from the under-estimate. Wolfe and Shepherd (2006a; 2006b) used the same analysis for their feasibility studies for on-farm bottling of milk in Morgan County Georgia and for Augusta area on-farm milk processing.

Becker et al. (2007) developed a cost and returns evaluation of alternative dairy products to determine the operational feasibility of a small-scale dairy processing facility. The start-up investment costs for each of the facilities would include land, buildings, site work, utilities, and equipment. The buildings would include the processing plant, office space, milk truck delivery bay, finished product cold storage, dry product warehouse space, wastewater treatment capacity, and shipping/loading dock area. The most significant operating costs are labor, raw milk prices, factory overhead, and interest expenses.

Hammarlund (2003) describes the financial projections of a dairy processing facility. The study looked at the costs and revenues for a smaller and larger operation. A range was estimated for the projected revenue. Expenses were based on per gallon cost for each facility. Costs such as enrichments, flavoring, supplies, and packaging did not vary dramatically with the size of operation. Costs such as labor, utilities, and depreciation varied on a per unit basis based on the amount of volume for each plant. Cost of delivery was added to expenses. Delivery and distribution costs are extremely variable depending on the market area.

When evaluating the costs of equipment for a processing facility, it is important to consider used equipment. Used equipment can reduce depreciation costs and other fixed plant costs; however, it may reduce plant efficiency which must be evaluated against the total cost of the equipment. The cost of plastic bottles is also a major factor. A large facility can justify the

purchase of a bottle blower, which can decrease the cost of the bottle by as much as 50 percent versus buying bottles already blown. Freight is the major cost difference (Hammarlund 2003).

Other costs that vary depending on the plant are labor costs, supplies and packaging, and utilities. Labor costs per gallon of milk are affected by the hourly wage rate and the efficiency of the plant. Supplies and packaging vary by containers used in each plant. Utilities vary depending on the plant size, efficiency, and location (Hammarlund 2003).

Plant costs vary greatly. Industry average plant costs vary widely due to different depreciation methods. The age of plant and equipment have a major impact on overhead costs. The higher the overhead costs, the more capital-intensive a plant becomes. Increasing overhead is offset by better labor efficiency (Hammarlund 2003).

The delivery system can be a costly part of the business, especially for smaller processors. Small operations will have higher costs because of shipping. Large processors serve big accounts and make large deliveries to relatively few points and uses efficient equipment (Hammarlund 2003).

McBride and Greene (2009) examined the feasibility of converting a conventional dairy farm to an organic dairy farm. Most organic dairy farmers start out as conventional dairy farmers and then decide to convert their operation to organic (McBride and Greene 2009). This entails costly changes that are required by the USDA to be certified organic. McBride and Greene (2009) suggest that large organic dairies are better able to generate revenue above their capital and labor costs, meaning that organic farm structure may move in the direction of conventional farm structure with larger, fewer farms.

Nicholson and Stephenson (2007) examined the financial performance for a dairy farm and dairy processing enterprise in New York, Vermont, and Wisconsin which included the full

economic costs of processing dairy products on-farm. Dyck et al (2009) outlines the steps for an organic system plan and how to transition to organic dairy. The organic system plan assesses a farm and abilities realistically due to the cost and time involved in the transition to organic dairy.

Nicholson and Stephenson (2007) and Dyck et al. (2009) note that value-added activities should not be undertaken by struggling farms and that many farms lose money by participating in on-farm activities. Value-added activities add more complexity to the management of the farm, and therefore will demand extra time and research. Operations that engage in more than one value-added activity are likely to lose money. Unless the activities depend on each other, it is likely that firms will want to specialize in one activity.

Bevandick et al. (2002) reported the issues that farmers face when transitioning to organic fluid milk production. The issues described were the transition period, land, feed, labor, herd health, equipment sanitation protocol, financial return, and markets. The financial returns listed were:

- The level of financial return is influenced by organic milk consumption and the organic milk supply.
- The price for organic milk is fairly stable, but may be more susceptible to supply changes than the conventional sector.
- Further market development is required before more products can be successfully introduced locally.

However there are also risks that involved in transitioning to organic milk production. This involves financial risks, production risks, handling risks, price risks, and market risks. The financial risks listed were:

- The level of investment capital is substantial for certified organic dairy production.

- When switching from conventional to organic the stability of returns may be an issue.
- Labor requirements for organic milk production are higher.

Table 1 summarizes data from three on-farm milk processing facilities that includes costs related to operating, startup, and prices for products.

Table 1. Summary of On-Farm Processing Costs and Prices

Study	Size of Dairy	Location	Product	Costs
Hammarlund (2003)	300,000 gallons/month and 1.2 million gallons/month	Kansas	Organic	**For 300,000 a month:** Gross Margin per Gallon: $0.44, Total Expenses $279,000.00, Net Income $(119,394.00); Gross Margin per Gallon: $0.54, Total Expenses $279,000.00, Net Income $(89,394.00); Gross Margin per Gallon: $0.75, Total Expenses $279,000.00, Net Income $(26,394.00); Gross Margin per Gallon: $0.90, Total Expenses $279,000.00, Net Income $18,606.00 **For 1.2 million a month:** Gross Margin per Gallon: $0.35, Total Expenses $720,000.00, Net Income $(189,576.00); Gross Margin per Gallon: $0.44, Total Expenses $720,000.00, Net Income $(81,576.00); Gross Margin per Gallon: $0.52, Total Expenses $720,000.00, Net Income $14,424.00; Gross Margin per Gallon: $0.60, Total Expenses $720,000.00, Net Income $110,424.00
Wolfe and Best (2005) Wolfe and Shepherd (2006a; 2006b)	100,000 gallons/year	Georgia	Locally-Produced Milk	**START-UP COST ESTIMATES:** Retail Facility: $80,000.00 Processing Facility Construction: $100,000.00 Milk Processing Equipment: $880,000.00 **PER UNIT COST ESTIMATES (including estimates for overhead):** Annual Retail Facility Overhead: $43,000.00 On-Farm Milk Processing: $2.00/gallon
Becker et al. (2007)	50 and 500 head	Vermont	Locally-Produced Milk, Cheese, and Yogurt	**Plant facility construction costs:** for 50 $450,000, for 500 $950,000 **Estimated plant and equipment investment costs:** for 50 $1,280,000 for 500 $1,780,000 **Retail dairy product price survey:** Fluid milk: for retail $2.69–2.89 per gallon, for wholesale $2.25 per gallon; Heavy cream: for retail $1.89–2.09 per quart, for wholesale $1.50 per quart; Yogurt: for retail $1.99–2.39 per quart, for wholesale $1.75 per quart; Cheese: for retail $5.25–8.50 per pound, for wholesale $5.50 per pound

2.1.2 Other Dairy Products

This section examines factors that need to be considered prior to entering into a value-added cheese or yogurt enterprise. Also, a list of market industry trends that were determined to affect the market for small-scale food processing was included.

Seeboth and Harker (2005) suggest factors that need to be taken into consideration when determining the profitability of value-added activities. The scale of small operations reduces the amount of products available, and the limited amounts result in less efficient utilization of plant capacities. Products such as yogurt and cheese can be stored for several weeks, and can be differentiated more effectively towards consumer preferences; however, the revenue of sales will be delayed from when the product was produced.

Monphongchai (2003) evaluated the potential of adding fruit juice to cheese. The study focused on the feasibility of producing apple, cantaloupe, honeydew, grape, and watermelon flavors. The sensory attributes given the greatest consideration were appearance, texture, color, and flavor. Apple juice produced the best sensory attributes.

Robinson (2008) led a study that evaluated the feasibility of a small-scale yogurt processing facility in Hope, British Columbia. It was determined that the greatest challenge for the industry is responding directly to the changing demands of consumer and food service markets, especially to hotel, restaurant and institutional buyers. These buyers have expressed a preference for regionally produced and healthy products, but the food service industry operators are not responding directly. The major industry trends that were determined to affect the market for small-scale food processing are:

- Population growth and demographic changes,
- Health and safety concerns,

- Changing ethnic, household and labor force compositions,
- Product innovation,
- Increase demand for organic products,
- Addition of sustainability to the organic food supply,
- Competitive price challenges,
- Exploitation of niche markets,
- Seasonality of crop production,
- Labor supply and cost,
- Fuel costs, and
- Appreciation of currency relative to other countries.

2.2 Consumer Demand and Preferences

2.2.1 Milk and Dairy Products

It is necessary that before beginning a value-added endeavor, one must test the market where the product will be sold. A study by Seeboth and Harker's (2005) focused on butter, cheese, ice cream, on-farm bottling/glass bottles, organic, rotational grazing/grass-based, seasonal dairying, unpasteurized milk, and yogurt. The study began by studying the potential customer, finding the right market channels for the product, and marketing placement. When researching the customer, they noted that it is necessary to determine who will be purchasing the product which can be done through interviews, surveys, and focus groups. The farmer must choose a strategy that fits their own particular set of needs. They explained that conventional market models do not always fit these needs. Markets are extremely competitive, which can make it difficult for farms to be competitive. Once the product is produced, the farmer must place it into the market. Seeboth and

Harker's (2005) keys to a marketing strategy are to make a true commitment to one's market, differentiate the product, and market it.

2.2.2 Organic/Natural

When considering organic or natural milk production, it is important to determine how the consumer views organic or natural milk. A survey by Hammarlund (2003) included questions about organic milk awareness, attitude to organic milk label, and attitude prior to reading an organic information booklet. Hammarlund (2003) confirmed that there are several differences between organic milk drinkers and conventional milk drinkers. According to Hammarlund's data, organic customers purchased fewer soft drinks, are more aware of the caloric content in milk, have a lower income and fewer children. A majority of the survey respondents after reading an informational brochure of organic milk were inclined to purchase more organic milk, and both groups would increase their purchases of organic milk if price decreased. The survey was administered by the Kansas State Dairy Club in July 2001. It included 547 consumers from a leading retail supermarket chain in Kansas City. In concurrence with Hammarlund (2003), Glaser and Thompson (2000) conclude that there is a small market available for organic milk.

Glaser and Thompson (2000) examined the retail sales of organic and conventional beverage milk, excluding buttermilk and flavored milk, using national level supermarket scanner data. In concurrence with Wolfe and Shepherd (2006a; 2006b) and Wolfe and Best (2005), it was determined that container size is an important factor in sales of milk. However, the two studies differ when recommending which container to utilize. Through their study it was indicated that organic milk and private label branded milk are substitutes; changes in organic milk prices have little effect on branded purchases but changes in branded prices have very pronounced effects on organic purchases.

Using the survey results from Wolfe et al. (2006), a consumer profile was built for the interest in purchasing organic/natural products produced on farm. The demographics that showed the highest tendency for purchasing an organic milk product were female, 48 years old, a salary of $50K/year, and a post-graduate degree.

2.2.3 Locally-Produced

Results from surveys taken in the Southeastern United States indicate that there are a significant number of respondents who are interested in purchasing a locally-produced milk product. In fact, nearly a quarter of respondents indicate that they would be willing to pay more for a locally-produced milk product (Hammarlund 2003). While market potential for on-farm milk processing products appears to exist in the region based upon the results from the study by Hammarlund (2003), it would be important to package the products according to consumer preferences and have them retailed where shoppers go to purchase milk products.

The demand for locally-produced milk products has been measured by surveys that gauge consumers' interest and willingness to pay for these products. Wolfe and Shepherd (2006a; 2006b) and Wolfe and Best (2005) conclude that it is important to determine the product consumption, purchase frequency, container preferences, purchase location, milk prices, likelihood to purchase milk, purchase preference and price, and product feature ratings. Results indicated that a significant number of respondents are interested in purchasing a locally-produced milk product, with some also indicating that they would be willing to pay more for a those products. However, they are quick to point out that the customer's true willingness to pay may not be accurately reported, and that the willingness may change when faced with a purchase decision. Each survey's results came from work previously done between the Center for Agribusiness and Economic Development and local high school's Distributive Education Clubs

of America (DECA) chapter. In each instance that information was used as a proxy to represent Augusta, GA area residents, Polk County, GA area residents and Morgan County, GA area residents.

Other important aspects that go into an individual's dairy product consumption and purchasing habits are frequency of milk product purchases, most frequently purchased milk product, most frequently purchased container, most frequently purchased container by milk product, most frequently purchased container by shopper type, type of dairy product shopper by market segment, milk purchases by retail outlet-market segments, milk purchases by retail outlet-shopper type, and willingness to purchase and pay more for locally-produced milk (Wolfe et al. 2006; Wolfe and Shepherd 2006a; Wolfe and Shepherd 2006b).

Using the survey results from Wolfe et al. (2006), a consumer profile was built for the interest in purchasing locally-produced products. The demographics that showed the highest tendency for purchasing a locally-produced milk product are male, 48 years old, a salary of $56K/year, and a post-graduate degree.

2.2.4 Grass-Fed

Wolfe et al. (2006) surveyed consumer interest in purchasing milk from grass-fed dairy cows. In the Southeast, 65 percent of the respondents were interested or very interested in purchasing milk from grass-fed cows (Wolfe et al. 2006). Also, respondents who were more willing to pay for milk products with characteristics focusing on generic labels, brand name items, or health were more interested in milk from grass-fed cows than conventionally produced milk or other milk respondents (Wolfe et al. 2006). On average, female respondents are more interested in purchasing milk from grass-fed cows than males (Wolfe et al. 2006). Through the survey, it was determined that milk from grass-fed cows is viewed as a unique product (Wolfe et al. 2006).

Using the survey results from Wolfe et al. (2006), a consumer profile was built for the interest in purchasing grass-fed milk products. The demographics that had the highest percentage of respondents of purchasing a milk product from grass-fed cows was male, 48 years old, a salary of $25->$30K/year, with a college degree.

2.2.5 Animal Welfare

The concerns of consumers for the well being of animals can have dramatic impacts on food and livestock markets (Tonsor et al. 2008). For the dairy industry, it is important to examine the consumer preferences for the well being and treatment of dairy cows. In some livestock industries, prohibiting a production technique does not improve the consumer welfare. In such industries, consumer welfare is the same whether or not the production technique was used (Tonsor et al. 2008). Tonsor et al. (2008) says that is important to examine the underlying consumer valuations of the product attribute while considering preference heterogeneity as well as voluntary and legislative alternatives in producing the product.

Olynk et al. (2010) also states that consumers are increasingly sensitive to food production processes. Consumers also consider the production attributes that go beyond the well being of the animal such as environmental impact, food safety implications, and social implications of production methods (Olynk et al. 2010). Using the survey results from Olynk et al. (2010), a profile was estimated for a consumer sensitive to milk production practices. The average respondent is 52.6 years old, female, married, a salary between $20-$40K/year, attended college with no degree earned.

Table 2 lists the major findings for demographics for individuals purchasing specialty milk products. In each study, the consumer is at least 48 years old and attended college. Gender changes depending on the product and salary ranges from $20K/year to $56K/year.

Table 2. Summary of Demographic Studies

Study	Location	Characteristics	Demographics
Wolfe et al. 2006	Georgia	Organic/Natural	Female, 48 yrs. old, $50K salary, post-graduate degree
Wolfe et al. 2006	Georgia	Locally-Produced	Male, 48 yrs. old, $56K salary, post-graduate degree
Wolfe et al. 2006	Georgia	Grass-Fed	Male, 48 yrs. old, $25->30K salary, college degree
Olynk et al. 2010	Online	Milk Production Practices	Female, 52.6 yrs. old, $20-40K salary, attended college w/ no degree earned, married

2.3 Demographic Effects on Consumption

Several factors have been shown to influence the consumption of dairy products. Lin et al. (2003) found that income had a negative effect on per capita home consumption of milk while it had a positive effect on per capita home consumption of cheese. Age had a negative effect on both, while urbanization and education had a positive effect on both. Similar trends were projected for consumption away from home. Eating out had a negative effect on milk and yogurt consumption, but a positive effect on cheese consumption. Davis et al. (2011) found household size, college educated female heads of household who are age 40 and older, residing in the South, Central, and Western regions of the United States, as well as African-American heads of household, have positive statistically significant effects on consumers' cheese purchases for at home food purposes. A study by Robb et al. (2007) suggested that a number of factors influence probability of low-fat milk consumption as compared with high-fat milk consumption. Probability of low-fat milk consumption was found to be positively related to age, education level, and income level. Respondents designated as low income or living in the South were less likely to consume low-fat milk.

Regional influences also influence dairy product consumption. Lin et al. (2003) found that being located in the South had a negative influence on milk and cheese consumption. Huang and Raunikar (1983) reported that 75.5 percent of households in South reported whole milk expenditures, while only 67.2 percent reported whole milk expenditures in the U.S. In contrast, 18.11 percent of households in the South reported low fat milk expenditures, while 29.97 percent were reported nationwide. Prior studies by Boehm (1975); Boehm and Babb (1975); and Salathe (1979) reported similar regional findings. Robb et al. (2007) also found a negative effect of residing in the South on lowfat versus whole milk consumption. However, a more recent study by Davis, et al. (2011) found a positive effect on per capita cheese consumption for the South region.

2.4 Consumer Preferences for Type of Outlet

2.4.1 Farmers Market

Farmers markets offer an alternative to local farmers to market their product to the public (Lehman et al. 1998; Govindasamy et al. 2002). Farmers can receive a higher price for their product at a farmers market over the price received through the commercial wholesale market (Lehman et al. 1998). Lehman et al. (1998), Arrington et al. (2010), and Govindasamy et al. (2002) states that it is important for farmers to understand the reasons why consumers chose to purchase from direct markets. The main reasons that consumers shop at a direct market are food quality, price, savings, and social atmosphere (Sommer and Wing 1980; Lehman et al. 1998).

Arrington et al. (2010) divided farmers' market consumers into four clusters: Recreational, Minimalists, Enthusiasts, and Time-challenged. Through a consumer survey administered in several metropolitan cities in Indiana and Illinois, it was determined that recreationalists were the largest segment of consumers. Recreationalists are individuals that had

a low average expenditure per visit, a high distance traveled, and a high average of number of visits indicating they travel and visit often but were not as likely to spend large amounts of money (Arrington et al. 2010).

2.4.2 On-Farm Stores

On-farm stores face the same market challenges as a farmers market; however, market location plays a major role in the development of on-farm stores (Lehman et al. 1998). Regulated temperature, produce quality, produce appearance, service, cleanliness, and price were also other variables that are important to the consumer (Lehman et al. 1998).

2.5 Role of Feasibility Analysis

Myers et al. (1998) explains that a feasibility study is designed to provide an overview of the primary issues related to a business idea. A feasibility study looks at three major areas: market issues, organizational/technical issues, and financial issues. The key questions that should be answered in the market analysis section of the feasibility study are (Myers et al. 1998):

- What is the current or projected demand for your proposed products or services?
- What are the target markets for this product or service? What demographic characteristics do these potential customers have in common? How many of them are there?
- What is the projected supply in your area of the products or services needed for your project?
- What competition exists in this market?
- Is the location of your proposed business or project likely to affect its success? If so, is the identified site the most appropriate one available?

The key points that should be evaluated in the financial analysis section of the feasibility study are start-up costs, operating costs, revenue projections, sources of financing, and profitability analysis.

USDA-Rural Development (2010) suggested that a market feasibility include information on the sales organization and management, nature and extent of market and market area, marketing plans for sale of projected output, extent of competition, and commitments from customers or brokers. A financial feasibility include an opinion on the reliability of the financial projections and the ability of the business to achieve the projected income and cash flow and an assessment of the cost accounting system, the availability of short-term credit for seasonal business, and the adequacy of raw materials and supplies.

Hofstrand and Holz-Clause (2009) explained that elements in a feasibility study change according to the type of business venture and market opportunities. The basic premise of a feasibility study is to determine the potential for success of a proposed business venture. A market feasibility includes industry description, industry competitiveness, market potential, access to market outlets, and sales projection. A financial/economic feasibility estimates the total capital requirements, estimates equity and credit needs, and budgets expected costs and returns of various alternatives.

This manuscript and the information contained within will assist Tennessee dairy farmers who are considering on-farm value added products. The results should help them in making more informed decisions, because they will have market and financial analyses for enterprises which may be similar to those they are considering adding to their operations.

CHAPTER 3 METHODS

The objective of this study was to ascertain the feasibility of dairy farmers adding value through producing packaged milk, yogurt, or cheese on the farm. The methods for a feasibility analysis are presented in this chapter. The discussion of methods will be divided into two sections: market feasibility and financial feasibility analysis methods.

Market Feasibility Analysis

Market feasibility was evaluated for milk and selected dairy products in five study areas: Memphis, Nashville, Chattanooga, Knoxville, and Tri-Cities. Metropolitan Statistical Area MSA's. If counties in an MSA fell outside the state borders, they were omitted. Therefore, the Memphis Study Area consisted of Fayette, Shelby, and Tipton counties. The Nashville Study Area consisted of Cannon, Cheatham, Davidson, Dickson, Hickman, Macon, Robertson, Rutherford, Smith, Sumner, Trousdale, Williamson, and Wilson counties. The Chattanooga Study Area is Hamilton, Marion, and Sequatchie counties. The Knoxville Study Area is Anderson, Blount, Knox, Loudon, and Union counties. The Tri-Cities Study area was a grouping of the Johnson City and Kingsport/Bristol areas and consisted of Carter, Hawkins, Sullivan, Unicoi, and Washington counties. A map of these study areas is provided in Figure 6.

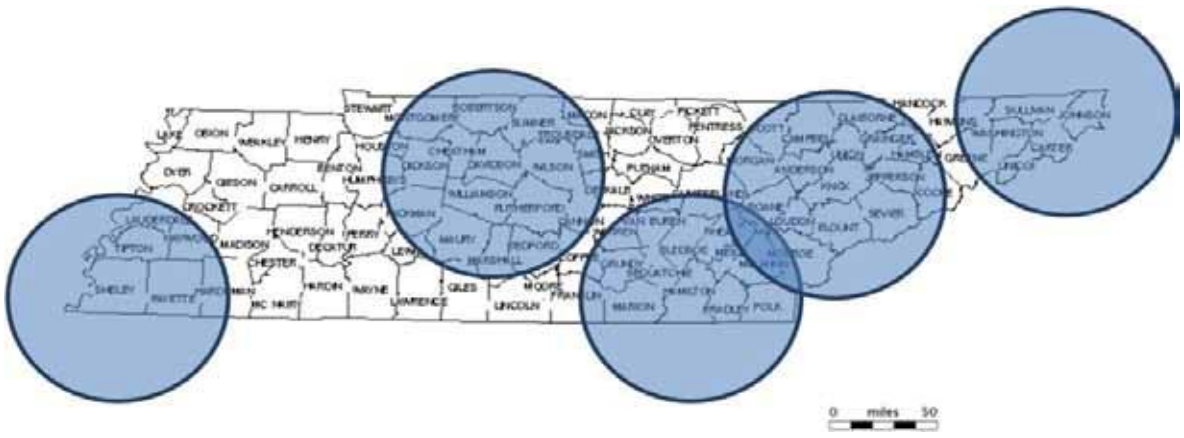

Figure 6. "Locally" Grown Regions for the Major Metropolitan Areas in Tennessee (Onozaka et al. 2010)

1. The Tennessee Dairy Industry Overview

In order to give an overview of the Tennessee dairy industry, analysis will be conducted using secondary source data. Trends for cow production, location, and site will be discussed. Summaries and trends of the Appalachian and Southeast Federal Milk Marketing Orders were summarized by listing the utilization of producer milk, uniform prices, and seasonal patterns (USDA-AMS 2009). Also, trends for the milk deficit for Tennessee (USDA-NASS 2010a; USDA-ERS 2010b; U.S. Census Bureau 2010), the role of milk marketing cooperatives (Ling 2007; Liebrand 2007; Sanford 2010) were determined and evaluated. Variable and fixed costs of producing milk in Tennessee will be identified based on updated dairy budgets from UT Extension.

In order to discuss the dairy marketing and processing for the state, the number and type of processors in the state needed to be identified along with the niche/specialty market processors that are available to Tennessee dairy farmers. First, the Federal Order distributing plants were identified along with the cheese, ice cream, yogurt, and sour cream plants in Tennessee (TDA 2010). Also, using census data, the production and employment levels for the dairy products manufacturing industry was determined (U.S. Census Bureau 2008a; U.S. Census Bureau 2008b). Second, using data from the Tennessee Department of Agriculture, on-farm dairy manufacturing facilities for fluid milk and for goat and sheep products was identified along with the location of each facility (TDA 2010).

Using the production levels previously calculated along with consumption levels calculated by multiplying milk consumption (USDA-NASS 2010a; USDA-ERS 2010b) and Tennessee population (U.S. Census Bureau 2010), structural projections were estimated. Using

data from the Tennessee Department of Agriculture, each on-farm product that is currently produced in the state will be identified (TDA 2010).

2. The Dairy Markets in Metropolitan Areas

A. Consumption Trends and Projections for Milk and Dairy Products

To analyze the market feasibility for introducing value-added dairy products into the major markets in Tennessee, examination of market trends for fluid milk and other dairy products of interest was needed. First, the overall U.S. trends were examined. Second, using per capita consumption estimates for the U.S. and population trends for the major Tennessee markets, consumption of fluid milk and other selected dairy products is estimated for each market.

Because per person consumption numbers were not available for the five study areas, estimates needed to be made. Past data on U.S. consumption of milk and selected dairy products was used to project consumption into the future (Data shown in Table 21). Projected values of fluid milk, yogurt, and cheese consumption were made beyond 2009 through 2020 using trend analysis (Trend regressions presented in Table 22-26). Trend regressions were calculated by taking past consumption rates and regressing on year. The projected values are based upon actual values for 1980 to 2009. Data are from the ERS Food Availability Data System (USDA-ERS 2011a). The projected values were calculated using national consumption data and applied to Tennessee. Tennessee consumption rates may not be accurately reflected by national consumption data.

To project overall consumption for the major metropolitan areas, population trends were needed. Population projections were made using population projections from Middleton and Murray (2009) for 2010, 2015, and 2020. Average annual change was calculated to fill in values

between these years. This provided population projections for every year from 2010-2020. The projected U.S. per capita consumption for each of the products was multiplied by the projected population for each of the study areas. The resulting value provides an estimate of what consumption might be for the five study areas.

B. Major Retailers

In addition to direct on-farm marketing, there are potential major sellers for milk and milk products in each metropolitan area in the state. These major sellers were listed and the possibility of using this outlet was explained (USDA-ERS 2011b).

C. Niche Sellers

Niche sellers are also a possible outlet for milk and milk products in each metropolitan area in the state. These niche sellers were listed and the possibility of using this outlet was explained (USDA-ERS 2011b).

D. Prices

Depending on the outlet chosen, prices can vary. A price for milk, cheese and yogurt were developed based on the outlet the farm will sell in. The prices for milk and milk products were identified by calling retailers or producers or finding the price on the outlet's website. The prices used are a combination of retail and wholesale prices. Producers that sell through a retail store will receive a wholesale price, while producers who sale directly to consumers will receive a retail price.

E. Product Attributes

Product Attributes vary according to the outlet through which the product is sold. The product attributes will be identified for the major and niche sellers in each metropolitan area.

This was done after identifying the products sold in each marketplace and then identifying the attributes for each outlet.

Financial Feasibility

1. **Dairy Budget of a Dairy in the State of Tennessee**

After the prices are estimated for the state, a budget for a representative dairy farm could be developed for Tennessee. The budget was set up according to the University of Tennessee Extension guidelines (UT Extension 2011). A representative dairy farm was created by using the average production per farm, costs per farm, and breed of animal used in production for the State. These data were collected from the Tennessee Department of Agriculture for each county (TDA 2011). After these data were collected, a representative dairy farm could be constructed for the State.

2. **Costs of Employing a Value-Added Activity**

Budgets for the on-farm processing were added for the state. Using the estimated costs found for each product, the added expenditures of on-farm processing can be determined by the average costs incurred per product that was created using conventional techniques subtracted from the average costs incurred per product that was created using a value-added enterprise.

$$C^* = C_V^*Q - C_C^*Q \,, \qquad (1)$$

where C* is the additional expenditures incurred by using Q units of milk to produce a value-added product instead of a conventional product, C_V is the cost per unit incurred from using Q units of milk to produce a value-added product, and C_C is the cost per unit incurred from using Q units of milk to produce a conventional product.

3. Projections

Using the representative dairy farm, prices for each product can be added to determine the profits/losses for the State.

$$\text{Max } Z_Y = (P_X * Q_X) - VC_X - FC_X \,, \tag{2}$$

where Z_Y is the profits/losses for the state, P_X is the estimated price received for product X, Q_X is the quantity of product X produced, VC_X is the estimated variable costs for producing Q_X, and FC_X is the estimated fixed cost for producing Q_X.

4. Comparison of Market Opportunities

For a capital analysis, prices from producing the milk and prices from processing the milk were kept separate, i.e., each entity was evaluated separately. The milk produced was valued at the price received from selling milk to an outside source (USDA-AMS 2011). The milk from processing was valued at the estimated prices for each product. The returns for each value-added product were compared along with the price of selling milk to an outside source.

5. Net Present Value

Net present value calculations were used to compare the profitability for employing alternative value-added activities for each product combination.

$$PV = A\left[\frac{}{}\right] \,, \tag{3}$$

where PV is the present value of future earnings, A is the annuity amount, *i* is the interest amount, and *n* is the time period (Becker et al. 2007), which can be calculated using Microsoft Excel 2007.

6. Internal Rate of Return (IRR)

Internal rate of return calculations are an alternative way of evaluating profitability that helps to assess the actual rate of return on a particular investment with unequal cash inflows and

outflows (Becker et al. 2007). Internal rate of return is the discount rate at which the net present value of an investment equals zero (e.g., Hayes 2002; Becker et al. 2007), which can be calculated using Microsoft Excel 2007 (Becker et al. 2007).

Net present value and internal rate of return were calculated for each of the value-added activities based on an initial investment in buildings and equipment, estimated operational costs, and estimated annual gross revenues which are obtained from the partial budgets (Becker et al. 2007).

7. Break Off Level

When the IRR is greater than the opportunity cost of the capital required, the investment under consideration can be undertaken. If the IRR is less than the opportunity cost of the capital required, then the investment under consideration should not be undertaken. The IRR of an investment in a value-added activity should be high enough to provide owners a rate of return sufficient to reward them for the risk involved in such an undertaking (Becker et al. 2007).

