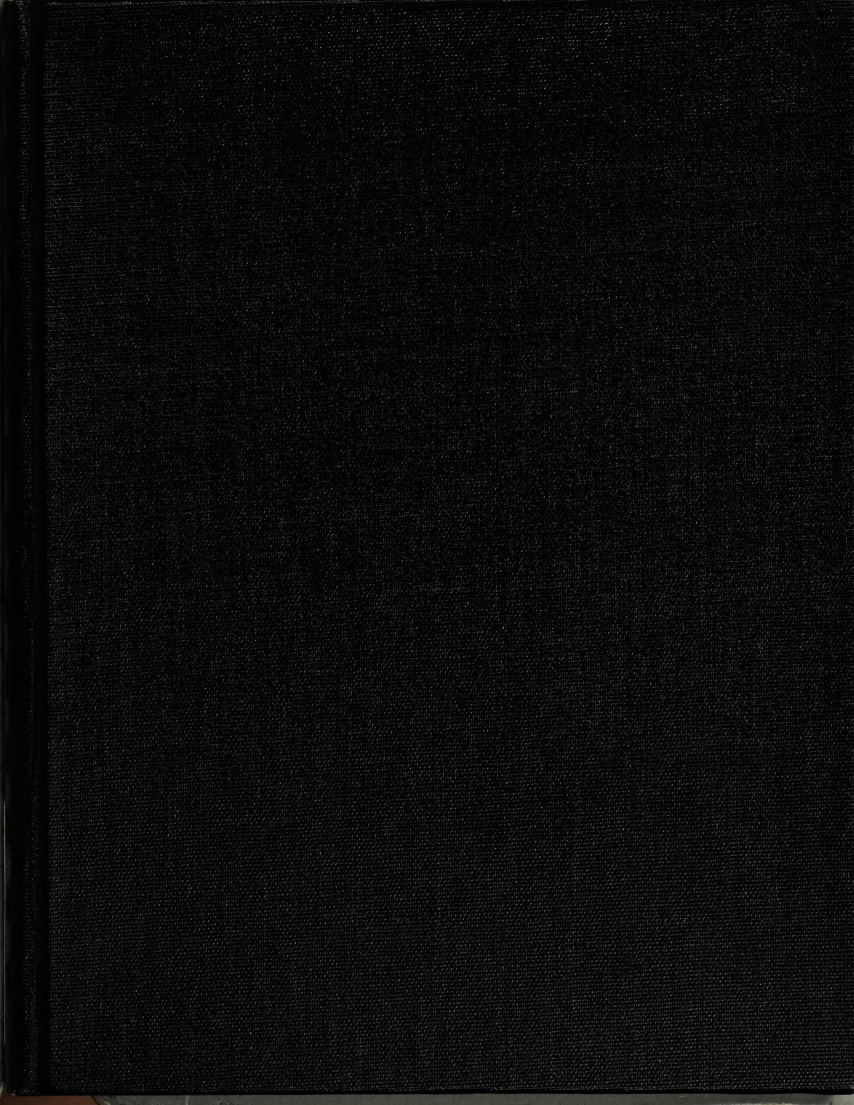






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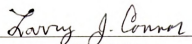
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*A FINANCIAL ANALYSIS OF MICHIGAN
PROTOTYPE DAIRY FARMS FOR 1995*

*By
Dale G. Darling*

A THESIS

*Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of*

MASTERS OF SCIENCE

Department of Agricultural Economics

1991

XL 99-50

ABSTRACT

A FINANCIAL ANALYSIS OF MICHIGAN PROTOTYPE DAIRY FARMS FOR 1995

By

Dale G. Darling

The financial position of Michigan dairy farmers has become an increasingly important topic in recent years. The dairy industry is undergoing a change and this is affecting the profitability of dairy farmers. Rising costs and decreasing prices are making dairy farmers reevaluate their financial situation. The purpose of the study was to financially analyze potential prototype dairy farms. The financial analysis is performed by computerized enterprise budgets. The prototype dairy farms for 1995 are based on farmer(s) purchasing the entire operation. All of the fixed costs are computed on an annual fixed cost basis for the duration of the assets useful life.

This study deals with scenarios which will likely take place in the year 1995. The prices and costs are trended to the year 1995 to be used in the prototype dairy farms. The milk price is established at \$10.00 per hundredweight, milk production of 19,200 pounds of marketed milk per cow, per year, and labor costs are \$5.00 per hour. The prototype farms are designed to house the cows in free stalls. The farms raise all of their feed, feeding a ration of haylage and high moisture corn to the milking

herd. The dairy farms are based on herd sizes of 60, 120, 250 and 400 cow operations.

Analyzing the four prototype dairy farms under the performance variables, the larger dairy operations are more profitable on a per cow basis than the small herds. The fixed costs, primarily buildings, facilities, and equipment, in the larger herds are spread out over more cows. The annual fixed costs per cow are the smallest in the large herds. The annual fixed cost per cow are the largest in the small herd.

In the larger herds the annual labor requirements per cow are significantly lower than the requirements in the smaller herd. The small herds have a larger expense per cow than the larger farms. The overall labor requirements are the largest in the 400 cow herd.

The smaller dairy herds in Michigan make the individual cow carry a large cost. For these herds to be profitable in 1995 under the base performance variables, they will have to produce over 21,250 pounds of marketed milk. These herds are going to need to be well managed to reduce cost and promote profits. The problem in cost reduction stems from the 60 cow farm having all the equipment, for so few acres and cows.

ACKNOWLEDGMENTS

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TABLE OF CONTENTS

LIST OF TABLES	VI
--------------------------	----

LIST OF FIGURES	VIII
---------------------------	------

CHAPTER

1. INTRODUCTION	1
---------------------------	---

Industry Environment	1
Specific Problems of Michigan Dairy Farms	4
Specific Objectives of Research	9
Organization of THESIS	10

2. RESEARCH DESIGN

Michigan Prototype Dairy Farms for 1995	11
The Expert Team	12
Breed of Dairy Cow	12
Herd Size	12
Housing	13
Milking System	16
Manure System	17
Cropping System	23
Facilities	25
Equipment	25
Land	25
Labor	26
Michigan Prototype Dairy Farms	30
Enterprise Budgets	31
Receipts	32
Variable Costs	32
Fixed Costs	34
Total Costs	37
Return	37
Cow and Replacement Heifer Budget	37
Performance Variables	38
Milk Revenues	38
Feed Costs	39
Crop Yields	40
Cost of Capital	40
Land Values	40
Labor Cost	41
Sensitivity Variables	41

3. RESULTS OF THE BASE PERFORMANCE VARIABLE FOR PROTOTYPE DAIRY FARMS

Financial Results	45
-----------------------------	----

4. RESULTS OF THE SENSITIVITY ANALYSIS

Milk Price	58
Milk Production	59
Soybean Meal Costs	61
Hay Yields	61
Corn Yields	62
Interest Rate on Land	62
Interest Rate on Buildings	63
Interest Rate on Equipment	63
Land Value	64
Labor Cost	64
Feed Acquirement	65

5. SUMMARY AND CONCLUSIONS

Major Findings	68
Implication for the Michigan Dairy Farms	69
Needs for Future Research	70
Appendix A	72
Appendix B	77
Bibliography	82

LIST OF TABLES

TABLE

2.1	Breakdown of Prototype Dairy Herds	14
2.2	Milking System	17
2.3	Manure Production Per Day	20
2.4	Earth Basins by Herd Size	21
2.5	Nutrient Composition of Pricing Feeds Used in Estimating Feed Budgets	22
2.6	Quantities of Feed Needed/Cow and 30% Replacement/Year by Herd Size	23
2.7	Estimated Annual Land Requirements in Acres	26
2.8	Estimated Annual Labor Requirements by Herd Size for Dairy . .	27
2.9	Estimated Annual Labor Requirements for Crops per Farm	28
2.10	Estimated Annual Total Labor Requirements per Farm	29
2.11	Michigan Prototype Dairy Farms for 1995	30
2.12	Capital Recovery Factors for Various Opportunity Costs of Capital and Planning Horizons	36
2.13	Performance Variables	42
2.14	Sensitivity Variable of the Base Prototype Dairy Farms	43
3.1	Enterprise Budget for 60 Cow Dairy Raising All Feed	46
3.2	Enterprise Budget for 120 Cow Dairy Raising All Feed	48
3.3	Enterprise Budget for 250 Cow Dairy Raising All Feed	50
3.4	Enterprise Budget for 400 Cow Dairy Raising All Feed	52
3.5	Replacement Heifer Budget	54

3.6	<i>Financial Returns of Prototype Dairy Farms Raising All Feed</i>	56
4.1	<i>Effects of Sensitivity Variables on Returns to Management . .</i>	60
4.2	<i>Sensitivity Analysis of Feed Acquirement</i>	66
A.1	<i>Dairy Buildings and Facilities: Herd Size 60</i>	73
A.2	<i>Dairy Buildings and Facilities: Herd Size 120</i>	74
A.3	<i>Dairy Buildings and Facilities: Herd Size 250</i>	75
A.4	<i>Dairy Buildings and Facilities: Herd Size 400</i>	76
B.1	<i>Equipment Estimates: Herd Size 60</i>	78
B.2	<i>Equipment Estimates: Herd Size 120</i>	79
B.3	<i>Equipment Estimates: Herd Size 250</i>	80
B.4	<i>Equipment Estimates: Herd Size 400</i>	81

LIST OF FIGURES

FIGURE

<i>2.1 Earth Storage Basin</i>	<i>19</i>
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CHAPTER 1

INTRODUCTION

The United States dairy industry is in a time period of change. The United States dairy industry is facing large surpluses of milk products, reduced price supports for milk, and the imminent introduction of production boosting technology. It is for these reasons farmers have had to reevaluate their financial situations. Dairy farmers are considering ways to reduce costs and increase profits to prevail in this changing industry. This thesis analyzes the present situation prevailing in the Michigan Dairy Industry and the potential financial conditions of Michigan prototype dairy farms for 1995.

The first chapter focusses on the current environment in the dairy industry and reasons for interest in the Michigan dairy farmer. This is followed by specific objectives of this research and an overview of the chapters comprising this thesis.

1.1 Industry Environment

The U.S. government is faced with difficult task of trying to balance the supply and demand for milk. In recent years, supply has exceeded demand and the government has had to purchase large quantities of milk products. In 1983, the USDA purchased 16.8 billion pounds of surplus milk, or about 11% of U.S. production¹. The federal government then revised its dairy policy and two forms of voluntary supply management programs were used. The first was titled the Milk Diversion Program (MDP)

¹Browne, William P., and Larry G. Hamm, Political Choices, Social Values, and the Economics of Biotechnology: A Lesson from the Dairy Industry, staff paper No 88-33, Department of Agriculture of Economics, Michigan State University, East Lansing, April, 1988.

whereby producers voluntarily signed up to decrease their overall milk production by a certain percentage. The second was the Dairy Termination Program (DTP), whose goal was to purchase 12 billion pounds of productive capacity out of the industry. In September 1987, milk production in the 48 DTP-states was estimated to be 1.6 percent below September 1985².

Total milk production in 1988 was 145.5 billion pounds, up 2 percent from 1987³. Total utilization was 137 billion pounds for a difference of 8.5 billion pounds⁴. The federal government realizes supply still exceed demand and has placed more emphasis on another area of dairy policy: the milk support price.

The dairy support price reached a high of \$13.50 per hundred weight in 1981 and a low of \$10.50 in 1988. The dairy price support has declined 20% since 1983 and has caused severe financial stress to many dairy farmers⁵. If over production persists, the current federal legislation calls for price deductions until supply and demand are in balance which will cause further financial stress to the dairy farmer.

Dairy policy makers have evaluated many alternative price determining mechanisms which would alter the current policy. One which is being analyzed is a regional pricing system in which the milk price would be determined within a region at a specific base point. This would be a

²Rourke, John P., Change in Production of DTP Nonparticipant and New Producers, Breeding paper 87-10, Dairy Market News Volume 54, Report 46 November 1987 pg.8.

³USDA, Dairy Situation and Outlook Report, DS-413, Economic Research Service, Washington, D.C. 20005, January 1988.

⁴IBID.

⁵Browne, William P., et al 1988.

major change from the current pricing system which depends on the M-W price. The other possibility, which many farmers have disapproved of, would be a quota system in which the dairy farmer would only produce a certain annual volume of milk.

Milk production per cow has steadily been increasing over the past four decades. In 1950, the United State production per cow was 5,314 pounds of milk annually. In 1988 the U.S. production per cow was 14,200 pounds of milk annually, up 3 percent from 1987⁶. In Michigan the 1950 average production per cow was 6,280 pounds annually compared to the 1988 figure of 14,900 pounds of milk annually produced⁷.

Over the past four decades cow numbers have been declining. In 1950 there were 21,944,000 milk cows and in 1987 there were half this number (10,233,400). The number of cows in Michigan has also been declining. In 1983 there were 404,000 milk cows in Michigan and in 1988 the State approached 350,000 milk cows⁸.

With the large decreased in cow numbers in recent years, it has become more difficult for the input-supply industry. Michigan companies are having to increase their market penetration and develop new marketing plans to sell their products to dairy farmers. With fewer cows, companies have become more competitive and have also had to look at ways of reducing costs to promote profits.

Milk cooperations are also concerned with large decreased in cow

⁶Michigan Farmer, Dairy Report, 1989.

⁷Michigan Agricultural Statistics Service, Michigan Agricultural Statistics, 1989, Mass 89-01, 201 Federal Building, P.O. Box 20008, Lansing, MI 48901 1989.

⁸Michigan Agricultural Statistics Service, 1989.

numbers. The milk cooperatives are concerned that they may not receive enough milk to fill their contracts with processors.

Dairy plays an important role in Michigan's agricultural economy. Dairying is the single largest agricultural enterprise. In Michigan, cash farm income from dairying is approximately 28 percent⁹.

A final concern effecting the dairy industry which is receiving tremendous amount of attention is the potential introduction of Bovine Somatotropin (BST). BST will be commercially available in the next year or two. BST has the potential to increase milk production per cow by an average of ten to twenty percent¹⁰. BST is a growth hormone naturally produced in the dairy cow. It is drawing attention from policy makers, dairy farmers and consumer groups as to the effects it will have on the supply of milk, the impact on the dairy cow, and the harm to consumers if traces of BST filter in the food chain.

