NET PRESENT VALUE ANALYSIS OF PLANT INVESTMENT TO ADD CAPACITY

by

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ABSTRACT

Providing a recommendation on whether to make a capacity expanding capital investment in an existing butter plant is the subject of this thesis. This is important as the success of this project will have a significant impact on the future profitability of Land O'Lakes and provide a significant home for its member's milk production.

The dairy industry has undergone change over the past decades. Milk production has moved from the traditional production area of the Upper Midwest to drier, more arid areas such as California. This has led to milk price premiums in the Upper Midwest and since milk is the major input to butter manufacturing, it has become more attractive to produce butter in other areas such as California.

Much of the data collected in review of the industry were obtained from the USDA. This data were used to describe the industry and focus on the number of butter plants over time, the milk productivity per cow, and the total milk production by state. It provides a clear picture of fewer bigger plants, more productive cows, and a dramatic shift in milk production to the West, primarily California.

A Net Present Value (NPV) model is developed to analyze the trade off between the initial capital investment and less costly milk procurement over time. The model also considers maintenance costs, salvage values, plant startup delays, and a one time salvage value gain by shutting down an Upper Midwest plant. After the initial model is developed, sensitivity analysis is conducted, focusing on key variables such as demand growth, and the spread between California and Upper Midwest milk prices.

The conclusion is that additional investment in California butter production would be profitable, earning a positive NPV and an Internal Rate of Return (IRR) greater than the Land O'Lakes cost of capital. The solution is robust as they remain the same even after modeling lower demand and smaller milk price differentials. Therefore, I recommend that Land O'Lakes move ahead with this capital investment.

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CHAPTER 1: INTRODUCTION

Land O'Lakes is a farmer owned national dairy cooperative headquartered in Arden Hills, Minnesota. The company was formed in 1921 as the Minnesota Cooperative Creamery Association. It has a history of innovation beginning with being the first to make butter with sweet cream and sell it in one-pound packages. It realized the need to capitalize on this strategic advantage and in 1924 began marketing butter under the name Land O'Lakes. In 1926, the company officially changed its name to Land O'Lakes Creameries, Inc., and later to Land O'Lakes, Inc. Over time, the Land O'Lakes brand has become synonymous with quality, wholesome, natural dairy products and is one of the most powerful food brands in the U.S.

Land O'Lakes is also the largest feed company in North America after its acquisition of Purina Mills and is the largest distributor of agronomy products in the U.S. Even though Land O'Lakes is a large and diverse cooperative, the focus of this project is on milk availability and butter production within its Dairy Foods division.

1.1 Products and Channels

Today, Land O'Lakes produces and markets over 300 dairy food products including butter, cheese sauce, dairy case cheese, deli cheese and spreads and has license agreements to leverage the power of the Land O'Lakes brand on items such as cocoa, cottage cheese, and fluid milk. Products are sold under the Land O'Lakes, Alpine Lace, New Yorker, and Lake to Lake brand names and move through a variety of channels including traditional grocery, club, mass merchant, foodservice, convenience and school lunch channels. Land O'Lakes also has significant private label butter business originating from their Madison, Wisconsin and Tulare, California plants. Today, Land O'Lakes is the only nationally marketed brand of butter and enjoys a 27% and 31% share in terms of pounds and dollars respectively.

1.2 Milk Supply Problem

U.S. milk production has changed significantly over the past 15 to 20 years and the changes have had significant financial impacts to Land O'Lakes. Both the company's and industry's butter assets have historically been based largely in the Upper Midwest since milk production was largest there. This has changed over time due to climate, space and technology and the industry has struggled to follow production. The existing dairy production asset base in the Upper Midwest has been chasing the declining supply of milk and driving up prices. This has meant that few, if any, of the facilities were economically profitable.

Thus, one would expect the industry to rationalize capacity to bring milk demand in line with supply and reduce the premiums being paid for milk. While rationalization has happened to some degree, it has occurred more slowly than necessary partly because of the slowness of the companies involved and partly because many of these are cooperatives who have somewhat limited options in these areas because they need to find a home for their members' milk. When they do make decisions such as closing plants, they are often not very nimble.

1.3 Land O'Lakes Butter Network

Land O'Lakes butter production was historically based in Minnesota and Wisconsin. In the late 1970s and 1980s, some of these assets were closed or converted into cheese and whey plants. This was done because the value of milk was greater in cheese and whey than it was in butter. For a time, Land O'Lakes primarily entrusted its butter supply to external suppliers such as Dairyman's Cooperative Creamery Association (DCCA), Maryland and Virginia Milk Producers, Madison Dairy, and the Atlantic Dairy Cooperative.

The current Land O'Lakes butter assets were largely gained through merger or acquisition. It did build a butter and spreads plant in Kent, Ohio in 1981. It merged with Atlantic Dairy Cooperative of Pennsylvania in 1997, adding the Carlisle, Pennsylvania dairy plant. Next they merged with DCCA of Tulare in 1998. Finally, Land O'Lakes purchased Madison Dairy in 2000.

The two mergers tripled Land O'Lakes's milk supply from four billion pounds per year to about twelve billion pounds per year. The California merger was particularly significant, given the growth and increasing importance of the California milk supply (Dobson and Christ, 2000).

It is becoming increasingly challenging to keep both the Madison and Carlisle plants supplied with milk due to the declining milk supply. Also, the milk that is available is more expensive than in California. All of these factors lead to the question of how Land O'Lakes should best optimize their butter network. One of the questions that has been asked is whether an additional investment should be made in the Tulare, CA plant to increase its butter capacity and long term profitability. That decision is complicated by the fact that it would require cheese production to cease in the Tulare facility and either be produced elsewhere, or outsourced this production entirely to a third party. A secondary decision that would occur if an expansion of the Tulare plant was warranted would be how utilization is affected at the other butter plants across the country. Given the difficulty in running butter plants with expensive milk or at less than full capacity, there may be an opportunity to shift some of this volume to Tulare and potentially close or sell another facility.

1.4 U.S. Milk Production

Over a period of decades, U.S. milk production and processing has steadily moved from the Northeast and Upper Midwest to the West, to the point that the volume centroid of milk production is in Northeastern Kansas (Peterson, 2002). The question is whether current milk production trends (both in terms of growth rates and geography) will continue. This is difficult to predict and could end up making what would otherwise be sound investments look poor a few years down the road. It seems Land O'Lakes is forever "chasing the milk." This it is worth examining why milk production has changed so dramatically in the past to attempt to predict where it may be headed in the future. In summary, Land O'Lakes needs to develop a strategy to position itself to be successful both now and into the future as milk supply and butter production continue to shift.