The break off rate was determined by using an estimated IRR of 1.21% as the break off level (Eberle et al. 2005). Any calculated IRR lower than 1.21% would not be recommended and any IRR larger than 1.21% would be recommended (Eberle et al. 2005).This break-off level is an IRR for a conventional 120-cow dairy that averages 21,000 pounds of milk per year per cow. This research is based on a conventional 100-cow dairy that averages 16,500 pounds of milk per year per cow. With limited data available, the IRR of 1.21% was used; however, the expected IRR from a Tennessee dairy farm could be lower.

8. Sensitivity Analysis

A sensitivity analysis was performed to access the variability of profits due to the change of input and output prices. The profits from the dairy farm along with each value-added

enterprise were analyzed by fluctuating variables from 0 to +/-10%. For the dairy farm, the price of milk was fluctuated along with feed costs. For the value-added enterprises, the price of dairy products was fluctuated along with ingredients and packaging costs.

CHAPTER 4 RESULTS

Market Feasibility Analysis

I. The Tennessee Dairy Industry Overview

As of May 2011, there were 450 Grade A dairies operating in 65 of Tennessee's counties with 42,340 dairy cows, or about 94 cows per dairy (TDA 2011). This represents a loss of nearly 14,000 cows since 2009 (Table 3). The average herd size also decreased from 106 in 2009 (USDA-NASS 2010a).

Tennessee's dairy farms are located primarily in Middle and East Tennessee (Figure 7). As of May 2011, the counties with the largest numbers of dairy cows on Grade A dairies were Greene (3,345), McMinn (2,975), Monroe (2,834), Marshall (2,346), Loudon (2,035), Robertson (1,764) and White (1,752) (TDA 2011).

Table 3. Overview of Tennessee Milk Production (USDA-NASS 2010b)

	2009	Rank Among All States
Number of Dairy Cows	56,000	29
Milk Production Per Cow (pounds)	16,232	41
Total Milk Production (million pounds)	909	30
Average Receipts ($/ cwt)	$14.10	22
Total Cash Receipts from Farm Marketings ($1,000)	$127,605	31

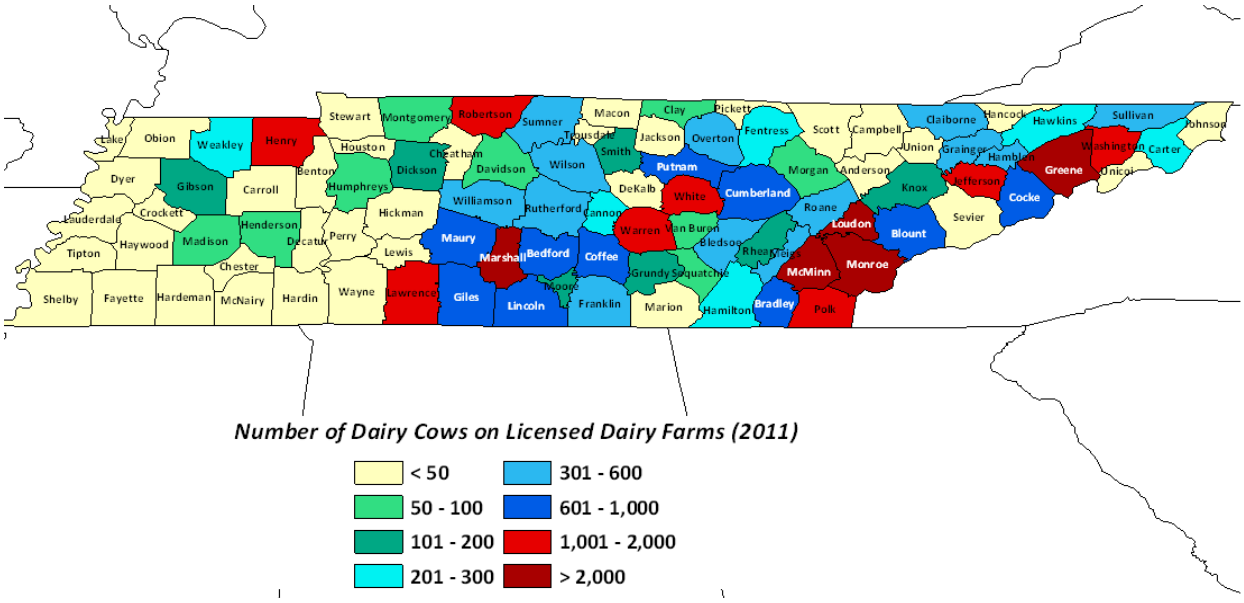

Figure 7. Number of Dairy Cows on Grade A Dairies in Tennessee, by County, 2011 (TDA 2011)

In addition to milk production from dairy cattle, Tennessee also has goat milk production. As of May 2011, there were three Grade A goat dairies with 115 milk goats (Figure 8; TDA 2011). Dairy goats may average 6 to 8 pounds of milk daily during a 10 month lactation. Hence, about 1,800 to 2,400 pounds of milk per year per goat might be expected. The milk generally averages 3.5 percent butterfat (American Dairy Goat Association 2004).

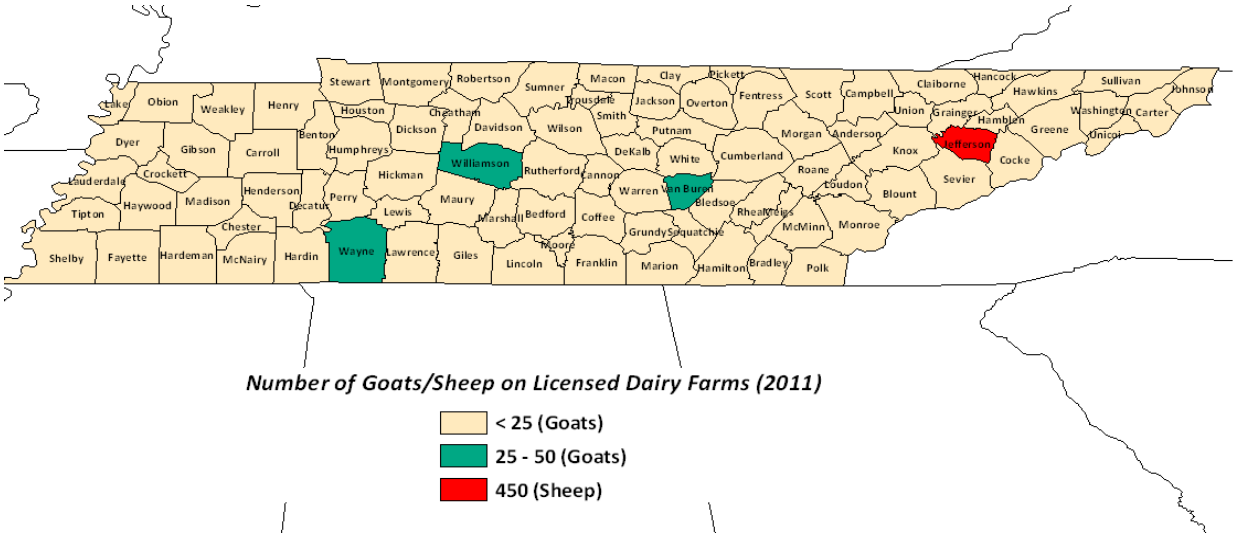

Figure 8. Number of Dairy Goats/Sheep on Grade A Dairies in Tennessee, by County, 2011 (TDA 2011)

In the South Central Region (including Tennessee), based on data from a 2008 goat milk processor survey, there were 17 processors, with about 88 percent selling soft cheese and 47 percent selling hard cheese (USDA-NASS 2008). About 60 percent acquired their milk from within 100 miles of the plant. Specialized dairy sheep breeds produce about 400 to 1,100 pounds of milk per lactation (Thomas 1996). Sheep's milk is lower in lactose than cow's milk and therefore may be more digestible for lactose- intolerant individuals. In addition, sheep's milk is higher in milk solids than goat's milk; hence, a gallon of sheep's milk will yield more cheese. Estimates of the number of sheep dairies across the U.S. are from 75 to 100 farms (Agricultural Marketing Resource Center 2011). Figure 8 displays the county locations of licensed dairy farms with goats or sheep.

As discussed in the introduction, overall milk production in the state, like much of the Southeastern United States, has been on the decline (USDA-NASS 2010a; USDA-NASS 2010b). A key contributing factor to this trend is the decline in the number of dairy farms (Sanford 2010; USDA-NASS 2010a; USDA- NASS 2010b). Significant gains in production per cow have been made through technology and improved management practices; however, the state's milk production per cow still falls below the U.S. average (USDA-ERS 2010b). Tennessee dairy cows average less milk production than the national average. There are numerous reasons that affect this inefficiency, but the more common reasons are environment, nutrition, and parlor practices (Pighetti 2012). In 2009, the total operating costs per cwt of cow's milk in the U.S. was $14.14. In Tennessee, these total operating costs averaged about $19.69 (USDA-ERS 2010a). On average, Tennessee producers spent 11 percent more on homegrown feed costs, relative to the U.S. average. With higher operating costs and lower milk production levels, Tennessee dairy farms are being squeezed out of the marketplace.

According to the most recent Census of Agriculture, Tennessee sales of milk and other dairy products were $180.5 million (USDA-NASS 2007). This is an increase of more than $7.5 million from the 2002 Census of Agriculture value, which was $173 million (USDA-NASS 2002). Tennessee ranks 29th in the U.S. in terms of dollar value sales of dairy products (USDA-NASS 2007).

In 2009, the utilization of producer milk in Class I was 70 percent in the Appalachian Order and 66 percent in the Southeast Order. The uniform price in the Appalachian Order was $14.00 per cwt and $14.23 per cwt in the Southeast Order (USDA-AMS 2009). By comparison, the all-market average for the U.S. was $12.44.

In Tennessee, as in the Southeastern US, milk production tends to have a seasonal pattern that is not mirrored by a seasonal pattern in demand. The milk- received data for the Appalachian and Southeast Orders show a distinct seasonal pattern, with the highest amount received in the spring months and the lower amounts received in the late summer through fall months (Figure 9; USDA-AMS 2009).

A producer may be exempt from paying into the pool on 150,000 lbs. or less. Any surplus (not bottled by the producer, but marketed to another handler) will receive Class IV value (Gooch 2012).

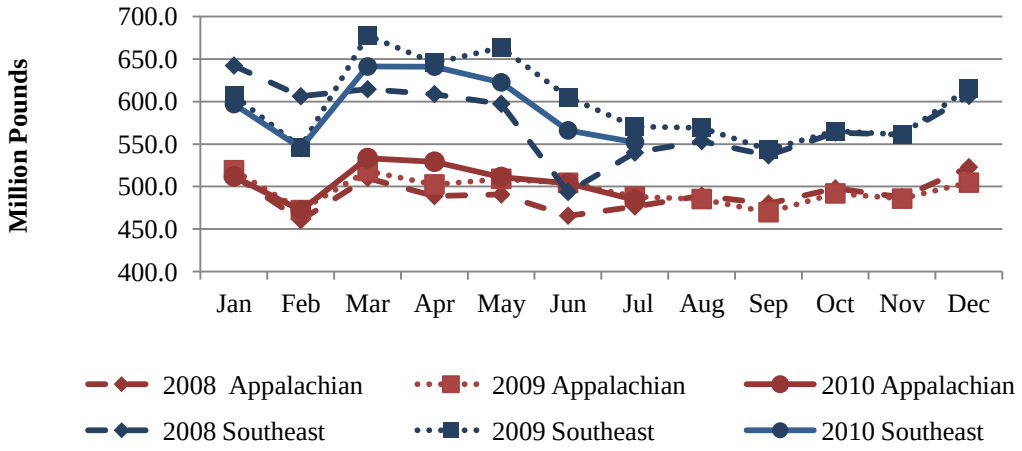

Figure 9. Federal Orders Milk Received: Appalachian and Southeast Order

Sometimes seasonal imbalances between supply and demand are generated. The percent Class I utilization (fluid milk) is at its highest in the fall, when school begins and milk received is at one of its seasonal low points (Figure 10).

An outcome of these seasonal imbalances is that costs of balancing occur: these are costs of disposing of seasonal surpluses and the seasonal costs of bringing in milk from outside the federal order to local processors when local supplies cannot meet the local demands. Seasonality of supply and demand are reflected in the price patterns for milk, with seasonal lows occurring in spring and price peaks occurring in late fall (Figure 11).

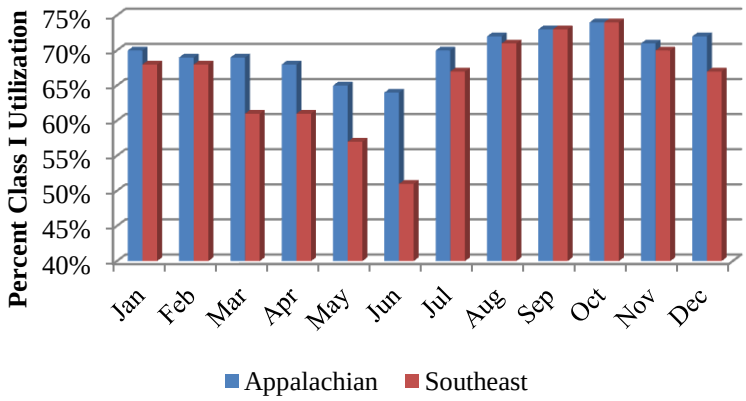

Figure 10. Percent Class I Utilization: Appalachian and Southeast Orders, 2009

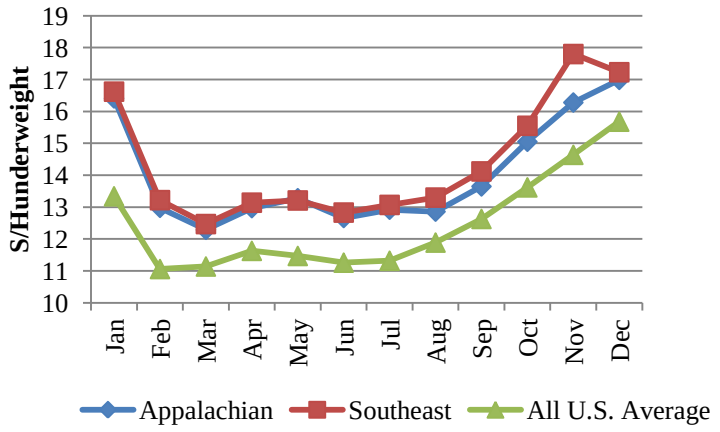

Figure 11. Federal Milk Marketing Order Uniform Prices, 2009: Appalachian, Southeast and All US

Tennessee milk processors tend to ship milk towards the south, especially during seasonal peak demand periods. As this milk is shipped south, milk is often brought in from the Great Lakes and Western regions to Tennessee. The fluid milk deficit for Tennessee can be illustrated by graphing production and estimated consumption over time (Figure 12).

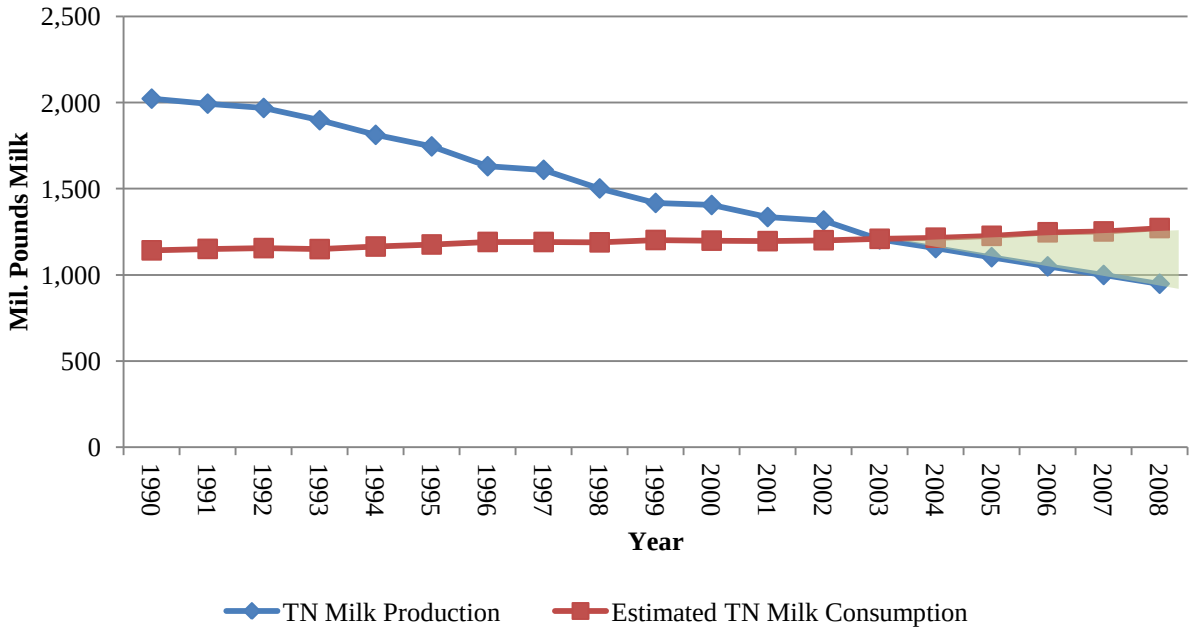

Figure 12. Tennessee Milk Production and Consumption (USDA-NASS 2010a; USDA-ERS 2010b; U.S. Census Bureau 2010)

Estimated milk consumption was found by using the national average per-person consumption of milk and multiplying this value by the Tennessee population. As can be seen from green shaded area of the Figure 12, consumption has outstripped production for the past several years.

Milk marketing cooperatives play a role in Tennessee's dairy industry, as well as nationwide. About 83 percent of the fluid milk marketed in the U.S. takes place through cooperatives (Ling 2007). The share of milk marketed through cooperatives varies by region, but the regional share of milk for the South Central region, which includes Tennessee, was about 89 percent, while the South Atlantic region, which includes states that received Tennessee fluid milk, was about 90 percent marketed through cooperatives (Liebrand 2007). When looking at the number of producers who sell through cooperatives, of the licensed milk cow dairies in Tennessee, 49 percent of the producers sell their milk through a cooperative, while 51 percent are independent producers (Sanford 2010).

Federal Milk Marketing Orders are regions in which producers sell their milk in an orderly, dependable process. Tennessee falls within two Federal Milk Marketing Order Areas, the Southeast and Appalachian (USDA-AMS 2010). The Southeast Order encompasses West and Middle Tennessee, while the Appalachian Order includes the eastern part of the state.

The variable costs for a Tennessee dairy farm include lactation feed, dry cow feed, milk replacer, calf starter, heifer feed (18% protein), heifer feed (14% protein), silage, alfalfa hay, fescue hay, orchard grass hay, pasture, breeding, veterinarian and medical, dairy supplies, bedding, DHIA, milk hauling, ADA (check-off), electricity, marketing fees, and machinery (Goan 2011; UT Extension 2011). Variable costs for an average size dairy in Tennessee are $296,294.13

The fixed costs for a Tennessee dairy farm included depreciation on buildings and equipment, repairs in buildings and equipment, machinery costs for depreciation, housing, and insurance, insurance for buildings and equipment, interest on cows, buildings and equipment, and machinery, and labor expenses (Goan 2011; UT Extension 2011). Fixed costs for an average size dairy in Tennessee are $135,441.53

In 2010, Tennessee had six Federal Order distributing plants in Tennessee (Figure 13). These were located in Powell, Athens (Appalachian Order), Nashville with two plants, Murfreesboro and Memphis (Southeast Order). The state also had three cheese plants (Greeneville, Philadelphia and Sequatchie), three ice cream plants (Athens, Memphis and Wildersville), one yogurt plant (Murfreesboro) and one sour cream plant (Antioch). In addition to the plants discussed above, as of 2010, three large projects were under construction. These were ice cream (Covington), cheese (Humboldt) and yogurt (Murfreesboro) plants. In 2009, Tennessee plants produced more than 14 million pounds of cottage cheese, 11.5 million gallons of ice cream and 284 million gallons of yogurt (TDA 2010).

Figure 13. Dairy Products Manufacturing Facilities in Tennessee, 2010

According to the 2008 Annual Survey of Manufacturers (U.S. Census Bureau 2008a), the dairy products manufacturing industry employed more than 2,000 people with an annual payroll of greater than $91 million. The total value of shipments was $1.3 billion. Much of the employment, about 1,500 workers, is found in fluid milk manufacturing (U.S. Census Bureau 2008b). Not included in the estimates are indirect employment related to dairy products manufacturing industry which include analytical laboratories, inspectors, transportation, cleaning and sanitizing suppliers, ingredient suppliers, etc.

The state was also home to six on-farm fluid milk plants in Wildersville, Franklin, Orlinda, Murfreesboro, Pikeville and Knoxville. These on-farm fluid milk plants may use direct marketing, in some cases selling through farmers' markets or with on-farm sales. Five goat and sheep on-farm milk manufacturing facilities occur across the state. On-farm goat cheese facilities were located in Pikeville, Waynesboro and Franklin and sheep on-farm cheese facilities were in Knoxville and Townsend.

The dairy industry in Tennessee is likely to retain its structure of many small farms, but with medium-sized farms comprising the largest percentage of the state's dairy herd. The majority of Grade A licensed dairy cow farms in Tennessee have less than 100 head (Figure 14). Large farms, those with 500 cows or greater, comprise around 1 percent of farms. The majority of head, however, are on farms between 100 and 499 head.

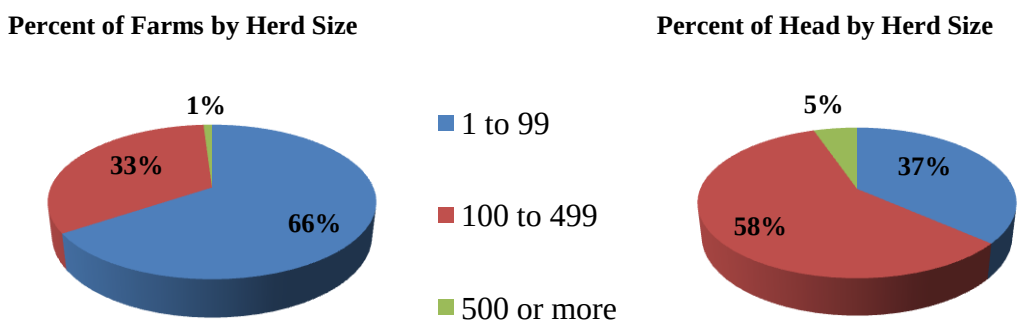

Figure 14. Percent of Farms and Head by Herd Size for Grade A Dairies in Tennessee

From 1990 to present, milk production in Tennessee declined by an average of 4.1 percent per year. Given 2009 milk production of 909 million pounds, if the industry follows the same rate of change, by 2015, the statewide production would be about 707.1 million pounds. Like much of the Southeast, Tennessee will likely continue to be a fluid milk deficit region. This means that higher milk prices in the areas south of Tennessee will attract milk from Tennessee, leaving the state in a milk deficit, and milk for Tennessee will be drawn in from areas to the west and Midwest. Opportunities to supply the demand for fluid milk to the south and east of Tennessee will continue.

The value-added marketplace is an ever changing environment. New products are continuously being introduced and producers are looking for ways to capture more of the food dollar. The most common products currently being produced or being introduced in the state of Tennessee are: farm-bottled milk, artisanal cheeses, yogurt, butter, ice cream and organic production of value-added products.

2. The Dairy Market in Metropolitan Areas

A. Consumption Trends and Projections for Milk and Dairy Products

Overall consumption of fluid milk has been declining in the US as other beverages such as soft drinks, sports drinks, flavored waters, and other beverages have gained popularity. Also, fluid milk consumption has declined in part due to the trend toward more meals eaten away from home (Lin et al. 2003). As can be seen in Figure 15, whole milk has shown a steady decline in consumption over the past 30 years. However the lower fat milks, such as skim, 1%, or 2% fat milks have not seen this steady decline.

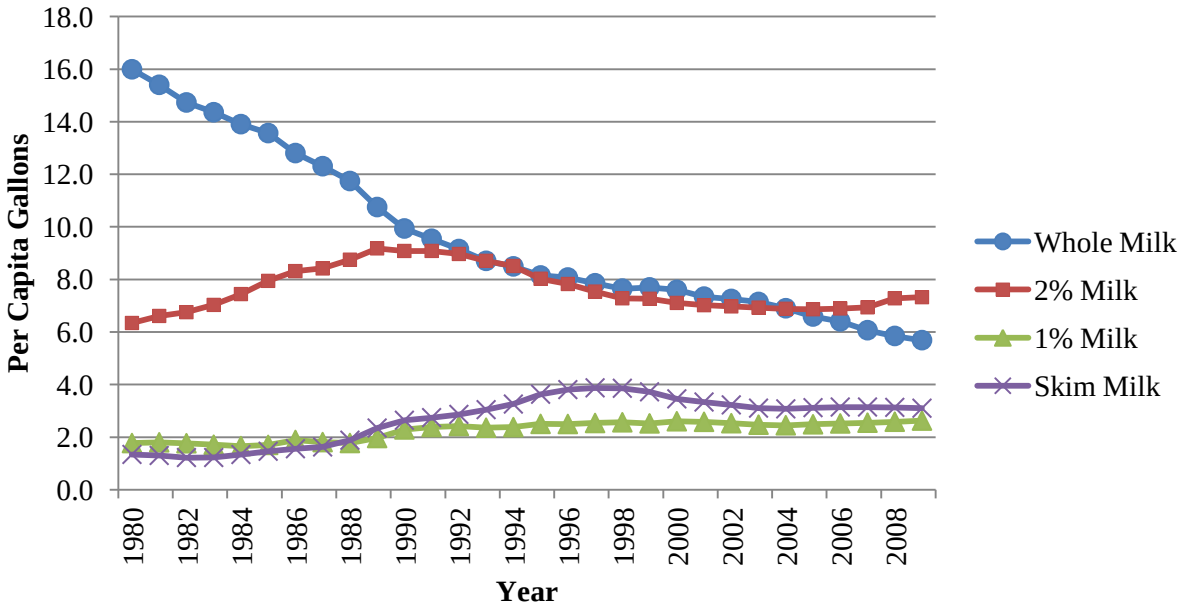

Figure 15. US Per Capita Consumption of Fluid Milk (USDA-ERS 2011a)

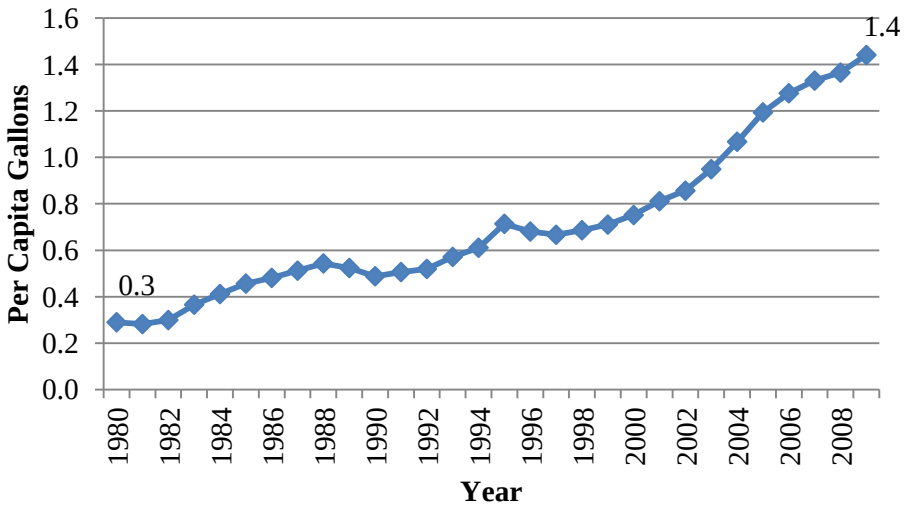

Figure 16. US Per Capita Consumption of Yogurt (USDA-ERS 2011a)

While fluid milk consumption has experienced a decline, other products such as yogurt and cheese have seen increases in consumption. As can be seen in Figure 16, per capita yogurt consumption rose from .3 gallons in 1980 to 1.4 gallons in 2009. The per capita consumption of cheese has increased over time (Figure 17). In particular with growth in pizza use, mozzarella use has steadily increased.

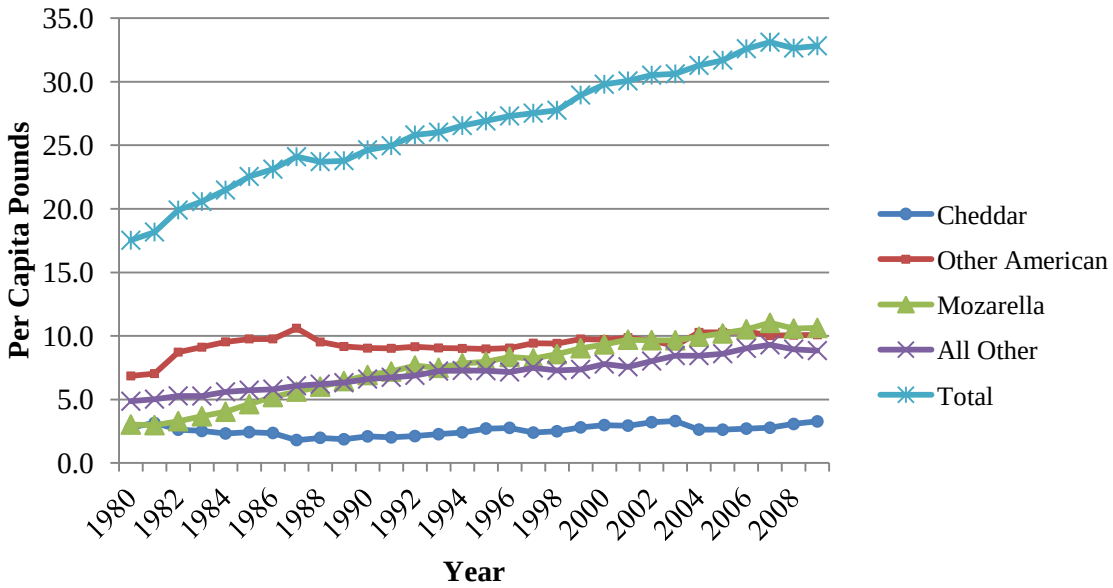

Figure 17. US Per Capita Consumption of Cheeses (USDA-ERS 2011a)

As explained in the methods chapter, consumption of milk and milk products were projected for five metropolitan areas in Tennessee. It is projected that per capita consumption of lowfat and skim milk, flavored lowfat milk, yogurt, and cheese will increase between 2010 and 2020; it is projected that per capita consumption of whole milk will decrease between 2010 and 2020 (Table 28). As noted earlier, this data is national per capita consumption rates and may not accurately reflect the per capita consumption rates for Tennessee.