1.2 Specific Problems of Michigan Dairy Farms

A major concern of the Michigan dairy farmer deals with their financial situation. The 1987 Michigan State University Dairy Farm Survey reported 23.1 percent of Michigan dairy farms had a 70 to 100 percent + debt-to-asset ratio¹¹. This is a critical debt-to-asset level which

⁹Hamm, Larry G., Upper Midwest Perspectives on the Dairy Price Support Program, staff paper number 87-77, Department of Agricultural Economics, Michigan State University, East Lansing, MI 48823, 1987.

¹⁰Browne, William P., et al 1988.

¹¹Connor, Larry J., Larry G. Hamm, Sherrill Nott, Dale G. Darling, William Bickert, Roger Mellenberger, H. Allen Tucker, Oran B. Hesterman, John A. Partridge and John H. Kirk, Michigan Dairy Farm Industry: Summary of the 1987 Michigan State University Dairy Farm Survey, special research report 498, Michigan State University Agricultural Experiment Stations, East Lansing, MI

financial experts state would be difficult to overcome. These dairy farmers represent 23.3 percent of the milk volume sold in Michigan. An additional 23.7 percent of Michigan dairy farms representing 27.8 percent of the milk volume have a 40 to 69 percent debt to asset ratio¹².

A second problem the MSU Dairy Farm Survey uncovered was the age of equity capital. The age of total capital refers to the age of physical capital such as when buildings and equipment were built and purchased respectively. The average year housing facilities were built was 1963, milking facilities was 1964, and feed storage facilities was 1969¹³. All three facilities average 23.7 years old. These facilities will need to be replaced or updated in the near future. To carry this out will depend on the dairymen's equity position and net farm income.

A third problem in the MSU Dairy Farm Survey uncovered was the net farm income for all families operating the dairy farm. Over 29 percent of the Michigan dairy farms receive less than \$10,000 in net farm income¹⁴. Of this 29 percent, 30 percent divide the net farm income between two or more families. An additional 20 percent of the dairy farms received between \$10,000 and \$20,000 in net farm income. Of the 49 percent of dairy farmers receiving under \$20,000 in net farm income, 30 percent have a debt-to-asset ratio of 70 to 100 plus.

Falling land values in the 1980's have had negative impacts on dairy farmers equity position. In 1981 the average land value per acre less

48823, July 1989.

¹²Connor, Larry J., et al, 1989.

¹³IBID.

¹⁴IBID.

improvements was \$985.60¹⁵. In 1986 the average land value per acre less improvements was \$695.00 per acre¹⁶. The difference between these two values is 29 percent. This decrease in land value has a major impact on the dairy farms equity position. It decreased their equity position making it more difficult to borrow capital.

Milk price has a significant impact on a dairy farmers revenue. The MSU Dairy Farm Survey found 78.4 percent of a dairy farmers revenue came from the sale of milk. In 1981, the Michigan dairy farmer received an average price of \$13.80 per hundredweight. In 1987 this figure dropped to \$12.63 per hundredweight, This was an eight percent decrease in prices received.

The cost of production to produce a hundredweight of milk has also risen in this decade. A large percentage of this cost can be attributed to the variable cost which includes the feed cost. The price of hay has been increasing. In 1980 alfalfa hay cost \$36.50 per ton compared to \$57.00 per ton in 1987¹⁷. In 1988 these figures skyrocketed to \$99.00 per ton due to the severe drought. The price of soybean meal has varied. In 1980 it was \$280.00 per ton compared to \$220.00 per ton in 1987. The 1988 figure was extremely high, at \$300.00 per ton due to the drought. The high cost of soybean meal led producers to look at other forms of protein to feed their cows such as whole cotton seed. The price of corn has fluctuated up and

¹⁵Harvey, Lynn R., Al E., House, Karen K. Cylbuski, David R. Walker, Agricultural Land Values and Assessments in Selective Counties in Michigan, Agricultural Economics Report No. 503, Michigan State University, East Lansing, MI., November 1987.

¹⁶IBID.

¹⁷Michigan Agricultural Statistics Service, 1989.

down in the 1980's between \$1.50 to \$3.25 per bushel. Feed costs represent from 40 to 70 percent of dairy farmers total costs. Farmers have consequently evaluated many alternative feed products and are trying to minimize the cost of their rations.

Labor shortages and the cost of labor have had a significant effect on dairymen. With rising wages in other industries, dairy farmers are having to compete with these industries to supply their labor needs. They are performing this by offering higher wages per hour and/or adding incentives to their labor. The hourly wage rate in 1980 was \$3.64. In 1988 it was \$4.25 per hour. This is a 14 percent increase in eight years. The rising cost of labor and shortage of labor have caused dairy farmers to critically analyze their operations and find ways to reduce their labor requirements.

Michigan dairy farmers are having to face another problem in environmental restraints placed on the handling and disposal of manure. Emerging legislation and guidelines for Michigan are requiring some farms to have long-term storage facilities for their manure. If strict guidelines are enacted into law, it will cause many dairy farmers to change the existing manure handling practices. The 1987 MSU Dairy Farm Survey reports 38.2 percent of the dairy farms representing 30.7 percent of the milk volume haul their manure to a field on a daily basis. Additionally, 26.1 percent of the farms representing 22.5 percent of the milk volume haul their manure to a field on a bi-weekly basis. Of this 64.3 percent of the dairy farmers representing 53.2 percent of the milk volume, 42 percent have a debt-to-asset ratio of 40 to 100 plus. These farms would have severe problems if these laws were changed. In Michigan

only 5 percent of the dairy farmers have long term storage for all manure. An additional 16.6 percent of the dairy farmers representing 24 percent of the milk volume have long-term storage for only their milking cows' manure. If the state requires the manure handling practices to be changed, many farmers will be forced out or large investments in manure facilities will be required.

The 1987 MSU Dairy Farm Survey revealed another interesting fact pertaining to the age of the principle operator of the dairy farm. The average age of the Michigan dairy farmer is 50 years old. Over 22.6 percent of the Michigan dairy farmers are over the age of 60. The dairy farmers over 50 years old represent 54.4 percent of the milk volume produced in Michigan. Another significant finding is 71.7 percent of the dairy farms in Michigan are owned by a single individual. A major concern of the industry is who will take over these operations when the principle operator retires?

The Michigan dairy industry is facing some critical issues. It is for these reasons the Michigan dairy farming systems need to be evaluated. The prototype dairy farms are devised to help dairy farmers make comparisons of costs incurred in dairying. The prototype dairy farms evaluate specific parts of the dairy system which can be changed or improved to promote profitability. The prototype Michigan dairy farms try to describe the scenarios which dairy farmers will encounter in 1995. The prototype dairy farms are intended for Michigan dairy farmers to compare their own dairy farm to the prototype dairy farm. The study is not designed for comparison between size levels but only within a specific size. Each prototype farms has a different level of capital, labor, and

management requirements.

The prototype dairy farms are designed to look at the entire dairy farm system. They are based on the pertinent issues Michigan dairy farmers are going to be facing. The prototype farmers are designed around the individual components grouped together to form the entire dairy system. This way the entire dairy system can be analyzed. A system analysis looks at the entire operation so it is fully represented. The system analysis is based on performance variables which will likely occur in the future.

1.3 Specific Objectives of Research

- 1. Describe the present status of Michigan dairy farmer.*
- 2. Identify potential Michigan prototype dairy farms for varying herd sizes for 1995.*
- 3. Evaluate the financial returns of the different prototype dairy farms with respect to the following performance variables:*
 - a. Milk revenue*
 - b. Feed costs*
 - c. Crop yields*
 - d. Cost of capital*
 - e. Land prices*
 - f. Labor costs*
- 4. Analyze the impacts of selected sensitivity variables:*
 - a. Milk price*
 - b. Milk production level*
 - c. Feed costs*
 - d. Crop yields*
 - e. Cost of capital*
 - f. Land values*
 - g. Labor costs*
 - h. Purchasing all feed requirements*
 - i. Raising all forages and purchasing corn requirements*
- 5. Evaluate the potential applicability of the prototype dairy farms to current dairy farming situations.*

1.4 Organization of Thesis

The thesis is broken down into five chapters yielding insight into the problems of Michigan dairy farmers, potential prototype farms, an analysis of their performance variables, a sensitivity analysis of crucial variables and potential applicability of these prototypes to the Michigan dairy farmer.

Chapter 2 reviews the research design and methods of this study. It starts with specification of the 1995 prototype dairy farms. The computerized enterprise budget is then discussed. The performance requirements for the base model are presented along with the sensitivity variables to be analyzed.

Chapter 3 shows the results of the base model prototype farms. These results are based on the given performance requirements.

Chapter 4 contains the results of the sensitivity analysis. The sensitivity analysis examines milk prices, milk production, feed costs crop yields, cost of capital, labor costs, land values, and the sources of the dairy farmers feed.

Chapter 5 contains the summary and conclusion of the study. The major findings are presented followed by the implications of the findings to Michigan dairy farmers. This chapter concludes with the needs for future research in this area of study.

CHAPTER 2

RESEARCH DESIGN

This chapter specifies the Michigan prototype dairy farms for 1995 and how they are evaluated with selected variables. The chapter begins with a description of the components making up each prototype farm. The method of evaluating each farm is then defined. The performance, sensitivity variables and the financial variables summarizing the analyses are presented.

2.1 Michigan Prototype Dairy Farms for 1995

A prototype dairy farms is similar to a representative dairy farm. This is a concept referred to by researchers in evaluating the potential effects of new technology and institutional policies. "By representative, the farm is defined to be typical of internal characteristics and external conditions of some specified group or population of farms. Internal characteristics include size and type of farm, quality of resources, level of management and technology used. The external conditions of a representative's farm refer to the market conditions, climate, credit system, and other conditions faced by a specified population of farms"¹⁸. The 1995 prototype dairy farms are based on likely technology and institutional policies prevailing in the 1990's. Current price levels are utilized since relative price levels are most important in comparing farms.

¹⁸Harsh, Stephen B., Larry J. Connor, and Gerald D. Schwad, Managing the Farm Business, Prentice Hall, Inc., Englewood Cliffs, New Jersey 07632, 1981.

2.1.1 The Expert Team

The selection of the Michigan prototype dairy farms for 1995 was performed by an expert team. The team consisted of members from six different disciplines all with related interest to dairy. The members included from the Department of Agricultural Economics: Drs. Larry Connor, Larry Hamm, and Sherrill Nott; Agricultural Engineering: Dr. William Bickert; Animal Science: Drs. Roger Mellenberger and H. Allen Tucker; Crop and Soil Science: Dr. Oran B. Hesterman; Food Science and Human Nutrition: Dr. John A. Partridge; and Large Animal, Clinical Sciences: Dr. John H. Kirk. This group in future text will be referred to as the "Expert Team".

2.1.2 Breed of Dairy Cow

The first consideration was the breed of dairy animal to use. Holsteins are used since over 90 percent of the dairy cattle in Michigan are Holsteins. The Holstein breed possess a distinct type. The dairy cow is a large well-framed cow, with ample strength and depth of body to enable her to consume large quantities of feed and sustain high level of milk production¹⁹. The mature Holstein cow should weigh 1500 pounds.

2.1.3 Herd Size

Determining the herd size was a difficult process. In Michigan the average herd size of milking and dry cows is 74.4 cow per farm²⁰. The

¹⁹Trimberger, George W., Dairy Cattle Judging Techniques Second Edition, Prentice-Hall Inc., Englewood Cliffs, New Jersey, 1977.

²⁰Connor, Larry J., et al, July 1989.

1987 Michigan State University Dairy Farm Survey also reported about future herd size plans for dairy farms for the next five years. Farmers with herds under 50 cows, which accounts for 26.6 percent, want to decrease their size, while farmers with herds over 50 cows want to increase their herd size. The projected herd size in 1995 would be 96.6 cows per farm. This data was taken into account along with considerations for buildings, facilities, labor requirements, and increased specialization resulting in larger herd sizes. The herd sizes used in the prototype dairy farms for Michigan are 60, 120, 250 and 400 milking and dry cows combined. Table 2.1 gives a complete breakdown on each herd.

2.1.4 Housing

With herd sizes established at 60, 120, 250, and 400 cows, the housing requirements were determined. In Michigan, 49.5 percent of the dairy farmers house their cows in free stalls while 34.6 percent of the dairy farmers house their cows in stanchion/comfort stalls²¹. The expert team concluded the majority of new housing facilities being built were free stalls compared to stanchions because of the considerable decrease in investment. Secondly, stanchion/comfort stalls were not economically feasible over sixty cows.

Calves from the age of 0-2 months old are raised in calf hutches. Calf hutches are being used successfully on dairy farms in most states²². The typical hutch is 4x8x4 feet in size and provides housing for one calf.

²¹Connor, Larry G., et al, July 1989.

²²Bickert, William G., Building and Remodeling Replacement Facilities to Enhance Management, Raising Dairy Heifers for More Profits, Cooperative Extension Services, Michigan State University, East Lansing, MI 44823, Pg. 10.1, 1987.

Table 2.1
Breakdown of Prototype Dairy Herds 1

Animal Category	HERD SIZE			
	60	120	250 ²³	400
	(number of head)			
<i>Calves and Heifers</i>	60	120	250	400
0 - 2 months	5	10	20	32
3 - 5 months	8	15	31	48
6 - 8 months	8	15	31	48
9 -12 months	10	21	43	72
13 -15 months	7	15	30	48
16 -24 months	22	44	95	152
<i>Dry Cows</i>	10	20	42	66
<i>Two-Year-Olds</i>	15	30	63	100
<i>Three Years and Older:</i>	35	70	145	234
High Producers	15	30	63	100
Medium Producers	10	20	41	67
Low Producers	10	20	41	67

1 Numbers assume uniform calving year round, 12 month calving interval, all males sold at birth and a 30% culling rate.

²³Bickert, William G., Building and Remodeling Dairy Cow Facilities to Enhance Management, Managing the Milking Herd for More Profit, Cooperative Extension Service, Michigan State University, East Lansing, MI 48823, P. 2, 1988.