1.5 Problem Statement

This thesis examines the financial impact of an expansion of the Land O'Lakes butter plant in Tulare, CA using a NPV model. The model will consider the initial capital outlay for the capacity expansion as well as the ongoing changes in net cash flow resulting from the expansion. The scope of the analysis is limited to the capital investment, plant operating cash flows, and logistics costs. These are the significant cost areas that would be significantly impacted by a plant expansion. There are other considerations such as how to replace the cheese production that would be displaced from using more milk for butter production but those are outside the scope of this analysis.

Most input data available directly from Land O'Lakes, with the remainder coming from the USDA. The capital expenditures have been estimated by a manufacturing and R&D team at Land O'Lakes. Production information such as milk to butter conversion ratios, inputs costs, and product values have been obtained from the Land O'Lakes finance team. Transportation costs have been provided by the corporate transportation department.

The model will be developed in a spreadsheet that uses much of the detailed data collected to calculate the net cash flows and discount them back to the present time. Different scenarios and sensitivity analysis are completed so that a number of what-if questions can be answered.

CHAPTER 2: INDUSTRY & LITERATURE REVIEW

2.1 U.S. Dairy Processing Companies

As with many other agricultural industries, the passing decades have brought fewer, larger firms to the dairy industry. Between 1982 and 1997, the number of U.S. butter companies fell 48%, from 61 to 32. Dairy cooperatives saw their numbers decline by 48% from 435 to 226 between 1980 and 1997. Further, the percentage of cooperatives marketing butter fell by 47% between 1992 and 1997 (Dobson and Christ, 2000). The cooperative numbers are discussed because of their importance in butter manufacturing. Cooperatives, led by Land O'Lakes, accounted for 65% and 61% of U.S. butter manufacturing in 1992 and 1997 respectively (Ling, 1999).

It is interesting that Kraft, the largest U.S. dairy product producer, does not compete in the butter market and instead focuses on natural and American cheese products. Associated Milk Producers, Inc. (AMPI) owns the biggest butter-only plant in the U.S. The plant, located in New Ulm, Minnesota, experienced a major fire late in 2004 but was rebuilt and reopened in December 2005.

2.2 U.S. Milk Production

Milk production in the U.S. has changed dramatically over the past 15 to 20 years with total U.S. milk production increasing from 145 million to 182 million pounds between 1988 and 2006. This averages 1.14% growth per year for a total increase of 25.4% over the eighteen year period. This growth in milk production comes despite a 0.6% annual decrease in the number of dairy cows for a total of a 10.8% decrease during the same time. Obviously, dairies have become more productive with an average annual increase of 2.2%

in milk output per cow for a total increase of 40.6% (USDA). Table 2.1 illustrated the change in number of milk cows, cow productivity, and total milk production over time.

The increase in milk production efficiency is due to innovations in genetics, drugs, artificial breeding tactics and information technology as well as a shift from pasture based to confined milk production systems. In short, milk production has changed from a largely nature driven biological phenomenon to more of an industrial production system. As production has moved west, dairy farms have become more industrial in nature (Roosen et al., 2004). Another change is that a much larger portion of the cows are now found in warm, arid regions that promote higher levels of milk production.

Table 2.1 Historical U.S. Milk Production

	Cows (1,000s)	Lbs./Cow	Total Milk (1,000s lbs.)	% Change
1988	10,224	14,185	145,034	N/A
1989	10,046	14,323	143,893	-0.8%
1990	9,993	14,782	147,721	2.7%
1991	9,826	15,031	147,697	0.0%
1992	9,688	15,574	150,885	2.2%
1993	9,581	15,722	150,636	-0.2%
1994	9,494	16,179	153,602	2.0%
1995	9,466	16,405	155,292	1.1%
1996	9,372	16,433	154,006	-0.8%
1997	9,252	16,871	156,091	1.4%
1998	9,151	17,185	157,262	0.8%
1999	9,153	17,763	162,589	3.4%
2000	9,199	18,197	167,393	3.0%
2001	9,103	18,162	165,332	-1.2%
2002	9,139	18,608	170,063	4.6%
2003	9,083	18,760	170,394	1.8%
2004	9,012	18,967	170,934	3.4%
2005	9,041	19,576	176,989	4.1%
2006	9,115	19,949	181,839	6.7%

Source: http://www.nass.usda.gov/QuickStats/Create_Federal_All.jsp

While the change in volume over time is important, the geographical changes in milk production have been much more significant. Although milk is produced in all 50 states, the majority of production comes from only a few. It is well known that milk production has been declining for years in the Upper Midwest, while increasing dramatically in California and other Western states. California overtook Wisconsin in 1993, becoming the leading milk producing state in America.

It is also well understood that a variety of factors have encouraged this movement. First, dairy cows thrive in a warm, dry climate. Second, the open, sparsely populated areas support large feedlot style dairy farming operations capable of realizing significant economies of scale. Third, producers in the West seem to have a lower degree of resistance to change and are early adopters of new technology such as improved genetics, antibiotics, information technology and animal shelter. Finally, some have argued there is an agglomeration effect that has led to more milk production (Peterson, 2002). Agglomeration is that past milk production expansion has encouraged further expansion because of the development of milk handling facilities, milk processing facilities, specialized labor and management skills and well developed input supplies. Once the production begins, a snowball effect takes over.

The future will likely bring more focus to the impact that expanded dairy production has on the environment. This focus will occur because some of the dairy expansion is occurring in environmentally sensitive parts of the country and because the expansion is in large, feedlot style operations. Environmental concerns are largely focused on waste management and water quality.

The fact that milk production is moving has put pressure on existing dairy facilities that are experiencing a decline in the amount of milk available and over time has created investment in new facilities in other parts of the country, notably the West Coast. The changes in processing facilities, however, have not kept pace with the change in milk supply. Dairy companies have struggled to adapt to the changes and now need to focus on how to align their production to best take advantage of where milk supply will be available in the future.

Looking specifically at the states in which Land O'Lakes has butter production facilities, we can see that not only did California's real milk output increase sharply, it also increased in proportion relative to that of the rest of the U.S. (Table 2.2). California went from accounting for 12.8% of the nation's milk in 1988 to 21.2% in 2005.