Shown in Table 27, the population of each of the major metropolitan areas is projected to grow between 2010 and 2020 with the exception of Memphis. The population projections were used along with the projected per capita consumption to calculate estimates of the consumption for each of the five study areas. Among the products examined, the highest per capita consumption is for plain low fat and skim milks followed by low fat flavored milks, and yogurt. When put on a milk equivalency basis, cheddar cheese is the second largest consumption behind plain low fat and skim milk.[1] The largest market by far is the Nashville/Davidson county areas, followed by Memphis, Knoxville, Tri-Cities, and Chattanooga area (Tables 29 and 30). Hence, the largest product/location market is the Nashville market for plain low fat and skim milk.

Since cheese has a longer shelf-life this product enables the processor to be more flexible with the method of sales and makes online sales a viable option. A local on-farm processor estimated that it will cost $9,000 a year for internet and for adequate protection and maintenance on a website. This cost is considerable; however, with the ability to sell on a national level this cost could be offset by an increase in sales.

[1] A pound of hard cheese requires about 10 pounds of milk and each gallon of milk weighs about 8.6 pounds, therefore the pounds of cheese can be converted to gallons of milk equivalency by multiplying the values by a factor of 10/8.6 or 1.16

Branding and marketability is also important when constructing and building a website. Some processors develop it themselves and others will hire consultants to assist them. Social media is also part of the online experience. Developing a branding strategy can be difficult; however, it is an important part of how consumers view products.

B. Major Retailers

The most common sellers of on-farm products are institutional food services and grocery stores. These outlets will give the product a large customer base and the potential for high volume of sales. The institutional food service market includes restaurants, schools, factories and hospitals, and is often served by large food distribution companies. Advantages of this market are that brand identification is less of an issue than with retail grocery stores and, in some cases, restaurants are locally owned, providing direct contact with the potential buyer. Many grocery stores require a "slotting fee" to place a product on their shelves. The slotting fee can be very expensive and prohibitive to small businesses. In addition, products must compete with branded products from large national food companies. If a farmer does decide to sell products through grocery facilities, working with a knowledgeable broker is very important. It can also be difficult for small producers to access major retail outlets because of policies and logistics. Major retail outlets may require producers to meet criteria that are not financially feasibility for small producers. While major retailers have the potential for high volume of sales, it can be more expensive for the producer and difficult for the producer to meet the guidelines.

Using data from USDA-ERS (2009a), the traditional retail sales by segments were calculated for national data. Displayed in Figure 18, grocery stores, including supermarkets, make up the largest segment where food is purchased.

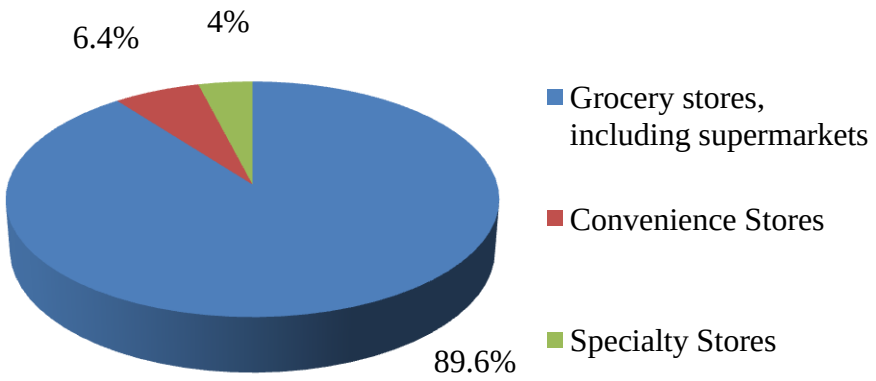

Figure 18. Traditional Foodstore Sales by Segment, 2009

The percent of each type of food outlet was calculated for each metropolitan county in Tennessee (USDA-ERS 2009b). In Figures 19-23, the percentages are shown for Shelby, Davidson, Hamilton, Knox, and Sullivan Counties, respectively. In each county, convenience stores have the most locations, followed by grocery stores.

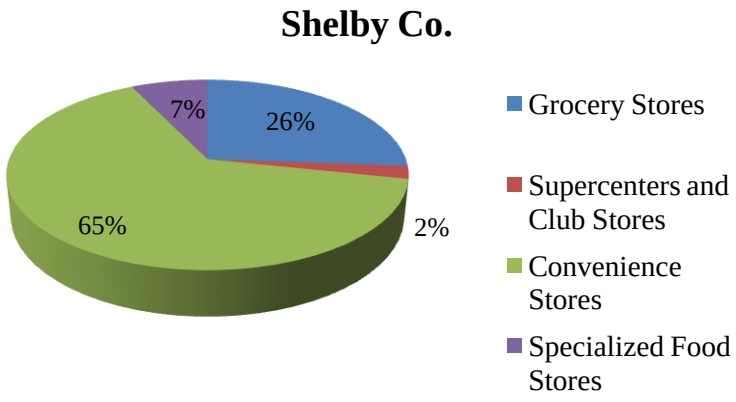

Figure 19. Percent of Food Retail Locations for Shelby Co.

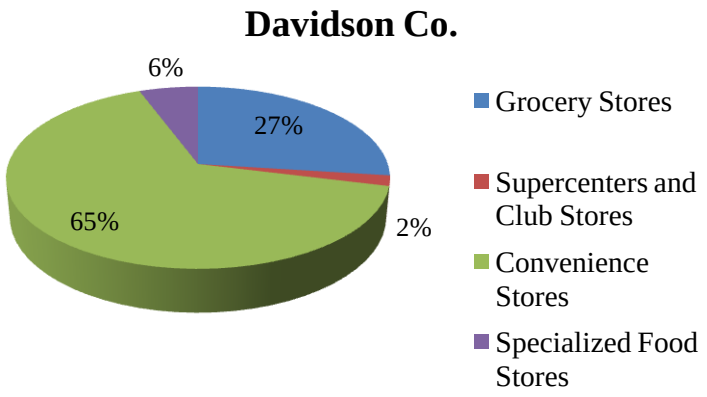

Figure 20. Percent of Food Retail Locations for Davidson Co.

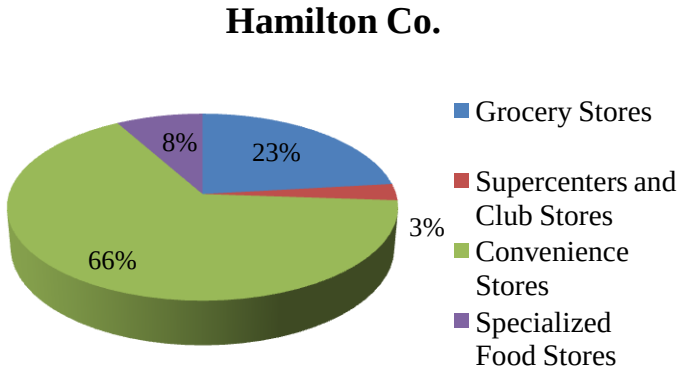

Figure 21. Percent of Food Retail Locations for Hamilton Co.

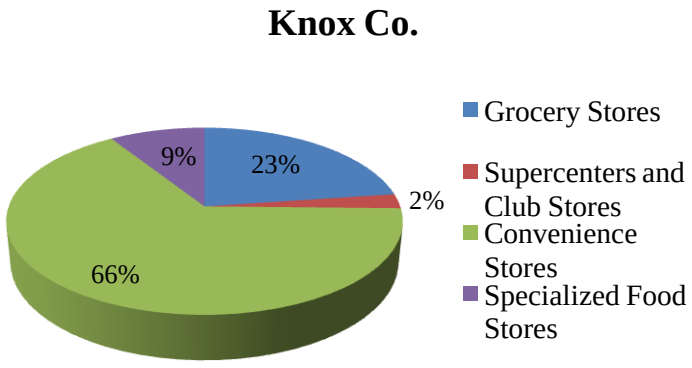

Figure 22. Percent of Food Retail Locations for Knox Co.

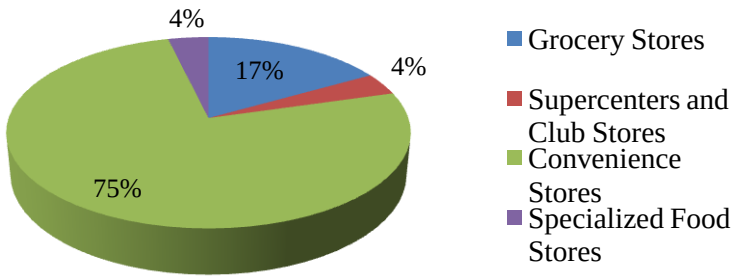

Figure 23. Percent of Food Retail Locations for Sullivan Co.

C. Niche Sellers

In addition to direct on-farm marketing, potential markets for these products include specialty or gourmet stores in larger metropolitan areas, such as Nashville, Memphis, Knoxville Chattanooga, or Tri-Cities. Others may sell through local farmers' markets or food cooperatives. Farmers' markets are often clustered around metropolitan areas to take advantage of a large customer base (Figure 24). Other types of specialized stores are often clustered around metropolitan areas also (Figure 25). Small producers can often sell through a niche market easier than major retail outlets. Many times a niche seller will not have the same criteria and requirements that major retail stores have. If a producer does not have a steady supply, then a major retail outlet may be unwilling to sell the product.

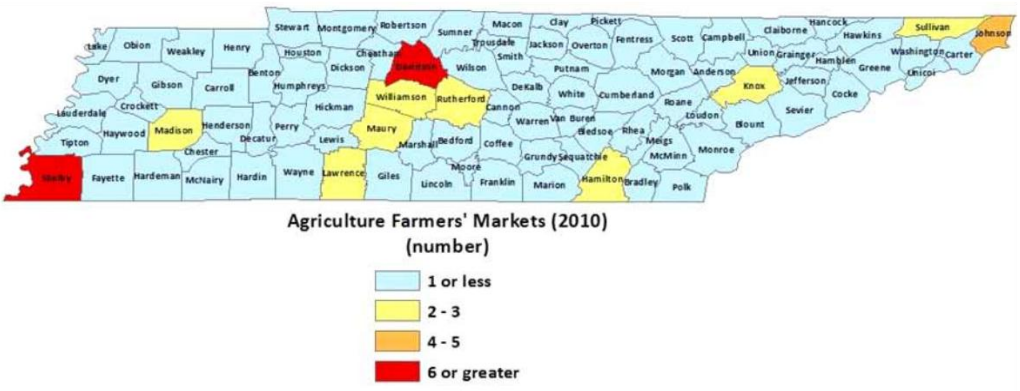

Figure 24. Number of Farmers' Markets, by County, 2010 (USDA-ERS 2011b)

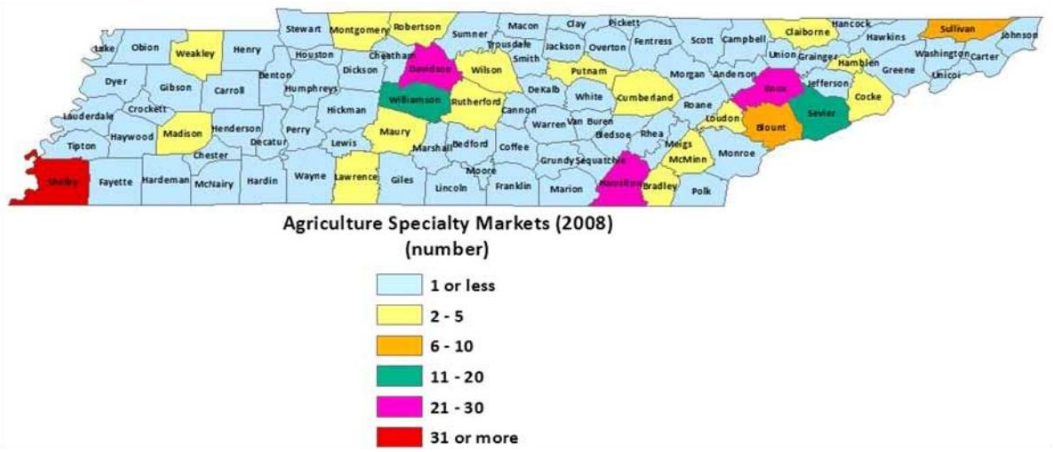

Figure 25. Number of Specialty Stores/Markets, by County, 2010 (USDA-ERS 2011b)

D. Prices

Prices can vary depending on the market outlet that a producer is selling through. When selling through a retail outlet, a producer will receive a wholesale price. With milk and yogurt products, the shelf life requires producers to sell the product quickly which requires the producer to sell through a retail outlet. With cheese products, the shelf life is longer which gives the producer the ability to sell directly to consumers such as through a farmers' market, on-farm store, or online. When selling directly to consumers, the producer receives a retail price. In this research it assumed that the milk and milk/yogurt value-added enterprises will be able to sell 5% of the products through outlets where the products will receive a retail price, the other 95% of production will receive a wholesale price. The price that is used in the value-added milk budget is an average of prices from selling 95% of production at wholesale prices and from selling 5% of production at retail prices. The price used for quarts is $2.25, for ½ gallons is $2.75, and a gallon is $3.75. The price used for butter is $4.25 a pound. It is assumed for cheese production that all production will be sold at retail prices. In this budget, approximately 1/3 of production from the dairy farm is used in cheese production. For an average sized dairy farm, it is assumed that 1/3 of production can be sold directly to consumers. If cheese production increased, then a

producer may consider selling cheese through retail markets. The price that is used for cheddar cheese is a retail value. The price for a ½ pound block is $5.00. The price that is used in the value-added milk/yogurt budget is an average of prices from selling 95% of production at wholesale prices and from selling 5% of production at retail prices. The price used for a quart of yogurt is $4.00. These prices were developed to fit each budget through communication with local on-farm processors and specialty retailers who stock on-farm products.

E. Product Attributes

On-farm products are currently being marketed several different ways. Some products are marketed based on quality and freshness. These products may come from a local farm where the producer is involved in production process and can insure the product meets a high standard of quality. In some instances, the producer will package their product to reflect these differences such as bottling milk in glass bottles. Other producers will market their product as a better tasting product. The producer may add an extra ingredient or different ingredient in order to enhance the product such as adding special spices to cheese or bottling milk from a non-Holstein cow.

Financial Feasibility

1. Dairy Budget of a Dairy in the State of Tennessee

An updated dairy budget was made for a Tennessee dairy that is current as of July 2012 (Table 31). The budget outline came from a UT Extension dairy budget (UT Extension 2011). The budget is representative of an average size dairy farm in the state of Tennessee. While prices can vary throughout the state and available resources change from region to region, this budget attempts to get the averages for the state.

Assumptions and formulas used to build the budget are explained in detail in Table 32. The budget is comprised of revenues, variable expenses, and fixed expenses. Table 4 displays the

revenues and variable expenses from a 100 cow dairy farm. Each cow is averaging 16,500 pounds of milk per year. The total revenue received per year is $317,107.50. Variable expenses are mostly comprised of feed costs. Tennessee has higher feed costs and lower production levels than the national average. As explained earlier, higher feed costs are attributed to higher costs for homegrown feed and lower production is attributed to environment, nutrition, and parlor practices (Pighetti 2012). The break-even levels for a dairy farm using national data (UMN Extension 2011) are between 74.5-88.8 head producing between 18,703-19,979 pounds. The assumptions that were made were a culling percentage of between 23.7-26.7, turnover rate between 31.1-34.2, percent of barn capacity between 101.0-105.4, feed cost per head between $2,463.98-$2,343.19, average milk price per cwt between $19.65-$19.82. The total variable expenses are $ 296,294.13 and the return above variable costs is $20,813.37. Table 5 displays the fixed expenses associated with a dairy farm. These will include depreciation, repairs, insurance, interest and labor. The depreciation schedule is displayed in Table 33. The initial prices for the buildings and equipment were from the Sustainable Dairy Systems Manual (UT and UK Extension 1997 and UT Extension 2011). Using a projected price index (RSMeans Assemblies Cost Data 2010) for the buildings and structures, an updated price was determined. Online dairy equipment websites were used to update equipment prices. Waste storage facility prices were updated using a price rate from the TN 2011 EQIP Payment Schedule Final (USDA-NRCS 2011). While the dairy farm is able to have a positive return above variable expenses, the fixed costs offset the return and overall negative returns are incurred. The total for all expenses is $431,735.66. The return to land, management and risk is $ -114,628.16. While the average conventional dairy farm has negative returns there are possibilities to increase returns by using

alternative dairy practices such as intensive grazing, economies of scale by increasing herd numbers, and increase milk yields per cow.

Table 4. Dairy Production Revenues and Variable Expenses

ITEM	DESCRIPTION		UNIT	QUANTITY	PRICE	TOTAL	PER COW
REVENUE							
Milk	100	Cows	cwt	165.00	16.75	276375.00	2763.75
Bull Calves	45	Calves	head	1.00	102.50	4612.50	46.13
Cull Cows	23	Cows	cwt	13.00	75.00	22425.00	224.25
Cull Heifers	15	Heifers	cwt	11.00	83.00	13695.00	136.95
						---	---
			TOTAL REVENUE			317107.50	3171.08
-	-	-	-	-	-	-	-
VARIABLE EXPENSES							
Lactation Feed	100	Cows	ton	3.44	322.00	110768.00	1107.68
Dry Cow Feed	100	Cows	ton	0.14	373.00	5222.00	52.22
Milk Replacer	45	Heifers	lbs	57.00	1.68	4309.20	43.09
Calf Starter	45	Heifers	lbs	57.00	0.24	615.60	6.16
Heifer Feed (18%)	42	Heifers	tons	1.00	380.00	15960.00	159.60
Heifer Feed (14%)	40	Heifers	tons	0.88	237.00	8295.00	82.95
Silage	100	Cows	tons	11.58	50.00	57900.00	579.00
Alfalfa Hay	100	Cows	tons	0.91	160.00	14608.00	146.08
Fescue Hay	100	Cows	tons	0.20	45.00	882.00	8.82
Orchard Grass Hay	100	Cows	tons	0.20	50.00	1000.00	10.00
Orchard Grass Hay	42	Heifers	tons	2.50	50.00	5250.00	52.50
Pasture			acre	82.50	100.00	8250.00	82.50
Breeding			cow	100	50.00	5000.00	50.00
Vet & Med			cow	100	80.00	8000.00	80.00
Dairy Supplies			cow	100	60.00	6000.00	60.00
Bedding			cow	100	66.00	6600.00	66.00
DHIA			cow	100	24.00	2400.00	24.00
Milk Hauling	100	Cows	cwt	165	0.85	14025.00	140.25
ADA	100	Cows	cwt	165	0.15	2475.00	24.75
Electricity			kwh	55836	0.10	5583.60	55.84
Marketing Fees			head	83	16.00	1328.00	13.28
Machinery			hour	1314	9.00	11822.73	118.23
						-	-
			TOTAL VARIABLE EXPENSES			296294.13	2962.94
			RETURN ABOVE VARIABLE EXPENSES			20813.37	208.13

Table 5. Dairy Production Fixed Expenses

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
DEPRECIATION, REPAIRS, INSURANCE						
Depreciation	Buildings, equipment				30476.67	304.77
Repairs	Buildings, equipment				16436.00	164.36
Machinery		hour	1314	1.00	1313.64	13.14
Insurance	Buildings, equipment	month	12.00	106.58	1278.96	12.79
					-	-
		TOTAL FIXED EXPENSES			49505.26	495.05
	TOTAL VARIABLE & FIXED EXPENSES				345799.39	3457.99
RETURN TO LAND, LABOR, CAPITAL, MANAGEMENT, RISK					-28691.89	-286.92
-	-	-	-	-	-	-	-
INTEREST						
Cows					7800.00	78.00
Bldgs. & Equip					16665.00	166.65
Machinery		hour	1314	1.12	1471.27	14.71
					-	-
	TOTAL INTEREST EXPENSE				25936.27	259.36
	TOTAL VARIABLE, FIXED, INTEREST EXPENSE				371735.66	3717.36
NET RETURN TO LAND, LABOR, MANAGEMENT, RISK					-54628.16	-546.28
-	-	-	-	-	-	-	-
LABOR EXPENSES						
LABOR		hour	6000	10.00	60000.00	600.00
		TOTAL ALL EXPENSES			431735.66	4317.36
	RETURN TO LAND, MANAGEMENT, RISK				-114628.16	-1146.28

2. Costs of Employing a Value-Added Activity

The three value-added enterprises to be evaluated are for milk, cheese, and yogurt. Each value-added enterprise has a budget that is specific for each product. Each budget also has assumptions and formulas used in the calculations and quantities.

When entering into a value-added enterprise it is necessary to purchase additional equipment and requires more labor hours to perform the additional work associated with the new enterprise. Table 41 lists the additional equipment along with the cost, interest rate, life, depreciation, interest per year, repairs per year and the total per year for milk and yogurt (Burch

and Goan 2011a). Table 43 lists the additional equipment along with the cost, interest rate, life, depreciation, interest per year, repairs per year and the total per year for cheese (Burch and Goan 2011a). Figure 26 is a layout for a value-added dairy processing plant (Burch and Goan 2011a). This was designed with costs and efficiency in mind. This includes the locations where the equipment can be located in the plant for a milk and yogurt facility.

For value-added milk production, it is assumed that the facility will process all milk produced from a 100 cow dairy farm which is 1,650,000 pounds of milk. Total production will be 191,860 gallons of milk. Total production is calculated by dividing the total pounds of milk by 8.6 which is the weight of a gallon of milk. For this budget, it is assumed that total production will be divided equally into quarts, ½ gallons, and gallons. Of the total production, 50 percent will be 2% milk, 20 percent will be whole milk, 25 percent will be skim milk, and 5 percent will be chocolate milk. The percentages are future projections of per capita consumption of milk (USDA-ERS 2011a). For this dairy processing facility, it is assumed that 95 percent of bottled milk and butter will be sold through wholesale markets. During milk processing, cream is left over. In order to use the cream, butter will be produced. Table 35 displays the value-added milk production budget. Assumptions and formulas used to build the budget are explained in detail in Table 36. In Table 6, the revenue from milk sales and butter sales are shown. The total revenue is $1,320,544.00

Table 6. Value-Added Milk Production Revenues

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
REVENUE						
Milk Sales	1 Year	Quart	255813	2.25	575579.25	5755.79
Milk Sales	1 Year	1/2 Gal	127906	2.75	351741.50	3517.42
Milk Sales	1 Year	Gal	63953	3.75	239823.75	2398.24
Butter Sales	1 Year	Pound	36094	4.25	153399.50	1534.00
					---	---
		TOTAL REVENUE			1320544.00	13205.44

Table 7 displays the variable expenses associated with ingredients, laboratory supplies, utilities, cleaning supplies, and packaging materials. Vitamin A Palmitate and Vitamin D3 are added to milk. Cocoa, sugar, starch, salt, and carrageenan are ingredients used in chocolate milk. The remaining expenses are overhead expenses and estimated on a monthly basis. Table 8 displays the overhead expenses.

Table 7. Value-Add Milk Production Variable Expenses

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
VARIABLE EXPENSES						
Fluid Milk	100 Cows	cwt	165.00	16.75	276375.00	2763.75
Vitamin A Palmitate		kg	77	60.00	4604.62	46.05
Vitamin D3		kg	77	200.00	15348.74	153.49
Cocoa		pound	600	6.75	4047.05	40.47
Sugar		pound	2398	0.75	1798.69	17.99
Starch		pound	199	5.00	995.27	9.95
Salt		pound	199	0.63	125.40	1.25
Carrageenan		pound	8	43.00	340.31	3.40
Inhibitor testing		Test Kit	9	65.00	585.00	5.85
Petrifilm Testing		50 Pack	5	70.00	350.00	3.50
Pasteurization Check		Test Kit	3	40.00	120.00	1.20
PH & Acidity Checking		50 Pack	5	20.00	100.00	1.00
Direct Microscopic Slides		70 Pack	4	5.00	20.00	0.20
Utilities		Month	12	2000.00	24000.00	240.00
Cleaning Supplies		Day	156	33.62	5243.94	52.44
Jugs-Quart		EA	255813	0.31	79302.03	793.02
Jugs-1/2 Gal		EA	127906	0.35	44767.10	447.67
Jugs-Gal		EA	63953	0.38	24302.14	243.02
Caps		EA	447672	0.03	13430.16	134.30
Labels		EA	483766	0.03	14512.98	145.13
Butter Packaging		EA	36094	0.02	721.88	7.22
Cardboard Boxes		EA	46639	0.75	34979.06	349.79

Table 8. Value-Added Milk Production Overhead Expenses

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
Supplies		Month	12	1250.00	15000.00	150.00
Transportation		Month	12	20833.33	249999.96	2500.00
Waste and Wastewater Treatment		Month	12	94.58	1134.96	11.35
Lot Improvements		Month	12	75.00	900.00	9.00
Advertising/Marketing		Month	12	4166.67	50000.04	500.00
Product Loss/Samples		Month	12	3333.33	39999.96	400.00
Phone and Internet		Month	12	1000.00	12000.00	120.00
Credit Card Transaction Fees		Month	12	130.68	1568.15	15.68
FICA		Month	12	1075.59	12907.07	129.07
Insurance		Month	12	876.39	10516.68	105.17
Worker's Comp		Month	12	684.75	8217.00	82.17
Unemployment Taxes		Month	12	213.75	2565.00	25.65
Licenses, Permits and Fees		Month	12	25.00	300.00	3.00
Secretarial/Bookkeeping/Accounting		Month	12	1666.66	19999.92	200
Legal Costs		Month	12	625.00	7500.00	75.00
					-	-
		TOTAL VARIABLE EXPENSES			978678.12	9786.78
	RETURN ABOVE VARIABLE EXPENSES				341865.88	3418.66

The total variable costs are $978,678.12. The return above variable expenses is $341,865.88. The remaining expenses are fixed, which include depreciation, repairs, interest, and labor (Table 9). The fixed expenses schedule is displayed in Table 41. Total expenses are $1,315,336.12. The return to land, management, and risk is $5,207.88.

Table 9. Value-Added Milk Production Fixed Expenses

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
DEPRECIATION AND REPAIRS						
Depreciation	Equipment & Building				89210.00	892.10
Repairs	Equipment & Building				27715.00	277.15
					-	-
		TOTAL FIXED EXPENSES			116925.00	1169.25
		TOTAL VARIABLE & FIXED EXPENSES			1095603.12	10956.03
RETURN TO LAND, LABOR, CAPITAL, MANAGEMENT, RISK					224940.88	2249.41
-	- - - - - -				-	-
INTEREST						
Equipment					71013.00	710.13
					-	-
		TOTAL INTEREST EXPENSE			71013.00	710.13
	TOTAL VARIABLE, FIXED, INTEREST EXPENSE				1166616.12	11666.16
NET RETURN TO LAND, LABOR, MANAGEMENT, RISK					153927.88	1539.28
-	- - - - - -				-	-
LABOR EXPENSES						
LABOR		hour	14872	10.00	148720.00	1487.20
		TOTAL ALL EXPENSES			1315336.12	13153.36
	RETURN TO LAND, MANAGEMENT, RISK				5207.88	52.08

The labor schedule by hour is in Table 10. The labor expenses are $148,720. A weekly schedule of hours is included in Table 42. There will be four full-time workers and four part-time workers to operate and maintain the milk processing facility. The four full-time employees will be dedicated to deliveries, retail sales, and processing. The four part-time employees will be dedicated to packaging and processing if needed. The part-time employees will each work 25 hours a week.

Table 10. Milk Processing Weekly Work Schedule

# People	Day of Week	Step	Total Time Associated
1	Saturday	Milk Delivery	2hrs
2 Dedicated to Processing	Monday	Milk Delivery	2hrs
		Set up & Sanitation	1hr 30mins
		Separation & Blending	1hr 55mins
		Pasteurization, Homogenization, and cleaning	4hrs 10mins
		Separator Cleaning	1hr 30mins
		Blend Tanks & Pipe Cleaning	2hr 30mins
		3 Pasteurizers Cleaning	2hrs 15mins
		Homogenizer and Plate Cooler Cleaning	1hr
4 Dedicated to Packaging		Packaging and Cleaning of Packaging Area	32hrs 30mins
1	Tuesday	Check & Maintenance	4hrs
6	Wednesday	Same Schedule as Monday	49hrs 15mins
2	Thursday	Butter Churn Pack & Clean	8 Hrs
6	Friday	Same Schedule as Monday	49hrs 15mins
1	Saturday	Butter Pack Clean	4hrs
1	Sunday	Check & Secure Building	1hr

# People	Step	Total Time Associated
1	Laboratory Week Total	20hrs
1	Route Delivery	40hrs
1.5	Sales Room Sales	60hrs
Weekly Total		286hrs

For value-added cheese production, it is assumed that the facility will process milk once a week. This will be approximately 1/3 of milk produced from a 100 cow dairy farm which is 520,000 pounds of milk. The cheese vat used for processing is 10,000 pounds. It is assumed that each pound of cheese requires 10 pounds of milk; therefore, 520,000 pounds of milk will produce 52,000 pounds of cheese. Table 11 describes the revenue and variable expenses associated with cheese production. Table 37 displays the value-added cheese production budget. Assumptions and formulas used to build the budget are explained in detail in Table 38.