On the 60 cow herd, the heifers from ages 3-15 months are raised in a counter-sloped barn sometime referred to as the Virginia style heifer barn. This facility is based on a counter-sloped, self cleaning floors and is intended for use with little or no bedding. A main advantage of this design is the low investment-less than 50 percent of the investment required for a free stall facility²⁴. A second advantage of this design is it is very effective in smaller herds. Heifers from the ages of 15 months until freshening are raised in free stalls. Regardless of the housing type, the heifers are grouped by age and weight depending on the management plan to promote maximum growth.

On the 120, 250 and 400 cow operations are raised in the 3-5 month old heifers in super hutches. Super hutches are designed similar to calf hutches but in a larger version. These pens allow between 4-8 calves to be grouped together. Super hutches are thought of as transition pens. They allow calves, raised individually, to be placed with other calves to be raised in a group style. Heifers from the ages 6 months to freshening are raised in free stalls. The animals are grouped by age and weight according to management style to provide maximum growth and health.

The non-latching cows (dry cows) are housed in free stalls. When the animal approaches parturition (delivery time) the animal is placed in a maternity pen. The maternity pens are 12x12 feet and provide water and available feed. A complete list of the housing by herd size is in Appendix 1.

²⁴IBID, p. 10.14.

2.1.5 Milking System

The milking system designed for all four herd sizes is a herringbone milking parlor. The parlors are double-herringbone having units on each side connected to a low-line pipeline. The parlors are equipped with automatic take-offs for each unit. In the parlor no grain-concentrate is fed. The holding pen outside the parlor has a crowd gate to minimize milking time and labor. The herd size and corresponding parlor are in Table 2.2.

Table 2.2
Milking System 1

<i>Herd Size</i>	<i>Herringbone Milking Parlor</i>
60	Double -- 4
120	Double -- 6
250	Double -- 8
400	Double -- 10

1 sizes are based on Expert Teams Recommendations.

2.1.6 Manure System

The manure system designed for the Michigan prototype dairy farms had to meet various specifications. First, it needed to account for environmental constraints. Secondly, the manure system needed to have a longer time period of storage capacity than what is presently in Michigan. Third, it needed to be of minimum cost. The earth basin met all three qualifications.

The earth basin is designed to have storage capacity for eight months for all the animals on the farm and to prevent ground and surface water contamination. Earth storage basin for dairy manure generally produces relatively little odor during the storage period because a floating crust consisting of bedding and organic matter in the manure develops over the surface.

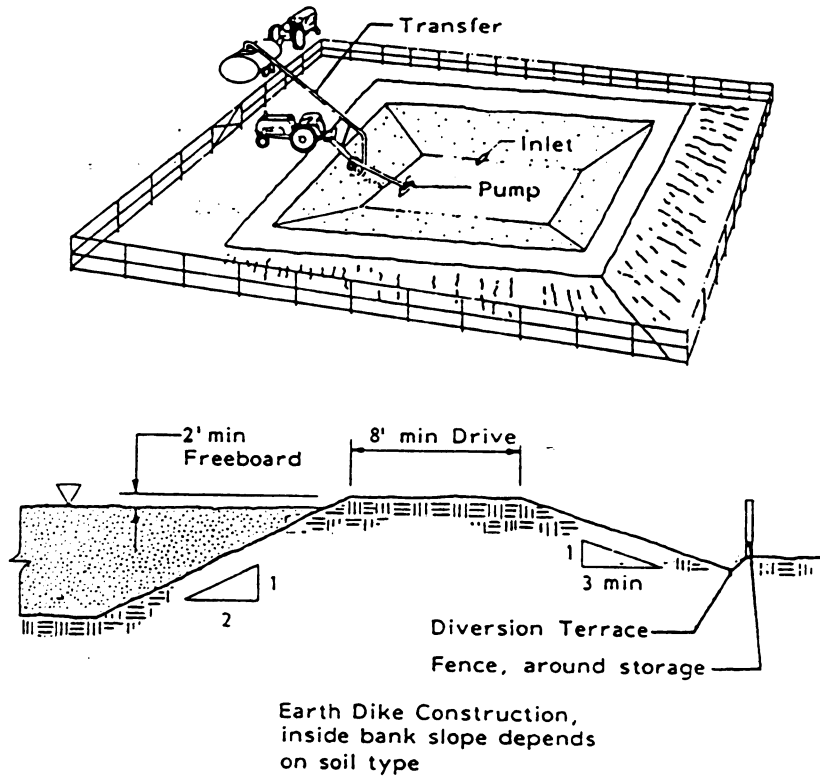
The manure is transferred to the earth basin by a transfer pump. The transfer pump, also known as a piston-style pump, pumps the manure through

a buried pipeline into the bottom of the basin. This method allows for more even distribution of the manure through the basin and prevents pile-ups on the top in the winter which would occur if manure were added from the top.

The earth basin is a earth-walled structured formed by excavation and earth berms so they are partly above and partly below grade. The earth basin is designed by excavating down six feet and creating a four foot berm. This allows ten vertical feet storage capacity. When calculating the storage capacity the earth basin is designed to store eight vertical feet, this system allows for a two foot free-board. The berm is eight foot wide. The design of the earth basin resembles Figure 2.1.

Figure 2.1²⁵

Earth Storage Basin



A gitate and pump with modified 3-point mounted liquid manure pump.

²⁵Midwest Plan Service, Livestock Waste Facilities Handbook, Second Edition, Iowa State University, Ames, Iowa 50011, p. 6.4, 1985

To calculate the capacity required per herd for an earth basin the process was broken down per animal based on its weight. The mature cows weighs 1500 pounds but not all of the milking herd is mature so an average weight of 1400 pounds per cow was used. Table 2.3 gives a break down in cubic feet per day of manure produced.

Table 2.3
Manure Production Per Day

<i>Animal by Weight</i>	<i>Cubic Feet of Manure/Day²⁶</i>
1400 lbs.	2.10 ft ³ /Day ^a
1000 lbs.	1.32 ft ³ /Day
500 lbs.	.66 ft ³ /Day
250 lbs.	.32 ft ³ /Day
150 lbs.	.19 ft ³ /Day

^a Includes .3 ft³ /day allowance for water from milking and parlor cleanup.

The manure storage is for eight months so the cow numbers were multiplied by 240 days multiplied by the manure production per day. The size of the earth basins is shown in Table 2.4.

²⁶Midwest Plan Service, P. 2.1, 1985

Table 2.4
Earth Basins by Herds Size

<i>Herd Size</i>	<i>Cubic Feet</i>	<i>Dimensions in Feet</i>
60	40,000 ft ³	8'x103'x100'
120	80,000 ft ³	8'x122'x150'
250	162,991 ft ³	8'x150'x225'
400	265,008 ft ³	8'x274'x200'

The Michigan prototype dairy farms for 1995 use feeds produced in Michigan. The feeds produced on the dairy farms are haylage, hay, and high moisture corn. The rations are balanced by the Sparton Ration Evaluator for Dairy Cattle²⁷. In addition to the primary feeds, minerals, vitamins, buffers, soybean and meal are added to the ration to balance it. The rations are fed as a total mixed ration.

The nutrient composition of the primary feeds are listed in Table 2.5.

The milking herd is fed by groups based on milk production and age. The heifers are fed by groups based on their age and weight.

The milking herd is divided up into a high group, low group, and two year old group. These cows are fed haylage, high moisture corn, soybean

²⁷Bucholtz, H.f., J.W. Walter, R.A. Patton, S.T. Hayes, Sparton Dairy Ration Evaluator, CP-0112, Version 10, Cooperative Extension Service Software Library, Michigan State University, East Lansing, MI 48823, June 1987.

Table 2.5
Nutrient Composition of Pricing Feeds Used
in Estimating Feed Budgets

<i>Feed</i>	<i>% DM</i>	<i>% CP</i>	<i>MCal NE/lb.</i>	<i>% ADF</i>	<i>% NDF</i>
<i>Early Alfalfa Hay^a</i>	88	20	.61	33	40
<i>Early Alfalfa Hay^a</i>	50	20	.61	30	40
<i>High Moisture Corn</i>	89	10	.93	10	13
<i>Soybean Meal</i>	90	48	.85	10	14

^aAlfalfa is cut early to maximize crude protein in the plant. Alfalfa as a main ingredient, high in CP% greatly reduces the need to purchase protein.

meal, and minerals and vitamins. The dry cows are in their own group and they are fed a ration of dry hay and haylage and those animals close to parturition (delivery time) have high moisture corn supplemented to their diet to adjust their rumens.

The heifers are fed haylage and hay with some supplementation of corn. The younger heifers definitely receive corn. The calves are fed whole milk, hay, and calf starter. The heifers are all fed according to age and weight.

The total quantity of feed needed annually is in Table 2.6.

Table 2.6
Quantities of Feed Needed/Cow and
30% Replacement/Year by Herd Size

Feed	Cow	<u>60 Cow Herd</u>		Total Need
		30% Replacement	Heifer	
Hay ^a	.29 ton	.73 ton		1.02 ton
Haylage ^b	5.98 ton	1.49 ton		7.47 ton
H.M. Corn ^c	79.50 bu	6.92 bu		86.30 bu
Soybean Meal	184.33 lb.	19.60 lb		203.93 lb.

^aThese figures include a storage and feeding loss of 18 percent.

^bThese figures include a storage and feeding loss of 18 percent.

^cThese figures include a storage and feeding loss of 10 percent.

^dThese figures include a storage and feeding loss of 2 percent.

Feed	Cow	<u>120, 150, and 400 Cow Herd</u>		Total Need
		30% Replacement	Heifer	
Hay ^a	.32 ton	.73 ton		1.05 ton
Haylage ^b	6.31 ton	1.57 ton		7.80 ton
H.M. Corn ^c	79.50 bu	6.92 bu		86.30 bu
Soybean Meal	184.33 lb.	19.60 lb		203.93 lb.

^aThese figures include a storage and feeding loss of 18 percent.

^bThese figures include a storage and feeding loss of 24 percent.

^cThese figures include a storage and feeding loss of 10 percent.

^dThese figures include a storage and feeding loss of 2 percent.

2.1.8 Cropping System

The cropping system has two components in the base prototype farm. The primary crop grown is alfalfa. The alfalfa is made into haylage

primarily and secondarily in baled hay. The second crop grown is corn. The corn is used for high moisture corn.

The alfalfa is harvested early to maximize the percent crude protein in the plant. The main theme is harvesting quality not quantity. The reason this is stressed is alfalfa as a main ration ingredient with a high amount of crude protein reduces the purchased protein needed. Protein costs are extremely high and by raising a high protein alfalfa this dramatically decreased the annual feed costs.

Both haylage and baled hay are harvested early to maximize the percent crude protein. The 60, 120, 250, 400 cow operations use large bales. The large bales are used to reduce the labor required when using small bales. Small bales may be used on an option on the smaller herd sizes but it is not economical on large herds.

High moisture corn is harvested at a 28-30 percent moisture content. The high moisture corn is custom harvested on the 60 and 120 cow operations. It would not be economically efficient to own a combine for those few acres to make the machine cost effective. On the 250 and 400 herd sizes this could be a viable option. Under these prototype farms all corn is custom harvested.

The reason for not using corn silage was two-fold. Haylage, if harvested correctly, is higher in nutritional value than corn silage. Secondly, without corn silage, one storage facility is eliminated. It also decreases equipment costs which are not acquired to harvest corn silage. It was for these reasons that the expert team recommended a ration consisting without corn silage.

2.1.9 Facilities

The facilities required to store the feeds include upright silos for the high moisture corn, upright or bunker silos for haylage, and a no-sided roofed building for the dry hay. these silos are designed to be filled one time a year and provide a one year supply. The haylage facilities are designed for 80 percent annual need, because they are filled in the beginning of the summer and refilled late in the summer. The 60 cow operation stores its haylage in an upright silo while the 120, 250, and 400 cow operation stores their haylage in bunker silos. The baled hay building is designed for storage for a complete year. The purchased soybean meal is stored in a metal grain-style bin. A building is provided to store equipment. A complete list of the facilities is in Appendix A.

2.1.10 Equipment

The equipment required for the Michigan prototype dairy farms for 1995 includes everything needed to raise all of the dairy's feed requirements, to feed the animals, and to remove the manure from the animals. The complete lists of equipment for each prototype farm in Appendix.

2.1.11 Land

The land required for the Michigan prototype dairy farms includes

-
- a Storage and feeding losses are compensated. The upright silos for high moisture corn have 10 percent factor. The haylage horizontal silo has a 24 percent factor. The dry hay has an 18 percent factor compensated.*

the land for the crops and building and facilities. Table 2.7 gives a breakdown in acres for the building and facilities, crops and a combined total.

Table 2.7
Estimated Annual Land Requirements in Acres

<i>Herd Size</i>	<i>Building & Facilities (acres)</i>	<i>Hay (acres)</i>	<i>Haylage (acres)</i>	<i>H.M. Corn (acres)</i>	<i>Total (acres)</i>
60	2.0	12.2	87.6	57.8	155.7
120	3.0	25.2	187.2	103.7	318.9
250	6.5	52.5	390.0	216.0	664.7
400	8.0	84.0	624.0	345.7	1061.7

The amount of land required depends on the yields from the crops. The land is based on the performance variables listed in Section 2.3

2.1.12 Labor

The labor required per farm is broken down into the labor required for the dairy in Table 2.8 and the labor required for the crops in Table 2.9. The total labor required per dairy farm is in Table 2.10. The total amount required increases with increasing herd sizes. However, with increasing herd sizes more specialization occurs and the actual labor on a per cow declines with increasing herd sizes.

Table 2.8
Estimated Annual Labor Requirements
by Herd Size for Dairy
(Hours/Year)*

Item	HERD SIZE			
	60	120	250	400
Total Hours/Cow/Year	55	43	35	30
Total Hours/Annual Farm/Year ^{abcd}	3,300	5,160	8,750	12,000
Total Hours/Cow and Heifer/Year	63	50	40	35
Total Hours/Annual Farm/Year	3,780	6,000	10,000	13,600

* These figures are based on milking, manure handling, feeding, bedding, heat detection, breeding, young stock, dry cow care, records, and miscellaneous.