Table 2.2 Historical U.S. Milk Production – Key States

	California		Pennsylvania		Wisconsin		
	Lbs.	% of US	Lbs.	% of US	Lbs.	% of US	Total
1988	18,607	12.8%	10,204	7.0%	25,000	17.2%	145,034
1989	19,420	13.5%	9,998	6.9%	23,898	16.6%	143,893
1990	20,947	14.2%	10,014	6.8%	24,187	16.4%	147,721
1991	21,407	14.5%	10,058	6.8%	23,770	16.1%	147,697
1992	22,092	14.6%	10,368	6.9%	23,844	15.8%	150,885
1993	22,924	15.2%	10,181	6.8%	22,844	15.2%	150,636
1994	25,234	16.4%	10,230	6.7%	22,412	14.6%	153,602
1995	25,327	16.3%	10,489	6.8%	22,942	14.8%	155,292
1996	25,848	16.8%	10,484	6.8%	22,376	14.5%	154,006
1997	27,582	17.7%	10,662	6.8%	22,368	14.3%	156,091
1998	27,620	17.6%	10,847	6.9%	22,842	14.5%	157,262
1999	30,444	18.7%	10,931	6.7%	23,071	14.2%	162,589
2000	32,245	19.3%	11,156	6.7%	23,259	13.9%	167,393
2001	33,217	20.1%	10,849	6.6%	22,199	13.4%	165,332
2002	35,065	20.6%	10,775	6.3%	22,074	13.0%	170,063
2003	35,437	20.8%	10,338	6.1%	22,266	13.1%	170,394
2004	36,465	21.3%	10,062	5.9%	22,085	12.9%	170,934
2005	37,564	21.2%	10,503	5.9%	22,866	12.9%	176,989

Source: http://www.nass.usda.gov/QuickStats/Create_Federal_All.jsp

Wisconsin has a different story. Wisconsin's milk production as a percentage of the national output fell from 17.2% to 12.9%. More importantly, their production fell from 25.0 million pounds to 22.9 million pounds. Pennsylvania milk production stayed flat at around 10 million pounds throughout this time period.

Milk cow productivity has also changed significantly over the past 15 to 20 years. This phenomenon is widespread, regardless of geography. All key Land O'Lakes states experienced growth of roughly 4,000 pounds of milk output per cow. Of course, California dairies already enjoyed high productivity, so their advances have come on top of their already enviable position. The combined increase in number of cows and efficiency have led California to account for over 20% of the nation's milk supply.

2.3 U.S. Milk Production Seasonality

Milk production in the U.S. has historically been seasonal, driven by biological constraints and traditional non capital intensive production strategies such as pasture feeding. This phenomenon, while still present, has begun to disappear as capital intensive confined animal feeding operations have broken some of the traditional breeding cycles. This has made it possible to produce milk at high volumes year round in order to spread high fixed capital investment costs (Roosen et al., 2004).

2.4 U.S. Milk Market Risk

Due in part to the USDA dairy price support program, U.S. milk processors enjoyed predictability in the prices paid for milk because these prices were dependent on support price floors until 1989 (Dobson and Christ, 2000). The 1996 Federal Agriculture

Improvement and Reform Act (FAIR) was supposed to abolish price supports. However, later legislation has extended some level of support through 2011 (Peterson, 2002).

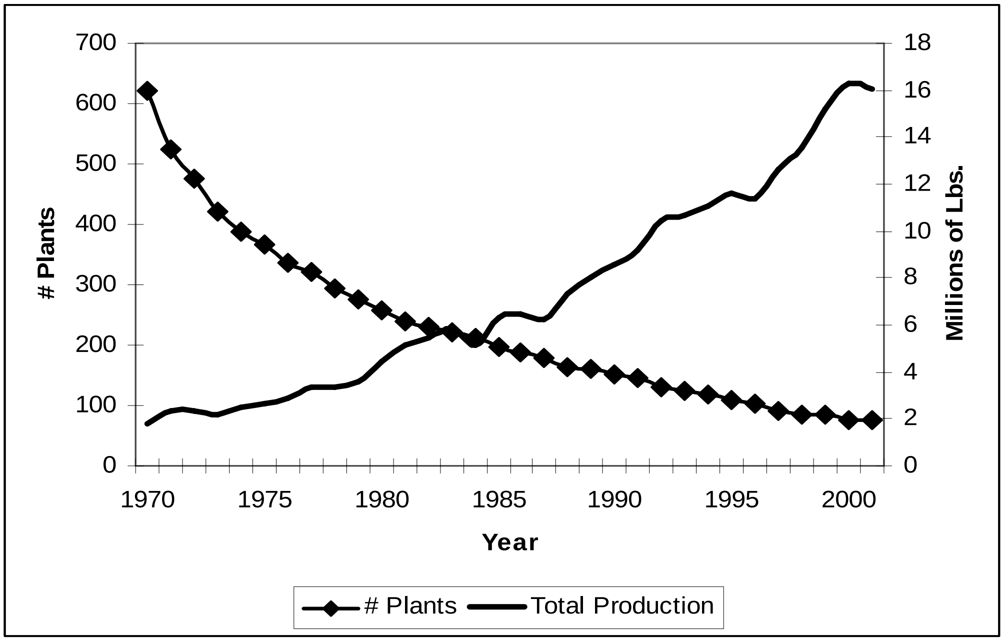
The milk processing industry is not directly affected by imports or exports because fluid milk is highly perishable. Of course, milk processors are affected by the import and export of dairy products, notably natural cheese.

2.5 U.S. Butter Manufacturing

Closely related to the changes in U.S. milk production are the decisions that firms make regarding butter production facilities, especially involving new construction. Investment in dairy processing assets has clearly followed the milk to the West. There is no evidence to suggest that this trend will change anytime soon. Even though the trend in processing assets is clearly moving to the West, the processing base has not left as quickly as the milk. Many of the companies, particularly cooperatives, have found it difficult to make these changes quickly because they have an additional concern of trying to find a home for their members' milk.

Another important point is that the industry is utilizing fewer, larger plants. In 2001, there were 71 butter producing plants, down from 622 in 1970. (Figure 2.1) This decline occurred even as total butter volume remained relatively flat, increasing by just 8% (Blayney and Miller, 2003). Clearly, today's plants are larger and more efficient than the older plants that have been taken offline. An interesting question for the future is whether new investment in butter plants is warranted given the fact it is a very mature industry with relatively flat demand.

Figure 2.1: Butter Plants and Output per Plant



Source: http://www.nass.usda.gov/QuickStats/Create_Federal_All.jsp

2.6 Butter Market Dynamics

As butter has transitioned from a government price support system to a market one, inventories and price stability have changed markedly. From the late 1980s through 1995 butter inventories fell as the system moved toward a free market. At that point, butter inventories dropped to less than a one month's supply. This drop in inventory corresponded with a drastic increase in butter price volatility (Schaefer, 2000). Presumably, the higher government assured price meant that firms felt less price risk of holding inventory. Once the inventory decreased, there was less insulation from supply and demand shocks and hence the butter price became much more volatile. This is understandable in an industry with seasonal production and consumption.