Table 11. Value-Added Cheese Production Revenues and Variable Expenses

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
REVENUE						
Cheese Sales	1 Year	1/2 lb.	104000	5.00	520000.00	5200.00
					---	---
		TOTAL REVENUE			520000.00	5200.00
-	- -	-	-	-	-	-
VARIABLE EXPENSES						
Fluid Milk		cwt	5200	16.75	87100.00	871.00
Coloring		ounces	520	0.50	260.00	2.60
Salt		pounds	1482	0.63	933.66	9.34
Calcium Chloride		ounces	1560	0.38	596.70	5.97
Starter Cultures		pounds	624	1.84	1148.16	11.48
Rennet		ounces	1560	2.00	3120.00	31.20
Inhibitor testing		Test Kit	3	65.00	195.00	1.95
Petrifilm Testing		50 Pack	2	70.00	140.00	1.40
Pasteurization Check		Test Kit	1	40.00	40.00	0.40
PH & Acidity Checking		50 Pack	2	20.00	40.00	0.40
Direct Microscopic Slides		70 Pack	1	5.00	5.00	0.05
Utilities		Month	12	1375.00	16500.00	165.00
Cleaning Supplies		Day	52	11.63	604.76	6.05
Packaging		EA	104000	0.02	2080.00	20.80
Labels		EA	104000	0.03	3120.00	31.20
Supplies		Month	12	833.33	9999.96	100.00
Transportation		Month	12	4583.33	54999.96	550.00
Waste and Wastewater Treatment		Month	12	31.35	376.25	3.76
Lot Improvements		Month	12	75.00	900.00	9.00
Advertising/Marketing		Month	12	2500.00	30000.00	300.00
Product Loss/Samples		Month	12	1666.66	19999.92	200.00
Phone and Internet		Month	12	1000.00	12000.00	120.00
Credit Card Transaction Fees		Month	12	1029.17	12350.00	123.50
FICA		Month	12	391.17	4694.04	46.94
Insurance		Month	12	846.24	10154.88	101.55
Worker's Comp		Month	12	356.75	4281.00	42.81
Unemployment Taxes		Month	12	95.00	1140.00	11.40
Licenses, Permits and Fees		Month	12	25.00	300.00	3.00
Secretarial/Bookkeeping/Accounting		Month	12	1250.00	15000.00	150.00
Legal Costs		Month	12	416.66	4999.92	50.00
					-	-
		TOTAL VARIABLE EXPENSES			297079.21	2970.79
	RETURN ABOVE VARIABLE EXPENSES				222920.79	2229.21

Total revenue from cheese production is $520,000. Total variable expenses are $297,079.21, which returns $222,920.79 above variable expenses. Table 12 displays the fixed expenses. The fixed expenses schedule is displayed in Table 43. Total expenses are $508,474.71. The return to land, management, and risk is $11,525.29. There will be four full-time workers to operate and maintain the cheese processing facility. Each employee will have the ability to perform each task. This is to prevent stoppages if an employee is sick, on vacation, or leaves for lunch. The labor schedule by hour is shown in Table 45 and a weekly hour schedule is shown in Table 13 and the flow diagram for cheese production is shown in Table 44.

Table 12. Value-Added Cheese Production Fixed Expenses

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
DEPRECIATION AND REPAIRS						
Depreciation	Equipment & Building				67570.00	675.70
Repairs	Equipment & Building				21123.00	211.23
					-	-
		TOTAL FIXED EXPENSES			88693.00	886.93
	TOTAL VARIABLE & FIXED EXPENSES				385772.21	3857.72
RETURN TO LAND, LABOR, CAPITAL, MANAGEMENT, RISK					134227.79	1342.28
-	- -	-	-	-	-	-
INTEREST						
Equipment					61342.50	613.43
					-	-
	TOTAL INTEREST EXPENSE				61342.50	613.43
	TOTAL VARIABLE, FIXED, INTEREST EXPENSE				447114.71	4471.15
NET RETURN TO LAND, LABOR, MANAGEMENT, RISK					72885.29	728.85
-	- -	-	-	-	-	-
LABOR EXPENSES						
LABOR		hour	6136	10.00	61360.00	613.60
	TOTAL ALL EXPENSES				508474.71	5084.75
	RETURN TO LAND, MANAGEMENT, RISK				11525.29	115.25

Table 13. Cheese Processing Weekly Work Schedule

Task	Hours
Store/Retail	54 hours
Delivery	20 hours
Processing	17 hours
Packaging	20 hours
Lab Work	4 hours
Check and Maintenance	3 hours
Total Weekly Hours	118 hours

For value-added milk/yogurt production, it is assumed that the facility will process all milk produced from a 100 cow dairy farm which is 1,650,000 pounds of milk. Total production will be 191,860 gallons of milk. Total production is calculated by dividing the total pounds of milk by 8.6 which is the weight of a gallon of milk. Total production will be divided into milk and yogurt production. It is assumed that 7/8 of total production (1,443,750 pounds; 167,877 gallons) will be milk production and 1/8 of total production (206,250 pounds; 23,982 gallons) will be drinkable yogurt production. It is assumed that milk production will be divided equally into quarts, ½ gallons, and gallons. Yogurt is bottled in quarts. Of the milk production, 50 percent will be 2% milk, 20 percent will be whole milk, 25 percent will be skim milk, and 5 percent will be chocolate milk. The percentages are future projections of per capita consumption of milk (USDA-ERS 2011a). Yogurt is produced with whole milk. For this dairy processing facility, it is assumed that 95 percent of bottled milk, yogurt and butter will be sold through wholesale markets. During milk processing, cream is left over. In order to use the cream, butter will be produced.

Table 14. Value-Added Yogurt Production Revenues

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
REVENUE						
Milk Sales	1 Year	Quart	223836	2.25	503631.00	5036.31
Milk Sales	1 Year	1/2 Gal	111918	2.75	307774.50	3077.75
Milk Sales	1 Year	Gal	55959	3.75	209846.25	2098.46
Yogurt Sales	1 Year	Quart	95930	4.00	383720.00	3837.20
Butter Sales	1 Year	Pound	32228	4.25	136969.00	1369.69
					---	---
		TOTAL REVENUE			1541940.75	15419.41

In Table 14, the revenue from milk, yogurt and butter sales are shown. . Table 39 displays the value-added yogurt production budget. Assumptions and formulas used to build the budget are explained in detail in Table 40. The total revenue is $1,541,940.75.

Table 15 displays the variable expenses associated with ingredients, laboratory supplies, utilities, cleaning supplies, and packaging materials. Vitamin A Palmitate and Vitamin D3 are added to milk. Cocoa, sugar, starch, salt, and carrageenan are ingredients used in chocolate milk. Evaporated cane juice, cultures, puree, and pectin are ingredients used in yogurt. The remaining expenses are overhead expenses and estimated on a monthly basis. Table 16 displays the overhead expenses.

Table 15. Value-Added Yogurt Production Variable Expenses

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
Fluid Milk	100 Cows	cwt	165.00	16.75	276375.00	2763.75
Vitamin A Palmitate		kg	67	60.00	4029.05	40.29
Vitamin D3		kg	67	200.00	13430.16	134.30
Cocoa		pound	525	6.75	3541.16	35.41
Sugar		pound	2098	0.75	1573.85	15.74
Starch		pound	174	5.00	870.86	8.71
Salt		pound	174	0.63	109.73	1.10
Carrageenan		pound	7	43.00	297.77	2.98
Evaporated Cane Juice		pound	14090	1.75	24657.01	246.57
Cultures		pound	222	2.00	443.68	4.44
Puree		pound	47965	1.25	59956.25	599.56
Pectin		pound	881	3.00	2644.07	26.44
Inhibitor testing		Test Kit	9	65.00	585.00	5.85
Petrifilm Testing		50 Pack	5	70.00	350.00	3.50
Pasteurization Check		Test Kit	3	40.00	120.00	1.20
PH & Acidity Checking		50 Pack	5	20.00	100.00	1.00
Direct Microscopic Slides		70 Pack	4	5.00	20.00	0.20
Utilities		Month	12	2500.00	30000.00	300.00
Cleaning Supplies		Day	156	33.62	5243.94	52.44
Jugs-Quart		EA	319766	0.31	99127.46	991.27
Jugs-1/2 Gal		EA	111918	0.35	39171.30	391.71
Jugs-Gal		EA	55959	0.38	21264.42	212.64
Caps		EA	487643	0.03	14629.29	146.29
Labels		EA	519871	0.03	15596.13	155.96
Butter Packaging		EA	32228	0.02	644.56	6.45
Cardboard Boxes		EA	46524	0.75	34892.81	348.93

Total variable costs are $1,197,670.12. The return above variable expenses is $344,270.03. The remaining expenses are fixed, which include depreciation, repairs, interest, and labor (Table 17). The fixed expenses schedule is displayed in Table 41. Total expenses are $1,534,328.72. The return to land, management, and risk is $7,612.03.

Table 16. Value-Added Yogurt Production Overhead Expenses

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
Supplies		Month	12	2083.33	24999.96	250.00
Transportation		Month	12	25000.00	300000.00	3000.00
Waste and Wastewater Treatment		Month	12	94.58	1134.96	11.35
Lot Improvements		Month	12	75.00	900.00	9.00
Advertising/Marketing		Month	12	5000.00	60000.00	600.00
Product Loss/Samples		Month	12	6424.75	77097.04	770.97
Phone and Internet		Month	12	1000.00	12000.00	120.00
Credit Card Transaction Fees		Month	12	152.59	1831.05	18.31
FICA		Month	12	1107.46	13289.58	132.90
Insurance		Month	12	888.56	10662.72	106.63
Worker's Comp		Month	12	684.75	8217.00	82.17
Unemployment Taxes		Month	12	213.75	2565.00	25.65
Licenses, Permits and Fees		Month	12	25.00	300.00	3.00
Secretarial/Bookkeeping/Accounting		Month	12	2083.33	24999.96	250.00
Legal Costs		Month	12	833.33	9999.96	100.00
					-	-
		TOTAL VARIABLE EXPENSES			1197670.72	11976.71
	RETURN ABOVE VARIABLE EXPENSES				344270.03	3442.70

The labor hours for milk/yogurt follow the same structure as milk except 1 day of milk production will be substituted for yogurt production. The flow chart for the production of yogurt is shown in Table 46.

Table 17. Value-Added Yogurt Production Fixed Expenses

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
DEPRECIATION AND REPAIRS						
Depreciation	Equipment & Building				89210.00	892.10
Repairs	Equipment & Building				27715.00	277.15
					-	-
		TOTAL FIXED EXPENSES			116925.00	1169.25
		TOTAL VARIABLE & FIXED EXPENSES			1314595.72	13145.96
RETURN TO LAND, LABOR, CAPITAL, MANAGEMENT, RISK					227345.03	2273.45
-	- -	- -	-	-	-	-
INTEREST						
Equipment					71013.00	710.13
					-	-
		TOTAL INTEREST EXPENSE			71013.00	710.13
	TOTAL VARIABLE, FIXED, INTEREST EXPENSE				1385608.72	13856.09
NET RETURN TO LAND, LABOR, MANAGEMENT, RISK					156332.03	1563.32
-	- -	- -	-	-	-	-
LABOR EXPENSES						
LABOR		hour	14872	10.00	148720.00	1487.20
		TOTAL ALL EXPENSES			1534328.72	15343.29
	RETURN TO LAND, MANAGEMENT, RISK				7612.03	76.12

3. Projections

Future projections for the dairy enterprise and value-added enterprises were made by using the Prices Paid Index and the Livestock and Products Index in past years (USDA-NASS 2012). The indexes were used to calculate the prices going back to 2001.

Starting at 2011, each year has been discounted according to the percentage change from that year to the next year. The discount formula used is (1/(1+% change)) and the year is calculated by multiplying the later year by the discount rate formula.

Table 18. Livestock and Products Percent Change by Year

Year	Percent Change
2010-2011	18.0%
2009-2010	13.0%
2008-2009	-0.8%
2008-2007	-10.0%
2007-2006	20.0%
2006-2005	-5.8%
2005-2004	-0.8%
2004-2003	7.1%
2003-2002	24.0%
2002-2001	-5.2%

After the past prices were calculated using the index, the average percentage change was calculated for each year (Tables 18 & 19). Then the yearly average change was used to make future projections based off of the 2011 budget. The average percent change for cash inflows is 5.95% and the average percent change for cash outflows is 5.11%.

Straight-Line Depreciation is used; therefore the depreciation is the same for every year. Each year the same amount is depreciated and since all the equipment has at least a 10 year life there is no change from year to year.

Table 19. Prices Paid Index Percent Change by Year

Year	Percent Change
2010-2011	8.5%
2009-2010	7.3%
2008-2009	-0.6%
2008-2007	6.6%
2007-2006	8.7%
2006-2005	3.5%
2005-2004	6.7%
2004-2003	3.9%
2003-2002	4.0%
2002-2001	2.5%

Future projections were made for the prices listed in the dairy budget to 2021. As can be seen in the Table 34, the total cash outflows are increasing faster than the total cash outflows. Each year the net cash flow yields a larger negative return. In 2021 the projected net cash flow is $-125,747.

For the value-added enterprise projections, the Livestock and Products Index was applied to the value-added products and to the milk price which is a cash outflow in these projections. The Prices Paid Index was applied to the remaining cash outflows.

Displayed in Table 47, for value-added milk production cash inflows are increasing faster that cash outflows each year and each year the net cash flow yields a larger return. In 2021 the projected net cash flow is $208,608.

As can be seen in Table 48, for value-added cheese production cash inflows are increasing faster that cash outflows each year and each year the net cash flow yields a larger return. In 2021 the projected net cash flow is $121,662.

Shown in Table 49, for value-added yogurt production cash inflows are increasing faster that cash outflows each year and each year the net cash flow yields a larger return. In 2021 the projected net cash flow is $242,759.

4. Comparison of Market Opportunities

For a dairy farm selling milk to an outside source, the return is $-114,628.16. If the dairy farm undertakes a value-added enterprise the return for milk is $-109,420, the return for cheese is $-103,103, and the return for yogurt is $-107,016. Each value-added enterprise is able to return a small profit, but is not able to offset the loss from the dairy farm. Projections for each value-added enterprise combined with the dairy farm can be seen in Table 50-52.

5. **Net Present Value**

Using Microsoft Excel 2007, the NPV was calculated for milk, cheese, and yogurt and for milk, cheese, and yogurt combined with the returns from the dairy budget. A rate of 6% was used in calculations. The NPV for milk was $654,213.34. The NPV for cheese was $427,622.00. The NPV for yogurt was $766,792.66. The initial costs for a milk and milk/yogurt processing facility is $2,367,100. In each case, the NPV is less than the initial costs. The initial cost for a cheese processing facility is $2,044,750; the NPV is less than the initial costs. The NPV for milk combined with the dairy budget returns was $-296,693.12. The NPV for cheese combined with the dairy budget returns was $-523,284.45. The NPV for yogurt combined with the dairy budget returns was $-184,113.80.

6. **Internal Rate of Return (IRR)**

Using Microsoft Excel 2007, the IRR was calculated for each value-added enterprise. The initial investment for buildings and equipment was compiled from data received from Burch and Goan (2011a). The returns were taken from the value-added projections. The initial investment for milk production was $2,367,100, which produced an IRR of -9%. The initial investment for cheese production was $2,044,750, which produced an IRR of -13%. The initial investment for yogurt production was $2,367,100, which produced an IRR of -8%.

7. **Break Off Level**

According to the break-off rate of 1.21% used by Eberle et al. (2005), the dairy farm would fall below the break off level. The value-added enterprises also had negative IRRs; therefore, the IRR would be negative if the value-added enterprises were combined with the dairy farm or if the value-added enterprises were operated as only processing facilities. With the

large capital investment and low rate of returns, the investments do not provide owners a rate of return sufficient to reward them for the risk involved in such an undertaking.

8. Sensitivity Analysis

The sensitivity analysis fluctuated costs and prices to determine the range of returns that can be expected if the costs and prices increased or decreased by 0%, 5%, and 10%. Tables 53-56 describe the range of returns. The initial return is 0% change in costs and 0% change in prices, which are the returns in the budgets. From the initial returns, the costs and prices are fluctuated to determine the range for the dairy farm and value-added enterprises.

The sensitivity analysis for the dairy farm fluctuated milk price and feed costs which included lactation feed, dry cow feed, milk replacer, calf starter, heifer feed (18%), heifer feed (14%), silage, alfalfa hay, fescue hay, orchard grass hay for both cows and heifers, and pasture. As can be seen in Table 53, the variability of profits can range from $-165,571.64 to $-63,684.68.

The sensitivity analysis for the value-added milk enterprise fluctuated the price for bottled milk and packaged butter and ingredient and packaging costs which included the price of fluid milk, Vitamin A Palmitate, Vitamin D3, sugar, cocoa, starch, salt, carrageenan, jugs, caps, labels, butter packaging, and cardboard boxes. As can be seen in Table 54, the variability of profits can range from $-178,411.52 to $188,827.28.

The sensitivity analysis for the value-added cheese enterprise fluctuated the price for cheese and ingredient and packaging costs which included the price of fluid milk, coloring, salt, calcium chloride, starter cultures, rennet, packaging, and labels. As can be seen in Table 55, the variability of profits can range from $-3,510.61to $26,561.19.

The sensitivity analysis for the value-added yogurt enterprise fluctuated the price for bottled milk, bottled yogurt, and packaged butter and ingredient and packaging costs which included the price of fluid milk, Vitamin A Palmitate, Vitamin D3, sugar, cocoa, starch, salt, carrageenan, evaporated cane juice, cultures, puree, pectin, jugs, caps, labels, butter packaging, and cardboard boxes. As can be seen in Table 56, the variability of profits can range from $-207,907.57 to $223,131.63.

CHAPTER 5 CONCLUSION

The Tennessee dairy industry has changed over the past few decades. The number of dairy farms is decreasing along with overall milk production. Many farmers are looking for ways to capture more of the food dollar. One option dairy farmers are considering is starting a value-added enterprise. With the population of Tennessee expected to increase, dairy farmers are looking to meet the demands for milk and dairy products. This research projected milk consumption levels for five metropolitan areas in Tennessee: Memphis, Nashville, Chattanooga, Knoxville, and the Tri-Cities. With farmers' markets and specialty stores located in and around these metropolitan areas, there is the potential to sell farm products directly to the consumer. In most cases, consumers are willing to pay more for an on-farm produced product. With higher prices for products, increasing demand, and established outlets available, market potential exists for value-added products. However, the financial feasibility of undertaking a value-added enterprise must be considered before entering into the market.

An average size conventional dairy farm is expected to lose money. This research includes an updated 100-cow dairy for the state of Tennessee. With the dairy farm already losing money, value-added enterprises are not recommended as a means to turn the farm around. The value-added enterprise should build upon the strengths of a successful dairy and be used as a means to sustain the farm. Value-added budgets were built for the production of milk, cheese, and yogurt. In each budget the profits were positive; however, the profits were not great enough to offset the losses incurred from the dairy farm. Using Solver in Microsoft Excel, the milk production per cow would need to be 23,343 pounds in order for the farm to break-even. Also, the dairy farm would break-even if the price of milk increased to $23.70 per cwt.

Projections were made for the dairy budget and value-added enterprises. In a 10-year period the profits from a milk and yogurt value-added enterprise are able to offset the losses from the dairy farm. However, with such an undertaking, large capital investments are needed for a facility and equipment. With the large capital investments, previous research suggests that the projections do not meet the levels of return sufficient enough to reward the producer for the amount of risk involved. In order for an IRR of 0% to be attained for the value-added milk enterprise, product prices would need to increase between 6.5% and 7%. In order for the break-even IRR to be attained for the value-added cheese enterprise, product prices would need to increase between 17.5% and 18%. In order for the break-even IRR to be attained for the value-added yogurt enterprise, product prices would need to increase between 4.5% and 5%.

If a dairy farmer wanted to add a value-added enterprise to his farm, the dairy farm and the value-added enterprise would need to reach positive NPVs and IRRs. For a Tennessee dairy farm to reach profitability, alternative dairy practices, economies of scale, and increases in production need to be considered. For a value-added enterprise to be considered, economies of scale should be considered along with methods to lower costs or increase product prices.

As part of this research, a decision tool was developed to assist Tennessee dairy farmers who may be considering adding a value-added enterprise to their farm operation. This decision tool is designed to assist Tennessee dairy farmers who are considering on-farm value added products. The results of this study should help them in making more informed decisions; however, it will not determine whether an individual should enter into a value-added enterprise.

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Appendix

Table 20. Projected Economic Impacts from Milk Production and Processing In Tennessee, 2010

Impact Type	**Employment (Jobs)**	**Output**
Farm Level Milk and Dairy Production (2010$)		
Direct Effect	4,460	$200,153,049
Total Effect	5,113	$278,198,666
Fluid Milk and Dairy Products Processing (2010$)		
Direct Effect	2,212	$1,855,355,548
Total Effect	7,811	$2,890,921,682

Table 21. US Per Capita Consumption of Milk and Selected Dairy Products, 1980-2009

Year	Plain Whole Milk	Plain Lowfat Milk	Flavored Lowfat Milk	Skim Milk	Yogurt	Cheddar Cheese
		Per Capita Gallons				Per Capita Pounds
1980	16.5	8.1	0.6	1.3	0.3	6.8
1981	15.9	8.4	0.6	1.3	0.3	7.0
1982	15.2	8.5	0.6	1.2	0.3	8.7
1983	14.8	8.7	0.7	1.2	0.4	9.1
1984	14.3	9.1	0.7	1.3	0.4	9.5
1985	13.9	9.6	0.7	1.5	0.5	9.8
1986	13.1	10.2	0.7	1.6	0.5	9.8
1987	12.6	10.2	0.8	1.6	0.5	10.6
1988	12.0	10.5	0.8	1.9	0.5	9.5
1989	11.0	11.1	0.8	2.3	0.5	9.2
1990	10.2	11.4	0.8	2.6	0.5	9.0
1991	9.8	11.5	0.8	2.7	0.5	9.0
1992	9.4	11.4	0.8	2.9	0.5	9.1
1993	8.9	11.1	0.8	3.0	0.6	9.1
1994	8.7	10.9	0.8	3.3	0.6	9.0
1995	8.3	10.5	0.8	3.6	0.7	9.0
1996	8.2	10.3	0.9	3.8	0.7	9.0
1997	8.0	10.1	0.9	3.9	0.7	9.4
1998	7.7	9.8	0.9	3.9	0.7	9.4
1999	7.8	9.8	1.0	3.7	0.7	9.8
2000	7.7	9.7	1.0	3.5	0.8	9.7
2001	7.4	9.6	1.0	3.3	0.8	9.9
2002	7.3	9.5	1.2	3.2	0.9	9.6
2003	7.2	9.4	1.2	3.1	0.9	9.2
2004	7.0	9.3	1.4	3.1	1.1	10.3
2005	6.6	9.4	1.4	3.1	1.2	10.3
2006	6.5	9.4	1.4	3.1	1.3	10.4
2007	6.1	9.5	1.4	3.1	1.3	10.0
2008	5.9	9.9	1.4	3.1	1.4	10.1
2009	5.7	10.0	1.4	3.1	1.4	10.1

Table 22. US Plain Whole Milk Consumption Regression on Year and Projected Values

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	725.3200	39.3965	18.4108	3.52E-17***
Year	-0.3588	0.01975	-18.1625	5E-17***
R Square	0.9218			
N=30				
	Projections (Per Capita			
Year	Gallons)			
2010	4.23			
2011	3.87			
2012	3.51			
2013	3.15			
2014	2.79			
2015	2.43			
2016	2.07			
2017	1.71			
2018	1.36			
2019	1.00			
2020	.64			

Table 23. US Plain Lowfat and Skim Milk Consumption Regression on Year and Projected Values

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-170.1530	53.3106	-3.1917	0.003477***
Year	0.0916	0.0267	3.4279	0.001901***
R Square	0.2956			
N=30				

Year	Projections (Per Capita Gallons)
2010	14.01
2011	14.10
2012	14.19
2013	14.28
2014	14.37
2015	14.46
2016	14.56
2017	14.65
2018	14.74
2019	14.83
2020	14.92

Table 24. US Flavored Lowfat Milk Consumption Regression on Year and Projected Values

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-57.8018	3.8898	-14.8600	8.25E-15***
Year	0.0294	0.0020	15.1029	5.5E-15***
R Square	0.8908			
N=30				

Year	Projections (Per Capita Gallons)
2010	1.40
2011	1.43
2012	1.46
2013	1.49
2014	1.52
2015	1.55
2016	1.58
2017	1.61
2018	1.64
2019	1.67
2020	1.70

Table 25. US Yogurt Consumption Regression on Year and Projected Values

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-70.7364	4.7361	-14.9357	7.27E-15***
Year	0.0358	0.0024	15.0862	5.65E-15***
	0.8905			
R Square				
N=30				

Year	Projections (Per Capita Gallons)
2010	1.27
2011	1.30
2012	1.34
2013	1.37
2014	1.41
2015	1.45
2016	1.48
2017	1.52
2018	1.55
2019	1.59
2020	1.62

Table 26. U.S. Cheddar Cheese Consumption Regression on Year and Projected Values

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-105.668	27.7313	-3.81042	0.000697***
Year	0.057683	0.013904	4.148724	0.000282***
R Square	0.3807			
N=30				
Year	Projections (Per Capita Pounds)			
2010	10.27			
2011	10.33			
2012	10.39			
2013	10.45			
2014	10.51			
2015	10.56			
2016	10.62			
2017	10.68			
2018	10.74			
2019	10.79			
2020	10.85			

Table 27. Population Projections for the Five Metropolitan Areas[a]

	Population Projections				
Year	Memphis	Nashville	Chattanooga	Knoxville	Tri-Cities
2010	**1,007,811**	**1,573,108**	**367,779**	**687,589**	**404,343**
2011	1,005,995	1,614,361	368,468	698,210	407,278
2012	1,004,179	1,655,614	369,157	708,832	410,213
2013	1,002,362	1,696,866	369,846	719,453	413,147
2014	1,000,546	1,738,119	370,535	730,075	416,082
2015	**998,730**	**1,779,372**	**371,224**	**740,696**	**419,017**
2016	998,213	1,809,031	371,587	747,741	420,677
2017	997,697	1,838,690	371,949	754,785	422,336
2018	997,180	1,868,350	372,312	761,830	423,996
2019	996,664	1,898,009	372,674	768,874	425,655
2020	**996,147**	**1,927,668**	**373,037**	**775,919**	**427,315**

[a] The bolded numbers are taken from Middleton and Murray (2009). The bolded numbers were then used to calculate annual projections.

Table 28. Projected Per Capita Consumption of Milk and Selected Dairy Products, 2010-2020

Year	Whole Milk	Lowfat and Skim Milk	Flavored Lowfat Milk	Yogurt	Cheddar Cheese
		(Per Capita Gallons)			Per Capita (Pounds)
2010	4.23	14.01	1.40	1.27	10.27
2011	3.87	14.10	1.43	1.30	10.33
2012	3.51	14.19	1.46	1.34	10.39
2013	3.15	14.28	1.49	1.37	10.45
2014	2.79	14.37	1.52	1.41	10.51
2015	2.43	14.46	1.55	1.45	10.56
2016	2.07	14.56	1.58	1.48	10.62
2017	1.71	14.65	1.61	1.52	10.68
2018	1.36	14.74	1.64	1.55	10.74
2019	1.00	14.83	1.67	1.59	10.79
2020	0.64	14.92	1.70	1.62	10.85

Table 29. Projected Consumption of Milk, by Study Area, 2010-2020

Year	Memphis	Nashville	Chattanooga	Knoxville	Tri-Cities
			Plain Whole Milk (Gallons)		
2010	4,258,720	6,647,503	1,554,128	2,905,554	1,708,637
2011	3,890,141	6,242,668	1,424,851	2,699,951	1,574,927
2012	3,522,866	5,808,234	1,295,079	2,486,728	1,439,110
2013	3,156,893	5,344,201	1,164,813	2,265,884	1,301,188
2014	2,792,224	4,850,568	1,034,052	2,037,419	1,161,160
2015	2,428,858	4,327,337	902,797	1,801,333	1,019,027
2016	2,069,489	3,750,470	770,371	1,550,210	872,144
2017	1,710,491	3,152,323	637,684	1,294,034	724,070
2018	1,351,863	2,532,896	504,738	1,032,802	574,805
2019	993,607	1,892,187	371,531	766,516	424,350
2020	635,720	1,230,198	238,065	495,175	272,704
			Plain Lowfat and Skim Milk (Gallons)		
2010	14,115,407	22,032,961	5,151,115	9,630,376	5,663,231
2011	14,182,140	22,758,658	5,194,525	9,843,110	5,741,651
2012	14,248,541	23,491,914	5,238,061	10,057,791	5,820,609
2013	14,314,608	24,232,730	5,281,723	10,274,418	5,900,105
2014	14,380,342	24,981,105	5,325,511	10,492,992	5,980,138
2015	14,445,744	25,737,039	5,369,426	10,713,511	6,060,710
2016	14,529,730	26,331,779	5,408,716	10,883,914	6,123,257
2017	14,613,621	26,931,954	5,448,073	11,055,608	6,186,109
2018	14,697,417	27,537,564	5,487,495	11,228,593	6,249,265
2019	14,781,119	28,148,608	5,526,985	11,402,868	6,312,725
2020	14,864,726	28,765,088	5,566,541	11,578,435	6,376,489
			Flavored Lowfat Milk (Gallons)		
2010	1,411,822	2,203,735	515,214	963,229	566,436
2011	1,438,908	2,309,075	527,032	998,674	582,543
2012	1,465,888	2,416,845	538,891	1,034,744	598,823
2013	1,492,760	2,527,045	550,790	1,071,440	615,276
2014	1,519,526	2,639,675	562,730	1,108,761	631,902
2015	1,546,184	2,754,735	574,710	1,146,709	648,701
2016	1,574,786	2,853,935	586,217	1,179,639	663,661
2017	1,603,357	2,954,883	597,744	1,212,984	678,719
2018	1,631,898	3,057,577	609,293	1,246,744	693,874
2019	1,660,408	3,162,019	620,863	1,280,919	709,128
2020	1,688,888	3,268,208	632,455	1,315,509	724,479

Table 30. Projected Consumption of Yogurt and Cheese, by Study Area, 2010-2020

Year	Memphis	Nashville	Chattanooga	Knoxville	Tri-Cities
			Yogurt (Gallons)		
2010	1,277,205	1,993,609	466,089	871,386	512,426
2011	1,310,941	2,103,720	480,161	909,858	530,735
2012	1,344,547	2,216,786	494,283	949,091	549,255
2013	1,378,022	2,332,808	508,455	989,086	567,984
2014	1,411,368	2,451,786	522,676	1,029,841	586,924
2015	1,444,583	2,573,719	536,946	1,071,357	606,074
2016	1,479,594	2,681,423	550,781	1,108,333	623,545
2017	1,514,569	2,791,252	564,643	1,145,813	641,134
2018	1,549,506	2,903,206	578,531	1,183,798	658,842
2019	1,584,407	3,017,285	592,445	1,222,288	676,669
2020	1,619,270	3,133,489	606,384	1,261,282	694,615
			Cheddar Cheese (Pounds)		
2010	10,354,988	16,163,263	3,778,831	7,064,793	4,154,516
2011	10,394,355	16,680,245	3,807,164	7,214,199	4,208,163
2012	10,433,513	17,201,987	3,835,577	7,364,831	4,262,149
2013	10,472,462	17,728,487	3,864,070	7,516,689	4,316,473
2014	10,511,201	18,259,747	3,892,642	7,669,772	4,371,136
2015	10,549,731	18,795,766	3,921,293	7,824,080	4,426,138
2016	10,601,854	19,213,411	3,946,558	7,941,625	4,467,934
2017	10,653,917	19,634,477	3,971,864	8,059,982	4,509,922
2018	10,705,920	20,058,965	3,997,212	8,179,153	4,552,101
2019	10,757,865	20,486,874	4,022,602	8,299,136	4,594,472
2020	10,809,749	20,918,205	4,048,033	8,419,932	4,637,034

Table 31. Dairy Production (100 Cows, 16,500 Annual Production Per Cow) Estimated Costs and Returns

ITEM	DESCRIPTION		UNIT	QUANTITY	PRICE	TOTAL	PER COW
REVENUE							
Milk	100	Cows	cwt	165.00	16.75	276375.00	2763.75
Bull Calves	45	Calves	head	1.00	102.50	4612.50	46.13
Cull Cows	23	Cows	cwt	13.00	75.00	22425.00	224.25
Cull Heifers	15	Heifers	cwt	11.00	83.00	13695.00	136.95
						---	---
			TOTAL REVENUE			317107.50	3171.08
-	-	-	-	-	-	-	-
VARIABLE EXPENSES							
Lactation Feed	100	Cows	ton	3.44	322.00	110768.00	1107.68
Dry Cow Feed	100	Cows	ton	0.14	373.00	5222.00	52.22
Milk Replacer	45	Heifers	lbs	57.00	1.68	4309.20	43.09
Calf Starter	45	Heifers	lbs	57.00	0.24	615.60	6.16
Heifer Feed (18%)	42	Heifers	tons	1.00	380.00	15960.00	159.60
Heifer Feed (14%)	40	Heifers	tons	0.88	237.00	8295.00	82.95
Silage	100	Cows	tons	11.58	50.00	57900.00	579.00
Alfalfa Hay	100	Cows	tons	0.91	160.00	14608.00	146.08
Fescue Hay	100	Cows	tons	0.20	45.00	882.00	8.82
Orchard Grass Hay	100	Cows	tons	0.20	50.00	1000.00	10.00
Orchard Grass Hay	42	Heifers	tons	2.50	50.00	5250.00	52.50
Pasture			acre	82.50	100.00	8250.00	82.50
Breeding			cow	100	50.00	5000.00	50.00
Vet & Med			cow	100	80.00	8000.00	80.00
Dairy Supplies			cow	100	60.00	6000.00	60.00
Bedding			cow	100	66.00	6600.00	66.00
DHIA			cow	100	24.00	2400.00	24.00
Milk Hauling	100	Cows	cwt	165	0.85	14025.00	140.25

Table 31 contd.