^a Milking time for herd sizes is based on Wetzal, 1979, Table 3.1. Hours per milking is based on JLUbik, 1984, Table 4.16.

^b Manure handling labor is based on Bath et al., 1978, Appendix V-I, P/ 531.

^c Bedding and other labor costs with exception of records and dry cow care are based on bath et. al, 1978, Appendix Atable V-I.

Table 2.9
Estimated Annual Labor Requirements for Crops per Farm
(Hours/Year)

<i>Herd Size</i>	<i>Item</i>	<i>Labor/Acre²⁸</i>	<i>Acres</i>	<i>Total Hours</i>
60	<i>Haylage</i>	8.4	89.6	753.0
	<i>Hay</i>	10.1	12.2	124.0
	<i>H.M. Corn</i>	3.1	51.8	<u>160.7</u>
				1037.7
120	<i>Haylage</i>	7.0	187.2	1310.0
	<i>Hay</i>	10.1	25.2	255.0
	<i>H.M. Corn</i>	2.5	103.0	<u>259.0</u>
				1824.0
250	<i>Haylage</i>	5.0	390.0	1950.0
	<i>Hay</i>	8.1	52.5	425.0
	<i>H.M. Corn</i>	2.0	216.0	<u>432.0</u>
				2807.0
120	<i>Haylage</i>	4.4	624.0	2746.0
	<i>Hay</i>	7.0	84.0	588.0
	<i>H.M. Corn</i>	2.0	345.7	<u>691.0</u>
				4025.0

²⁸Hlubik, Joseph G., The Profitability of Purchasing Vs. Growing Feeds on Dairy Farms in Southern Michigan, Michigan State University, East Lansing, MI 48823, Table D18, 1984.

Table 2.10
Estimated Annual Total Labor Requirements per Farm
(Hours/Year)

<i>Herd Size</i>	<i>Dairy^a</i> <i>(Hours)</i>	<i>Crops^b</i> <i>(hours)</i>	<i>Total/Year</i> <i>(Hours)</i>
60	3,780	1,037	4,953.05
120	6,000	1,761	8,007.50
250	10,000	2,807	13,185.50
400	13,600	4,025	18,176.00

^aDairy labor requirements are based on 1989 Table 2.3.

^bCrop labor requirements are based on 1989, Table 2.4

2.1.13 Michigan Prototype Dairy Farms

A compiled list of the prototype dairy farms for the 60, 120, 250, and 400 cow operations are in Table 2.11.

Table 2.11
Michigan Prototype Dairy Farms for 1995^a

Item	Herd Size			
	60	120	250	400
<i>Cows</i>	<i>Free Stall</i>	<i>Free Stall</i>	<i>Free Stall</i>	<i>Free Stall</i>
<i>Dry Cows</i>	<i>Free Stall</i>	<i>Free Stall</i>	<i>Free Stall</i>	<i>Free Stall</i>
<i>Heifers 14-24 m</i>	<i>Free Stall</i>	--	--	--
<i>Heifers 3-15 m</i>	<i>Counter-Slope</i>	--	--	--
<i>Heifers 6-24 m</i>	--	<i>Free Stall</i>	<i>Free Stall</i>	<i>Free Stall</i>
<i>Heifers 3-5 m</i>	--	<i>Super Hutch</i>	<i>Super Hutch</i>	<i>Super Hutch</i>
<i>Heifers 0-2 m</i>	<i>C. Hutch</i>	<i>C. Hutch</i>	<i>C. Hutch</i>	<i>C. Hutch</i>
<i>Milking Parlor</i>	<i>D-4</i>	<i>D-6</i>	<i>D-8</i>	<i>D-10</i>
<i>Manure Storage</i>	<i>8 month</i>	<i>8 month</i>	<i>8 month</i>	<i>8 month</i>
<i>Haylage</i>	<i>Upright Silo</i>	<i>Bunker Silo</i>	<i>Bunker Silo</i>	<i>Bunker Silo</i>
<i>H.M. Corn</i>	<i>Upright Silo</i>	<i>Upright Silo</i>	<i>Upright Silo</i>	<i>Upright Silo</i>
<i>Hay</i>	<i>Building</i>	<i>Building</i>	<i>Building</i>	<i>Building</i>
<i>Feeding System</i>	<i>Fixed-Mechanical</i>	<i>Mobile</i>	<i>Mobile</i>	<i>Mobile</i>
<i>Equipment</i>	<i>Building</i>	<i>Building</i>	<i>Building</i>	<i>Building</i>
<i>Maternity-Hospital-</i>				
<i>Treatment Plus</i>	5	10	16	22
<i>Land Base (Acres)</i>	155.73	318.86	664.75	1061.68
<i>Labor (Hours/year)</i>	4,953.05	8,007.50	13,185.50	18,176.00

^aBased on expert team's recommendation.

2.2 Enterprise Budgets

The Michigan prototype dairy farms for 1995 are based on whole farm enterprise budgets. An enterprise is defined as a single, separate project undertaken for the purpose of making a profit. "Enterprise budgets are prepared by stating the income, expenses, and resource needs of a productive activity of the farming business on a per unit basis. The income, expenses, and resource needs are treated as a package in examining various adjustments related to the business."²⁹

Enterprise budgets provide guides for the expected quantity of production, kinds and quantities of feed required, operating expenses, and building, equipment, manure and labor requirements. The returns to both labor and management and profitability of the enterprise can be calculated. The bottom line of any enterprise budget reflects the profitability of that enterprise. The returns to an enterprise can be classified in one of four ways. The first figure, gross receipts, is based solely on the production and price received of the particular enterprise. "Returns over variable costs, or gross margins, reflect the short-run profitability of an enterprise (in other words tells if it is covering variable cost)".³⁰ The returns to unpaid labor and management show the return to those resources. Deducting the cost of labor gives us the returns to management. Enterprise budgets can serve as short-run planning guides using this year's expected prices and costs or as long-run forward

²⁹Harsh, Stephen B., Et al, P. 190, 1981.

³⁰Luenig, R.A., R.M. Klemme and W.T. Howard, Wisconsin Farm Enterprise Budgets, Dairy Cows Replacements, A 27 31, University of Wisconsin Agricultural Bulletin Room 245, 30 N Murray St., Madison, Wisconsin 53715, P. 4, 1987.

planning guides based on longer run projections.

The Michigan prototype dairy farms for 1995 are computerized enterprise budgets. Computerizing the enterprise budgets make it very easy and quick to make adjustments to the budget. For example, if the price of milk received per hundred weight is changed, the new price is typed in and the computer automatically computes a new financial result.

Enterprise budgets are based on a per unit basis. These enterprise budgets are all based on a per cow basis. All revenues, costs, and returns are on a per cow basis. The enterprise budgets are based on prototype dairy farms raising only enough of their own feed to feed their cows. The budgets are designed on a per cow basis with a raised replacement heifer. There are five main components of an enterprise budget. The first section deals with the variable costs involved in the enterprise. The third section deals with the fixed costs. The fourth area is combined total of the variable and fixed costs. The fifth deals with the returns to the enterprise.

2.2.1 Receipts

The receipts section represents the sales of milk, cull cows, cull heifers, and bull calves sold. The total of these four are combined into gross receipts per cow per year.

2.2.2 Variable Costs

Variable costs change with the level of production. The variable costs are broken down into two types: feed costs and livestock costs.

The feed costs include forage (haylage and hay), corn, soybean meal,

minerals, vitamins, and milk (for calves 0-2 months). The soybean meal, minerals, vitamins, and milk are charged at the current market price per unit based on the performance variables in Section 2.3. The forages and corn price is more complicated.

The prototype dairy farm income comes only from the sales of dairy products. The farms are raising all of their own feed so their is equipment specifically used for crops. However, there are no revenues from crop sales, because the only crops grown are what the dairy animals require, A set price per bushel or ton is not used in this budget because it would bring in the factor of relative efficiency of the crop production enterprise, which would obscure the true profit from the dairy herd. The equipment required to raise the feed is placed in the fixed cost section under equipment. The labor required to raise the feeds comes under labor cost. The costs attributed to variable costs are seed, chemical, fertilizer, and fuel costs to produce the feed the cow and replacement heifer need.

The livestock costs are the remainder of the variable costs. They include the cost for bedding the animals. Milk hauling costs very directly with the level of production. The next item is the veterinarian and medicine costs. The breeding costs are based on a 1.5 services per conception rate. The final three livestock costs include the power and fuel, supplies (soaps, inflations, etc.), and overhead (DHIA, legal, accounting, etc.).

A final item which appears under the variable costs is the operating capital interest cost. The interest on operating capital is calculated on 50 percent of the forage, corn and bedding costs.

2.2.3 Fixed Costs

Fixed costs are costs which do not vary with the level of production. The fixed costs are often referred to as the DIRT five: depreciation, interest, repairs, taxes, and insurance. Calculating fixed costs is a two step process that consists of placing a value on the equipment, buildings, manure facility, and breeding livestock and calculating an annual cost for each of these fixed assets whose productive value extends over several years. Calculating the actual fixed cost requires a current value, salvage value, expected life, and an opportunity cost of capital.

Fixed assets are divided into two groups: those that generally depreciate in value (most buildings, breeding livestock, and equipment) and a groups that generally appreciate in value (land)³¹. The depreciating fixed asset costs consist of an allowance for the loss in value, an opportunity charge for capital invested, and annual charges for repairs, taxes, and insurance. A Capital Recovery Charge (CRC) can be computed that accounts for the first two components (depreciation and interest) of the fixed costs. The annual fixed costs of depreciating assets are found by adding the capital recovery charge the fixed cash costs of repairs, taxes, and insurance.

The capital recovery charge is found by first computing an annual loss in value, To do this multiply the loss in value of the fixed asset (original value minus salvage value) by the capital factor found in Table 2.1.2. The interest charge is computed by multiplying the salvage value byu the opportunity cost of capital. The capital recovery change is then

³¹Luening, R.A., et al, p. 3, 1987.

the sum of the annual loss in value and the interest charge.

The formula used for figuring the Annual Fixed Cost is:

(purchase-salvage) x CRC factor + interest (on salvage) + taxed,
insurance and repairs = annual fixed cost.

Salvage value is equal to 10% of purchased price

Salvage value of cattle is slaughter value

Useful life:

Farm, buildings and facilities	20 years
Farm equipment	7 years
Cattle (5 years, milking 3 years)	3 years

Taxes, insurance, and repairs:

taxes	0.5 %
insurance	0.5 %
repairs	1.0 %

The six fixed costs in the total fixed cost figure are buildings, equipment, livestock, death loss, manure facility, and land. The buildings, facilities, and manure storage are based on a twenty year life span. The equipment has a seven year life span, and the producing cows is expected to be in the milking herd for three years. Death loss figures are included as a fixed costs since it is a cost that does not vary with the level of production per cow, Land does not depreciate so a CRC factor is not used. An interest rate charge per acre and a real estate tax per acre (46 mill or 2 percent of purchase price) are combined for an annual fixed cost on land. The manure facility does not have a salvage value included. For the buildings, equipment, and facilities the salvage value is 10 percent of the purchase price. The livestock salvage value is what the animal would receive at slaughter,

The fixed costs are all added together to give a total fixed cost figure.

Table 2.12
Capital Recovery Factors for Various Opportunity
Costs of Capital and Planning Horizons³²

Number of Years in Planning Horizon	Opportunity Cost of Capital (%)					
	8	9	10	11	12	15
1	1.0800	1.0900	1.1000	1.1100	1.1200	1.1500
2	0.5608	0.5685	0.5762	0.5839	0.5917	0.6151
3	0.3880	0.3951	0.4021	0.4092	0.4163	0.4380
4	0.3019	0.3087	0.3155	0.3223	0.3292	0.3503
5	0.2505	0.2571	0.2638	0.2706	0.2774	0.2983
6	0.2163	0.2229	0.2296	0.2364	0.2432	0.2642
7	0.1921	0.1987	0.2054	0.2122	0.2191	0.2404
8	0.1740	0.1807	0.1874	0.1943	0.2013	0.2229
9	0.1601	0.1668	0.1736	0.1806	0.1877	0.2096
10	0.1490	0.1558	0.1627	0.1698	0.1770	0.1993
15	0.1168	0.1241	0.1315	0.1391	0.1468	0.1710
20	0.1019	0.1095	0.1175	0.1256	0.1339	0.1598
25	0.0937	0.1018	0.1102	0.1187	0.1275	0.1547
30	0.0888	0.0973	0.1061	0.1150	0.1241	0.1523

The formula used to calculate the CRF is

$$CRF = \frac{i (1+i)^n}{(1+i)^n - 1}$$

Where i = opportunity cost of capital
 n = length of planning horizon

³²Luening, R.A., et al, p. 22, 1987.

2.2.4 Total Costs

The total cost section is the variable costs plus the fixed costs. This figure does not include any costs for labor and management.

2.2.5 Return

The return section shows the profitability or losses to the prototype dairy farm. There are seven parts to the return section. It starts with the gross receipts. Then variables costs are subtracted off. This figure is the returns above variable costs. Then fixed costs are subtracted off. This figure gives the returns to labor and management. Then labor costs are subtracted off. The final figure is the returns to management. This figure represents the bottom line. In some cases it is positive and some cases negative.

2.2.6 Cow and Replacement Heifer Budget

There are two parts to each enterprise budget. The first part deals exclusively with the cow. The second part deals with the replacement heifer. To put an enterprise budget together for a cow plus replacement heifer the two had to first be broken apart. The primary reason being 30 percent of the cow is replaced annually by a new two-year old (a recently fresh heifer). A complete heifer budget was designed for each prototype dairy farm. The budget was complete from birth until the animal freshened. It takes two years to raise a heifer. Only 30 percent of the totals required for each area in the heifer budget were added to the cow budget because 30 percent of the cows are placed annually.