In addition to production and demand for butter, there are other factors that influence the price. At times, the butter market appears to defy the law of supply. When butter prices have increased, the quantity supplied has actually decreased (Schaefer, 2000). A closer look shows that the law of supply has not been repealed. One of the determinants of butter supply is the cost of fat. Milk fat is used in many ways including ice cream, cream cheese, whipped cream and cheese. Each of these products places a higher value on the milk fat than does butter. Therefore, butter essentially is the residual demander of fat.

Consequently, the cost and supply of butter is dependent not only on what is happening in the butter market, but also what is happening in several other dairy product markets. In economic terms, the market was experiencing a leftward shift in the supply curve (increasing cost of fat) rather than simply a movement along the supply curve. This allows for a higher market price and lower quantity supplied, given a static demand curve. This is similar to how rising costs of natural gas raises the price of anhydrous ammonia.

2.7 Butter Market Concentration

Butter production is more concentrated than the other dairy manufacturing sectors. One measure of market concentration is the Herfindahl Hirschman Index (HHI). HHI is calculated as the sum of the squared market shares (Economist.com, 2008). The HHI for the butter market was 1,262 in 1997 which is in the range (1,000 to 1,800) considered moderately concentrated. The top four producers accounted for 57% of the market with the top eight accounting for 76% of all butter produced. These concentration numbers will likely be greater when more recent (2002) data becomes available, due to additional recent consolidation in the industry.

This concentration helps butter manufacturers deal with the ever increasing size of their customer base. Having significant volume helps manufacturers remain competitive in this day of substantial investment in supplier/retailer relationships. It's unlikely that the butter sector will become less concentrated anytime soon and there is a good chance that the industry will become slightly more concentration moving forward.

CHAPTER 3: THEORETICAL MODEL

3.1 Net Present Value (NPV)

When firms face investment decisions they often turn to Net Present Value (NPV) as a tool to help make decisions. There are several competing decision tools such as Internal Rate of Return (IRR), payback period and book rate of return. As we will see, IRR is very comparable to NPV but has some important limitations, while the value of payback period and book rate of return as investment decision tools have more severe limitations. NPV is one of the cornerstones of finance and is built on several key concepts.

The discount factor is a critical concept in NPV analysis. The discount factor concept recognizes that a dollar today is worth more than a dollar tomorrow. Why? Because a dollar today gives one the ability to invest it in an alternative project or pay down existing debt. The expected return on the new investment or the interest rate avoided by paying debt early is one way to think of a firm's or individual's discount factor. Firms often arrive at their discount factor by calculating their opportunity cost of capital. The discount factor is expressed as $1 / (1 + r)$, where r is the rate of return or cost avoidance (Brealey and Myers, 2003).

Opportunity cost of capital refers to the return that a firm could yield in its next best investment opportunity. This could be a competing investment alternative or it could be the firm's cost of borrowing money. Often firms will have a pre-established number based on the weighted sources of capital that is ready to be used in evaluating different investment alternatives.

The NPV concept converts all future cash flows (positive or negative) into present values. The present values can then be summed and the net value of the investment at the present (NPV) can be determined. For example, the NPV of a $10,000 investment today would be $(10,000). This number does not need to be discounted because there is no time component to the cash flow. If the firm receives a $3,000 inflow a year later resulting from the investment the NPV would be $3,000 multiplied by the discount factor or $3,000 * 1 / (1 + r). A similar $3,000 inflow two years after the initial investment would have a NPV equal to $3,000 * 1 / $(1 + r)^2$.

Table 3.1 NPV Calculations

Year	Net Cash Inflow		Discount Factor	NPV	
0	$	(10,000)	-	$	(10,000)
1	$	3,000	0.89	$	2,667
2	$	3,000	0.79	$	2,370
3	$	3,000	0.70	$	2,107
4	$	3,000	0.62	$	1,873
5	$	3,000	0.55	$	1,665
6	$	3,000	0.49	$	1,480
7	$	3,000	0.44	$	1,315
			Sum of Net Present Value (NPV):	**$**	**3,477**
			Discount Rate:	**12.5%**	

As you can see in Table 3.1, the NPV of the $3,000 nominal inflow decreases the farther out in time away from the present, due to the decreasing size of the discount factor. It's interesting to note that in year six, the NPV of the $3,000 is worth half of what it is at time zero, clearly illustrating the concept of the time value of money.

As mentioned earlier, a competing financial decision tool is IRR. The IRR is the discount rate where the sum of the NPV of future cash flows is equal to zero. Table 3.2

illustrates the concept of IRR. The discount rate would have to increase from 12.5% to 22.9% for the project to fall to break even status.

Table 3.2 NPV and IRR Calculations

Year		Net Cash Inflow	Discount Factor		NPV
0	$	(10,000)	-	$	(10,000)
1	$	3,000	0.81	$	2,440
2	$	3,000	0.66	$	1,985
3	$	3,000	0.54	$	1,615
4	$	3,000	0.44	$	1,314
5	$	3,000	0.36	$	1,069
6	$	3,000	0.29	$	869
7	$	3,000	0.24	$	707
			Sum of Net Present Value (NPV):	**$**	**0**
			Discount Rate / IRR:		**22.9%**

3.2 NPV Assumptions and Pitfalls

NPV assumes that future nominal cash inflows and outflows are known with certainty. Obviously, this is not always the case. For this reason, we speak in terms of expected payoffs and results. Also, NPV analysis does not account for the fact that different investment alternatives have different risks. Of course, if faced with two alternatives and the same rate of return, most people would choose the alternative with lower risk. Modeling risk and uncertainty is handled by adjusting the discount rate.

The basic NPV rule is that if NPV is positive, it is a good investment for the firm and it should move forward. This reflects that NPV represents economic benefits to an investment because the opportunity cost of capital is included through the use of a discount rate.

When conducting a NPV analysis, cash activities should be the only area of focus. For example, depreciation should not be included because it is not a cash expense. The depreciation (use of an asset) is accounted for at the time of the capital investment. Including depreciation would amount to double counting and, even if done as an alternative to using the initial capital investment, it would misstate the timing of the cash outflow. Also, since the focus is on cash, tax effects are included in a NPV analysis. Tax law affects cash flows and can change decisions based on incremental costs or savings.