ADA	100	Cows	cwt	165	0.15	2475.00		24.75
Electricity			kwh	55836	0.10	5583.60		55.84
Marketing Fees			head	83	16.00	1328.00		13.28
Machinery			hour	1314	9.00	11822.73		118.23
						-	-	
			TOTAL VARIABLE EXPENSES			296294.13		2962.94
		RETURN ABOVE VARIABLE EXPENSES				20813.37		208.13
-	-	-	-	-	-	-	-	
DEPRECIATION, REPAIRS, INSURANCE								
Depreciation	Buildings, equipment					30476.67		304.77
Repairs	Buildings, equipment					16436.00		164.36
Machinery			hour	1314	1.00	1313.64		13.14
Insurance	Buildings, equipment		month	12.00	106.58	1278.96		12.79
						-	-	
			TOTAL FIXED EXPENSES			49505.26		495.05
		TOTAL VARIABLE & FIXED EXPENSES				345799.39		3457.99
RETURN TO LAND, LABOR, CAPITAL, MANAGEMENT, RISK						-28691.89		-286.92
-	-	-	-	-	-	-	-	
INTEREST								
Cows						7800.00		78.00
Bldgs. & Equip						16665.00		166.65
Machinery			hour	1314	1.12	1471.27		14.71
						-	-	
			TOTAL INTEREST EXPENSE			25936.27		259.36
		TOTAL VARIABLE, FIXED, INTEREST EXPENSE				371735.66		3717.36
NET RETURN TO LAND, LABOR, MANAGEMENT, RISK						-54628.16		-546.28
-	-	-	-	-	-	-	-	

Table 31 contd.

LABOR EXPENSES					
LABOR	hour	6000	10.00	60000.00	600.00
TOTAL ALL EXPENSES				431735.66	4317.36
RETURN TO LAND, MANAGEMENT, RISK				-114628.16	-1146.28

Table 32. Dairy Production Receipt Explanations

Row 9 is milk sales. This is the milk from 100 cows. It is assumed that each cow will average 16,500 pounds of milk (UT Extension 2011). The price of milk can fluctuate greatly. Currently, a cwt of milk is $16.75 (USDA-AMS 2012a). The price is an average of the Appalachian and Southeast Milk Marketing Orders. The total sales from 165 cwts of milk are $276,375. Row 10 is bull calf sales. It is assumed that a 90% live birthrate, 50% of calves will be bull calves and calves will be sold at 3 days old (UT Extension 2011). There will be 45 bull calves sold at $102.50 (USDA-AMS 2012b). Total sales from bull calves will be $4,612.50. Row 11 is cull cow sales. It is assumed that a 25% cull rate will be used with 2 cows dying yearly (UT Extension 2011). There will be 23 cows averaging 13 cwt. Cull cows are sold for $75.00 per cwt (USDA-AMS 2012b). Total sales from cull cows will be $22,425. Row 12 is cull heifer sales. It is assumed that 25 heifers will be kept and 15 will be sold (UT Extension 2011). There will be 15 heifers averaging 11 cwt. Heifers are sold for $83.00 per cwt (USDA-AMS 2012b). Total sales from cull heifers are $13,695. Total Revenue is $317,107.50.

Variable expenses are mostly comprised of feed costs. Rows 18-29 are feed costs. Row 18 is lactation feed. It is assumed that 100 cows will each consume 3.44 tons (UT Extension 2011). Lactation feed costs $322 per ton for a total cost of $110,768 (TN Co-Op 2011b). Row 19 is dry cow feed. It is assumed that each cow will each consume 0.14 tons (UT Extension 2011). Dry cow feed costs $373 per ton for a total cost of $5,222 (TN Co-Op 2011b). Row 20 is milk replacer. It is assumed that 45 heifers will each consume 57 pounds (UT Extension 2011). Milk replacer costs $1.68 per pound for a total cost of $4309.20 (TN Co-Op 2011a). Row 21 is calf starter. It is assumed that 45 heifers will each consume 57 pounds (UT Extension 2011). Calf starter costs $0.24 per pound for a total cost of $615.60 (TN Co-Op 2011a). Row 22 is heifer

Table 32 contd.

feed (18%). It is assumed that 42 heifers will each consume 1 ton (UT Extension 2011). Heifer feed (18%) costs $380 per ton for a total cost of $15,960 (TN Co-Op 2011b). Row 23 is heifer feed (14%). It is assumed that 40 heifers will each consume 0.88 tons (UT Extension 2011). Heifer feed (14%) costs $237 per ton for a total cost of $8,295 (TN Co-Op 2011a). Row 24 is silage. It is assumed that 100 cows will each consume 11.58 tons (UT Extension 2011). Silage costs $50 per ton for a total cost of $57,900 (Eric Goan 2011). Row 25 is alfalfa hay. It is assumed that 100 cows will each consume 0.91 tons (UT Extension 2011). Alfalfa hay costs $160 per ton for a total cost of $14,608 (Eric Goan 2011). Row 26 is fescue hay. It is assumed that 100 cows will each consume 0.20 tons (UT Extension 2011). Alfalfa hay costs $45 per ton for a total cost of $882 (Eric Goan 2011). Row 27 is orchard grass hay. It is assumed that 100 cows will each consume 0.20 tons (UT Extension 2011). Orchard grass hay costs $50 per ton for a total cost of $1,000 (Eric Goan 2011). Row 28 is orchard grass hay. It is assumed that 42 heifers will each consume 2.50 tons (UT Extension 2011). Orchard grass hay costs $50 per ton for a total cost of $5,250 (Eric Goan 2011). Row 29 is pasture. It is assumed that the dairy will use 82.50 acres of pasture land (UT Extension 2011). Pasture costs $100 per acre to use and maintain for a total cost of $8,250 (UT Extension 2011).

Rows 30-39 are other variable costs related to maintenance and production. Row 30 is breeding. It is assumed that artificial insemination is used. Costs can vary depending on the semen used. Breeding costs $50 per cow for a total cost of $5,000. Row 31 is veterinarian and medicine. This will include veterinarian visits, vaccines, medicines, and hoof trimming. Costs vary greatly depending on the vaccines and vet program used. Veterinarian and medicine costs $80 per cow for a total of $8,000. Row 32 is dairy supplies. This will include paper towels,

Table 32 contd.

sanitizing solution, teat dip, dip cup, inflation lines, milk line, filter socks, vacuum pump oil, jetter cups, recharge kit for test kits, etc. Dairy supplies cost $60 per cow for a total of $6,000. Row 33 is bedding. It is assumed that sand is used. Bedding costs $66 per cow for a total of $6,600 (Rhea 2012). Row 34 is DHIA. Each cow costs $2.00 per month or $24 per year for a total of $2400 (Mitchell 2011). Row 35 is milk hauling. Each cow will produce 165 cwt. It costs $0.85 per cwt to haul for a total of $14,025 (Local Farmer 2011). Row 36 is ADA (check-off). Each cow will produce 165 cwt. It costs $0.15 per cwt for a total of $2,475. Row 37 is electricity. It is assumed that 55,836 kwh will be used (UT Extension 2011). Electricity costs approximately $0.10 per kwh for a total of $5,583.60. Row 38 is marketing fees. This is the cost to sell 83 bull calves, cull cows or heifers. The average cost is $16 per animal for a total of $1,328. Row 39 is machinery costs. This is the variable expense associated to run the equipment. There are 1,314 hours that cost $9 per hour for a total of $11,822.73. The total variable cost is $ 296,294.13.

Rows 45-48 are depreciation, repairs and insurance. Row 45 is depreciation for buildings and equipment. It costs $30,476.67 using the depreciation schedule in Table 33. Row 46 is repairs for buildings and equipment. It costs $16,436.00 using the repair schedule in Table 33. Row 47 is fixed costs for machinery. It costs $1,313.64 using the schedule in Table 33. Row 48 is insurance. It costs $106.58 to insure the property and equipment for a total of $1,278.96. Total fixed costs are $49,505.26.

Rows 55-57 are interest costs. Row 55 is interest on cows. It costs $7,800. Row 56 is interest on buildings and equipment. It costs $16,665. Row 57 is interest on machinery. It costs $1.12 per hour for a total of $1,471.27. Total interest costs are $25,936.27.

Table 32 contd.

Row 66 is labor expenses. A dairy requires 6,000 hours to operate (UT Extension 2011). Each hour is $10 for a total labor cost of $60,000. The total for all expenses is $431,735.66. The return to land, management and risk is $ -114,628.16.

Table 33. Dairy Production Building, Equipment, and Livestock Fixed Expenses

ITEM	COST ($)	INTEREST RATE (%)	LIFE (YEARS)	DEPREC. ($/YEAR)	INTEREST ($/YEAR)	REPAIRS ($/YEAR)	TOTAL ($/YEAR)
Buildings and Equipment							
Milk Parlor	63000	6.00	20	3150.00	1890.00	1260.00	6300.00
Milking Equipment	136000	6.00	15	9066.67	4080.00	6800.00	19946.67
Free Stall Barn	64000	6.00	20	3200.00	1920.00	1920.00	7040.00
Pole Barn	23000	6.00	20	1150.00	690.00	230.00	2070.00
Calf Hutches	6000	6.00	10	600.00	180.00	300.00	1080.00
Heifer Barn	20000	6.00	20	1000.00	600.00	1000.00	2600.00
Heifers Feeders	7700	6.00	10	770.00	231.00	385.00	1386.00
Bunkers	83000	6.00	50	1660.00	2490.00	415.00	4565.00
4-Bay Commodity Shed	25000	6.00	20	1250.00	750.00	250.00	2250.00
3-ton Hopper Bin	1800	6.00	10	180.00	54.00	36.00	270.00
Manure Pit	38000	6.00	20	1900.00	1140.00	380.00	3420.00
Lagoon	45000	6.00	20	2250.00	1350.00	450.00	4050.00
Mixing Wagon	20000	6.00	10	2000.00	600.00	1400.00	4000.00
Manure Spreader	15000	6.00	10	1500.00	450.00	1050.00	3000.00
20 ft Cattle Trailer	8000	6.00	10	800.00	240.00	560.00	1600.00
				-	-	-	-
TOTAL BUILDLINGS AND EQUIPMENT				30476.67	16665.00	16436.00	63577.67
Livestock							
Cows $1300	130000	6.00		n. a.	7800.00	n. a.	7800.00
	Hours	Int/Hr	Total Int	FC/HR	VC/HR	Total FC	Total VC
Machinery							
Tractor, 85 HP	500	1.12	560.00	1.00	9.00	500.00	4500.00

Table 33 contd.

Tractor, 110 HP	150	1.12	168.00	1.00	9.00	150.00	1350.00
Skid Steer	300	1.12	336.00	1.00	9.00	300.00	2700.00
	---		---			---	---
	950		1064.00			950.00	8550.00
	Miles	Int/Mile	Total Int	FC/Mile	VC/Mile	Total FC	Total VC
3/4 Ton Pickup	20000	0.02	400	0.018	0.164	360	3280
	---		---			---	---
Total Machinery	1314		1464.00			1310.00	11830.00

Table 34. Dairy Production Future Projections, 2011-2021

CASH INFLOWS	Individual Time Periods											Total for
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All Periods
Milk	$276,375	$292,819	$310,242	$328,701	$348,259	$368,981	$390,935	$414,196	$438,840	$464,951	$492,616	$4,126,916
Bull Calves	$4,613	$4,887	$5,178	$5,486	$5,812	$6,158	$6,524	$6,913	$7,324	$7,760	$8,221	$68,875
Cull Calves	$22,425	$23,759	$25,173	$26,671	$28,258	$29,939	$31,720	$33,608	$35,607	$37,726	$39,971	$334,857
Cull Heifers	$13,695	$14,510	$15,373	$16,288	$17,257	$18,284	$19,372	$20,524	$21,746	$23,039	$24,410	$204,498
Total Cash Inflows	**$317,108**	**$335,975**	**$355,966**	**$377,146**	**$399,586**	**$423,361**	**$448,551**	**$475,240**	**$503,517**	**$533,476**	**$565,218**	$4,735,146

CASH OUTFLOWS	Individual Time Periods											Total for
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All Periods
Lactation Feed	$110,768	$116,428	$122,378	$128,631	$135,204	$142,113	$149,375	$157,008	$165,031	$173,465	$182,329	$1,582,731
Dry Cow Feed	$5,222	$5,489	$5,769	$6,064	$6,374	$6,700	$7,042	$7,402	$7,780	$8,178	$8,596	$74,616
Milk Replacer	$4,309	$4,529	$4,761	$5,004	$5,260	$5,529	$5,811	$6,108	$6,420	$6,748	$7,093	$61,573
Calf Starter	$616	$647	$680	$715	$751	$790	$830	$873	$917	$964	$1,013	$8,796
Heifer Feed (18%)	$15,960	$16,776	$17,633	$18,534	$19,481	$20,476	$21,523	$22,623	$23,779	$24,994	$26,271	$228,048
Heifer Feed (14%)	$8,295	$8,719	$9,164	$9,633	$10,125	$10,642	$11,186	$11,758	$12,359	$12,990	$13,654	$118,525
Silage	$57,900	$60,859	$63,969	$67,237	$70,673	$74,285	$78,081	$82,070	$86,264	$90,672	$95,306	$827,316
Alfalfa Hay	$14,608	$15,354	$16,139	$16,964	$17,831	$18,742	$19,699	$20,706	$21,764	$22,876	$24,045	$208,729
Fescue Hay	$882	$927	$974	$1,024	$1,077	$1,132	$1,189	$1,250	$1,314	$1,381	$1,452	$12,603
Grass Hay	$1,000	$1,051	$1,105	$1,161	$1,221	$1,283	$1,349	$1,417	$1,490	$1,566	$1,646	$14,289
Grass Hay	$5,250	$5,518	$5,800	$6,097	$6,408	$6,736	$7,080	$7,442	$7,822	$8,222	$8,642	$75,016
Pasture	$8,250	$8,672	$9,115	$9,580	$10,070	$10,585	$11,125	$11,694	$12,292	$12,920	$13,580	$117,882
Breeding	$5,000	$5,256	$5,524	$5,806	$6,103	$6,415	$6,743	$7,087	$7,449	$7,830	$8,230	$71,443
Vet & Med	$8,000	$8,409	$8,838	$9,290	$9,765	$10,264	$10,788	$11,340	$11,919	$12,528	$13,168	$114,310
Dairy Supplies	$6,000	$6,307	$6,629	$6,968	$7,324	$7,698	$8,091	$8,505	$8,939	$9,396	$9,876	$85,732
Bedding	$6,600	$6,937	$7,292	$7,664	$8,056	$8,468	$8,900	$9,355	$9,833	$10,336	$10,864	$94,305
DHIA	$2,400	$2,523	$2,652	$2,787	$2,929	$3,079	$3,236	$3,402	$3,576	$3,758	$3,950	$34,293
Milk Hauling	$14,025	$14,742	$15,495	$16,287	$17,119	$17,994	$18,913	$19,880	$20,896	$21,963	$23,086	$200,399
ADA	$2,475	$2,601	$2,734	$2,874	$3,021	$3,175	$3,338	$3,508	$3,687	$3,876	$4,074	$35,365

Table 34 contd.

Electricity	$5,584	$5,869	$6,169	$6,484	$6,815	$7,164	$7,530	$7,914	$8,319	$8,744	$9,191	$79,782
Marketing Fees	$1,328	$1,396	$1,467	$1,542	$1,621	$1,704	$1,791	$1,882	$1,979	$2,080	$2,186	$18,975
Machinery	$11,823	$12,427	$13,062	$13,729	$14,431	$15,168	$15,943	$16,758	$17,614	$18,515	$19,461	$168,931
Depreciation (Buildings & Equip)	$30,477	$30,477	$30,477	$30,477	$30,477	$30,477	$30,477	$30,477	$30,477	$30,477	$30,477	$335,243
Repairs (Buildings & Equip)	$16,436	$17,276	$18,159	$19,087	$20,062	$21,087	$22,165	$23,297	$24,488	$25,739	$27,054	$234,849
Machinery (Dep., Housing)	$1,314	$1,381	$1,451	$1,525	$1,603	$1,685	$1,771	$1,862	$1,957	$2,057	$2,162	$18,770
Insurance	$1,279	$1,344	$1,413	$1,485	$1,561	$1,641	$1,725	$1,813	$1,906	$2,003	$2,105	$18,275
Cows (Interest)	$7,800	$8,199	$8,618	$9,058	$9,521	$10,007	$10,519	$11,056	$11,621	$12,215	$12,839	$111,452
Bldgs. & Equip (Interest)	$16,665	$17,517	$18,412	$19,353	$20,341	$21,381	$22,473	$23,622	$24,829	$26,098	$27,431	$238,121
Machinery (Interest)	$1,471	$1,546	$1,625	$1,709	$1,796	$1,888	$1,984	$2,085	$2,192	$2,304	$2,422	$21,023
Labor	$60,000	$63,066	$66,289	$69,676	$73,236	$76,979	$80,912	$85,047	$89,393	$93,961	$98,762	$857,322
	$431,736	**$452,240**	**$473,792**	**$496,446**	**$520,257**	**$545,284**	**$571,591**	**$599,242**	**$628,306**	**$658,855**	**$690,965**	$6,068,713

	Individual Time Periods											Total for
SUMMARY	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All Periods
Net Cash Flow	**($114,628)**	**($116,265)**	**($117,826)**	**($119,300)**	**($120,670)**	**($121,923)**	**($123,039)**	**($124,002)**	**($124,789)**	**($125,379)**	**($125,747)**	**($1,333,567)**
Beginning cash balance	$0											
Cumulative Net Cash Flow	**($114,628)**	**($230,893)**	**($348,719)**	**($468,019)**	**($588,689)**	**($710,612)**	**($833,651)**	**($957,653)**	**($1,082,442)**	**($1,207,820)**	**($1,333,567)**	

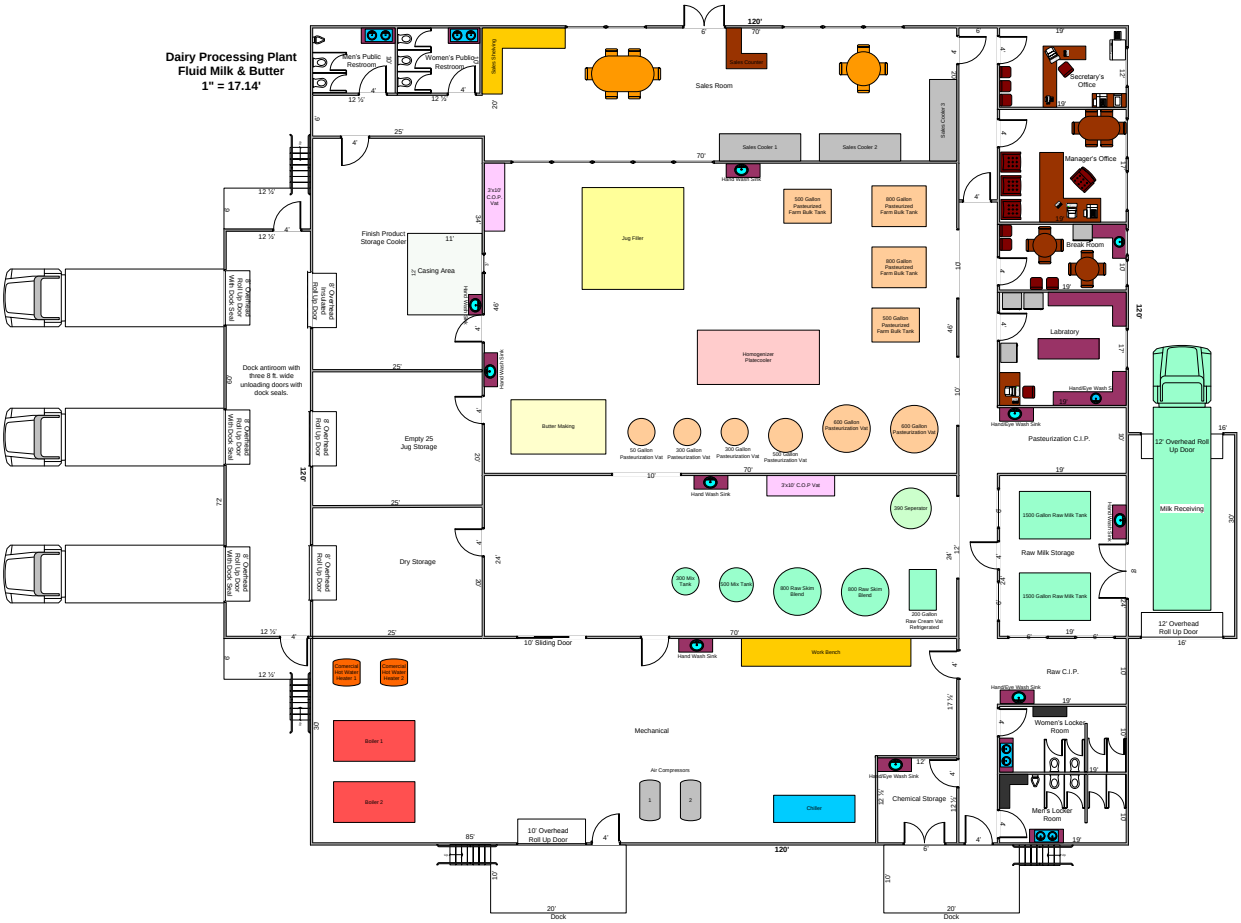


Figure 26. Dairy Processing Plant Layout (Burch and Goan 2011a)

Table 35. Value-Added Milk Production Estimated Costs and Returns

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
REVENUE						
Milk Sales	1 Year	Quart	255813	2.25	575579.25	5755.79
Milk Sales	1 Year	1/2 Gal	127906	2.75	351741.50	3517.42
Milk Sales	1 Year	Gal	63953	3.75	239823.75	2398.24
Butter Sales	1 Year	Pound	36094	4.25	153399.50	1534.00
					---	---
		TOTAL REVENUE			1320544.00	13205.44
-	- -	-	-	-	-	-
VARIABLE EXPENSES						
Fluid Milk	100 Cows	cwt	165.00	16.75	276375.00	2763.75
Vitamin A Palmitate		kg	77	60.00	4604.62	46.05
Vitamin D3		kg	77	200.00	15348.74	153.49
Cocoa		pound	600	6.75	4047.05	40.47
Sugar		pound	2398	0.75	1798.69	17.99
Starch		pound	199	5.00	995.27	9.95
Salt		pound	199	0.63	125.40	1.25
Carrageenan		pound	8	43.00	340.31	3.40
Inhibitor testing		Test Kit	9	65.00	585.00	5.85
Petrifilm Testing		50 Pack	5	70.00	350.00	3.50
Pasteurization Check		Test Kit	3	40.00	120.00	1.20
PH & Acidity Checking		50 Pack	5	20.00	100.00	1.00
Direct Microscopic Slides		70 Pack	4	5.00	20.00	0.20
Utilities		Month	12	2000.00	24000.00	240.00
Cleaning Supplies		Day	156	33.62	5243.94	52.44
Jugs-Quart		EA	255813	0.31	79302.03	793.02
Jugs-1/2 Gal		EA	127906	0.35	44767.10	447.67
Jugs-Gal		EA	63953	0.38	24302.14	243.02
Caps		EA	447672	0.03	13430.16	134.30
Labels		EA	483766	0.03	14512.98	145.13

Table 35 contd.

Butter Packaging		EA	36094	0.02	721.88	7.22
Cardboard Boxes		EA	46639	0.75	34979.06	349.79
Supplies		Month	12	1250.00	15000.00	150.00
Transportation		Month	12	20833.33	249999.96	2500.00
Waste and Wastewater Treatment		Month	12	94.58	1134.96	11.35
Lot Improvements		Month	12	75.00	900.00	9.00
Advertising/Marketing		Month	12	4166.67	50000.04	500.00
Product Loss/Samples		Month	12	3333.33	39999.96	400.00
Phone and Internet		Month	12	1000.00	12000.00	120.00
Credit Card Transaction Fees		Month	12	130.68	1568.15	15.68
FICA		Month	12	1075.59	12907.07	129.07
Insurance		Month	12	876.39	10516.68	105.17
Worker's Comp		Month	12	684.75	8217.00	82.17
Unemployment Taxes		Month	12	213.75	2565.00	25.65
Licenses, Permits and Fees		Month	12	25.00	300.00	3.00
Secretarial/Bookkeeping/Accounting		Month	12	1666.66	19999.92	200
Legal Costs		Month	12	625.00	7500.00	75.00
					-	-
			TOTAL VARIABLE EXPENSES		978678.12	9786.78
		RETURN ABOVE VARIABLE EXPENSES			341865.88	3418.66
-	-	-	-	-	-	-
DEPRECIATION AND REPAIRS						
Depreciation	Equipment & Building				89210.00	892.10
Repairs	Equipment & Building				27715.00	277.15
					-	-
			TOTAL FIXED EXPENSES		116925.00	1169.25
		TOTAL VARIABLE & FIXED EXPENSES			1095603.12	10956.03
RETURN TO LAND, LABOR, CAPITAL, MANAGEMENT, RISK					224940.88	2249.41

Table 35 contd.

INTEREST							
Equipment						71013.00	710.13
						-	-
			TOTAL INTEREST EXPENSE			71013.00	710.13
			TOTAL VARIABLE, FIXED, INTEREST EXPENSE			1166616.12	11666.16
NET RETURN TO LAND, LABOR, MANAGEMENT, RISK						153927.88	1539.28
-	-	-	-	-	-	-	-
LABOR EXPENSES							
LABOR			hour	14872	10.00	148720.00	1487.20
			TOTAL ALL EXPENSES			1315336.12	13153.36
			RETURN TO LAND, MANAGEMENT, RISK			5207.88	52.08

Table 36. Value-Added Milk Production Receipt Explanations

Row 9 is the milk sales for 1 year of milk bottled in quarts. The quantity is 255,813. This is calculated by dividing 191,860 gallons by 3 and then multiplying by 4 since there are 4 quarts in a gallon. The price of $2.25 is an average of the wholesale and retail prices of 2%, whole, skim, and chocolate milk bottled in quarts. The total is the quantity multiplied by the price; this is gross sales of milk bottled in quarts which is $575,579. The per cow value is the total divided by 100 since there are 100 cows in the dairy; this is the value per cow of milk bottled in quarts. Row 10 is the milk sales for 1 year of milk bottled in ½ gallons. The quantity is 127,906. This is calculated by dividing 191,860 gallons by 3 and then multiplying by 2 since there are 2 ½ gallons in a gallon. The price of $2.75 is an average of the wholesale and retail prices of 2%, whole, skim, and chocolate milk bottled in ½ gallons. The total is the quantity multiplied by the price; this is gross sales of milk bottled in ½ gallons which is $351,742. The per cow value is the total divided by 100 since there are 100 cows in the dairy; this is the value per cow of milk bottled in ½ gallons. Row 11 is the milk sales for 1 year of milk bottled in gallons. The quantity is 63,953. This is calculated by dividing 191,860 gallons by 3. The price of $3.75 is an average of the wholesale and retail prices of 2%, whole, skim, and chocolate milk bottled in gallons. The total is the quantity multiplied by the price; this is gross sales of milk bottled in gallons which is $239,824. The per cow value is the total divided by 100 since there are 100 cows in the dairy; this is the value per cow of milk bottled in gallons. Row 12 is the butter sales for 1 year of 1 pound blocks. Using the fat content percentage and overrun percentage from McKay and Larsen (1922), butter can be calculated. First the total amount of cream is calculated by multiplying total milk pounds of 1,650,000 by 3.5% fat. There is 57,750 pounds of cream. The total amount of cream is subtracted from by the fat put back into the milk. Whole milk makes up 20% of

Table 36 contd.

production, which is 330,000 pounds and has 3.25% fat that equals 10,725 pounds of cream added back to milk. 2% milk makes up 50% of production, which is 825,000 pounds and has 2% fat that equals 16,500 pounds of cream added back to milk. Skim milk is fat-free; therefore, it does not require fat added back into the milk. Chocolate milk is formulated using 2% milk. Chocolate milk makes up 5% of production, which is 82,500 pounds and has 2% fat that equals 1,650 pounds of cream added back to milk. The cream for the milk products is 28,875 pounds. The cream used in the milk is subtracted from the 57,750 pounds of total cream. The remainder of cream that is used for butter is 28,875 pounds. Using the overrun of 125%, the total pounds of butter is 36,094. The total for butter is $153,400.The total revenue is the total prices of each product added together which is $1,320,544. The total revenue per cow is total revenue divided by 100 cows.