Dividing the fixed costs which were attributed to cows and to the

replacement heifer was the next phase. Any fixed costs related to feed equipment, crop equipment, and storage facilities was broken down to 59 percent is required by the cow and 41 percent by the heifer. Any fixed costs attributed to manure handling and storage were broken down into 70 percent to the cow and 30 percent to the heifer. These figures are based on the manure annually produced per cow and heifer on the prototype farm.

2.3 Performance Variables

Performance variables are the base variables which are used in all four prototype farms. These base variables are used to evaluate the prototype farms, The areas evaluated are in the financial performance section of the enterprise budget. The evaluations are based on variable costs, fixed costs, labor costs, and returns to management to four different herd sizes. The base performance variables refer to the essential variables in a dairy farm which have a definite impact on the financial returns to the far.

2.3.1 Milk Revenues

The first two variables which are very obvious to farmers deal with revenues. The variables are milk production and milk price. These variables are based on trends and the impact of future legislation. Milk production was based on the past 25 years of data provided by the Michigan Dairy Herd Improvement Association. In 1961 the state DHIA average was 11,101 pounds of milk per cow per year. In 1986 the average was 17,041 pounds. this is a 237.8 pound per year increase. Projecting this trend out to 1995 the state DHIA average would be 19,200 pounds of milk per cow. The

milk price in 1995 stems from recent developments in legislation affecting the milk price. In the base model a conservative price, \$10.00 hundredweight is used. This price is based on recent projections by the expert team.

2.3.2 Feed Costs

A second area of the base performance variables is feed costs. The feed cost for a dairy farmer can make up from 40 to 70 percent of the total costs. For this reason it is an important concern to dairy farmers, The three main feed costs are haylage and dry hay combined, high moisture corn, and soybean meal. The costs of these fees have varied over the past decade. One of the main things which has affected the price of these feeds is the supply. The supply has been significantly affected by the weather. When the Midwest has been in a drought such as in 1988 the price of these three feeds increase significantly. In years of adequate to above average rains the prices have been lower. A third weather factor affecting the supply of feed in Michigan was the flood of 1986 which severely reduced the supply of alfalfa for the following year. The base prices for these feeds are based on the past decade's prices projected to 1995. The prices are for corn \$2.50 per bushel, soybean meal \$300 per ton (\$15/cwt.), and a \$60 per ton average for dry hay and haylage. The hay and haylage combined is at \$60 per ton because haylage which is cheaper is the primary feed and the higher prices dry hay makes up a small part of the ration. The corn and hay price is not used in the base prototype farm, but they are in the final sensitivity analysis.

2.3.3 Crop Yields

A third area of base performance variables deals with the yields of the feeds grown. The yield per acre has a significant impact on the acres required to raise the feed. The base yield variables are based on what the yields in Michigan have been for the past decade projected out to 1995. The alfalfa yield per acres is based on 5 tons of dry matter per acre. The base yield for corn is 100 bushels per acre for 1995.

2.3.4 Cost of Capital

A fourth area deals with the cost of capital. Specifically, what the interest rates are. Interest rates play a significant role in determining the annual fixed costs. The interest rates are broken down into rates for land, building, and equipment. These three make up the primary costs comprising the fixed costs and this is why they are assigned there own specific rates. In the early 1980's the rates were extremely high while in other years they were much lower. The base rates for the prototype farms are as follows: land 10 percent, buildings 11 percent, and equipment 11 percent.

2.3.5. Land Values

The fifth area deals with the price of land per acre. Land prices in Michigan have varied significantly. In the early 1980's the prices per acre reached record levels. However, since then the price of land has been declining each year. The 1987 agricultural land value per acre minus improvements for Michigan was \$697.00 per acres³³. It is difficult to

³³Harvey, Lynn, et al, 1988.

project land values in the future so the base price per acres minus improvements used in the prototype farm is \$697.00 per acre.

2.3.6 Labor Cost

The final area deals with the price of labor per hour. Labor shortages on farms in recent years have made wages more competitive. Labor prices have increased 14 percent in the past eight years to a 1988 figure of \$4.25 per hour. The labor price used on the Michigan prototype dairy farm for 1995 is \$5.00 per hour. This figure is based on the past decade of wage rates and projected out to 1995.

2.4 Sensitivity Variables

Chapter 5 looks at the results of the base prototype dairy farms under a different set of assumptions. "The process of using different assumptions and observing the impact on the alternatives being analyzed is called sensitivity analysis"³⁴. The process allows a dairy farmer to determine the impact of changing assumptions on the sensitivity of the profitability of the dairy. Sensitivity analysis is very important in long-range financial planning. Sensitivity analyses allow a manager to know that an apparently profitable alternative can become potentially disastrous with only a slight change in the assumptions.

In section 2.3 the base variables in the prototype dairy farms were given. The first sensitivity analysis takes the base variables and adjusts them to an upper level and down to a lower level. the second sensitivity analysis looks at the entire prototype dairy farm. In this analysis the base variable is the farm raising all of its feed. The other variables are

³⁴Harsh, Stephen B., et al, p. 215, 1981.

Table 2.13
Performance Variables

<i>Item</i>	<i>Value</i>
<i>Milk Price</i>	<i>\$10.00 per hundredweight</i>
<i>Milk Production</i>	<i>19,200 pounds/cow/year</i>
<i>Haylage and hay</i>	<i>\$60.00 per ton</i>
<i>H.M. Corn</i>	<i>\$2.50 per bushel</i>
<i>Soybean Meal</i>	<i>\$300.00 per ton (\$15 per cwt.)</i>
<i>Hay Yield</i>	<i>5 ton DM per acre</i>
<i>Corn Yield</i>	<i>100 bushels</i>
<i>Land Interest Rate</i>	<i>10 percent</i>
<i>Building Interest Rate</i>	<i>11 percent</i>
<i>Equipment Interest Rate</i>	<i>11 percent</i>
<i>Land Price</i>	<i>\$697.00 per acre</i>
<i>Labor Price</i>	<i>\$5.00 per hour</i>

the dairy farm raising only it forages and purchasing its corn, and the dairy farm purchasing all of its feed (both forage and corn). This analysis uses all of the base performance variables listed in table 2.13.

The compiled lower, base and upper variables are in table 2.14.

The second sensitivity analysis dealing with the origin of the feed is more complicated. In this analysis equipment requirements are altered. The dairy raising only forages will neither have the equipment dealing with corn production nor the labor costs associated with corn production. These farms are charged \$2.50 per bushel for corn. The farms purchasing all of their feed will have a significant reduction in equipment requirements. These are charged \$2.50 per bushel of corn and \$60 per ton for hay and haylage combined.

Table 2.14
Sensitivity Variable of the Base Prototype Dairy Farms

<i>Item</i>	<i>Lower Variable</i>	<i>Base Variable</i>	<i>Upper Variable</i>
<i>Milk Price</i>	<i>\$9/cwt.</i>	<i>\$10/cwt.</i>	<i>\$11/cwt.</i>
<i>Milk Production</i>	<i>12,100 lbs.</i>	<i>19,200 lbs.</i>	<i>21,200 lbs.</i>
<i>Soybean Meal Price</i>	<i>\$13/hdwt.</i>	<i>\$15/hdwt.</i>	<i>\$17/hdwt.</i>
<i>Corn Yield/Acre</i>	<i>80 bu.</i>	<i>100 bu.</i>	<i>120 bu.</i>
<i>Hay Yield /Acre in Dry Matter</i>	<i>4 ton</i>	<i>5 ton</i>	<i>6 ton</i>
<i>Interest Rate on Land</i>		<i>10%</i>	<i>12%</i>
<i>Interest Rate on Buildings</i>		<i>11%</i>	<i>13%</i>
<i>Interest Rate on Equipment</i>		<i>11%</i>	<i>13%</i>
<i>Land Value/Acre</i>		<i>\$697.00</i>	<i>\$997.00</i>
<i>Labor Cost/Hour</i>		<i>\$5.00</i>	<i>\$10.00</i>

CHAPTER 3

RESULTS OF THE BASE PERFORMANCE VARIABLES FOR PROTOTYPE DAIRY FARMS

The performance variables specified in Table 2.13 are used to analyze the Michigan prototype dairy farms for 1995. The analyses are based on the enterprise budget explained in Chapter 2. Each prototype farm is established with the performance variables and analyzed in the enterprise budget format. There is a complete enterprise budget based on the cow and a 30 percent replacement rate for the 60, 120, 250, and 400 cow operations. Additionally, one 250 cow operation heifer enterprise budget is included. Only one heifer enterprise budget is included for all four prototype farms, to show its format and findings.

The primary analysis is contained in Section IV of the enterprise budget entitled Returns. The Returns evaluate the bottom line profitability of the prototype farms. It also breaks down essential components comparing the budgets to identify which items are of major importance. Tables 3.1 through 3.4 are the complete enterprise budgets for the Michigan prototype dairy farms for 1995. Table 3.5 is the replacement heifer budget from birth until freshening for the 250 cow operation. Thirty percent of the replacement heifer budget is included to comprise the cow replacement heifer enterprise budget. These enterprise budgets are based on the prototype dairy farms raising all of their feed.

For a financial summary of the 60, 120, 250, and 400 cow prototype dairy farms, Table 3.6 was compiled. This table lists all of the components of the financial returns for each farm.

The results of the prototype farms are based on the specific prototype farms. These results are not intended to make comparisons

between herd sizes, but only an analysis the specific prototype farm. Each prototype farm has a different level of capital, labor, land and management requirements.

3.1 Financial Results

There is a significant difference between the profitability levels of the prototype farms. Essentially all four farms have identical gross receipts because they are all based on the same production level and milk price. The variable costs are all similar because the feed requirements per animal are the same. The returns above variable costs are also very similar. The returns above variable costs vary by \$7.23 per cow. The first three items on the financial return section are similar. However, the remainder of the returns vary significantly.

The fixed costs between the 60 cow operation and the 400 cow operation vary by \$511.41 per cow. The primary reason for this large difference is on the 400 cow operation the fixed costs are spread over more animals, reducing the cost per animal, than on the 60 cow operation. The two fixed costs which vary significantly between the 60 and 400 cow herd sizes are building costs and equipment costs.

The building costs vary by \$106.04 per cow. The reason for this difference stems from storage facilities. Bunker silos are more economical per animal in a 400 cow herd than a vertical silo per animal in a 60 cow herd for storing haylage.

The equipment cost varied by \$404.03 per cow between the 400 cow operation and the 60 cow operation. There are two components to the fixed equipment costs. The first is the dairy equipment and the second part is the crop equipment to raise the feed. The reason for the difference is

Table 3.1
Enterprise Budget for 60 cow Dairy
Raising All Feed
[Raised Replacement Heifer Budget Included]

ITEM	AMOUNT
I. RECEIPTS	
1. Milk-192.00 cwt. x \$10.00/cwt	\$1,920.00
2. Calf-90% calf crop: .47 bull calf sold .45 heifer calf raised .90 calf minus .45 raised = .475 sold x \$110.25	52.37
3. Cull Cow-30% x 1400 lbs. x \$48/cwt.	201.60
4. Cull Heifer-12% x 950 lbs. x \$53/cwt. x 30%	<u>18.13</u>
5. Gross Receipts	\$2,192.09

	Price Per Unit	Amount	Dollar Value
II. VARIABLE COSTS			
A. Feed Requirement			
1. Forage (tons) ^a		8.49	60.48
2. Corn Equivalent bushels		86.30	84.48
3. Soybean Meal cwt.	15.00	1.97	29.55
4. Vitamins cwt.	58.76	6.26	10.49
5. Minerals cwt.	10.15	40.84	71.07
6. Whole Milk	10.00	217.69	<u>21.77</u>
7. Total Feed Costs			277.84
B. Livestock Costs			
1. Bedding ton	50.00	1.52	75.88
2. Milk Hauling cwt.	.50	192.00	96.00
3. Veterinarian & Medicine			48.49
4. Breeding			33.33
5. Power and Fuel			70.56
6. Supplies, Soap, etc.			35.61
7. Overhead (DHIA, legal, etc.)			<u>59.78</u>
8. Livestock Costs			<u>419.65</u>
9. Capital Interest Total ^b			<u>16.86</u>
10. Total Variable Costs			714.35

III. FIXED COSTS

1. Building	324.25
2. Equipment	580.95
3. Livestock	115.38
4. Death Loss ^C	30.00
5. Manure Facility	16.50
6. Land	<u>179.58</u>
7. Total Fixed Costs	1,246.65

IV. TOTAL COSTS

(Except labor and Management) 2,103.70

V. RETURNS

1. Gross Receipts	2,192.09
2. Less Variable Costs	<u>714.35</u>
3. Returns Above Variable Costs	1,477.74
4. Less Fixed Costs	<u>1,246.65</u>
5. Returns to Labor and Management	231.09
6. Less Labor Costs \$5.00/hr.	<u>400.48</u>
7. Returns to Management	(169.39)

^aForage ration of 84% haylage and 16% hay (C.P. 20%, ADF 33%, NDF 40%) Includes allowances of 18% for feeding and storage losses.

^bInterest on operating capital is calculated on 50% of the forages, corn, and bedding costs.

^cThe death loss figure is included as a fixed cost since it is a cost that does not vary with the level of production.