Inflation should be treated consistently when conducting a NPV analysis. In other words, when using nominal cash flows, use nominal interest rates. Alternatively, when using real cash flows, use real interest rates. The answer will be correct either way, the key is to be consistent with the methodology.

3.3 NPV Compared to Other Tools

NPV is superior compared to IRR, payback period and book rate of return. Book rate of return is based on values that are on the books and may not accurately reflect true market values. Also, book rate of return uses accounting profit which includes some non-cash income and expenses. For these reasons, NPV decisions are superior.

Payback period can be a weak decision aid because it ignores all income after the payback period is met and doesn't consider the time value of money. Stated differently, it treats all cash flows as equal, regardless of time, and does not consider any cash flows that occur after the break even point.

IRR is a capable decision aid and if used properly will yield the same decisions as NPV. There are, however, a few instances in which IRR will not provide the correct answer. The most problematic of these seems to be the inability to deal with mutually exclusive investment alternatives.

This spreadsheet model will itemize individual investment costs and cash flows and utilize NPV as the primary decision aid. In addition, an IRR will be calculated for ease of comparison amongst scenarios.

CHAPTER 4: DATA COLLECTION AND NPV MODEL

Aside from the data collected from the USDA NASS to aid in a review of the industry, all other data were obtained directly from Land O'Lakes. Historical butter shipment data were used as a baseline of how much butter is produced and shipped annually. Some cleansing of the shipment data was needed to remove miscellaneous rush shipments and double movements of product that were done in emergency to protect service levels. An optimal solution should not be developed with emergency shipments included as these are not a normal business process.

4.1 Milk to Butter Conversion, Tax, and Cost Data

The variable production cost and milk to butter conversion data were obtained from the Land O'Lakes finance team and the Land O'Lakes Annual Report and is based on historical results. It takes roughly 21.2 pounds of milk to produce one pound of butter. Also, the average effective tax rate is 19.8% and is calculated by dividing income tax paid by net income from the annual report. Tax rates are complicated for cooperatives because only income generated from non-member business is taxed. More detail is not shared as it is proprietary.

4.2 Project Objective

The objective of the project is to determine if Land O' Lakes should invest in an expansion of the Tulare, CA butter plant. The decision aid chosen is a discounted cash flow NPV model. The model is contained within a Microsoft Excel spreadsheet. There are three main portions of the model. The first portion of the model lays out the current production volumes by plant and serves as the baseline for the analysis. The second portion is the proposed alternative production plan by plant. Finally, the third portion takes the two production plans and incorporates the cash flows of each option to develop the financial NPV model comparing the two alternatives.

4.3 Baseline Production Model

The baseline production model is based on 2007 total production and sales of 110,000,000 lbs. The branded butter market is very mature and has shown limited growth in recent years. Based on historical Land O'Lakes sales, an annual growth rate of 1.1% was assumed. The baseline model includes production at the existing plants in the same proportion as recent history suggests. The three plants are located in Carlisle, PA, Madison, WI, and Tulare, CA. Table 4.1 illustrates Land O'Lakes butter production by plant over time.

Table 4.1 Projected Production at Carlisle, Madison, and Tulare Plants

Year	Tulare Butter	Carlisle Butter	Madison Butter	Total Butter
0	65,393,000	38,987,000	6,583,000	110,963,000
1	66,112,323	39,415,857	6,655,413	112,183,593
2	66,839,559	39,849,431	6,728,623	113,417,613
3	67,574,794	40,287,775	6,802,637	114,665,206
4	68,318,116	40,730,941	6,877,466	115,926,524
5	69,069,616	41,178,981	6,953,119	117,201,715
6	69,829,381	41,631,950	7,029,603	118,490,934
7	70,597,505	42,089,901	7,106,928	119,794,334
8	71,374,077	42,552,890	7,185,105	121,112,072
9	72,159,192	43,020,972	7,264,141	122,444,305
10	72,952,943	43,494,203	7,344,046	123,791,192
11	73,755,426	43,972,639	7,424,831	125,152,895
12	74,566,735	44,456,338	7,506,504	126,529,577
13	75,386,969	44,945,358	7,589,076	127,921,403
14	76,216,226	45,439,757	7,672,555	129,328,538
15	77,054,604	45,939,594	7,756,954	130,751,152

4.4 Future Production Model

The future production model assumes the Madison, WI facility would be closed and the butter production would be handled with current capacity at the Carlisle, PA location and increased capacity at the Tulare, CA facility. Table 4.2 projects butter production by plant over time under the Tulare plant expansion scenario.

Table 4.2 Projected Production at Carlisle, and Modified Tulare Plants

Year	Tulare Butter	Carlisle Butter	Total Butter
0	71,976,000	38,987,000	110,963,000
1	72,767,736	39,415,857	112,183,593
2	73,568,181	39,849,431	113,417,613
3	74,377,431	40,287,775	114,665,206
4	75,195,583	40,730,941	115,926,524
5	76,022,734	41,178,981	117,201,715
6	76,858,984	41,631,950	118,490,934
7	77,704,433	42,089,901	119,794,334
8	78,559,182	42,552,890	121,112,072
9	79,423,333	43,020,972	122,444,305
10	80,296,990	43,494,203	123,791,192
11	81,180,256	43,972,639	125,152,895
12	82,073,239	44,456,338	126,529,577
13	82,976,045	44,945,358	127,921,403
14	83,888,781	45,439,757	129,328,538
15	84,811,558	45,939,594	130,751,152

In another spreadsheet, the NPV model uses the variable costs of current and proposed production together along with the proposed plant expansion investment cost of $25,000,000 as well as some other financial considerations. The initial expansion investment is included at time zero.

4.5 Cheese Production Loss Avoidance

In addition to producing butter, the Tulare, CA facility also manufactures cheese. This cheese operation is currently generating an annual loss of $3,800,000. If Land

O'Lakes ceases cheese production at the Tulare plant and the milk currently used for cheese is instead used for butter, the loss will be avoided. The space in the plant that currently houses the cheese production lines would instead hold additional butter production equipment. The model includes the savings from the loss that would be avoided by ceasing cheese production. This savings is reflected on an annual basis and discounted to time zero.

Another question is would this investment make sense if it were not for the cheese loss avoidance. This question will be addressed in the sensitivity analysis chapter.

4.6 Madison Plant Closure

Closing the Madison plant is estimated to generate net cash flow of $1,000,000. This includes estimates for selling plant assets as well as the real estate under the plant. The estimated cash flow is net of plant demolition and site cleanup. This net cash flow is estimated to happen in year two.