Variable Expenses are rows 18-54. Row 18 is fluid milk. This is the total milk produced from the 100-cow dairy. There are 100 cows each producing 165 cwt of milk (16,500 pounds) and the milk price per cwt is $16.75. The total amount is $276,375, which is calculated by multiplying the number of cows by the amount of milk production by the price of milk. Row 19 is Vitamin A Palmitate. It is an ingredient that is added to milk. It is commonly sold by kilograms. The recipe was developed by comparing numerous recipes online. It requires 1 kilogram per 10,000 quarts. There is 767,436 total quarts of milk which is divided by 10,000 to equal 77 kilograms used in production. The price per kilogram of $60 is an average price used by comparing numerous online food service prices. The total cost of $4,604.62 is the price multiplied by the quantity. Row 20 is Vitamin D3, which is also an ingredient that is added to

Table 36 contd.

milk. Following the same process as Vitamin A Palmitate, is also requires 77 kilograms. The price is $200 per kilogram which gives a total of $15,348.74.

Rows 21-25 are ingredients used in the production of chocolate milk. The recipe was developed by comparing numerous recipes online. Chocolate milk is 5% of total production, which is 38,372 quarts. Row 21 is cocoa, the recipe calls for 0.25 oz per quart. There are 16 oz in a pound. The quantity of 600 pounds is calculated by multiplying the quarts by the oz of product and then dividing by 16 to get the total pounds of cocoa used in production. The price is $6.75 per pound and the total is calculated by multiplying the quantity and price together to equal $4,047.05. Row 22 is sugar. Similar to cocoa, the recipe calls for 1 oz of sugar per quart; the quantity will be 2398 pounds. The price is $0.75 per pound. The total will be $1798.69. Row 23 is cornstarch. Similar to cocoa, the recipe calls for 0.083 oz of cornstarch per quart; the quantity will be 199 pounds. The price is $5.00 per pound. The total will be $995.27. Row 24 is salt. Similar to cocoa, the recipe calls for 0.083 oz of salt per quart; the quantity will be 199 pounds. The price is $0.63 per pound. The total will be $125.40. Row 25 is carrageenan. Similar to cocoa, the recipe calls for 0.0033 oz of carrageenan per quart; the quantity will be 8 pounds. The price is $43.00 per pound. The total will be $340.31.

Rows 26-30 are laboratory supplies purchased on a yearly basis. Costs came from online scientific chemical companies. The laboratory supply list was provided by Burch and Goan (2011a). Row 26 is inhibitor (antibiotic) testing. Testing the milk 4 times a week, will require 208 tests a year. Inhibitor testing kits have 25 tests in each kit. That will require 9 kits, each costing $65 giving a total cost of $585. Row 27 is Petrifilm^{TM} testing. Testing the milk 4 times a week, will require 208 tests a year. Petrifilm^{TM} is packaged in 50-packs. That will require 5

Table 36 contd.

packs, each costing $70 giving a total cost of $350. Row 28 is pasteurization check. Testing the milk 4 times a week, will require 208 tests a year. Pasteurization check kits have 100 tests in each kit. That will require 3 kits, each costing $40 giving a total cost of $120. Row 29 is pH and acidity checking. Testing the milk 4 times a week, will require 208 tests a year. pH and acidity checking is packaged in 50-packs. That will require 5 packs, each costing $20 giving a total cost of $100. Row 30 is direct microscopic slides that will be used with a microscope. Testing the milk 4 times a week, will require 208 tests a year. Direct microscopic slides are packaged in 70-packs. That will require 4 packs, each costing $5 giving a total cost of $20.

Row 31 presents utility costs. Using an estimate from an on-farm processer, it is expected that utilities will cost $2,000 a month and $24,000 per year. The electric system will use a 3-phase, 440 volt. Row 32 is cleaning supplies. Since the dairy farm is processing 3 times a week, the facility will need to be cleaned after each processing which will be 156 times a year. Using a quote from an on-farm processor, each cleaning requires 4.5 gallons of detergent that costs $4.95 per gallon, 1.5 gallons of acid that costs $6.06 per gallon, and 16 oz of sanitizer that costs $18.00 per gallon. Each cleaning will cost a total of $33.62 and a total of $5,243.94 per year.

Rows 33-39 include packaging item costs. Using a quote from a national packaging supplier, prices were assigned to jugs and caps. Row 33 is quart size plastic jugs. 255,813 quarts will be packaged with a cost of $0.31 a jug which gives a total cost of $79,302.03. Row 34 is ½ gallon jugs. 127,906 ½ gallons will be packaged with a cost of $0.35 a jug which gives a total cost of $44,767.10. Row 35 is 1 gallon jugs. 63,953 gallons will be packaged with a cost of $0.38 a jug which gives a total cost of $24,302.14. Row 36 is caps. Caps will fit all jugs. 447,672 caps will be used that cost $0.03 which gives a total of $13,430.16. Row 37 is labels. The price is an

Table 36 contd.

average online price of an adhesive label. 483,766 is the amount of labels for milk and butter products. At a cost of $0.03 a piece, the total cost will be $14,512.98. Row 38 is butter packaging. The price is an average online price of a wax-based wrap. 36,094 blocks of butter with a packaging cost of $0.02 a piece, the total cost will be $721.88. Row 39 is cardboard boxes. The price is an average online price of a 12x12x12 box. Only the products sold on a wholesale market will be boxed. The capacity for each box is 4 gallons/8 ½ gallons/16 quarts/32 blocks of butter. 45,567 boxes will be used for milk packaging and 1,072 boxes will be used for butter packaging which is a total of 46,639 boxes. At a cost of $0.75 per box, the total cost is $34,979.06.

Rows 40-54 contain overhead costs for the processing plant. Row 40 is supplies; this includes office supplies, plant supplies, miscellaneous supplies, travel, and education and convention dues. Travel costs and education and convention fees can vary greatly depending on the number of seminars and schools that are attended by the processing plant work force. Supplies cost is estimated to be $1,250 per month and $15,000 per year. Row 41 is transportation costs, which vary depending on the location of the processing facility and the number of deliveries. The processing facility is bottling milk 3 times a week; deliveries will be the day after processing in order to provide the freshest milk. Transportation costs are an estimate from an on-farm processor which is $20,833 per month and $250,000 per year. Row 42 is Waste and Wastewater Treatment. The yearly cost of maintenance for a 1.2 million gallon lagoon that is used in the dairy farm budget is $4,050 per year. Each cleaning will require 255 gallons, which is approximately 40,000 gallons of waste per year. The cost per gallon is $0.003375. The total cost to add the additional waste to the lagoon is $135 per year. Water costs are $25.00 per thousand

Table 36 contd.

gallons which will be approximately $1,000 per year in water costs. The total costs for waste and wastewater treatment is $95 per month and $1,035 per year. Row 43 is lot improvement costs. This is the estimated costs for maintaining a parking lot, driveway, and landscape. The total cost is $75 per month and $900 per year. Row 44 is Advertising/Marketing. It will include donations, ads for billboards and radio, social media, and printed ads. Costs can vary greatly depending on the level of commitment to advertising/marketing. The price is a quote from an on-farm processor. The total costs are $4,167 per month and $50,000 per year. Row 45 is product loss/samples. Using a quote from an on-farm processor, it is estimated that the total costs will be $3,333 per month and $40,000 per year. Row 46 is phone and internet. The cost for service and maintenance of a commercial phone package is $3,000 per year. The cost for service and maintenance for internet that includes the ability to sell products online is $9,000. The total costs are $1,000 per month and $12,000 per year. Row 47 is credit card transaction fees. 5% of sales are on the retail market, it is assumed that 95% of retail sales will be purchased with a credit/debit card. This is 4.75% of total sales which is $62,725.84. Credit card fees are 2.5%. Total credit card costs will be $131 per month and $1,568 per year. Row 48 is FICA. This is social security and Medicare taxes which has a rate of 7.65%. The gross labor costs are $168,720; therefore, the total FICA taxes are $1,075.59 and $12,907 per year. Row 49 is Insurance. This will include general liability, building and equipment insurance, vehicle insurance, and product liability. The price is a quote from a national insurance company. The total costs are $876.39 per month and $10,517 per year. Row 50 is worker's compensation. It is a quote from a national insurance company. The total cost is $684.75 per month and $8,217 per year. Row 51 is unemployment taxes. The state of Tennessee's unemployment tax rate is 2.7%

Table 36 contd.

for the first $9,000 of earnings by each employee. The federal tax rate is 0.6% for the first $7,000 of earnings by each employee. There are 9 employees so state unemployment tax is $2,187 and the federal tax is $378. The total tax rate is $213.75 per month and $2,565 per year. Row 52 is licenses, permits and fees. This is the cost to have the necessary permits and licenses to operate the processing facility. The cost is a quote from an on-farm processor. The total costs are $25 per month and $300 per year. Row 53 is secretarial/bookkeeping/accounting. This is the cost to employ a full-time secretary at $10 per hour. The costs are $1,667 per month and $20,000 per year. Row 54 is legal costs. This includes CPA and attorney fees that will be incurred throughout the year. The cost is a quote from an on-farm processor. The total costs are $625 per month and $7,500 per year.

Rows 60-61 are depreciation and repairs. Depreciation is $89,210 and repairs are $27,715. The costs are from Table 41. Row 68 is the interest expense which is shown in Table 41. The interest expense is $71,013.

Row 77 is labor. The labor schedule by hour is in Table 10. The labor expenses are $148,720. A weekly schedule of hours is included in Table 42. There will be four full-time workers and four part-time workers to operate and maintain the milk processing facility. The four full-time employees will be dedicated to deliveries, retail sales, and processing. The four part-time employees will be dedicated to packaging and processing if needed. The part-time employees will each work 25 hours a week. The total costs are $1,315,336.12. The return to land, management, and risk is $5,207.88.

Table 37. Value-Added Cheese Production Estimated Costs and Returns

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
REVENUE						
Cheese Sales	1 Year	1/2 lb.	104000	5.00	520000.00	5200.00
		TOTAL REVENUE			520000.00	5200.00
VARIABLE EXPENSES						
Fluid Milk		cwt	5200	16.75	87100.00	871.00
Coloring		ounces	520	0.50	260.00	2.60
Salt		pounds	1482	0.63	933.66	9.34
Calcium Chloride		ounces	1560	0.38	596.70	5.97
Starter Cultures		pounds	624	1.84	1148.16	11.48
Rennet		ounces	1560	2.00	3120.00	31.20
Inhibitor testing		Test Kit	3	65.00	195.00	1.95
Petrifilm Testing		50 Pack	2	70.00	140.00	1.40
Pasteurization Check		Test Kit	1	40.00	40.00	0.40
PH & Acidity Checking		50 Pack	2	20.00	40.00	0.40
Direct Microscopic Slides		70 Pack	1	5.00	5.00	0.05
Utilities		Month	12	1375.00	16500.00	165.00
Cleaning Supplies		Day	52	11.63	604.76	6.05
Packaging		EA	104000	0.02	2080.00	20.80
Labels		EA	104000	0.03	3120.00	31.20
Supplies		Month	12	833.33	9999.96	100.00
Transportation		Month	12	4583.33	54999.96	550.00
Waste and Wastewater Treatment		Month	12	31.35	376.25	3.76
Lot Improvements		Month	12	75.00	900.00	9.00
Advertising/Marketing		Month	12	2500.00	30000.00	300.00
Product Loss/Samples		Month	12	1666.66	19999.92	200.00
Phone and Internet		Month	12	1000.00	12000.00	120.00
Credit Card Transaction Fees		Month	12	1029.17	12350.00	123.50

Table 37 contd.

FICA		Month	12	391.17	4694.04	46.94
Insurance		Month	12	846.24	10154.88	101.55
Worker's Comp		Month	12	356.75	4281.00	42.81
Unemployment Taxes		Month	12	95.00	1140.00	11.40
Licenses, Permits and Fees		Month	12	25.00	300.00	3.00
Secretarial/Bookkeeping/Accounting		Month	12	1250.00	15000.00	150.00
Legal Costs		Month	12	416.66	4999.92	50.00
					-	-
		TOTAL VARIABLE EXPENSES			297079.21	2970.79
		RETURN ABOVE VARIABLE EXPENSES			222920.79	2229.21
-	- -	-	-	-	-	-
DEPRECIATION AND REPAIRS						
Depreciation	Equipment & Building				67570.00	675.70
Repairs	Equipment & Building				21123.00	211.23
					-	-
		TOTAL FIXED EXPENSES			88693.00	886.93
		TOTAL VARIABLE & FIXED EXPENSES			385772.21	3857.72
RETURN TO LAND, LABOR, CAPITAL, MANAGEMENT, RISK					134227.79	1342.28
-	- -	-	-	-	-	-
INTEREST						
Equipment					61342.50	613.43
					-	-
		TOTAL INTEREST EXPENSE			61342.50	613.43
		TOTAL VARIABLE, FIXED, INTEREST EXPENSE			447114.71	4471.15
NET RETURN TO LAND, LABOR, MANAGEMENT, RISK					72885.29	728.85
-	- -	-	-	-	-	-

Table 37 contd.

LABOR EXPENSES					
LABOR	hour	6136	10.00	61360.00	613.60
TOTAL ALL EXPENSES				508474.71	5084.75
RETURN TO LAND, MANAGEMENT, RISK				11525.29	115.25

Table 38. Value-Added Cheese Production Receipt Explanations

Row 9 is the cheese sales for 1 year of production. The cheese is packaged in ½ pound blocks. With 52,000 pounds of cheese, there will be 104,000 ½ blocks of cheese. Each cheese block will be sold for $5.00 on a retail market. It is assumed that all cheese can be sold through a retail market. The total sales of cheese will be $520,000 per year.

Rows 15-44 are variable costs. Row 15 is the amount of milk used from the 100-cow dairy farm. 5,200 cwt will be purchased at $16.75 per cwt which will be $87,100 per year. Rows 16-20 are the ingredients used in production. The recipe was developed by comparing numerous recipes online. The prices are an average of online foodservice prices. Row 16 is coloring, such as annatto, the recipe calls for 1 oz per 1,000 pounds of milk. Since there are 520,000 pounds of milk there will be 520 ounces of coloring used. Coloring is $0.50 an ounce and a total of $260. Row 17 is salt, the recipe calls for 2.85 pounds of salt per 1,000 pounds of milk. There will be 1,482 pounds of salt used that costs $0.63 per pound and a total of $933.66. Row 18 is food grade calcium chloride, the recipe calls for 3 ounces of calcium chloride per 1,000 pounds of milk. There will be 1,560 ounces of calcium chloride used that costs $0.38 per ounce and a total of $596.70. Row 19 is bacterial starter cultures, the recipe calls for 1.2 pounds of starter cultures per 1,000 pounds of milk. There will be 624 pounds of starter cultures used that costs $1.84 per pound and a total of $1,148.16. Row 20 is rennet, the recipe calls for 3 ounces of rennet per 1,000 pounds of milk. There will be 1,560 ounces of rennet used that costs $2.00 per ounce and a total of $3,120.

Rows 21-25 are laboratory supplies purchased on a yearly basis. Costs came from online scientific chemical companies. The laboratory supply list was provided by Burch and Goan (2011a). Row 21 is inhibitor testing. Testing the milk once a week, will require 52 tests a year.

Table 38 contd.

Inhibitor testing kits have 25 tests in each kit. That will require 3 test kits that cost $65 for a total of $195. Row 22 is Petrifilm™ testing. Testing the milk once a week, will require 52 tests a year. Petrifilm™ is packaged in 50-packs. That will require 2 packs, each costing $70 giving a total cost of $140. Row 23 is pasteurization check. Testing the milk once a week, will require 52 tests a year. Pasteurization check kits have 100 tests in each kit. That will require 1 kit that costs $40. Row 24 is pH and acidity checking. Testing the milk once a week, will require 52 tests a year. pH and acidity checking is packaged in 50-packs. That will require 2 packs, each costing $20 giving a total cost of $40. Row 25 is direct microscopic slides for a microscope. Testing the milk once a week, will require 52 tests a year. Direct microscopic slides are packaged in 70-packs. That will require 1 pack, costing $5.

Row 26 is utility costs. Using an estimate from an on-farm processer, it is expected that utilities will cost $1,375 a month and $16,500 per year. The electric system will use a 3-phase, 440 volt. Row 27 is cleaning supplies. Cleaning supplies for cheese average $0.01 per gallon. The dairy farm is processing 1,163 gallons a week; the facility will need to be cleaned after each processing which will be 52 times a year. Each cleaning will cost a total of $11.63 and a total of $604.76 per year for sanitizers.

Rows 28-29 are packaging costs. Row 28 is plastic packaging. The price is an average online price of a plastic package that will be used with an on-site vacuum packager. 104,000 blocks of cheese with a packaging cost of $0.02 a piece, the total cost will be $2,080. Row 29 is labels. The price is an average online price of an adhesive label. 104,000 labels for cheese blocks, at a cost of $0.03 a piece, the total cost will be $3,120. The processing equipment costs

Table 38 contd.

are shown in Table 43. Cheese will need a cold storage facility which is shown in Figure 26 in the processing plant layout.

Rows 30-44 are overhead costs for the processing plant. Row 30 is supplies; this includes office supplies, plant supplies, miscellaneous supplies, travel, and education and convention dues. Travel costs and education and convention fees can vary greatly depending on the number of seminars and schools that are attended by the processing plant work force. Supplies cost is estimated to be $833.33 per month and $10,000 per year. Row 31 is transportation costs, which vary depending on the location of the processing facility and the number of stops. Transportation costs are an estimate from an on-farm processor which is $4,583 per month and $55,000 per year. Row 32 is Waste and Wastewater Treatment. The yearly cost of maintenance for a 1.2 million gallon lagoon that is used in the dairy farm budget is $4,050 per year. Each cleaning will require 255 gallons, which is 13,260 gallons of waste per year. The cost per gallon is $0.003375. The total cost to add the additional waste to the lagoon is $44.75 per year. Water costs are $25.00 per thousand gallons which will be $331.50 per year in water costs. The total costs for waste and wastewater treatment is $31.35 per month and $376.25 per year. Whey can also be an added expense. Whey has uses that can be beneficial to the farm but would require additional equipment. If the processing facility was going to discard the whey additional costs would be incurred. Row 33 is lot improvement costs. This is the estimated costs for maintaining a parking lot, driveway, and landscape. The total cost is $75 per month and $900 per year. Row 34 is Advertising/Marketing. It will include donations, ads for billboards and radio, social media, and printed ads. Costs can vary greatly depending on the level of commitment to advertising/marketing. The price is a quote from an on-farm processor. The total costs are $2,500

Table 38 contd.

per month and $30,000 per year. Row 35 is product loss/samples. Using a quote from an on-farm processor, it is estimated that the total costs will be $1,667 per month and $20,000 per year. Row 36 is phone and internet. The cost for service and maintenance of a commercial phone package is $3,000 per year. The cost for service and maintenance for internet that includes the ability to sell products online is $9,000. The total costs are $1,000 per month and $12,000 per year. Row 37 is credit card transaction fees. It is assumed that 95% of retail sales will be purchased with a credit/debit card. Credit card fees are 2.5%. Total credit card costs will be $1,029 per month and $12,350 per year. Row 38 is FICA. This is social security and Medicare taxes which has a rate of 7.65%. The gross labor costs are $76,360; therefore, the total FICA taxes are $391.17 and $4,694.04 per year. Row 39 is Insurance. This will include general liability, building and equipment insurance, vehicle insurance, and product liability. The price is a quote from a national insurance company. The total costs are $846.24 per month and $10,155 per year. Row 40 is worker's compensation. It is a quote from a national insurance company. The total cost is $356.75 per month and $4,281 per year. Row 41 is unemployment taxes. The state of Tennessee's unemployment tax rate is 2.7% for the first $9,000 of earnings by each employee. The federal tax rate is 0.6% for the first $7,000 of earnings by each employee. There are 4 employees so state unemployment tax is $972 and the federal tax is $168. The total tax rate is $95 per month and $1,140 per year. Row 42 is licenses, permits and fees. This is the cost to have the necessary permits and licenses to operate the processing facility. The cost is a quote from an on-farm processor. The total costs are $25 per month and $300 per year. Row 43 is secretarial/bookkeeping/accounting. This is the cost to employ a part-time secretary at $10 per hour. The costs are $1,250 per month and $15,000 per year. Row 44 is legal costs. This includes

Table 38 contd.

CPA and attorney fees that will be incurred throughout the year. The cost is a quote from an on-farm processor. The total costs are $417 per month and $5,000 per year.

Rows 50-51 are depreciation and repairs. Depreciation is $67,570 and repairs are $21,123. The costs are from Table 23. Row 58 is the interest expense which is shown in Table 43. The interest expense is $61,342.50. Line 67 is labor. The labor expenses are $61,360. The total costs are $508,474.71. The return to land, management, and risk is $11,525.29.

Table 39. Value-Added Milk & Yogurt Production Estimated Costs and Returns

ITEM	DESCRIPTION	UNIT	QUANTITY	PRICE	TOTAL	PER COW
REVENUE						
Milk Sales	1 Year	Quart	223836	2.25	503631.00	5036.31
Milk Sales	1 Year	1/2 Gal	111918	2.75	307774.50	3077.75
Milk Sales	1 Year	Gal	55959	3.75	209846.25	2098.46
Yogurt Sales	1 Year	Quart	95930	4.00	383720.00	3837.20
Butter Sales	1 Year	Pound	32228	4.25	136969.00	1369.69
					---	---
		TOTAL REVENUE			1541940.75	15419.41
-	- -	-	-	-	-	-
VARIABLE EXPENSES						
Fluid Milk	100 Cows	cwt	165.00	16.75	276375.00	2763.75
Vitamin A Palmitate		kg	67	60.00	4029.05	40.29
Vitamin D3		kg	67	200.00	13430.16	134.30
Cocoa		pound	525	6.75	3541.16	35.41
Sugar		pound	2098	0.75	1573.85	15.74
Starch		pound	174	5.00	870.86	8.71
Salt		pound	174	0.63	109.73	1.10
Carrageenan		pound	7	43.00	297.77	2.98
Evaporated Cane Juice		pound	14090	1.75	24657.01	246.57
Cultures		pound	222	2.00	443.68	4.44
Puree		pound	47965	1.25	59956.25	599.56
Pectin		pound	881	3.00	2644.07	26.44
Inhibitor testing		Test Kit	9	65.00	585.00	5.85
Petrifilm Testing		50 Pack	5	70.00	350.00	3.50
Pasteurization Check		Test Kit	3	40.00	120.00	1.20
PH & Acidity Checking		50 Pack	5	20.00	100.00	1.00
Direct Microscopic Slides		70 Pack	4	5.00	20.00	0.20
Utilities		Month	12	2500.00	30000.00	300.00
Cleaning Supplies		Day	156	33.62	5243.94	52.44

Table 39 contd.

Jugs-Quart		EA	319766	0.31	99127.46	991.27
Jugs-1/2 Gal		EA	111918	0.35	39171.30	391.71
Jugs-Gal		EA	55959	0.38	21264.42	212.64
Caps		EA	487643	0.03	14629.29	146.29
Labels		EA	519871	0.03	15596.13	155.96
Butter Packaging		EA	32228	0.02	644.56	6.45
Cardboard Boxes		EA	46524	0.75	34892.81	348.93
Supplies		Month	12	2083.33	24999.96	250.00
Transportation		Month	12	25000.00	300000.00	3000.00
Waste and Wastewater Treatment		Month	12	94.58	1134.96	11.35
Lot Improvements		Month	12	75.00	900.00	9.00
Advertising/Marketing		Month	12	5000.00	60000.00	600.00
Product Loss/Samples		Month	12	6424.75	77097.04	770.97
Phone and Internet		Month	12	1000.00	12000.00	120.00
Credit Card Transaction Fees		Month	12	152.59	1831.05	18.31
FICA		Month	12	1107.46	13289.58	132.90
Insurance		Month	12	888.56	10662.72	106.63
Worker's Comp		Month	12	684.75	8217.00	82.17
Unemployment Taxes		Month	12	213.75	2565.00	25.65
Licenses, Permits and Fees		Month	12	25.00	300.00	3.00
Secretarial/Bookkeeping/Accounting		Month	12	2083.33	24999.96	250.00
Legal Costs		Month	12	833.33	9999.96	100.00
					-	-
			TOTAL VARIABLE EXPENSES		1197670.72	11976.71
		RETURN ABOVE VARIABLE EXPENSES			344270.03	3442.70
-	-	-	-	-	-	-
DEPRECIATION AND REPAIRS						
Depreciation	Equipment & Building				89210.00	892.10

Table 39 contd.

Repairs	Equipment & Building					27715.00	277.15
-	-	-	-	-	-	-	-
			TOTAL FIXED EXPENSES			116925.00	1169.25
			TOTAL VARIABLE & FIXED EXPENSES			1314595.72	13145.96
RETURN TO LAND, LABOR, CAPITAL, MANAGEMENT, RISK						227345.03	2273.45
-	-	-	-	-	-	-	-
INTEREST							
Equipment						71013.00	710.13
						-	-
			TOTAL INTEREST EXPENSE			71013.00	710.13
			TOTAL VARIABLE, FIXED, INTEREST EXPENSE			1385608.72	13856.09
NET RETURN TO LAND, LABOR, MANAGEMENT, RISK						156332.03	1563.32
-	-	-	-	-	-	-	-
LABOR EXPENSES							
LABOR			hour	14872	10.00	148720.00	1487.20
			TOTAL ALL EXPENSES			1534328.72	15343.29
			RETURN TO LAND, MANAGEMENT, RISK			7612.03	76.12

Table 40. Value-Added Yogurt Production Receipt Explanations

Row 9 is the milk sales for 1 year of milk bottled in quarts. The quantity is 223,836. This is calculated by dividing 167,877 gallons by 3 and then multiplying by 4 since there are 4 quarts in a gallon. The price of $2.25 is an average of the wholesale and retail prices of 2%, whole, skim, and chocolate milk bottled in quarts. The total is the quantity multiplied by the price; this is gross sales of milk bottled in quarts which is $503,631. The per cow value is the total divided by 100 since there are 100 cows in the dairy; this is the value per cow of milk bottled in quarts. Row 10 is the milk sales for 1 year of milk bottled in ½ gallons. The quantity is 111,918. This is calculated by dividing 167,877 gallons by 3 and then multiplying by 2 since there are 2 ½ gallons in a gallon. The price of $2.75 is an average of the wholesale and retail prices of 2%, whole, skim, and chocolate milk bottled in ½ gallons. The total is the quantity multiplied by the price; this is gross sales of milk bottled in ½ gallons which is $307,775. The per cow value is the total divided by 100 since there are 100 cows in the dairy; this is the value per cow of milk bottled in ½ gallons. Row 11 is the milk sales for 1 year of milk bottled in gallons. The quantity is 55,959. This is calculated by dividing 167,877 gallons by 3. The price of $3.75 is an average of the wholesale and retail prices of 2%, whole, skim, and chocolate milk bottled in gallons. The total is the quantity multiplied by the price; this is gross sales of milk bottled in gallons which is $209,846. The per cow value is the total divided by 100 since there are 100 cows in the dairy; this is the value per cow of milk bottled in gallons. Row 12 is the yogurt sales for 1 year bottled in quarts. The quantity is 95,930. This is calculated by multiplying 23,982.5 by 4 since there are 4 quarts in a gallon. The price of $4.00 is an average of wholesale and retail prices. The total is the quantity multiplied by the price; this is gross sales of yogurt which is $383,720. Row 13 is the butter sales for 1 year of 1 pound blocks. Using the fat content percentage and overrun

Table 40 contd.

percentage from McKay and Larsen (1922), butter can be calculated. First the total amount of cream is calculated by multiplying total milk pounds of 1,650,000 by 3.5% fat. There is 57,750 pounds of cream. The total amount of cream is subtracted from by the fat put back into the milk. Whole milk makes up 17.5% of production, which is 288,749 pounds and has 3.25% fat that equals 9,384 pounds of cream added back to milk. 2% milk makes up 43.75% of production, which is 721,873 pounds and has 2% fat that equals 14,437 pounds of cream added back to milk. Skim milk is fat-free; therefore, it does not require fat added back into the milk. Chocolate milk is formulated using 2% milk. Chocolate milk makes up 4.375% of production, which is 72,187 pounds and has 2% fat that equals 1,444 pounds of cream added back to milk. Yogurt is processed using whole milk. Yogurt makes up 12.5% of production, which is 206,249 pounds and has 3.25% fat that equals 6,703 pounds of cream added back to milk. The cream for the milk products is 31,968 pounds. The cream used in the milk is subtracted from the 57,750 pounds of total cream. The remainder of cream that is used for butter is 25,782 pounds. Using the overrun of 125%, the total pounds of butter is 32,228. The total for butter is $136,969.The total revenue is the total prices of each product added together which is $1,541,941. The total revenue per cow is total revenue divided by 100 cows.