Based on material from Luening, Klemme, Howard, 1987, p. 22

Table 3.2
Enterprise Budget for 120 cow Dairy
Raising All Feed
[Raised Replacement Heifer Budget Included]

ITEM	AMOUNT
I. RECEIPTS	
1. Milk-192.00 cwt. x \$10.00/cwt	\$1,920.00
2. Calf-90% calf crop: .47 bull calf sold .45 heifer calf raised .90 calf minus .45 raised = .475 sold x \$110.25	52.37
3. Cull Cow-30% x 1400 lbs. x \$48/cwt.	201.60
4. Cull Heifer-12% x 950 lbs. x \$53/cwt. x 30%	<u>18.13</u>
5. Gross Receipts	\$2,192.09

	Price Per Unit	Amount	Dollar Value
II. VARIABLE COSTS			
A. Feed Requirement			
1. Forage (tons) ^a		8.49	60.48
2. Corn Equivalent bushels		86.30	84.54
3. Soybean Meal cwt.	15.00	1.97	29.55
4. Vitamins cwt.	58.76	6.26	10.49
5. Minerals cwt.	20.15	40.84	71.07
6. Whole Milk	10.00	217.69	<u>21.77</u>
7. Total Feed Costs			277.90
B. Livestock Costs			
1. Bedding ton	50.00	1.52	75.88
2. Milk Hauling cwt.	.50	192.00	96.00
3. Veterinarian & Medicine			48.49
4. Breeding			33.33
5. Power and Fuel			70.56
6. Supplies, Soap, etc.			35.61
7. Overhead (DHIA, legal, etc.)			<u>59.78</u>
8. Livestock Costs			<u>419.65</u>
9. Capital Interest Total ^b			<u>16.87</u>
10. Total Variable Costs			714.42

III. FIXED COSTS

1. Building	281.86
2. Equipment	347.58
3. Livestock	115.38
4. Death Loss ^C	30.00
5. Manure Facility	14.14
6. Land	<u>178.93</u>
7. Total Fixed Costs	967.90

IV. TOTAL COSTS

(Except labor and Management) 1,825.00

V. RETURNS

1. Gross Receipts	2,192.09
2. Less Variable Costs	<u>714.42</u>
3. Returns Above Variable Costs	1,477.67
4. Less Fixed Costs	<u>967.90</u>
5. Returns to Labor and Management	509.77
6. Less Labor Costs \$5.00/hr. cow 43h. x \$5.00 heifer 4.84 h. x \$5.00	<u>322.87</u>
7. Returns to Management	186.90

^aForage ration of 84% haylage and 16% hay (C.P. 20%, ADF 33%, NDF 40%) Includes allowances of 18% for feeding and storage losses.

^bInterest on operating capital is calculated on 50% of the forages, corn, and bedding costs.

^cThe death loss figure is included as a fixed cost since it is a cost that does not vary with the level of production.
Based on material from Luening, Klemme, Howard, 1987, p. 22

Table 3.3
Enterprise Budget for 250 cow Dairy
Raising All Feed
[Raised Replacement Heifer Budget Included]

ITEM	AMOUNT		
I.	RECEIPTS		
1.	Milk-192.00 cwt. x \$10.00/cwt		\$1,920.00
2.	Calf-90% calf crop: .47 bull calf sold .45 heifer calf raised .90 calf minus .45 raised = .475 sold x \$110.25		52.37
3.	Cull Cow-30% x 1400 lbs. x \$48/cwt.		201.60
4.	Cull Heifer-12% x 950 lbs. x \$53/cwt. x 30%		<u>18.13</u>
5.	Gross Receipts		\$2,192.09
	Price Per Unit	Amount	Dollar Value
II.	VARIABLE COSTS		
A.	Feed Requirement		
1.	Forage (tons) ^a	8.49	59.59
2.	Corn Equivalent bushels	86.30	84.73
3.	Soybean Meal cwt. 15.00	1.97	29.55
4.	Vitamins cwt. 58.76	.18	10.49
5.	Minerals cwt. 20.15	3.53	71.07
6.	Whole Milk 10.00	217.69	<u>21.77</u>
7.	Total Feed Costs		277.20
B.	Livestock Costs		
1.	Bedding ton 50.00	1.52	75.88
2.	Milk Hauling cwt. .50	192.00	96.00
3.	Veterinarian & Medicine		48.49
4.	Breeding		33.33
5.	Power and Fuel		70.56
6.	Supplies, Soap, etc.		35.61
7.	Overhead (DHIA, legal, etc.)		<u>59.78</u>
8.	Livestock Costs		<u>419.65</u>
9.	Capital Interest Total ^b		<u>16.83</u>
10.	Total Variable Costs		713.68

III. FIXED COSTS

1. Building	262.51
2. Equipment	248.13
3. Livestock	115.38
4. Death Loss ^C	30.00
5. Manure Facility	11.84
6. Land	<u>182.91</u>
7. Total Fixed Costs	850.76

IV. TOTAL COSTS

(Except labor and Management) 1,707.13

V. RETURNS

1. Gross Receipts	2,192.09
2. Less Variable Costs	<u>713.68</u>
3. Returns Above Variable Costs	1,478.41
4. Less Fixed Costs	<u>850.76</u>
5. Returns to Labor and Management	627.65
6. Less Labor Costs \$5.00/hr. cow 35h. x \$5.00 heifer 3.46 h. x \$5.00	<u>265.00</u>
7. Returns to Management	362.65

^aForage ration of 84% haylage and 16% hay (C.P. 20%, ADF 33%, NDF 40%) Includes allowances of 18% for feeding and storage losses.

^bInterest on operating capital is calculated on 50% of the forages, corn, and bedding costs.

^cThe death loss figure is included as a fixed cost since it is a cost that does not vary with the level of production.
Based on material from Luening, Klemme, Howard, 1987, p. 22

Table 3.4
Enterprise Budget for 400 cow Dairy
Raising All Feed
[Raised Replacement Heifer Budget Included]

ITEM	AMOUNT		
I. RECEIPTS			
1. Milk-192.00 cwt. x \$10.00/cwt			\$1,920.00
2. Calf-90% calf crop: .47 bull calf sold .45 heifer calf raised .90 calf minus .45 raised = .475 sold x \$110.25			52.37
3. Cull Cow-30% x 1400 lbs. x \$48/cwt.			201.60
4. Cull Heifer-12% x 950 lbs. x \$53/cwt. x 30%			<u>18.13</u>
5. Gross Receipts			\$2,192.09
	Price Per Unit	Amount	Dollar Value
II. VARIABLE COSTS			
A. Feed Requirement			
1. Forage (tons) ^a		8.49	59.59
2. Corn Equivalent bushels		86.30	84.92
3. Soybean Meal cwt.	15.00	1.97	22.90
4. Vitamins cwt.	58.76	6.26	10.49
5. Minerals cwt.	10.15	40.84	71.07
6. Whole Milk	10.00	217.69	<u>21.77</u>
7. Total Feed Costs			270.70
B. Livestock Costs			
1. Bedding ton	50.00	1.52	75.88
2. Milk Hauling cwt.	.50	192.00	96.00
3. Veterinarian & Medicine			48.49
4. Breeding			33.33
5. Power and Fuel			70.56
6. Supplies, Soap, etc.			35.61
7. Overhead (DHIA, legal, etc.)			<u>59.78</u>
8. Livestock Costs			<u>419.65</u>
9. Capital Interest Total ^b			<u>16.84</u>
10. Total Variable Costs			707.19

III. FIXED COSTS

1. Building	218.21
2. Equipment	176.92
3. Livestock	115.38
4. Death Loss ^C	30.00
5. Manure Facility	11.51
6. Land	<u>183.23</u>
7. Total Fixed Costs	735.24

IV. TOTAL COSTS

(Except labor and Management) 1,549.55

V. RETURNS

1. Gross Receipts	2,192.09
2. Less Variable Costs	<u>707.19</u>
3. Returns Above Variable Costs	1,484.90
4. Less Fixed Costs	<u>735.24</u>
5. Returns to Labor and Management	749.66
6. Less Labor Costs \$5.00/hr. cow 30h. x \$5.00 heifer 3.46 h. x \$5.00	<u>224.52</u>
7. Returns to Management	525.14

^aForage ration of 84% haylage and 16% hay (C.P. 20%, ADF 33%, NDF 40%) Includes allowances of 18% for feeding and storage losses.

^bInterest on operating capital is calculated on 50% of the forages, corn, and bedding costs.

^CThe death loss figure is included as a fixed cost since it is a cost that does not vary with the level of production.

Based on material from Luening, Klemme, Howard, 1987, p. 22

Table 3.5
Replacement Heifer Budget

Age at First Freshening										12 to 24 months	
Item	Price Per Unit (\$)	Amount	Factor	Total Amount	Dollar Value	Amount	Factor	Total Amount	Dollar Value		
I. RECEIPTS											
II. VARIABLE COSTS:											
A. Feed Requirements											
1. Forage	60.00/ton	1100.00/lb.	2.00	2200/lb.	66.00	8644.21/lb.	1.06	9119.64/lb.	255.35		
2. Corn Equivalent	2.50/bu.	0.0	2.00	0.0	0.00	283.80/bu.	1.06	299.14/bu.	13.37		
3. Soybean Meal	15.00/cwt.	0.0	2.00	0.0	0.00	0.0	1.06	0.0	0.00		
4. Minerals	20.15/cwt.	2.0/lb.	2.00	4.0	0.81	61.43/lb.	1.06	64.81/lb.	13.06		
5. Vitamins	58.76/cwt.	3.0/lb.	2.00	6.0	3.53	7.20/lb.	1.06	7.60/lb.	4.46		
6. Whole Milk	10.00/cwt.	0.0	2.00	0.0	0.00	0.00	1.06	0.0	0.0		
7. Total Feed Costs					70.33				286.24		
B. Livestock Costs											
1. Bedding	50.00/ton	85.0/lb.	2.00	170.0	4.25	1090.00/lb.	1.06	1149.95/lb.	28.75		
2. Veterinarian Medicine		\$0.75	2.00		1.50	6.00	1.06		6.33		
3. Breeding		0.00	2.00		0.0	20.00	1.06		21.11		
4. Power and Fuel		\$1.25	2.00		1.25	6.00	1.06		6.33		
5. Supplies		\$.25	2.00		.50	12.00	1.06		12.66		
6. Overhead Supplies		0.00	2.00		0.0	9.00	1.06		9.50		
7. Total Livestock Costs					7.50	14.87	1.06		34.68		
8. Interest		\$.29	2.00		1.54				15.69		
9. Total Variable Costs					78.37				386.61		
III. FIXED COSTS											
1. Buildings		4.78	2.00		9.55	57.84	1.06		61.03		
2. Equipment		4.52	2.00		9.04	53.60	1.06		56.55		
3. Livestock		0.50	2.00		1.00	4.00	1.06		4.22		
4. Manure Factory		0.15	2.00		0.29	1.82	1.06		1.92		
5. Land		4.27	2.00		8.54	51.21	1.06		54.28		
6. Total Fixed Costs		14.21	2.00		28.43	168.48	1.06		178.00		
7. Total Cost (Except Labor)					106.80				564.61		
8. Labor	5.00/hr.	.42	2.00	0.84	4.20	5.00	1.06		178.00		
IV. TOTAL COSTS OF ABOVE COSTS (Excluding Management and Calf Costs)											
111.00											
590.99											

Table 3.5 (continued)

3 to 12 months				0 to 3 months				Total Replacement Helper				301 Replacement Helper			
Amount	Factor	Total Amount	Dollar Value	Amount	Factor	Total Amount	Dollar Value	Amount	Dollar Value	Factor	Amount	Dollar Value	Amount	Dollar Value	Factor
1. 3019.74/lb.	1.07	3231.12/lb.	90.47	198.40/lb.	1.13	223.20/lb.	6.25	14744.0/lb.	418.07	0.30	4432.2/lb.	125.42	0.30	4432.2/lb.	125.42
2. 748.20/bu.	1.07	800.57/bu.	35.74	170.28/bu.	1.13	191.57/bu.	8.55	1291.5/bu.	57.66	0.30	387.5/bu.	17.30	0.30	387.5/bu.	17.30
3. 40.00/lb.	1.07	42.80/lb.	4.15	20.00/lb.	1.13	22.50/lb.	2.18	65.3/lb.	6.33	0.30	19.6/lb.	1.90	0.30	19.6/lb.	1.90
4. 41.46/lb.	1.07	44.36/lb.	8.94	11.07/lb.	1.13	12.45/lb.	2.51	125.6/lb.	25.31	0.30	37.7/lb.	7.59	0.30	37.7/lb.	7.59
5. 4.92/lb.	1.07	5.26/lb.	3.09	1.44/lb.	1.13	1.62/lb.	0.95	20.5/lb.	12.03	0.30	6.1/lb.	3.61	0.30	6.1/lb.	3.61
6. 0.00	1.07	0.00	0.00	645.00/lb.	1.13	725.63/lb.	22.56	725.6/lb.	22.56	0.30	212.7/lb.	21.77	0.30	212.7/lb.	21.77
7.			142.40				93.01	2210.0/lb.	591.97	0.30	663.0/lb.	177.59	0.30	663.0/lb.	177.59
1. 825.00/lb.	1.07	882.75/lb.	22.07	220.00/lb.	1.13	247.50/lb.	6.19	2450.2/lb.	61.26	0.30	735.0/lb.	18.38	0.30	735.0/lb.	18.38
2. 6.00	1.07		6.42	8.00	1.13	0.00	9.04		23.29	0.30		6.99	0.30		6.99
3. 0.00	1.07		0.00	0.00	1.13	0.00	0.00		21.11	0.30		6.33	0.30		6.33
4. 6.00	1.07		6.42	4.00	1.13	6.42	4.52		18.52	0.30		5.56	0.30		5.56
5. 2.00	1.07		2.14	3.00	1.13	3.39	3.39		18.69	0.30		5.61	0.30		5.61
6. 6.00	1.07		6.42	0.00	1.13	6.42	0.00		15.92	0.30		4.78	0.30		4.78
7.			43.47				23.14		158.79	0.30		47.64	0.30		47.64
8. 5.56	1.07		5.95	0.26	1.13		0.22		22.47	0.30		6.74	0.30		6.74
9.			191.81				116.44		773.23	0.30		231.97	0.30		231.97
1. 43.07	1.07		46.08	20.10	1.13		22.72		139.38	0.30		41.81	0.30		41.81
2. 39.16	1.07		41.91	11.16	1.13		12.61		120.11	0.30		36.03	0.30		36.03
3. 1.31	1.07		1.40	3.75	1.13		4.24		10.86	0.30		3.26	0.30		3.26
4. 1.42	1.07		1.51	0.30	1.13		0.34		4.07	0.30		1.22	0.30		1.22
5. 38.41	1.07		41.10	12.80	1.13		14.47		118.39	0.30		35.52	0.30		35.52
6. 123.36	1.07		132.00	48.12	1.13		54.38		392.81	0.30		117.84	0.30		117.84
7.			323.81				170.81		1166.03	0.30		349.81	0.30		349.81
8. 3.75	1.07	4.01	20.06	1.25	1.13	1.41	7.06		57.50	0.30		17.31	0.30		17.31
			343.88				177.87		1223.73	0.30		367.12	0.30		367.12

Table 3.6
Financial Returns of Prototype Dairy Farms
Raising All Feeds

	HERD SIZE			
	60	120	250	400
Item	Dollars/Cow			
Gross Receipts	\$2,192.09	\$2,192.09	\$2,192.09	\$2,192.09
Less Variable Costs	714.35	714.42	713.68	707.19
Returns above				
Variable Costs	1,477.74	1,477.67	1,478.41	1,484.90
Less Fixed Costs	1,246.65	967.90	850.76	735.24
Returns to Labor				
and Management	231.09	509.77	627.65	749.66
Less Labor Costs	400.48	322.87	256.00	224.52
Returns to Management	(169.39)	186.90	362.65	525.14

again the advantage of the 400 cow operation, spreading the costs over more animals. On the 60 cow operation basic equipment is required to perform certain activities. In raising the crops on the 60 cow operation, equipment is required to till on few acres. On the larger farms the operations can go to larger equipment but with the additional cows the costs are less on a per cow basis. The equipment, required specifically for the dairy varies from \$328.25 per cow for the 60 cow operation to \$82.02 per cow for the 400 cow operation. The same pattern holds true on the crop equipment: \$173.00 per cow for the 60 cow herd and \$68.90 per cow for the 400 cow herd.