4.7 Depreciation, Maintenance, and Salvage Value

The model depreciates the plant investment over 15 years and calculates the net cash flow benefit from avoided income taxes to be $333,333 per year. This figure is determined through two steps. First, by dividing the $25,000,000 by 15 years the model calculates the annual depreciation to be $ 1,666,666. This annual depreciation is multiplied by the LOL effective tax rate of 19.8%. The tax rate was derived from the LOL annual report by dividing total income tax paid by total earnings. Cooperatives only pay income tax on non-member business so it is somewhat difficult to determine the actual tax impact of the investment depreciation, therefore the overall effective tax rate was used. The annual maintenance costs are estimated to be $100,000 each year for the 15 year life of the investment. The salvage value, net of removal and disposal costs, is estimated to be zero.

4.8 Milk to Butter Conversion

The primary input to butter production is milk. The model includes a factor of 21.2 pounds of milk required to produce one pound of butter. This conversion factor was obtained from the LOL finance team. Table 4.3 shows the butter production and milk usage by plant over time. The manufacturing process is very similar at each plant and a constant factor is used for all plants within the model.

Table 4.3 Current Milk to Butter Conversion at Carlisle, Madison, and Tulare Plants

Tul But	Tul Milk	Carl But	Car Milk	Mad But	Mad Milk
65,393,000	1,386,331,600	38,987,000	826,524,400	6,583,000	139,559,600
66,112,323	1,401,581,248	39,415,857	835,616,168	6,655,413	141,094,756
66,839,559	1,416,998,641	39,849,431	844,807,946	6,728,623	142,646,798
67,574,794	1,432,585,626	40,287,775	854,100,834	6,802,637	144,215,913
68,318,116	1,448,344,068	40,730,941	863,495,943	6,877,466	145,802,288
69,069,616	1,464,275,853	41,178,981	872,994,398	6,953,119	147,406,113
69,829,381	1,480,382,887	41,631,950	882,597,337	7,029,603	149,027,580
70,597,505	1,496,667,099	42,089,901	892,305,907	7,106,928	150,666,884
71,374,077	1,513,130,437	42,552,890	902,121,272	7,185,105	152,324,219
72,159,192	1,529,774,872	43,020,972	912,044,606	7,264,141	153,999,786
72,952,943	1,546,602,396	43,494,203	922,077,097	7,344,046	155,693,783
73,755,426	1,563,615,022	43,972,639	932,219,945	7,424,831	157,406,415
74,566,735	1,580,814,787	44,456,338	942,474,364	7,506,504	159,137,885
75,386,969	1,598,203,750	44,945,358	952,841,582	7,589,076	160,888,402
76,216,226	1,615,783,991	45,439,757	963,322,840	7,672,555	162,658,175
77,054,604	1,633,557,615	45,939,594	973,919,391	7,756,954	164,447,415

The butter conversion ratio will not change in the future but the amount of butter produced at the plants will change. Specifically, the Madison plant will have zero production and all other production will occur at the Tulare facility. Table 4.4 illustrates butter production and milk usage by plant over time.

Table 4.4 Future Milk to Butter Conversion at Carlisle and Tulare Plants

Sales Volume	Tul But	Tul Milk	Carl But	Car Milk
110,963,000	71,976,000	1,525,891,200	38,987,000	826,524,400
112,183,593	72,767,736	1,542,676,003	39,415,857	835,616,168
113,417,613	73,568,181	1,559,645,439	39,849,431	844,807,946
114,665,206	74,377,431	1,576,801,539	40,287,775	854,100,834
115,926,524	75,195,583	1,594,146,356	40,730,941	863,495,943
117,201,715	76,022,734	1,611,681,966	41,178,981	872,994,398
118,490,934	76,858,984	1,629,410,468	41,631,950	882,597,337
119,794,334	77,704,433	1,647,333,983	42,089,901	892,305,907
121,112,072	78,559,182	1,665,454,656	42,552,890	902,121,272
122,444,305	79,423,333	1,683,774,658	43,020,972	912,044,606
123,791,192	80,296,990	1,702,296,179	43,494,203	922,077,097
125,152,895	81,180,256	1,721,021,437	43,972,639	932,219,945
126,529,577	82,073,239	1,739,952,673	44,456,338	942,474,364
127,921,403	82,976,045	1,759,092,152	44,945,358	952,841,582
129,328,538	83,888,781	1,778,442,166	45,439,757	963,322,840

4.9 Labor Cost

Actual labor costs were obtained for each production location on a per pound basis. There are two major reasons that per unit labor costs vary by production facility. First, hourly wage rates vary by region depending on the local market for plant employee labor. Second, the plants have different butter manufacturing process and productivity levels, therefore impacting per unit labor cost. Although the labor cost per pound did not vary drastically at the different plants, this factor was included in the model.

4.10 Energy Cost

Energy costs, specifically natural gas and electricity, represent significant cost components to butter manufacturing plants. The costs were obtained for each plant from the LOL finance department and did not vary significantly from plant to plant. Because this factor isn't significantly different across plant, it was not included in the model.

4.11 Milk Pricing

Milk prices vary significantly by region. This difference in pricing creates a savings opportunity that the model is evaluating. Table 4.5 illustrates the three year milk price average that was calculated using 2006 through 2008 data. The absolute prices of milk by region are not as important as the difference between milk prices in the various regions. Therefore, the sensitivity analysis done later will focus strictly on the difference in the milk prices. There is a current proposal to change the California make allowance which would essentially lower the milk price spread between California and the Upper Midwest. This proposal would most likely not change the milk price spread by more than $.005 per pound change so that is the amount the sensitivity analysis will consider.

Table 4.5 Milk Prices by Region

Three Year Average Milk Price	
Area	**Cost/Lb.**
Upper Midwest	$ 0.1648
East	$ 0.1598
West	$ 0.1518

Source: Land O'Lakes, Inc.

The model essentially trades off the milk cost savings against the increased capital investment in the plant due to the expansion of capacity while including factors such as tax savings due to depreciation, maintenance, Madison plant closure impact, and salvage value.

4.12 Net Cash Flow and NPV Calculations

For each year, both the positive and negative cash flows are listed. Then the net cash flow for the year is calculated. Each year's net cash flows were discounted back to time zero, using the Land O'Lakes discount rate. The model assumes that only half of the projected year one savings would actually be realized due to potential startup delays and temporary lower production efficiency at startup. Finally, the discounted cash flows for each year were summed to calculate the NPV.