Variable Expenses are rows 19-59. Row 19 is fluid milk. This is the total milk produced from the 100-cow dairy. There are 100 cows each producing 165 cwt of milk (16,500 pounds) and the milk price per cwt is $16.75. The total amount is $276,375, which is calculated by multiplying the number of cows by the amount of milk production by the price of milk. Row 20 is Vitamin A Palmitate. It is an ingredient that is added to milk. It is commonly sold by kilograms. The recipe was developed by comparing numerous recipes online. It requires 1

Table 40 contd.

kilogram per 10,000 quarts. There is 671,508 total quarts of milk which is divided by 10,000 to equal 67.15 kilograms used in production. The price per kilogram of $60 is an average price used by comparing numerous online food service prices. The total cost of $4,029.05 is the price multiplied by the quantity. Row 21 is Vitamin D3, which is also an ingredient that is added to milk. Following the same process as Vitamin A Palmitate, is also requires 67.15 kilograms. The price is $200 per kilogram which gives a total of $13,430.16.

Rows 22-26 are ingredient costs in the production of chocolate milk. The recipe was developed by comparing numerous recipes online. Chocolate milk is 5% of milk production, which is 33,575 quarts. Row 22 is cocoa, the recipe calls for 0.25 oz per quart. There are 16 oz in a pound. The quantity of 525 pounds is calculated by multiplying the quarts by the oz of product and then dividing by 16 to get the total pounds of cocoa used in production. The price is $6.75 per pound and the total is calculated by multiplying the quantity and price together to equal $3,541.16. Row 23 is sugar. Similar to cocoa, the recipe calls for 1 oz of sugar per quart; the quantity will be 2,098 pounds. The price is $0.75 per pound. The total will be $1573.85. Row 24 is cornstarch. Similar to cocoa, the recipe calls for 0.083 oz of cornstarch per quart; the quantity will be 174 pounds. The price is $5.00 per pound. The total will be $870.86. Row 25 is salt. Similar to cocoa, the recipe calls for 0.083 oz of salt per quart; the quantity will be 174 pounds. The price is $0.63 per pound. The total will be $109.73. Row 26 is carrageenan. Similar to cocoa, the recipe calls for 0.0033 oz of carrageenan per quart; the quantity will be 7 pounds. The price is $43.00 per pound. The total will be $297.77.

Rows 27-30 are ingredient costs in the production of yogurt. The recipe was developed by comparing numerous recipes online. Yogurt is 1/8 of total production which is 95,930 quarts.

Table 40 contd.

Row 27 is evaporated cane juice, the recipe calls for 2.35 oz per quart. There are 16 oz in a pound. The quantity of 14,090 pounds is calculated by multiplying the quarts by the oz of product and then dividing by 16 to get the total pounds of evaporated cane juice used in production. The price is $1.75 per pound and the total is calculated by multiplying the quantity and price together to equal $24,657.01. Row 28 is cultures. Similar to evaporated cane juice, the recipe calls for 0.037 oz of cultures per quart; the quantity will be 222 pounds. The price is $2.00 per pound. The total will be $443.68. Row 29 is puree. Similar to evaporated cane juice, the recipe calls for 2 pounds of puree per gallon; the quantity will be 47,965 pounds. The price is $1.25 per pound. The total will be $59,956.25. Row 30 is pectin. Similar to evaporated cane juice, the recipe calls for 0.147 oz of pectin per quart; the quantity will be 881 pounds. The price is $3.00 per pound. The total will be $2,644.07.

Rows 31-35 are laboratory supply costs purchased on a yearly basis. Costs came from online scientific chemical companies. The laboratory supply list was provided by Burch and Goan (2011a). Row 31 is inhibitor testing. Testing the milk 4 times a week, will require 208 tests a year. Inhibitor testing kits have 25 tests in each kit. That will require 9 kits, each costing $65 giving a total cost of $585. Row 32 is Petrifilm™ testing. Testing the milk 4 times a week, will require 208 tests a year. Petrifilm™ is packaged in 50-packs. That will require 5 packs, each costing $70 giving a total cost of $350. Row 33 is pasteurization check. Testing the milk 4 times a week, will require 208 tests a year. Pasteurization check kits have 100 tests in each kit. That will require 3 kits, each costing $40 giving a total cost of $120. Row 34 is pH and acidity checking. Testing the milk 4 times a week, will require 208 tests a year. pH and acidity checking is packaged in 50-packs. That will require 5 packs, each costing $20 giving a total cost of $100.

Table 40 contd.

Row 35 is direct microscopic slides for a microscope. Testing the milk 4 times a week, will require 208 tests a year. Direct microscopic slides are packaged in 70-packs. That will require 4 packs, each costing $5 giving a total cost of $20.

Row 36 is utility costs. Using an estimate from an on-farm processer, it is expected that utilities will cost $2,500 a month and $30,000 per year. The electric system will use a 3-phase, 440 volt. Row 37 is cleaning supplies. Since the dairy farm is processing 3 times a week, the facility will need to be cleaned after each processing which will be 156 times a year. Using a quote from an on-farm processor, each cleaning requires 4.5 gallons of soap that costs $4.95 per gallon, 1.5 gallons of acid that costs $6.06 per gallon, and 16 oz of sanitizer that costs $18.00 per gallon. Each cleaning will cost a total of $33.62 and a total of $5,243.94 per year.

Rows 38-44 contain packaging costs. Using a quote from a national packaging supplier, prices were assigned to jugs and caps. Row 38 is quart size plastic jugs. A total of 319,766 quarts of milk and yogurt will be packaged with a cost of $0.31 a jug which gives a total cost of $99,127.46. Row 39 is ½ gallon jugs. 111,918 ½ gallons will be packaged with a cost of $0.35 a jug which gives a total cost of $39,171.30. Row 40 is 1 gallon jugs. 55,959 gallons will be packaged with a cost of $0.38 a jug which gives a total cost of $21,264.42. Row 41 is caps. Caps will fit all jugs of milk and yogurt. 487,643 caps will be used that cost $0.03 which gives a total of $14,629.29. Row 42 is labels. The price is an average online price of an adhesive label. 519,871 is the amount of labels for milk, yogurt and butter products. At a cost of $0.03 a piece, the total cost will be $15,596.13. Row 43 is butter packaging. The price is an average online price of a wax-based wrap. 32,228 blocks of butter with a packaging cost of $0.02 a piece, the total cost will be $644.56. Row 44 is cardboard boxes. The price is an average online price of a

Table 40 contd.

12x12x12 box. Only the products sold on a wholesale market will be boxed. The capacity for each box is 4 gallons/8 ½ gallons/16 quarts/32 blocks of butter. 45,567 boxes will be used for milk and yogurt packaging and 957 boxes will be used for butter packaging which is a total of 46,524 boxes. At a cost of $0.75 per box, the total cost is $34,892.81.

Rows 45-59 are overhead costs for the processing plant. Row 45 is supplies; this includes office supplies, plant supplies, miscellaneous supplies, travel, and education and convention dues. Travel costs and education and convention fees can vary greatly depending on the number of seminars and schools that are attended by the processing plant work force. Supplies cost is estimated to be $2,083 per month and $25,000 per year. Row 46 is transportation costs, which vary depending on the location of the processing facility and the number of deliveries. The processing facility is bottling milk 3 times a week; deliveries will be the day after processing in order to provide the freshest milk. Transportation costs are an estimate from an on-farm processor which is $25,000 per month and $300,000 per year. Row 47 is Waste and Wastewater Treatment. The yearly cost of maintenance for a 1.2 million gallon lagoon that is used in the dairy farm budget is $4,050 per year. Each cleaning will require 255 gallons, which is approximately 40,000 gallons of waste per year. The cost per gallon is $0.003375. The total cost to add the additional waste to the lagoon is $135 per year. Water costs are $25.00 per thousand gallons which will be approximately $1,000 per year in water costs. The total costs for waste and wastewater treatment is $95 per month and $1,135 per year. Row 48 is lot improvement costs. This is the estimated costs for maintaining a parking lot, driveway, and landscape. The total cost is $75 per month and $900 per year. Row 49 is Advertising/Marketing. It will include donations, ads for billboards and radio, social media, and printed ads. Costs can vary greatly depending on

Table 40 contd.

the level of commitment to advertising/marketing. The price is a quote from an on-farm processor. The total costs are $5,000 per month and $60,000 per year. Row 50 is product loss/samples. Using a quote from an on-farm processor, it is estimated that 5% of total production is to be loss or used as samples. The total costs will be $6,425 per month and $77,097 per year. Row 51 is phone and internet. The cost for service and maintenance of a commercial phone package is $3,000 per year. The cost for service and maintenance for internet that includes the ability to sell products online is $9,000. The total costs are $1,000 per month and $12,000 per year. Row 52 is credit card transaction fees. 5% of sales are on the retail market, it is assumed that 95% of retail sales will be purchased with a credit/debit card. This is 4.75% of total sales which is $73,242.19. Credit card fees are 2.5%. Total credit card costs will be $153 per month and $1,831 per year. Row 53 is FICA. This is social security and Medicare taxes which has a rate of 7.65%. The gross labor costs are $173,720; therefore, the total FICA taxes are $1,107.46 and $13,289.58 per year. Row 54 is Insurance. This will include general liability, building and equipment insurance, vehicle insurance, and product liability. The price is a quote from a national insurance company. The total costs are $888.56 per month and $10,663 per year. Row 55 is worker's compensation. It is a quote from a national insurance company. The total cost is $684.75 per month and $8,217 per year. Row 56 is unemployment taxes. The state of Tennessee's unemployment tax rate is 2.7% for the first $9,000 of earnings by each employee. The federal tax rate is 0.6% for the first $7,000 of earnings by each employee. There are 9 employees so state unemployment tax is $2,187 and the federal tax is $378. The total tax rate is $213.75 per month and $2,565 per year. Row 57 is licenses, permits and fees. This is the cost to have the necessary permits and licenses to operate the processing facility. The cost is a quote

Table 40 contd.

from an on-farm processor. The total costs are $25 per month and $300 per year. Row 58 is secretarial/bookkeeping/accounting. This is the cost to employ a full-time secretary at $10 per hour. The costs are $2,083 per month and $25,000 per year. Row 59 is legal costs. This includes CPA and attorney fees that will be incurred throughout the year. The cost is a quote from an on-farm processor. The total costs are $833 per month and $10,000 per year.

Rows 65-66 are depreciation and repairs. Depreciation is $89,210 and repairs are $27,715. The costs are from Table 41. Row 73 is the interest expense which is shown in Table 41. The interest expense is $71,013. Line 82 is labor. The labor expenses are $148,720. The total costs are $1,534,328.72. The return to land, management, and risk is $7,612.03.

Table 41. Value-Added Equipment and Labor for Milk and Milk/Yogurt Production

ITEM	COST ($)	INTEREST RATE (%)	LIFE (YEARS)	DEPREC. ($/YEAR)	INTEREST ($/YEAR)	REPAIRS ($/YEAR)	TOTAL ($/YEAR)
Equipment & Buildings							
Dairy Processing Facility	1500000	6.00	50	30000.00	45000.00	7500.00	82500.00
600 Gal Pasteurizer	35000	6.00	15	2333.33	1050.00	700.00	4083.33
600 Gal Pasteurizer	35000	6.00	15	2333.33	1050.00	700.00	4083.33
500 Gal Pasteurizer	30000	6.00	15	2000.00	900.00	600.00	3500.00
300 Gal Pasteurizer	25000	6.00	15	1666.67	750.00	500.00	2916.67
300 Gal Pasteurizer	25000	6.00	15	1666.67	750.00	500.00	2916.67
50 Gal Pasteurizer	20000	6.00	15	1333.33	600.00	400.00	2333.33
200 Gal Self-Refig Farm Tank	3000	6.00	15	200.00	90.00	60.00	350.00
800 Gal Tank	2500	6.00	30	83.33	75.00	25.00	183.33
800 Gal Tank	2500	6.00	30	83.33	75.00	25.00	183.33
500 Gal Mix Tank	12000	6.00	30	400.00	360.00	120.00	880.00
300 Gal Mix Tank	10000	6.00	30	333.33	300.00	100.00	733.33
Jug Filler	35000	6.00	15	2333.33	1050.00	700.00	4083.33
Separator	50000	6.00	15	3333.33	1500.00	1000.00	5833.33
Homogenizer	40000	6.00	15	2666.67	1200.00	800.00	4666.67
CIP System	30000	6.00	15	2000.00	900.00	600.00	3500.00
CIP System	30000	6.00	15	2000.00	900.00	600.00	3500.00
Plate Heat Exchanger	20000	6.00	15	1333.33	600.00	400.00	2333.33
Boiler	60000	6.00	15	4000.00	1800.00	1200.00	7000.00
Boiler	60000	6.00	15	4000.00	1800.00	1200.00	7000.00
Chilled Water Tank	60000	6.00	15	4000.00	1800.00	1200.00	7000.00
Conveyor	15000	6.00	15	1000.00	450.00	300.00	1750.00
Piping and Valves	50000	6.00	10	5000.00	1500.00	2500.00	9000.00
Storage Cooler	20000	6.00	10	2000.00	600.00	1000.00	3600.00
Butter Churn	15000	6.00	15	1000.00	450.00	300.00	1750.00

Table 41 contd.

ITEM	COST ($)	INTEREST RATE (%)	LIFE (YEARS)	DEPREC. ($/YEAR)	INTEREST ($/YEAR)	REPAIRS ($/YEAR)	TOTAL ($/YEAR)
Commercial Hot Water Heater	6000	6.00	15	400.00	180.00	120.00	700.00
Commercial Hot Water Heater	6000	6.00	15	400.00	180.00	120.00	700.00
Air Compressor	1300	6.00	10	130.00	39.00	65.00	234.00
Air Compressor	1300	6.00	10	130.00	39.00	65.00	234.00
3' X 10' COP Vat	3000	6.00	30	100.00	90.00	30.00	220.00
3' X 10' COP Vat	3000	6.00	30	100.00	90.00	30.00	220.00
3' X 8' COP Vat	2500	6.00	30	83.33	75.00	25.00	183.33
1500 Gallon Raw Milk Tank	22500	6.00	30	750.00	675.00	225.00	1650.00
1500 Gallon Raw Milk Tank	22500	6.00	30	750.00	675.00	225.00	1650.00
500 Gallon Pasteurized Farm Bulk Tank Refrigerated	7500	6.00	15	500.00	225.00	150.00	875.00
500 Gallon Pasteurized Farm Bulk Tank Refrigerated	7500	6.00	15	500.00	225.00	150.00	875.00
800 Gallon Pasteurized Farm Bulk Tank Refrigerated	12000	6.00	15	800.00	360.00	240.00	1400.00
800 Gallon Pasteurized Farm Bulk Tank Refrigerated	12000	6.00	15	800.00	360.00	240.00	1400.00
Lab Equipment*	15000	6.00	10	1500.00	450.00	750.00	2700.00
Office Equipment and Furniture	10000	6.00	15	666.67	300.00	200.00	1166.67
Delivery Truck	30000	6.00	10	3000.00	900.00	1500.00	5400.00
1000 Gal Bulk Tank-Refrig	15000	6.00	15	1000.00	450.00	300.00	1750.00
Trailer	5000	6.00	10	500.00	150.00	250.00	900.00
TOTAL EQUIPMENT				89210.00	71013.00	27715.00	187938.00
LABOR EXPENSES							
LABOR			hour	14872	10.00	148720.00	1487.20

*includes equipment for inhibitor testing, Petrifilm™ testing, pasteurization check, butter fat and leucocyte testing, pH and acidity checking, and direct microscopic slides

Table 42. Milk Production Labor Hours Explanation

The bottling and cleaning of the milk will require a total of 32.5 hours assuming that while packaging the milk the filler will operate at 18 gallons per minute at 90% efficiency and can package 1400 gallons of product at 90% efficiency.

The total hours will break down as follows:

Jug Filler operator- 5 hours

One person placing empty jugs on conveyor- 5 hours

Two people in cooler boxing jugs of milk- 10 hours

Clean jug filler and area- 1.5 hours

Clean boxing area- 1.5 hours

Clean empty jug storage area- 0.5 hours

Package 1400 gallons of product- 1 hour and 20 minutes

600 gallon Whole Milk- Gallons, ½ Gallons, and Pints

600 gallon 2% Milk- Gallons, ½ Gallons, and Pints

200 gallon Chocolate Milk- ½ Gallons and Pints

5 size changes- 30 minutes each total 2.5 hours

3 product changes- 20 minutes each total 1 hour

Saturday

On Saturday nights picking up the raw milk will require a total of 2 hours.

This will include:

Travel to milking parlor

Table 42 contd.

Set up lines for loading raw milk and sanitize loading lines- 0.5 hour

Collect Quality samples, check temperature, smell and visual check for milk quality- 20 minutes

Load Milk- 20 minutes

Disassemble loading lines, wash bulk tank and set up for next milking- 45 minutes

Receiving milk at the processing plant will require 2 hours and 15 minutes

Return to processing plant

Check milk for inhibitors, temperature, smell, visual, DMC if questionable. Set up receiving lines and raw storage tank. Sanitize lines and tank- 45 minutes.

Unload milk, wash delivery tank, clean receiving lines, clean receiving area, and cool milk below 40°F. - 1 hour

Secure Building- 30 minutes

Monday

On Monday mornings there will be time spent leaving the processing plant to travel to the milking parlor after the Saturday night activities. This will require 2 hours.

Then return to the plant and repeat the Saturday night activities and start boiler and chiller and secure the building. This will require 2 hours and 15 minutes.

Milk Processing will require a total of 1.5 hours to set up separator and necessary piping for processing 1500 gallon milk into whole milk, 2% milk, chocolate milk, and buttermilk. Make connections for use of 4 blend tanks and one raw cream tank. Make connections for moving milk

Table 42 contd.

from blend tanks to 4 pasteurizers. Set up pasteurizers for processing. Make connections to send milk from 4 pasteurizers through homogenizer plate cooler and into 3 pasteurized surge tanks. Buttermilk will stay in pasteurizer for inoculation. Make connection to send milk from 3 pasteurized surge tanks to filling machine. Sanitize all of the above setups leaving sanitizer in filler until time for filling operation to begin.

Also there will be time spent to do the following:

Start separator- 20 minutes

Separate 567 gallons skim- 50 minutes

Blend 2% milk, whole milk, and chocolate milk- 45 minutes

Check Butterfat for proper standardization. Regenerate and standardize if necessary.

Start pumping to pasteurizers and begin processing. Time varies according to volume of whole milk- 2% pump time 20 minutes each.

Buttermilk and chocolate milk- 10 minutes each

Pasteurization- 20 minutes to heat

30 minutes holding time

20 minutes cooling time for homogenization

Homogenizer-1200 gallons per hour with plate cooler designed accordingly.

Processing Activities will over lap

Whole milk and 2 %- 20 minutes fill past each

70 minutes heat and cool for homogenization each

30 minutes transferring to past surge each

Table 42 contd.

Chocolate milk- 10 minutes fill past

70 minutes heat and cool for homogenization

10 minutes transferring to past surge

Buttermilk- 5 minutes fill past

180 minutes (3hrs) pasteurize and cool to inoculation temperature

For Cleaning:

Separator- clean and assemble- 1 hour and 30 minutes

3 blend tanks- 1 hour and 30minutes

Connecting piping & work area- 1 hour

3 pasteurizers- 2 hours and 15minutes

Cleaning Homogenizer 7 Plate Cooler- 45 minutes

Monday total is 49 hours and 15 minutes

Saturday Night- 2 hours

Sunday Check- 45 minutes

Monday Milk Delivery- 2 hours

Setup and sanitation- 1 hour 30 minutes

Separation, blending, and standardization- 1 hour 55 minutes

Pasteurization to surge tanks- 3 hours 30 minutes

Packaging & Cleaning packaging area 4 people- 32 hours and 30 minutes

Table 42 contd.

Calculations:
286 total labor hours
x 60 minutes per hour
17,160minutes per week
÷ 3500 gallons of milk per week
4.9 minutes per gallon

$10 per hour labor
÷60 minutes hour
0.17 cost per min @ $10 per hour labor
*4.9 minutes labor per gallon
$0.833 a gallon of processing for labor
X3500 Gallons of milk per week
$2,905.00 Labor cost per week

3500 gallons
x 8.6 pounds per gallon of milk
30100 pounds per week of milk
÷100 pounds is paid per 100 lbs
301
x $20.00 Average pay per 100 lbs of milk
$6,020.00 for 3500 gallons of milk
+$2905.00 labor cost for 3500 gallons of milk a week
$8,925.00 Total cost up to packaging
÷3500 gallons of milk
$2.55 Total cost per gallon of milk to packaging

$0.34 per gallon Jug
+$0.01 per cap
$0.35 per gallon packaging cost
x 3500 gallons
$1225 cost of packaging for 3500 gallons
+$8925 total cost up to packaging
$10,150 cost per week
÷3500 gallons
$2.90 gallons up to delivery

Table 43. Value-Added Equipment and Labor for Cheese Production

ITEM	COST ($)	INTEREST RATE (%)	LIFE (YEARS)	DEPREC. ($/YEAR)	INTEREST ($/YEAR)	REPAIRS ($/YEAR)	TOTAL ($/YEAR)
Equipment & Buildings							
Dairy Processing Facility	1500000	6.00	50	30000.00	45000.00	7500.00	82500.00
600 Gal Pasteurizer	35000	6.00	15	2333.33	1050.00	700.00	4083.33
600 Gal Pasteurizer	35000	6.00	15	2333.33	1050.00	700.00	4083.33
CIP System	30000	6.00	15	2000.00	900.00	600.00	3500.00
CIP System	30000	6.00	15	2000.00	900.00	600.00	3500.00
Boiler	60000	6.00	15	4000.00	1800.00	1200.00	7000.00
Boiler	60000	6.00	15	4000.00	1800.00	1200.00	7000.00
Piping and Valves	50000	6.00	10	5000.00	1500.00	2500.00	9000.00
Refrigerator	20000	6.00	10	2000.00	600.00	1000.00	3600.00
Commercial Hot Water Heater	6000	6.00	15	400.00	180.00	120.00	700.00
Commercial Hot Water Heater	6000	6.00	15	400.00	180.00	120.00	700.00
Air Compressor	1300	6.00	10	130.00	39.00	65.00	234.00
Air Compressor	1300	6.00	10	130.00	39.00	65.00	234.00
3' X 10' COP Vat	3000	6.00	30	100.00	90.00	30.00	220.00
3' X 8' COP Vat	2500	6.00	30	83.33	75.00	25.00	183.33
1500 Gal Raw Milk Tank	22500	6.00	30	750.00	675.00	225.00	1650.00
10000 lbs Cheese Vat	38000	6.00	30	1266.67	1140.00	380.00	2786.67
Cheese Press	2000	6.00	30	66.67	60.00	20.00	146.67
Drain Table w/ agitator and forkers	12000	6.00	30	400.00	360.00	120.00	880.00
Cheese Knives	150	6.00	15	10.00	4.50	3.00	17.50
Molds (2000)	40000	6.00	15	2666.67	1200.00	800.00	4666.67
Packaging Machine	20000	6.00	15	1333.33	600.00	400.00	2333.33
Lab Equipment*	15000	6.00	10	1500.00	450.00	750.00	2700.00
Office Equipment and Furniture	10000	6.00	15	666.67	300.00	200.00	1166.67
Delivery Truck	25000	6.00	10	2500.00	750.00	1250.00	4500.00
1000 Gal Bulk Tank-Refrig	15000	6.00	15	1000.00	450.00	300.00	1750.00

Table 43 contd.

ITEM	COST ($)	INTEREST RATE (%)	LIFE (YEARS)	DEPREC. ($/YEAR)	INTEREST ($/YEAR)	REPAIRS ($/YEAR)	TOTAL ($/YEAR)
Trailer	5000	6.00	10	500.00	150.00	250.00	900.00
TOTAL EQUIPMENT				67570.00	61342.50	21123.00	150035.50
LABOR EXPENSES							
LABOR			hour	6136	10.00	61360	613.60

*includes equipment for inhibitor testing, Petrifilm™ testing, pasteurization check, butter fat and leucocyte testing, pH and acidity checking, and direct microscopic slides

Table 44. Flow Diagram for Cheddar Cheese

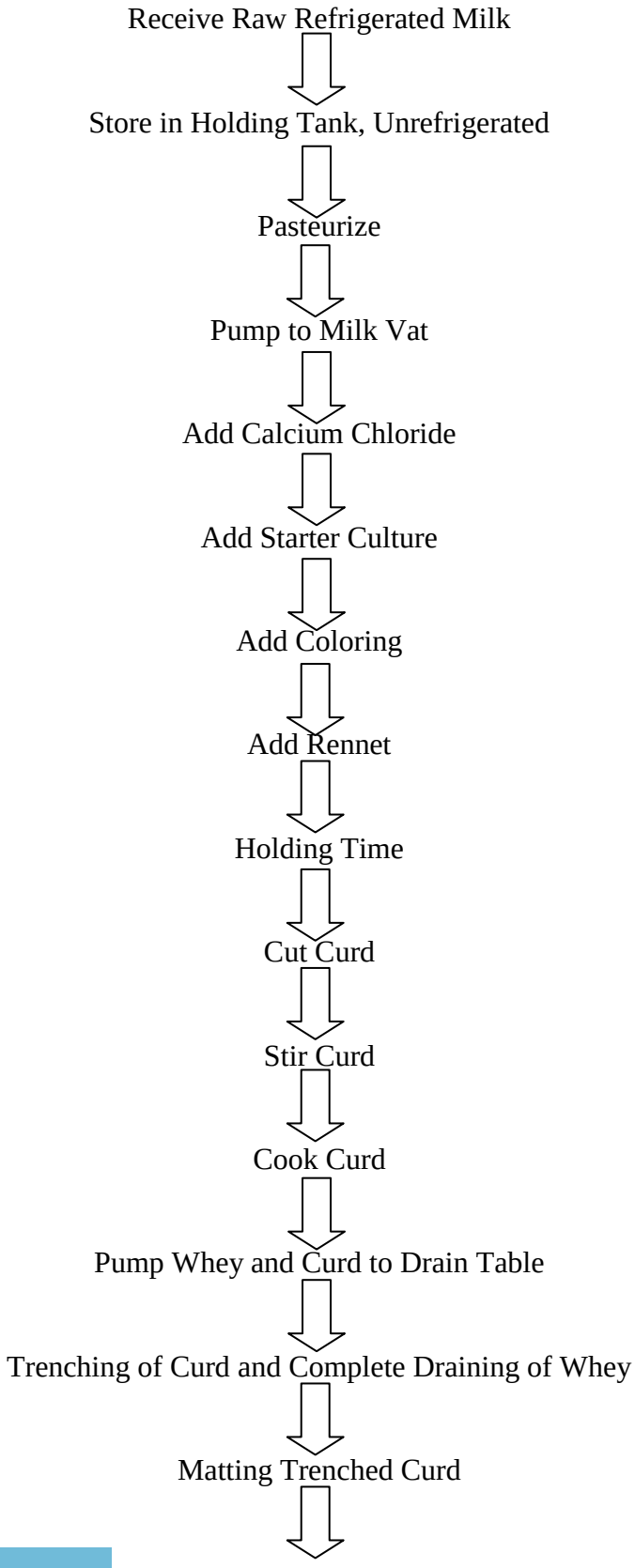
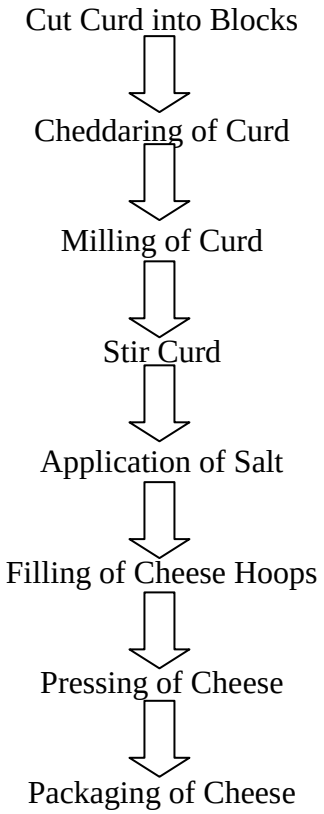


Table 44 contd.



(Source: UT Food Science Department)

Table 45. Cheese Production Labor Explanation

Morning-deliver milk to plant

Travel to milking parlor

Set up lines for loading raw milk and sanitize loading lines-30 minutes

Collect Quality samples, check temperature, smell and visual check for milk quality- 20 minutes

Load Milk-20 minutes

Disassemble loading lines, wash bulk tank and set up for next milking-45 minutes

Total Delivery to milk plant- 2 hours

Return to the plant- start boiler- 2 hours

Pasteurization- 20 minutes to heat

Holding time- 30 minutes

Cool to approximately 87-88° F and pump to cheese vat- 20 minutes

Fill Cheese Vat with milk and make cheese (from flow diagram) - 7 hours

Cleaning Times

3 Pasteurizers- 2 hours 15 minutes

Cheese Vat- 1 hour

Drain Table- 1 hour

Press- 30 minutes

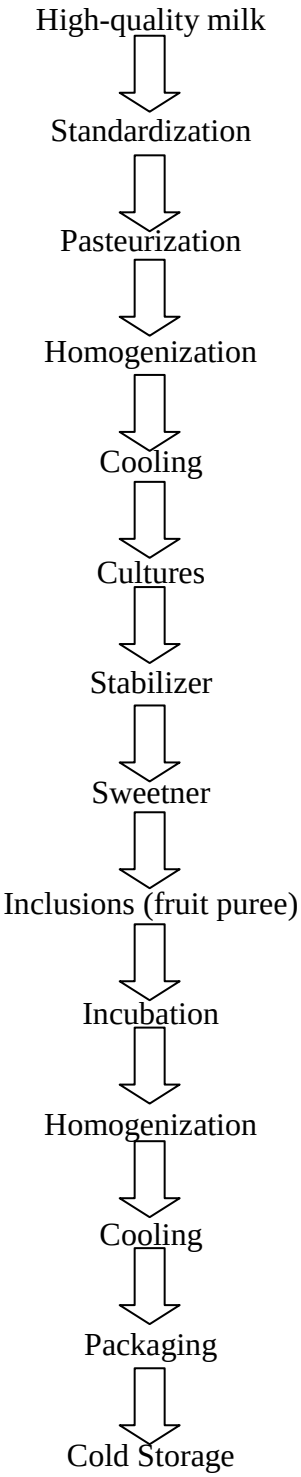
Approximately 17 total hours for total production hours for cheese

Table 45 contd.