With the large difference in fixed costs, the returns to labor and

management deviate between the four prototype farms. The 60 cow operation has the smallest returns to labor and management at \$231.09 per cow and the 400 cow operation has the largest returns to labor and management at \$749.66 per cow.

The cost of labor per cow varies because of hour requirements per cow are different on the four herd sizes. Referring to Table 2.8, the 60 cow operation requires 63 hours per year for the cow and replacement heifer while the 400 cow operation only requires 35 hours of labor. On the larger herds less labor is required per cow than on the small herd.

Taking all of the costs into account, the final returns to management vary by \$694.53 between herds. The 60 cow prototype farms has a loss of \$169.39 per cow. The 120 cow operation is showing a return of \$186.90 per cow. The 400 cow operation shows the largest profit per cow at \$525.14. From these results the larger Michigan prototype dairy farms for 1995 based on the performance variables listed in Table 2.13 have a profit per cow. These farms accomplish this by spreading the total costs over the larger number of cows on the larger farms. An area which is costly to the smaller prototype dairy farm is the fixed equipment costs. In the smaller herd, each cow is required to carry a large fixed cost.

CHAPTER 4

RESULTS OF THE SENSITIVITY ANALYSIS

Sensitivity analyses were performed with numerous variables to identify their effect on the profitability of prototype dairy farms. One variable at a time is altered from the base prototype and its effects are evaluated. The analysis is performed so there is an upper, lower and base variable. All three variables of each item are included in Table 4.1. The items which were analyzed included milk price, milk production per cow, soybean meal cost, hay yield, corn yield, interest rates on land, equipment and buildings, land values and labor costs. Each variable is analyzed and its implications are discussed in its respective section.

A second sensitivity analysis was performed on each prototype dairy farm to determine the effects of purchasing all feed or raising only forages and purchasing corn. Results of this analysis are Table 4.2.

Each sensitivity analysis is performed on each prototype farm. Sensitivity analysis does not compare different prototype farms to each other. Each prototype farm has a different level of capital, labor, and management requirements.

4.1 Milk Price

The price of milk per hundredweight is one of two primary factors influencing a dairy farmers' revenue. Base milk price was set at \$10.00 per cwt. Ten dollars cwt was compared to \$9.00 and \$11.00 cwt. At \$9.00 per hundred weight milk both the 60 and 120 cow operation are producing at a loss. The 250 cow operation shows a small profit per cow and the 400 cow operation also shows a profit. At \$11.00 per hundredweight, the three



larger prototype farms show a profit. Only at a price above \$11.65 per hundredweight will the 60 cow operation have a positive return, when 19,200 pounds of milk are marketed per cow. If milk prices continue to decrease in the future, dairy farms will have to increase their production levels and/or decrease their overall costs to be profitable in dairy farming. This analysis indicates the 60 cow operation to be in the most critical situation. However, this is based on the prototype farms stated in the previous chapter. In the prototype farms each farm is started from the ground up. These farms are based on an individual having to acquire all of the fixed capital and variable capital new to begin farming, thus, the high level of costs. Small herds in Michigan are profitable because of different capital and management levels.

4.2 Milk Production

The annual volume of milk production per cow is the second primary factor influencing a dairy farmers revenue. In the prototype dairy farms, the milk production is 19,200 pounds marketed annually per cow. At this level only the 60 cow operation is producing at a loss. At 17,200 pounds of marketed milk produced per cow, both 60 and 120 operation are at a loss, this is based on the basic parameters of 1995. When moving up to 21,200 pounds of milk, the three larger operations are able to produce at a substantial profit. Only at a level above 21,250 pounds of milk will the 60 cow system have a positive return. If the basic assumptions of the prototype farm are correct in 1995, larger herd sizes will be profitable over 21,200 pounds of milk but the small herds will have to have an even higher production level to cover their costs.

Table 4.1
Effects of Sensitivity Variables on Returns to Management
(Dollars/Cow/Year)

	HERD SIZE			
	60	120	250	400
	(\$)	(\$)	(\$)	(\$)
Milk Price				
1. \$ 9.00/hundredweight	(382.17)	(30.85)	151.15	306.60
2. \$10.00/hundredweight	(169.39)	186.90	362.65	525.14
3. \$11.00/hundredweight	(9.69)	341.63	523.63	679.13
Milk Production				
1. 17,200 pounds	(379.93)	(28.61)	153.39	315.49
2. 19,200 pounds	(169.39)	186.90	362.65	525.14
3. 21,100 pounds	(11.93)	339.39	521.39	683.49
Soybean Meal Cost				
1. \$260.00/ton	(165.71)	192.59	366.33	527.49
2. \$300.00/ton	(169.39)	186.90	362.65	525.14
3. \$340.00/ton	(173.08)	185.21	358.96	522.34
Hay Yield				
1. 4 ton/acre	(236.11)	125.02	302.45	466.42
2. 5 ton/acre	(169.39)	186.90	362.65	525.14
3. 6 ton/acre	(124.91)	231.48	402.78	564.28
Corn Yield				
1. 80 bu/acre	(209.55)	149.42	323.70	486.13
2. 100 bu/acre	(169.39)	186.90	362.65	525.14
3. 120 bu/acre	(142.62)	215.22	388.62	551.14
Interest Ray on Land				
1. 8 percent	(139.95)	218.23	392.63	555.17
2. 10 percent	(169.39)	186.90	362.65	525.14
3. 12 percent	(210.50)	159.58	332.66	496.10
Interest Rate on Buildings				
1. 9 percent	(135.28)	222.08	393.40	550.88
2. 11 percent	(169.39)	186.90	362.65	525.14
3. 13 percent	(198.83)	149.47	330.10	494.54
Interest Rate on Equipment				
1. 9 percent	(142.35)	204.70	374.18	533.22
2. 11 percent	(169.39)	186.90	362.65	525.14
3. 13 percent	(195.03)	173.92	351.40	517.48

<i>Land Value</i>				
1. \$ 697.00/acre	(169.39)	186.90	362.65	525.14
2. \$ 997.00/acre	(265.49)	111.88	283.92	446.27
3. \$1,297.00/acre	(323.98)	34.87	205.20	367.41
<i>Labor Cost</i>				
1. \$ 5.00/hour	(169.39)	186.90	362.65	525.14
2. \$ 7.50/hour	(376.66)	9.89	221.82	399.34
3. \$10.00/hour	(542.19)	(109.75)	106.24	317.93

Figures are all based on the base performance variables in the prototype dairy farm.

4.3 Soybean Meal Costs

Currently soybean meal costs account for an expensive portion of the purchased feed costs to dairy farmers. Dairy farmers who are feeding lower quality feed (15-17 percent crude protein) are having to supplement their rations with a large quantity of purchased protein. In the Michigan prototype farms, the goal in forage production is to produce a high quality forage (20 percent crude protein) so less purchased protein is required. The prototype dairy farms only requires 203.93 pounds of soybean meal annually per cow and replacement heifer. The quantity of protein required in the ration is low because of the high quality forage. By using a small amount of soybean meal in the ration, the variation in its price does not significantly effect the profitability of the prototype dairy farms.

4.4 Hay Yield

The prototype dairy farms have hay and haylage as the primary feed so many acres are devoted to growing this forage. The yield of hay has a significant effect on the quantity of land required and also on the total

costs of production to grow the forage. If it is high yielding hay there are fewer acres which entail a lower total cost of production to produce the entire quantity of hay needed.

The base yield is 5 tons per acres. The upper and lower variables are 6 and 4 tons per acres respectively. On the 60 cow operation there is \$111.20 difference between the upper variable and lower variable on the financial returns. On the 400 cow operation the difference is \$97.86 per cow, The yield of hay does have a significant effect on a dairy's financial return if the ration is primarily based on hay.

4.5 Corn Yield

The corn yield is very similar to the hay yield as to its effects and significance to the prototype dairy farms. The base variable, upper variable, and lower variable are 100, 120 and 80 bushels per acre respectively. On the 60 cow operation the difference between the high and low yield produces a \$66.93 difference in financial returns. This difference is very similar for all farm prototypes. This implies the lower its yield the less profitable it is on the overall financial return.

4.6 Interest Rate on Land

The prototype dairy farms raise all the feed required by the cow and replacement heifer. The feed is raised on land which the dairy farmer is paying an annual fixed cost. If the interest rates rise, the annual fixed cost of capital increases and if the interest rate decreases the annual fixed cost of capital declines. In the prototype farm 10 percent is the

base with the lower variable being 8 percent and the upper variable being 12 percent. Across all four farm prototype farms the difference between the upper and lower variable is roughly \$60.00 per cow. It is similar across all farms because the same amount of land is required to feed an individual a cow on the 60 cow operation as on the 250 cow operation.

4.7 Interest Rate on Buildings

The interest rate on buildings refers to the cost of capital for the buildings, manure facility, and feed facility. All of these are based on a lifetime of twenty years. The based interest rate is 11 percent, the upper variable is 13 percent and the lower variable is 9 percent. Across all four prototype dairy farms the difference between the upper and lower variable was between \$60.00 and \$70.00.

4.8 Interest Rates on Equipment

The interest rates on equipment refers to the cost of capital to own the equipment. On the prototype farms, the farms have all the equipment required to grow and feed the crops, remove the manure, and milk the cows. This all adds up to a large investment in equipment. The equipment has a useful life of seven years so it depreciates at a faster rate the buildings. The base interest rate is 11 percent, the upper is 13 percent and the low rate is 9 percent. The difference between the upper and lower variable is the most significant on the 60 cow operation at \$52.68 per cow. On the 400 cow operation the difference is only \$15.74. The main reason for this variation is because on the 400 cow operation the equipment is spread over more cows to reduce the costs per cow.

4.9 Land Value

The base land value is \$697.00 per acres. It is for this reason two upper variables were used instead of a lower variable. The two upper variable are \$997.00 per acre and \$1,297.00 per acre. Under the base variable the 60 operation has negative returns. At the two upper variables both the 60 and 120 cow operations have negative profits per cow.

The significance of using the upper variables for land value stems from the fact that many farmers purchased land in the late 1970's and early 1980's when land prices were high. These dairy farmers are still paying off the debts incurred from those purchases even though the value of the land has declined. The decline has pushed some dairy farmers from a low to moderate debt-to-asset ratio to a moderate to high debt-to-asset ratio. They moved into different equity positions because assets have decreased in value yet their debt level had remained the same.

4.10 Labor Cost

The prototype farm has a base wage of \$5.00 per hour. At this level the 60 cow operation and the 120 cow operation have a negative return. The cost of labor has been increasing on the farm level this decade. There have been shortage of labor making wages more competitive. The upper level labor cost is \$10.00 per hour. At this level, both the 60 and 120 cow operation are in the red. The 250 cow operation is at a positive \$106.24. Throughout all of the sensitivity analysis, raising the wage rate to \$10.00 hour gave the 400 cow operation one of its lowest return at \$317.93. This implies labor costs are a significant cost to the operation.

4.11 Feed Acquirement

The results of the sensitivity analysis on feed acquirement are in Table 4.2. This analysis looks at different ways of obtaining your feed. The base farm raises all of its feed. The second raised only its forages and purchased its corn. The third purchased all of its feed.

Under all three methods, the 60 cow operation has negative returns. For all four herd sizes, the purchasing option is the least profitable followed by raising only your forages. Raising all feed has the highest returns of the three methods. The advantage of raising all feed has over the other two options which purchased some feed, as it produces its feed at a cheaper rate than what the market price was charged.



Table 4.2
Sensitivity Analysis of Feed Acquisition
(Dollars/Cow/Year) ^a

<i>Herd Size</i>	<i>Purchase All Feed ^b</i>	<i>Raise Forages Purchase Corn ^c</i>	<i>Raise All Feed ^d</i>
60	(223.01)	(181.77)	(169.39)
120	139.75	155.12	186.90
250	273.76	354.10	362.65
400	392.42	493.16	525.14

^aAll three methods of acquiring feed is based on the base performance variables in the prototype farm.

^bDoes not include any equipment or labor required for crop production. Based on \$60/ton for forages and \$2.50/bu. for corn.

^cIncludes equipment and labor required for forage production. Based on \$2.50/bu. for corn.

^dInclude equipment and labor required for both forage and corn production.



CHAPTER 5

SUMMARY AND CONCLUSIONS

A financial analysis of Michigan prototype dairy farms for 1995 was conducted because of the growing concern among dairy farmers and the dairy industry pertaining to the financial conditions of Michigan dairy farmers. The dairy industry is undergoing a severe change and this is affecting the profitability of dairy farmers. Rising costs and decreasing prices are making dairy farmers reevaluate their financial situation. The purpose of this study was to financially analyze potential prototype dairy farms. The financial analysis is performed by computerized enterprise budgets. The prototype dairy farms for 1995 are based on an individual(s) purchasing the entire operation. All of the fixed costs are computed on an annual fixed cost basis for the duration of the assets useful life.