Table 4.6 Net Cash Flow and NPV

Initial Invest	Gain on Sale & Salvage Value	Annual Savings	Net CF	DCF	Cumm. DCF
$ 25,000,000		$ -	$ (25,000,000)	$ (25,000,000)	$ (25,000,000)
		$ 2,903,376	$ 2,903,376	$ 2,592,300	$ (22,407,700)
	$ 1,000,000	$ 5,826,296	$ 6,826,296	$ 5,441,881	$ (16,965,819)
		$ 5,846,055	$ 5,846,055	$ 4,161,107	$ (12,804,712)
		$ 5,866,032	$ 5,866,032	$ 3,727,969	$ (9,076,743)
		$ 5,886,228	$ 5,886,228	$ 3,340,004	$ (5,736,739)
		$ 5,906,647	$ 5,906,647	$ 2,992,491	$ (2,744,248)
		$ 5,927,290	$ 5,927,290	$ 2,681,205	$ (63,043)
		$ 5,948,160	$ 5,948,160	$ 2,402,362	$ 2,339,319
		$ 5,969,260	$ 5,969,260	$ 2,152,575	$ 4,491,894
		$ 5,990,592	$ 5,990,592	$ 1,928,810	$ 6,420,704
		$ 6,012,158	$ 6,012,158	$ 1,728,352	$ 8,149,056
		$ 6,033,962	$ 6,033,962	$ 1,548,768	$ 9,697,824
		$ 6,056,005	$ 6,056,005	$ 1,387,880	$ 11,085,704
		$ 6,078,291	$ 6,078,291	$ 1,243,739	$ 12,329,443
	$ -	$ 6,100,823	$ 6,100,823	$ 1,114,597	$ 13,444,040

The NPV for this investment is $13.44 million (Table 4.6). A fifteen year IRR was calculated by solving for the discount rate at which the NPV is equal to zero. The IRR is 20.70% for the future-state scenario. Table 4.6 outlines the net and discounted cash flows for each year of the life of the investment. Based on this NPV and IRR, this is a promising investment.

CHAPTER 5: SENSITIVITY ANALYSIS

The NPV analysis discussed in chapter four were conducted as if all key variables were known with certainty. However, there are two main uncertain variables that are critical components of the analysis. First, the price spread between milk in Wisconsin versus California. Second, production growth which the model assumes will be constant at 1.1% annually.

5.1 Milk Price Spread Uncertainty

The price spread is something that changes over time and is influenced by many factors including plant openings and closures, environmental concerns, regulatory changes, milk production quantity changes, and make allowances. While it seems likely that milk prices in California will continue to be lower than in Wisconsin, there is some risk in this area. For this reason, it's important to see what the NPV analysis looks like given different milk price spread scenarios. Another scenario was run, using a per pound milk price spread of $.0080 compared to $.0130 used in the baseline. This represents a half cent decrease in the milk price spread. Under this scenario, the fifteen year NPV is $8.73 million and the IRR is 17.85%. Table 5.1 shows the net cash flow and discounted cash flow by year for this scenario. Thus, there is some downside risk to this project if the milk price spread were to decrease. However, even in this example there is a positive NPV.

Table 5.1 Net Cash Flow and NPV-Milk Price Spread Decrease

Initial Invest	Gain on Sale & Salvage Value	Annual Savings	Net CF	DCF	Cumm. DCF
$ 25,000,000		$ -	$ (25,000,000)	$ (25,000,000)	$ (25,000,000)
		$ 2,554,477	$ 2,554,477	$ 2,280,783	$ (22,719,217)
	$ 1,000,000	$ 5,120,822	$ 6,120,822	$ 4,879,482	$ (17,839,735)
		$ 5,132,821	$ 5,132,821	$ 3,653,441	$ (14,186,294)
		$ 5,144,952	$ 5,144,952	$ 3,269,710	$ (10,916,584)
		$ 5,157,217	$ 5,157,217	$ 2,926,343	$ (7,990,241)
		$ 5,169,616	$ 5,169,616	$ 2,619,088	$ (5,371,152)
		$ 5,182,152	$ 5,182,152	$ 2,344,142	$ (3,027,010)
		$ 5,194,826	$ 5,194,826	$ 2,098,103	$ (928,907)
		$ 5,207,639	$ 5,207,639	$ 1,877,927	$ 949,019
		$ 5,220,593	$ 5,220,593	$ 1,680,891	$ 2,629,911
		$ 5,233,689	$ 5,233,689	$ 1,504,561	$ 4,134,471
		$ 5,246,930	$ 5,246,930	$ 1,346,756	$ 5,481,227
		$ 5,260,316	$ 5,260,316	$ 1,205,529	$ 6,686,756
		$ 5,273,849	$ 5,273,849	$ 1,079,134	$ 7,765,890
	$ -	$ 5,287,532	$ 5,287,532	$ 966,012	$ 8,731,902

On the other hand, the California milk price advantage could continue to increase. This would have the effect of making the plant expansion investment more advantageous. It is not clear how likely this would be, but since the impact on the proposed project would be significant it warrants analysis. Under this scenario, the fifteen year NPV is $18.16 million and the IRR is 23.45%. Table 5.2 shows the net cash flow and discounted cash flow by year for this scenario. Thus, there is considerable upside to this project if the milk price spread increases.

Table 5.2 Net Cash Flow and NPV-Milk Price Spread Increase

Initial Invest	Gain on Sale & Salvage Value	Annual Savings	Net CF	DCF	Cumm. DCF
$ 25,000,000		$ -	$ (25,000,000)	$ (25,000,000)	$ (25,000,000)
		$ 3,252,275	$ 3,252,275	$ 2,903,817	$ (22,096,183)
	$ 1,000,000	$ 6,531,770	$ 7,531,770	$ 6,004,281	$ (16,091,902)
		$ 6,559,289	$ 6,559,289	$ 4,668,773	$ (11,423,130)
		$ 6,587,111	$ 6,587,111	$ 4,186,228	$ (7,236,902)
		$ 6,615,240	$ 6,615,240	$ 3,753,665	$ (3,483,237)
		$ 6,643,677	$ 6,643,677	$ 3,365,894	$ (117,343)
		$ 6,672,428	$ 6,672,428	$ 3,018,267	$ 2,900,924
		$ 6,701,494	$ 6,701,494	$ 2,706,621	$ 5,607,545
		$ 6,730,881	$ 6,730,881	$ 2,427,223	$ 8,034,768
		$ 6,760,591	$ 6,760,591	$ 2,176,729	$ 10,211,498
		$ 6,790,627	$ 6,790,627	$ 1,952,143	$ 12,163,641
		$ 6,820,994	$ 6,820,994	$ 1,750,779	$ 13,914,420
		$ 6,851,695	$ 6,851,695	$ 1,570,232	$ 15,484,652
		$ 6,882,734	$ 6,882,734	$ 1,408,344	$ 16,892,995
	$ -	$ 6,914,114	$ 6,914,114	$ 1,263,183	$ 18,156,178

5.2 Butter Demand Uncertainty

The butter market is very mature and has been growing only slightly for years. Nevertheless, since it seems likely the solution would be sensitive to changes in butter demand it is important to analyze the impact of such changes.