Weekly Breakdown of Hours:
Store/Retail: 54 hours
Delivery: 20 hours
Processing: 17 hours
Packaging: 20 hours
Lab Work: 4 hours
Check and Maintenance: 3 hours
Total Weekly hours: 118 hours

(Source: UT Food Science Department)

Table 46. Flow Diagram for Drinkable Yogurt



(Source: Hui et al. 2004)

Table 47. Value-Added Milk Production Future Projections, 2011-2021

	Individual Time Periods											Total for
CASH INFLOWS	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All Periods
Milk Sales	$575,579	$609,826	$646,111	$684,554	$725,285	$768,440	$814,162	$862,605	$913,930	$968,309	$1,025,923	$8,594,724
Milk Sales	$351,742	$372,670	$394,844	$418,337	$443,228	$469,600	$497,542	$527,145	$558,510	$591,742	$626,950	$5,252,311
Milk Sales	$239,824	$254,093	$269,212	$285,230	$302,201	$320,182	$339,233	$359,417	$380,803	$403,460	$427,466	$3,581,121
Butter Sales	$153,400	$162,527	$172,197	$182,443	$193,298	$204,799	$216,985	$229,896	$243,574	$258,067	$273,422	$2,290,608
Total Cash Inflows	**$1,320,544**	**$1,399,116**	**$1,482,364**	**$1,570,564**	**$1,664,013**	**$1,763,022**	**$1,867,922**	**$1,979,063**	**$2,096,817**	**$2,221,578**	**$2,353,762**	$19,718,765

	Individual Time Periods											Total for
CASH OUTFLOWS	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All Periods
Fluid Milk	$276,375	$292,819	$310,242	$328,701	$348,259	$368,981	$390,935	$414,196	$438,840	$464,951	$492,616	$4,126,916
Vitamin A Palmitate	$4,605	$4,840	$5,087	$5,347	$5,620	$5,908	$6,210	$6,527	$6,860	$7,211	$7,579	$65,794
Vitamin D3	$15,349	$16,133	$16,957	$17,824	$18,735	$19,692	$20,698	$21,756	$22,868	$24,036	$25,265	$219,314
Sugar	$4,047	$4,254	$4,471	$4,700	$4,940	$5,192	$5,458	$5,736	$6,030	$6,338	$6,662	$57,827
Cocoa	$1,799	$1,891	$1,987	$2,089	$2,195	$2,308	$2,426	$2,550	$2,680	$2,817	$2,961	$25,701
Starch	$995	$1,046	$1,100	$1,156	$1,215	$1,277	$1,342	$1,411	$1,483	$1,559	$1,638	$14,221
Salt	$125	$132	$139	$146	$153	$161	$169	$178	$187	$196	$206	$1,792
Carrageenan	$340	$358	$376	$395	$415	$437	$459	$482	$507	$533	$560	$4,863
Inhibitor testing	$585	$615	$646	$679	$714	$751	$789	$829	$872	$916	$963	$8,359
Petrifilm Testing	$350	$368	$387	$406	$427	$449	$472	$496	$521	$548	$576	$5,001
Pasteurization Check	$120	$126	$133	$139	$146	$154	$162	$170	$179	$188	$198	$1,715
PH & Acidity Checking	$100	$105	$110	$116	$122	$128	$135	$142	$149	$157	$165	$1,429
Direct Microscopic Slides	$20	$21	$22	$23	$24	$26	$27	$28	$30	$31	$33	$286
Utilities	$24,000	$25,226	$26,515	$27,870	$29,295	$30,792	$32,365	$34,019	$35,757	$37,584	$39,505	$342,929
Cleaning Supplies	$5,244	$5,512	$5,794	$6,090	$6,401	$6,728	$7,072	$7,433	$7,813	$8,212	$8,632	$74,929
Jugs-Quart	$79,302	$83,354	$87,614	$92,091	$96,797	$101,743	$106,942	$112,407	$118,151	$124,188	$130,534	$1,133,123
Jugs-1/2 Gal	$44,767	$47,055	$49,459	$51,987	$54,643	$57,435	$60,370	$63,455	$66,698	$70,106	$73,688	$639,664

Table 47 contd.

CASH OUTFLOWS	Individual Time Periods											Total for All Periods
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Jugs-Gal	$24,302	$25,544	$26,849	$28,221	$29,663	$31,179	$32,772	$34,447	$36,207	$38,058	$40,002	$347,246
Caps	$13,430	$14,116	$14,838	$15,596	$16,393	$17,231	$18,111	$19,037	$20,009	$21,032	$22,107	$191,900
Labels	$14,513	$15,255	$16,034	$16,853	$17,715	$18,620	$19,571	$20,571	$21,623	$22,728	$23,889	$207,372
Butter Packaging	$722	$759	$798	$838	$881	$926	$973	$1,023	$1,076	$1,130	$1,188	$10,315
Cardboard Boxes	$34,979	$36,766	$38,645	$40,620	$42,696	$44,877	$47,171	$49,581	$52,115	$54,778	$57,577	$499,805
Supplies	$15,000	$15,767	$16,572	$17,419	$18,309	$19,245	$20,228	$21,262	$22,348	$23,490	$24,691	$214,330
Transportation	$250,000	$262,775	$276,203	$290,317	$305,152	$320,745	$337,135	$354,363	$372,471	$391,504	$411,510	$3,572,174
Waste and Wastewater Treatment	$1,135	$1,193	$1,254	$1,318	$1,385	$1,456	$1,531	$1,609	$1,691	$1,777	$1,868	$16,217
Lot Improvements	$900	$946	$994	$1,045	$1,099	$1,155	$1,214	$1,276	$1,341	$1,409	$1,481	$12,860
Advertising/Marketing	$50,000	$52,555	$55,241	$58,063	$61,030	$64,149	$67,427	$70,873	$74,494	$78,301	$82,302	$714,436
Product Loss/Samples	$40,000	$42,044	$44,192	$46,451	$48,824	$51,319	$53,942	$56,698	$59,595	$62,641	$65,842	$571,547
Phone and Internet	$12,000	$12,613	$13,258	$13,935	$14,647	$15,396	$16,182	$17,009	$17,879	$18,792	$19,752	$171,464
Credit Card Transaction Fees	$1,568	$1,648	$1,733	$1,821	$1,914	$2,012	$2,115	$2,223	$2,336	$2,456	$2,581	$22,407
FICA	$12,907	$13,567	$14,260	$14,989	$15,754	$16,560	$17,406	$18,295	$19,230	$20,213	$21,246	$184,425
Insurance	$10,517	$11,054	$11,619	$12,213	$12,837	$13,493	$14,182	$14,907	$15,669	$16,469	$17,311	$150,270
Worker's Comp	$8,217	$8,637	$9,078	$9,542	$10,030	$10,542	$11,081	$11,647	$12,242	$12,868	$13,526	$117,410
Unemployment Taxes	$2,565	$2,696	$2,834	$2,979	$3,131	$3,291	$3,459	$3,636	$3,822	$4,017	$4,222	$36,651
Licenses, Permits and Fees	$300	$315	$331	$348	$366	$385	$405	$425	$447	$470	$494	$4,287
Secretarial/Bookkeeping/ Accounting	$20,000	$21,022	$22,096	$23,225	$24,412	$25,660	$26,971	$28,349	$29,798	$31,320	$32,921	$285,773
Legal Costs	$7,500	$7,883	$8,286	$8,710	$9,155	$9,622	$10,114	$10,631	$11,174	$11,745	$12,345	$107,165
Depreciation	$89,210	$89,210	$89,210	$89,210	$89,210	$89,210	$89,210	$89,210	$89,210	$89,210	$89,210	$981,310
Repairs	$27,715	$29,131	$30,620	$32,185	$33,829	$35,558	$37,375	$39,285	$41,292	$43,402	$45,620	$396,011
Interest	$71,013	$74,642	$78,456	$82,465	$86,679	$91,108	$95,764	$100,657	$105,801	$111,208	$116,890	$1,014,683
Labor	$148,720	$156,320	$164,308	$172,704	$181,529	$190,805	$200,555	$210,803	$221,575	$232,898	$244,799	$2,125,015
	$1,315,336	**$1,380,313**	**$1,448,748**	**$1,520,826**	**$1,596,743**	**$1,676,703**	**$1,760,923**	**$1,849,632**	**$1,943,069**	**$2,041,487**	**$2,145,154**	**$18,678,934**

Table 47 contd.

SUMMARY	Individual Time Periods Milk											Total for All Periods
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Net Cash Flow	**$5,208**	**$18,804**	**$33,616**	**$49,738**	**$67,270**	**$86,319**	**$106,998**	**$129,431**	**$153,748**	**$180,091**	**$208,608**	**$1,039,831**
Beginning cash balance	$0											
Cumulative Net Cash Flow	**$5,208**	**$24,012**	**$57,628**	**$107,366**	**$174,636**	**$260,955**	**$367,953**	**$497,384**	**$651,132**	**$831,223**	**$1,039,831**	

Table 48. Value-Added Cheese Production Future Projections, 2011-2021

	Individual Time Periods											Total for All Periods
CASH INFLOWS	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Cheese Sales	$520,000	$550,940	$583,721	$618,452	$655,250	$694,238	$735,545	$779,310	$825,679	$874,806	$926,857	$7,764,798
Total Cash Inflows	**$520,000**	**$550,940**	**$583,721**	**$618,452**	**$655,250**	**$694,238**	**$735,545**	**$779,310**	**$825,679**	**$874,806**	**$926,857**	$7,764,798

	Individual Time Periods											Total for All Periods
CASH OUTFLOWS	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Fluid Milk	$87,100	$92,282	$97,773	$103,591	$109,754	$116,285	$123,204	$130,534	$138,301	$146,530	$155,249	$1,300,604
Coloring	$260	$273	$287	$302	$317	$334	$351	$369	$387	$407	$428	$3,715
Salt	$934	$981	$1,032	$1,084	$1,140	$1,198	$1,259	$1,323	$1,391	$1,462	$1,537	$13,341
Calcium Chloride	$597	$627	$659	$693	$728	$766	$805	$846	$889	$934	$982	$8,526
Starter Cultures	$1,148	$1,207	$1,269	$1,333	$1,401	$1,473	$1,548	$1,627	$1,711	$1,798	$1,890	$16,406
Rennet	$3,120	$3,279	$3,447	$3,623	$3,808	$4,003	$4,207	$4,422	$4,648	$4,886	$5,136	$44,581
Inhibitor testing	$195	$205	$215	$226	$238	$250	$263	$276	$291	$305	$321	$2,786
Petri Film Testing	$140	$147	$155	$163	$171	$180	$189	$198	$209	$219	$230	$2,000
Pasteurization Check	$40	$42	$44	$46	$49	$51	$54	$57	$60	$63	$66	$572
PH & Acidity Checking	$40	$42	$44	$46	$49	$51	$54	$57	$60	$63	$66	$572
Direct Microscopic Slides	$5	$5	$6	$6	$6	$6	$7	$7	$7	$8	$8	$71
Utilities	$16,500	$17,343	$18,229	$19,161	$20,140	$21,169	$22,251	$23,388	$24,583	$25,839	$27,160	$235,764
Cleaning Supplies	$605	$636	$668	$702	$738	$776	$816	$857	$901	$947	$995	$8,641
Packaging	$2,080	$2,186	$2,298	$2,415	$2,539	$2,669	$2,805	$2,948	$3,099	$3,257	$3,424	$29,720
Labels	$3,120	$3,279	$3,447	$3,623	$3,808	$4,003	$4,207	$4,422	$4,648	$4,886	$5,136	$44,581
Supplies	$10,000	$10,511	$11,048	$11,613	$12,206	$12,830	$13,485	$14,174	$14,899	$15,660	$16,460	$142,886
Transportation	$55,000	$57,810	$60,765	$63,870	$67,133	$70,564	$74,170	$77,960	$81,944	$86,131	$90,532	$785,878
Waste and Wastewater Treatment	$376	$395	$416	$437	$459	$483	$507	$533	$561	$589	$619	$5,376
Lot Improvements	$900	$946	$994	$1,045	$1,099	$1,155	$1,214	$1,276	$1,341	$1,409	$1,481	$12,860

Table 48 contd.

Advertising/Marketing	$30,000	$31,533	$33,144	$34,838	$36,618	$38,489	$40,456	$42,524	$44,697	$46,980	$49,381	$428,661
Product Loss/Samples	$20,000	$21,022	$22,096	$23,225	$24,412	$25,660	$26,971	$28,349	$29,798	$31,320	$32,921	$285,773
Phone and Internet	$12,000	$12,613	$13,258	$13,935	$14,647	$15,396	$16,182	$17,009	$17,879	$18,792	$19,752	$171,464
Credit Card Transaction Fees	$12,350	$12,981	$13,644	$14,342	$15,075	$15,845	$16,654	$17,506	$18,400	$19,340	$20,329	$176,465
FICA	$4,694	$4,934	$5,186	$5,451	$5,730	$6,022	$6,330	$6,654	$6,994	$7,351	$7,727	$67,072
Insurance	$10,155	$10,674	$11,219	$11,793	$12,395	$13,029	$13,694	$14,394	$15,130	$15,903	$16,715	$145,100
Worker's Comp	$4,281	$4,500	$4,730	$4,971	$5,225	$5,492	$5,773	$6,068	$6,378	$6,704	$7,047	$61,170
Unemployment Taxes	$1,140	$1,198	$1,259	$1,324	$1,391	$1,463	$1,537	$1,616	$1,698	$1,785	$1,876	$16,289
Licenses, Permits and Fees	$300	$315	$331	$348	$366	$385	$405	$425	$447	$470	$494	$4,287
Secretarial/Bookkeeping/ Accounting	$15,000	$15,767	$16,572	$17,419	$18,309	$19,245	$20,228	$21,262	$22,348	$23,490	$24,691	$214,330
Legal Costs	$5,000	$5,255	$5,524	$5,806	$6,103	$6,415	$6,743	$7,087	$7,449	$7,830	$8,230	$71,442
Depreciation	$67,570	$67,570	$67,570	$67,570	$67,570	$67,570	$67,570	$67,570	$67,570	$67,570	$67,570	$743,270
Repairs	$21,123	$22,202	$23,337	$24,529	$25,783	$27,100	$28,485	$29,941	$31,471	$33,079	$34,769	$301,820
Interest	$61,343	$64,477	$67,772	$71,235	$74,875	$78,701	$82,723	$86,950	$91,393	$96,063	$100,972	$876,505
Labor	$61,360	$64,495	$67,791	$71,255	$74,896	$78,724	$82,746	$86,975	$91,419	$96,091	$101,001	$876,755
	$508,475	**$531,737**	**$556,231**	**$582,023**	**$609,181**	**$637,779**	**$667,894**	**$699,605**	**$732,999**	**$768,164**	**$805,195**	**$7,099,283**

	Individual Time Periods Cheese											Total for All Periods
SUMMARY	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Net Cash Flow	**$11,525**	**$19,203**	**$27,490**	**$36,430**	**$46,069**	**$56,458**	**$67,651**	**$79,704**	**$92,680**	**$106,642**	**$121,662**	**$665,515**
Beginning cash balance	$0											
Cumulative Net Cash Flow	**$11,525**	**$30,729**	**$58,219**	**$94,649**	**$140,718**	**$197,176**	**$264,827**	**$344,531**	**$437,211**	**$543,853**	**$665,515**	

Table 49. Value-Added Yogurt Production Future Projections, 2011-2021

	Individual Time Periods											Total for
CASH INFLOWS	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All Periods
Milk Sales	$503,631	$533,597	$565,346	$598,984	$634,624	$672,384	$712,391	$754,778	$799,687	$847,269	$897,681	$7,520,371
Milk Sales	$307,775	$326,087	$345,489	$366,046	$387,826	$410,901	$435,350	$461,253	$488,698	$517,775	$548,583	$4,595,782
Milk Sales	$209,846	$222,332	$235,561	$249,577	$264,427	$280,160	$296,829	$314,491	$333,203	$353,029	$374,034	$3,133,488
Yogurt Sales	$383,720	$406,551	$430,741	$456,370	$483,524	$512,294	$542,775	$575,071	$609,287	$645,540	$683,950	$5,729,824
Butter Sales	$136,969	$145,119	$153,753	$162,902	$172,594	$182,864	$193,744	$205,272	$217,485	$230,426	$244,136	$2,045,263
Total Cash Inflows	**$1,541,941**	**$1,633,686**	**$1,730,891**	**$1,833,879**	**$1,942,994**	**$2,058,602**	**$2,181,089**	**$2,310,864**	**$2,448,361**	**$2,594,038**	**$2,748,383**	$23,024,728

	Individual Time Periods											Total for
CASH OUTFLOWS	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All Periods
Fluid Milk	$276,375	$292,819	$310,242	$328,701	$348,259	$368,981	$390,935	$414,196	$438,840	$464,951	$492,616	$4,126,916
Vitamin A Palmitate	$4,029	$4,235	$4,451	$4,679	$4,918	$5,169	$5,433	$5,711	$6,003	$6,310	$6,632	$57,570
Vitamin D3	$13,430	$14,116	$14,838	$15,596	$16,393	$17,231	$18,111	$19,037	$20,009	$21,032	$22,107	$191,900
Sugar	$3,541	$3,722	$3,912	$4,112	$4,322	$4,543	$4,775	$5,019	$5,276	$5,546	$5,829	$50,599
Cocoa	$1,574	$1,654	$1,739	$1,828	$1,921	$2,019	$2,122	$2,231	$2,345	$2,465	$2,591	$22,488
Starch	$871	$915	$962	$1,011	$1,063	$1,117	$1,174	$1,234	$1,297	$1,364	$1,433	$12,443
Salt	$110	$115	$121	$127	$134	$141	$148	$156	$163	$172	$181	$1,568
Carrageenan	$298	$313	$329	$346	$363	$382	$402	$422	$444	$466	$490	$4,255
Evaporated Cane Juice	$24,657	$25,917	$27,241	$28,633	$30,097	$31,634	$33,251	$34,950	$36,736	$38,613	$40,586	$352,317
Cultures	$444	$466	$490	$515	$542	$569	$598	$629	$661	$695	$730	$6,340
Puree	$59,956	$63,020	$66,240	$69,625	$73,183	$76,923	$80,853	$84,985	$89,328	$93,892	$98,690	$856,697
Pectin	$2,644	$2,779	$2,921	$3,070	$3,227	$3,392	$3,566	$3,748	$3,939	$4,141	$4,352	$37,780
Inhibitor testing	$585	$615	$646	$679	$714	$751	$789	$829	$872	$916	$963	$8,359
Petrifilm Testing	$350	$368	$387	$406	$427	$449	$472	$496	$521	$548	$576	$5,001
Pasteurization Check	$120	$126	$133	$139	$146	$154	$162	$170	$179	$188	$198	$1,715
PH & Acidity Checking	$100	$105	$110	$116	$122	$128	$135	$142	$149	$157	$165	$1,429

Table 49 contd.

Direct Microscopic Slides	$20	$21	$22	$23	$24	$26	$27	$28	$30	$31	$33	$286
Utilities	$30,000	$31,533	$33,144	$34,838	$36,618	$38,489	$40,456	$42,524	$44,697	$46,980	$49,381	$428,661
Cleaning Supplies	$5,244	$5,512	$5,794	$6,090	$6,401	$6,728	$7,072	$7,433	$7,813	$8,212	$8,632	$74,929
Jugs-Quart	$99,127	$104,193	$109,517	$115,113	$120,996	$127,179	$133,677	$140,508	$147,688	$155,235	$163,168	$1,416,402
Jugs-1/2 Gal	$39,171	$41,173	$43,277	$45,488	$47,813	$50,256	$52,824	$55,523	$58,361	$61,343	$64,478	$559,707
Jugs-Gal	$21,264	$22,351	$23,493	$24,694	$25,956	$27,282	$28,676	$30,141	$31,682	$33,300	$35,002	$303,841
Caps	$14,629	$15,377	$16,163	$16,989	$17,857	$18,769	$19,728	$20,736	$21,796	$22,910	$24,080	$209,034
Labels	$15,596	$16,393	$17,231	$18,111	$19,037	$20,010	$21,032	$22,107	$23,236	$24,424	$25,672	$222,848
Butter Packaging	$645	$677	$712	$749	$787	$827	$869	$914	$960	$1,009	$1,061	$9,210
Cardboard Boxes	$34,893	$36,676	$38,550	$40,520	$42,590	$44,767	$47,054	$49,459	$51,986	$54,643	$57,435	$498,573
Supplies	$25,000	$26,277	$27,620	$29,032	$30,515	$32,074	$33,713	$35,436	$37,247	$39,150	$41,151	$357,217
Transportation	$300,000	$315,330	$331,443	$348,380	$366,182	$384,894	$404,562	$425,235	$446,965	$469,805	$493,812	$4,286,610
Waste and Wastewater Treatment	$1,135	$1,193	$1,254	$1,318	$1,385	$1,456	$1,531	$1,609	$1,691	$1,777	$1,868	$16,217
Lot Improvements	$900	$946	$994	$1,045	$1,099	$1,155	$1,214	$1,276	$1,341	$1,409	$1,481	$12,860
Advertising/Marketing	$60,000	$63,066	$66,289	$69,676	$73,236	$76,979	$80,912	$85,047	$89,393	$93,961	$98,762	$857,322
Product Loss/Samples	$77,097	$81,037	$85,178	$89,530	$94,105	$98,914	$103,969	$109,281	$114,866	$120,735	$126,905	$1,101,616
Phone and Internet	$12,000	$12,613	$13,258	$13,935	$14,647	$15,396	$16,182	$17,009	$17,879	$18,792	$19,752	$171,464
Credit Card Transaction Fees	$1,831	$1,925	$2,023	$2,126	$2,235	$2,349	$2,469	$2,595	$2,728	$2,867	$3,014	$26,163
FICA	$13,290	$13,969	$14,682	$15,433	$16,221	$17,050	$17,922	$18,837	$19,800	$20,812	$21,875	$189,891
Insurance	$10,663	$11,208	$11,780	$12,382	$13,015	$13,680	$14,379	$15,114	$15,886	$16,698	$17,551	$152,356
Worker's Comp	$8,217	$8,637	$9,078	$9,542	$10,030	$10,542	$11,081	$11,647	$12,242	$12,868	$13,526	$117,410
Unemployment Taxes	$2,565	$2,696	$2,834	$2,979	$3,131	$3,291	$3,459	$3,636	$3,822	$4,017	$4,222	$36,651
Licenses, Permits and Fees	$300	$315	$331	$348	$366	$385	$405	$425	$447	$470	$494	$4,287
Secretarial/Bookkeeping/ Accounting	$25,000	$26,277	$27,620	$29,032	$30,515	$32,074	$33,713	$35,436	$37,247	$39,150	$41,151	$357,217
Legal Costs	$10,000	$10,511	$11,048	$11,613	$12,206	$12,830	$13,485	$14,174	$14,899	$15,660	$16,460	$142,886
Depreciation	$89,210	$89,210	$89,210	$89,210	$89,210	$89,210	$89,210	$89,210	$89,210	$89,210	$89,210	$981,310

Table 49 contd.

Repairs	$27,715	$29,131	$30,620	$32,185	$33,829	$35,558	$37,375	$39,285	$41,292	$43,402	$45,620	$396,011
Interest	$71,013	$74,642	$78,456	$82,465	$86,679	$91,108	$95,764	$100,657	$105,801	$111,208	$116,890	$1,014,683
Labor	$148,720	$156,320	$164,308	$172,704	$181,529	$190,805	$200,555	$210,803	$221,575	$232,898	$244,799	$2,125,015
	$1,534,329	**$1,610,496**	**$1,690,693**	**$1,775,135**	**$1,864,047**	**$1,957,666**	**$2,056,244**	**$2,160,043**	**$2,269,342**	**$2,384,433**	**$2,505,625**	**$21,808,053**

	Individual Time Periods Yogurt											Total for
SUMMARY	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All Periods
Net Cash Flow	**$7,612**	**$23,190**	**$40,197**	**$58,743**	**$78,947**	**$100,936**	**$124,845**	**$150,821**	**$179,018**	**$209,605**	**$242,759**	**$1,216,675**
Beginning cash balance	$0											
Cumulative Net Cash Flow	**$7,612**	**$30,802**	**$71,000**	**$129,743**	**$208,691**	**$309,627**	**$434,472**	**$585,293**	**$764,311**	**$973,916**	**$1,216,675**	

Table 50. Value-Added Milk Production with Dairy Production Future Projections, 2011-2021

	Individual Time Periods for Combined Milk											Total for
SUMMARY	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All Periods
Net Cash Flow	**($109,420)**	**($97,461)**	**($84,210)**	**($69,561)**	**($53,400)**	**($35,604)**	**($16,041)**	**$5,429**	**$28,960**	**$54,712**	**$82,861**	**($293,736)**
Beginning cash balance	$0											
Cumulative Net Cash Flow	**($109,420)**	**($206,881)**	**($291,091)**	**($360,653)**	**($414,053)**	**($449,657)**	**($465,698)**	**($460,269)**	**($431,309)**	**($376,597)**	**($293,736)**	

Table 51. Value-Added Cheese Production with Dairy Production Future Projections, 2011-2021

	Individual Time Periods for Combined Cheese											Total for
SUMMARY	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All Periods
Net Cash Flow	**($103,103)**	**($97,061)**	**($90,336)**	**($82,870)**	**($74,601)**	**($65,465)**	**($55,389)**	**($44,297)**	**($32,109)**	**($18,736)**	**($4,085)**	**($668,052)**
Beginning cash balance	**$0**											
Cumulative Net Cash Flow	**($103,103)**	**($200,164)**	**($290,500)**	**($373,370)**	**($447,971)**	**($513,436)**	**($568,825)**	**($613,122)**	**($645,231)**	**($663,967)**	**($668,052)**	

Table 52. Value-Added Yogurt Production with Dairy Production Future Projections, 2011-2021

Individual Time Periods Combined Yogurt												Total for
SUMMARY	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	All Periods
Net Cash Flow	**($107,016)**	**($93,074)**	**($77,629)**	**($60,556)**	**($41,723)**	**($20,987)**	**$1,806**	**$26,819**	**$54,230**	**$84,226**	**$117,012**	**($116,892)**
Beginning cash balance	**$0**											
Cumulative Net Cash Flow	**($107,016)**	**($200,090)**	**($277,719)**	**($338,275)**	**($379,998)**	**($400,985)**	**($399,179)**	**($372,360)**	**($318,130)**	**($233,904)**	**($116,892)**	

Table 53. Dairy Production Sensitivity Testing

		Milk Revenues				
		248737.50	262556.25	276375	290193.75	304012.50
		Milk Price % Change				
Feed Costs	Feed Cost % Change	-10	-5	0	5	10
209753.82	-10	($118,959.68)	($105,140.93)	($91,322.18)	($77,503.43)	($63,684.68)
221406.81	-5	($130,612.67)	($116,793.92)	($102,975.17)	($89,156.42)	($75,337.67)
233059.80	0	($142,265.66)	($128,446.91)	($114,628.16)	($100,809.41)	($86,990.66)
244712.79	5	($153,918.65)	($140,099.90)	($126,281.15)	($112,462.40)	($98,643.65)
256365.78	10	($165,571.64)	($151,752.89)	($137,934.14)	($124,115.39)	($110,296.64)

Table 54. Value-Added Milk Production Sensitivity Testing

		Product Revenues				
		1188489.60	1254516.80	1320544	1386571.20	1452598.40
		Output Price % Change				
Input Costs	Input Cost % Change	-10	-5	0	5	10
464085	-10	($75,281.52)	($9,254.32)	$56,772.88	$122,800.08	$188,827.28
489867.50	-5	($101,064.02)	($35,036.82)	$30,990.38	$97,017.58	$163,044.78
515650	0	($126,846.52)	($60,819.32)	$5,207.88	$71,235.08	$137,262.28
541432.50	5	($152,629.02)	($86,601.82)	($20,574.62)	$45,452.58	$111,479.78
567215	10	($178,411.52)	($112,384.32)	($46,357.12)	$19,670.08	$85,697.28

Table 55. Value-Added Cheese Production Sensitivity Testing

		Cheese Revenues				
		46800	49400	52000	54600	57200
		Output Prices % Change				
Input Costs	Input Costs % Change	-10	-5	0	5	10
88523.10	-10	$16,161.19	$18,761.19	$21,361.19	$23,961.19	$26,561.19
93441.05	-5	$11,243.24	$13,843.24	$16,443.24	$19,043.24	$21,643.24
98359	0	$6,325.29	$8,925.29	$11,525.29	$14,125.29	$16,725.29
103276.95	5	$1,407.34	$4,007.34	$6,607.34	$9,207.34	$11,807.34
108194.90	10	($3,510.61)	($910.61)	$1,689.39	$4,289.39	$6,889.39

Table 56. Value-Added Yogurt Production Sensitivity Testing

		Product Revenues				
		1387746.90	1464843.95	1541941	1619038.05	1696135.10
		Output Prices % Change				
Input Costs	Input Costs % Change	-10	-5	0	5	10
551929.50	-10	(85,256.57)	(8,159.52)	68,937.53	146,034.58	223,131.63
582592.25	-5	(115,919.32)	(38,822.27)	38,274.78	115,371.83	192,468.88
613255.00	0	(146,582.07)	(69,485.02)	7,612.03	84,709.08	161,806.13
643917.75	5	(177,244.82)	(100,147.77)	(23,050.72)	54,046.33	131,143.38
674580.50	10	(207,907.57)	(130,810.52)	(53,713.47)	23,383.58	100,480.63

VITA

Jonathan Moss was born on January 15, 1988, in Nashville, TN, to Joel and Rebecca Moss. He graduated from Upperman High School in Baxter, TN, in 2006. He then attended Tennessee Technological University where he completed his Bachelor's of Science degree in Agribusiness Management in 2010. After completion of his undergraduate degree, Jonathan attended the University of Tennessee where he completed a Master's of Science degree in Agricultural Economics. He has now accepted an offer to pursue a Master's of Business administration from Tennessee Technological University.