The findings deal with scenarios which will likely take place in the year 1995. The prices and costs are trended to the year 1995 for use in the prototype dairy farms. The milk price is established at \$10.00 per hundredweight, milk production of 19,200 pounds of marketed milk per cow per year and labor costs are \$5.00 per hour. The prototype farms are designed to house the cows in free stalls. The farms raise all of their feed, feeding a ration of haylage and high moisture corn to the milking herd. The prototype farms are based on herd sizes of 60, 120, 250, and 400 cow operations.

This analysis is not intended to address which size level is most appropriate. The analysis addresses the specific size level of the operation. Each size requires different capital, labor, and management requirements. The analysis addresses the prototype dairy farms for 1995.

5.1 Major Findings

Analyzing the four prototype dairy farms under the performance variables, the larger dairy operations are more profitable on a per cow basis than the small herds. The fixed costs, primarily buildings, facilities, and equipment, in the larger herds are spread out over more cows. The annual fixed costs per cow are the smallest in the large herds. The annual fixed cost per cow are the largest in the small herd.

In the larger herds the annual labor requirements per cow are significantly lower than the requirements in the smaller herd. The small herds have a larger expense per cow than the larger farms. The overall labor requirements are the largest in the 400 cow herd.

The smaller dairy herds in Michigan make the individual cow carry a large cost. For these herds to be profitable in 1995 under the base performance variables, they will have to produce over 21,250 pounds of marketed milk. These herds are going to need to be well managed to reduce cost and promote profits. The problem in cost reduction stems from the 60 cow farm having all the equipment, for so few acres and cows.

The prototype farm analysis did not attempt to address which operations could be the best under capital and labor limitations. All four operations require a different level of capital and labor. The 400 cow operation required the most capital and labor while the 60 cow operation required the least.

Dairy farms raising all of their feed, as opposed to purchasing their feed is the most profitable approach to dairy farming based on the performance variables. Purchasing feeds ranked third under all farm herd sizes which agreed with Hlubik's findings in 1984. However, this does not

mean purchasing feeds is an inferior alternative. It will depend on an individuals capital, labor, and management limitations.

5.2 Implications for the Michigan Dairy Farms

If the forecasted performance variables occur, will Michigan dairy farmers survive? Presently if the prescribed conditions occurred many dairy farms would be in a severe financial strain; many would eventually fold.

Michigan dairy farmers need to analyze their financial position. Dairy farmers need to identify all of the costs their cows are carrying. The areas which are costly, such as buildings, facilities, and equipment need to be reduced or reorganized.

This analysis found the 60 cow herd to be producing with negative returns, but this does not imply this is happening in the industry. In the analysis the fixed costs are based on new facilities, buildings, and equipments. In the industry many dairy farmers are using old buildings and facilities which are fully depreciated. The annual fixed costs on these items are significantly lower than those represented in the prototype farms. A large portion of the annual fixed costs is based on the asset's depreciation.

The prototype analysis differs from Michigan dairy farmers based on the manure system required. The prototype dairy farms are required to have a storage facility capable of holding eight months of manure. In Michigan only five percent of the farms have long term storage. This storage facility is an additional cost on the prototype farms. If the Department of Natural Resources required long term manure storage, many dairy farmers

will be forced out or large investments in manure facilities will be required.

The production of high quality feed is essential to reducing purchased protein costs. Protein costs are extremely high and if a high quality forage (high in percent crude protein) can be produced, this will sharply reduce the dairy farmers feed costs.

The Michigan dairy farmers can look at one of the four prototype farms, which ever is the most similar to their farm and compare their farm to it. This will help them figure out which areas to restructure and improve.

5.3 Needs for Future Research

This thesis identifies pertinent problems the Michigan dairy farmer is facing currently and possibly in the near future. The research establishes profitable dairy enterprises for 1995. The next question is how do we get from the present to the future maintaining our industry? What programs and services can be offered in a cost-effective manner to promote profitability in dairy farming.

Dairy farms need to know if they can pay for a new investment. Financial education of the dairy farmer needs to occur to assure sounder financial decision making.

Future research needs to look at minimum cost systems. Is rotational grazing a viable option? Is feeding by-product feeds a cheaper yet productive technique for dairy farmers? Since the average herd size in Michigan is 74.4 cows per herd, more research should be conducted on the small dairy farms to identify which alternatives would be most profitable.

Research should be conducted on a given herd size to identify what is the best system of production for the herd size. There are many questions to be answered in dairy farming but what solutions are the most profitable in the long run?

APPENDIX A

Dairy Buildings and Facilities Estimates

Table A.1
Dairy Buildings and Facilities: Herd Size 60

<i>Item</i>	<i>Dimensions (Feet)</i>	<i>Investment Cost (Dollars)</i>
<i>Cow Freestalls</i>		<i>\$24,750</i>
<i>Dry Cow Freestalls</i>		<i>4,150</i>
<i>Heifer Freestalls</i>		<i>9,600</i>
<i>Virginia Heifer Barn</i>		<i>8,250</i>
<i>Calf Hutches</i>		<i>1,575</i>
<i>Maternity Treatment Pens</i>		<i>20,000</i>
<i>Milk House</i>		<i>20,000</i>
<i>Holding Pen and Crowd Gate</i>		<i>11,400</i>
<i>Equipment Building</i>		<i>18,000</i>
<i>Haylage Silo</i>	<i>60'x26'</i>	<i>24,000</i>
<i>H.M. Corn Silo</i>	<i>20'x40'</i>	<i>11,000</i>
<i>Hay Barn</i>		<i>1,500</i>
<i>Protein Bin</i>		<i>850</i>
<i>Manure Storage, 8 months</i>		<i>8,034</i>
<i>TOTAL</i>		<i>\$163,109</i>

Table A.2
Dairy Buildings and Facilities: Herd Size 120

<i>Item</i>	<i>Dimensions (Feet)</i>	<i>Investment Cost (Dollars)</i>
<i>Cow Freestalls</i>		<i>\$54,000</i>
<i>Heifer Freestalls</i>		<i>33,950</i>
<i>Super Hutches</i>		<i>3,750</i>
<i>Calf Hutches</i>		<i>2,250</i>
<i>Maternity Treatment Pens</i>		<i>40,000</i>
<i>Milk House</i>		<i>24,000</i>
<i>Holding Pen and Crowd Gate</i>		<i>14,000</i>
<i>Equipment Building</i>		<i>30,000</i>
<i>Haylage Silo</i>	<i>14'x55'x100'</i>	<i>41,325</i>
<i>H.M. Corn Silo</i>	<i>24'x55'</i>	<i>20,000</i>
<i>Hay Barn</i>		<i>3,000</i>
<i>Protein Bin</i>		<i>850</i>
<i>Manure Storage, 8 months</i>		<i>13,980</i>
<i>TOTAL</i>		<i>\$281,105</i>

Table A.3
Dairy Buildings and Facilities: Herd Size 250

<i>Item</i>	<i>Dimensions (Feet)</i>	<i>Investment Cost (Dollars)</i>
<i>Cow Freestalls</i>		<i>\$162,500</i>
<i>Heifer Freestalls</i>		<i>69,650</i>
<i>Super Hutches</i>		<i>7,750</i>
<i>Calf Hutches</i>		<i>4,500</i>
<i>Maternity Treatment Pens</i>		<i>64,000</i>
<i>Milk House</i>		<i>36,000</i>
<i>Holding Pen and Crowd Gate</i>		<i>22,500</i>
<i>Equipment Building</i>		<i>48,000</i>
<i>Haylage Silo</i>	<i>14'x80'x150'</i>	<i>67,200</i>
<i>H.M. Corn Silo</i>	<i>24'x55'</i>	<i>20,000</i>
	<i>24'x60'</i>	<i>22,000</i>
<i>Hay Barn</i>		<i>6,000</i>
<i>Protein Bin</i>		<i>1,700</i>
<i>Manure Storage, 8 months</i>		<i>24,300</i>
<i>TOTAL</i>		<i>\$556,100</i>



Table A.4
Dairy Buildings and Facilities: Herd Size 400

<i>Item</i>	<i>Dimensions (Feet)</i>	<i>Investment Cost (Dollars)</i>
<i>Cow Freestalls</i>		<i>\$220,000</i>
<i>Heifer Freestalls</i>		<i>112,000</i>
<i>Super Hutches</i>		<i>12,000</i>
<i>Calf Hutches</i>		<i>7,200</i>
<i>Maternity Treatment Pens</i>		<i>88,000</i>
<i>Milk House</i>		<i>40,000</i>
<i>Holding Pen and Crowd Gate</i>		<i>30,000</i>
<i>Equipment Building</i>		<i>60,000</i>
<i>Haylage Silo</i>	<i>14'x100'x195'</i>	<i>81,300</i>
<i>H.M. Corn Silo</i>	<i>28'x60'</i>	<i>27,000</i>
	<i>28'x60'</i>	<i>27,000</i>
<i>Hay Barn</i>		<i>10,000</i>
<i>Protein Bin</i>		<i>1,700</i>
<i>Manure Storage, 8 months</i>		<i>37,812</i>
<i>TOTAL</i>		<i>\$754,012</i>

APPENDIX B
Equipment Estimates



Table B.1
Equipment Estimates: Herd Size 60

Item	Investment Cost (Dollars)
1. Dairy Equipment	
Double-4 Herringbone Parlor	\$20,000
Milk Tank	9,600
Auto Takeoffs	6,000
Silo Unloaders	13,000
Batch Mixer	11,000
Conveyor	800
Manure Pump Agitator	6,440
Manure Spreader	8,000
Manure Scraper	500
Manure Transfer Pump	14,000
Unloader	4,000
Tractor, 45 HP	12,000
Tractor, 80 HP	19,200
Miscellaneous	<u>1,000</u>
Total Dairy Equipment	\$125,540
2. Crop Equipment	
Blower	3,000
Conditioner	8,500
Rake, Tandem	2,500
Chopper	8,000
Hay Head	1,570
Baler	8,000
Forage Wagon (2)	10,000
Drill	5,000
Plow, 4 bottom	3,200
Disc, 10 feet	4,000
Corn Planter, 4 row	6,000
Cultivator, 4 row	2,500
Sprayer	1,750
Pickup	8,500
Gravity Box	<u>1,600</u>
Total Crop Equipment	<u>\$ 74,120</u>
Total Dairy and Crop Equipment	\$199,660

Table B.2
Equipment Estimates: Herd Size 120

Item	Investment Cost (Dollars)
1. Dairy Equipment	
Double-6 Herringbone Parlor	\$26,000
Milk Tank	15,000
Auto Takeoffs	8,000
Silo Unloaders	6,500
Batch Mixer	16,800
Conveyor	1,600
Manure Pump Agitator	6,440
Manure Spreader	8,000
Manure Scraper	500
Manure Transfer Pump	14,000
Unloader	4,000
Tractor, 45 HP	12,000
Tractor, 80 HP	19,200
Miscellaneous	<u>1,500</u>
Total Dairy Equipment	\$139,540
2. Crop Equipment	
Blower	3,000
Conditioner	10,000
Rake, Tandem	4,000
Chopper	9,000
Hay Head	2,070
Baler	11,000
Forage Wagon (3)	15,000
Drill	5,000
Plow, 5 bottom	5,000
Disc, 12 feet	4,500
Corn Planter, 4 row	6,000
Cultivator, 4 row	2,500
Tractor, 90 HP	24,000
Sprayer	1,750
Pickup	8,500
Gravity Box (2)	<u>3,200</u>
Total Crop Equipment	<u>\$114,520</u>
Total Dairy and Crop Equipment	\$254,060

Table B.3
Equipment Estimates: Herd Size 250

Item	Investment Cost (Dollars)
1. Dairy Equipment	
Double-8 Herringbone Parlor	\$32,500
Milk Tank	25,000
Auto Takeoffs	11,000
Silo Unloaders	13,000
Batch Mixer	27,000
Conveyor	800
Manure Pump Agitator	7,000
Manure Spreader	10,000
Manure Scraper	500
Manure Transfer Pump	14,000
Skid Steer	14,000
Tractor, 55 HP	14,400
Tractor, 90 HP	21,600
Miscellaneous	<u>2,000</u>
Total Dairy Equipment	\$192,800
2. Crop Equipment	
Blower	3,000
Conditioner	13,000
Rake, Tandem	5,000
Chopper	12,000
Hay Head	2,570
Baler	12,000
Forage Wagon (4)	20,000
Drill	7,000
Plow, 7 bottom	7,000
Disc, 16 feet	7,000
Corn Planter, 8 row	10,000
Cultivator, 8 row	4,000
Tractor, 130 HP	33,000
Sprayer	1,750
Pickup	8,500
Gravity Box (2)	<u>3,200</u>
Total Crop Equipment	<u>\$146,020</u>
Total Dairy and Crop Equipment	\$338,820



Table B.4
Equipment Estimates: Herd Size 400

Item	Investment Cost (Dollars)
1. Dairy Equipment	
Double-10 Herringbone Parlor	\$37,500
Milk Tank	29,000
Auto Takeoffs	13,800
Silo Unloaders	13,000
Batch Mixer	30,000
Conveyor	1,600
Manure Pump Agitator	7,000
Manure Spreader	10,000
Manure Scraper	500
Manure Transfer Pump	14,000
Skid Steer	14,000
Tractor, 55 HP	14,400
Tractor, 120 HP	25,320
Miscellaneous	<u>2,000</u>
Total Dairy Equipment	\$212,120
2. Crop Equipment	
Blower	3,000
Conditioner	15,000
Rake, Tandem	5,000
Chopper	16,000
Hay Head	4,000
Baler	15,000
Forage Wagon (4)	20,000
Drill	8,000
Plow, 7 bottom (2)	14,000
Disc, 18 feet	10,000
Corn Planter, 8 row	10,000
Cultivator, 8 row	4,000
Tractor, 130 HP (2)	70,000
Sprayer	1,750
Pickup	10,000
Gravity Box (3)	<u>4,800</u>
Total Crop Equipment	<u>\$210,550</u>
Total Dairy and Crop Equipment	\$422,670

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