Since the butter market is mature, it's unlikely that LOL will experience extreme swings in demand. A 10% swing in demand would be considered large so that is the amount tested for sensitivity analysis.

The first look is at what would happen if demand were to decrease by ten percent in year one and then fall back into the normal 1.1% annual change. This scenario results in a NPV of $12.24 million and an associated IRR of 20.00%. Table 5.3 shows the net cash flow and discounted cash flow by year for this scenario.

Table 5.3 Net Cash Flow and NPV- Butter Demand Decrease

Initial Invest	Gain on Sale & Salvage Value	Annual Savings	Net CF	DCF	Cumm. DCF
$ 25,000,000		$ -	$ (25,000,000)	$ (25,000,000)	$ (25,000,000)
		$ 2,814,538	$ 2,814,538	$ 2,512,981	$ (22,487,019)
	$ 1,000,000	$ 5,646,666	$ 6,646,666	$ 5,298,682	$ (17,188,338)
		$ 5,664,450	$ 5,664,450	$ 4,031,843	$ (13,156,494)
		$ 5,682,429	$ 5,682,429	$ 3,611,286	$ (9,545,208)
		$ 5,700,605	$ 5,700,605	$ 3,234,677	$ (6,310,532)
		$ 5,718,982	$ 5,718,982	$ 2,897,414	$ (3,413,117)
		$ 5,737,561	$ 5,737,561	$ 2,595,381	$ (817,736)
		$ 5,756,344	$ 5,756,344	$ 2,324,891	$ 1,507,155
		$ 5,775,334	$ 5,775,334	$ 2,082,643	$ 3,589,798
		$ 5,794,532	$ 5,794,532	$ 1,865,684	$ 5,455,482
		$ 5,813,942	$ 5,813,942	$ 1,671,369	$ 7,126,852
		$ 5,833,566	$ 5,833,566	$ 1,497,331	$ 8,624,183
		$ 5,853,405	$ 5,853,405	$ 1,341,449	$ 9,965,632
		$ 5,873,462	$ 5,873,462	$ 1,201,827	$ 11,167,459
	$ -	$ 5,893,740	$ 5,893,740	$ 1,076,764	$ 12,244,223

The second scenario involves increasing demand by ten percent for one year and then falling back into the normal 1.1% annual change. This scenario resulted in a NPV of $14.64 million and an associated IRR of 21.45%. Table 5.4 shows the net cash flow and discounted cash flow by year for this scenario.

Table 5.4 Net Cash Flow and NPV- Butter Demand Increase

Initial Invest	Gain on Sale & Salvage Value	Annual Savings	Net CF	DCF	Cumm. DCF
$ 25,000,000		$ -	$ (25,000,000)	$ (25,000,000)	$ (25,000,000)
		$ 2,992,213	$ 2,992,213	$ 2,671,619	$ (22,328,381)
	$ 1,000,000	$ 6,005,926	$ 7,005,926	$ 5,585,081	$ (16,743,300)
		$ 6,027,661	$ 6,027,661	$ 4,290,370	$ (12,452,930)
		$ 6,049,635	$ 6,049,635	$ 3,844,652	$ (8,608,278)
		$ 6,071,851	$ 6,071,851	$ 3,445,331	$ (5,162,946)
		$ 6,094,311	$ 6,094,311	$ 3,087,568	$ (2,075,378)
		$ 6,117,019	$ 6,117,019	$ 2,767,029	$ 691,650
		$ 6,139,976	$ 6,139,976	$ 2,479,833	$ 3,171,483
		$ 6,163,186	$ 6,163,186	$ 2,222,507	$ 5,393,990
		$ 6,186,651	$ 6,186,651	$ 1,991,936	$ 7,385,926
		$ 6,210,374	$ 6,210,374	$ 1,785,334	$ 9,171,260
		$ 6,234,358	$ 6,234,358	$ 1,600,204	$ 10,771,465
		$ 6,258,606	$ 6,258,606	$ 1,434,311	$ 12,205,775
		$ 6,283,121	$ 6,283,121	$ 1,285,651	$ 13,491,426
	$ -	$ 6,307,905	$ 6,307,905	$ 1,152,431	$ 14,643,857

5.3 Sensitivity to Size of Cheese Loss Avoidance

The base model was set up so the current $3.8 million annual cheese loss at Tulare would be avoided if we switched to more butter production. One question that arises is does this investment still make sense if we do not count the cheese loss as a savings. One way to answer this question is to find the amount of savings that are needed for the investment to have a positive NPV.

Although the accounting numbers used in the model use total costs for cheese production, in reality there is a fixed overhead component along with a variable production cost component. Even if cheese production is stopped, the fixed cost component does not go away. Therefore, if the fixed cost component is greater than or equal to the break-even savings amount, it is a good investment. By adjusting the savings amount on the base model until the NPV is zero, we find the break-even cheese loss avoidance amount to be

$1.68 million, compared to the overall cheese production loss of $3.8 million. Therefore, if it is determined the fixed cost portion of the cheese production loss is $1.68 million or greater, the investment should be undertaken.

5.4 Overall Sensitivity to Changes in Key Variables

Although the NPV and IRR are somewhat sensitive to changes in butter demand and milk price spreads, it doesn't change the NPV significantly and will not alter the conclusion.

CHAPTER 6: CONCLUSIONS

6.1 Recommendation

Based on the basic NPV and sensitivity analysis the recommendation is to go forward with the Tulane expansion as well as close the Madison, WI facility. It looks to be a profitable venture and although there is some uncertainty in the financial outcome due to demand and milk price spread changes, it looks like the outcome will be positive under most probable scenarios.

There are risks associated with this project, particularly because the assets are so long lived and things can change dramatically over time. California is increasingly known for its environmental concerns and uncertain regulatory constraints. Also, the milk supply has traditionally moved around the country and could continue to do so.

6.2 Future Study

Future study could focus on predicting how the milk supply will change in the future and what impact that will have on the milk pricing spreads that are driving this capital expansion project. Also, further study is needed to assess the feasibility of making an additional capital expenditure to add modern efficient cheese manufacturing to the mix at the Tulare plant. This would allow Land O'Lakes to find a home for potential future growth in our members milk supply.

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