Growth in Dairy Farms: The Consequences of Taking Big Steps or Small Ones When Expanding

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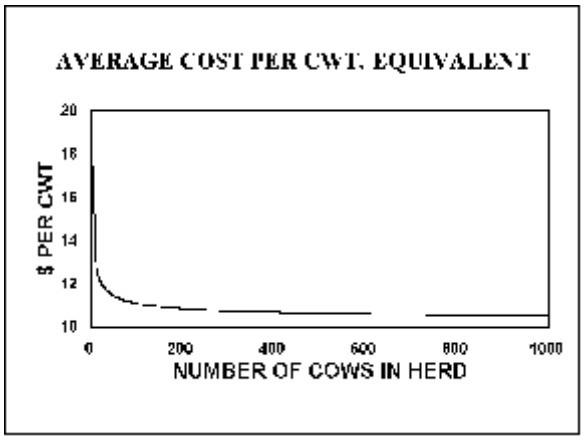
Through the years farms in this country have been growing in size and scale. This growth in farm size will most likely continue, and in the case of dairy, it is very probable that as many as a third of today's dairy farmers will double the size of their operations in the next decade or so.

This movement towards larger dairy farms is in part being driven by the fact that dairy farmers can generally increase profits as they expand their operations. This growth in profits occurs primarily because average costs of production tend to fall as dairy farms grow in size. This point is illustrated by the following average cost curve for dairies.

Figure 1: Average costs of a select group of Wisconsin dairy farms by herd size



The curve in Figure 1 was estimated using cost and herd size data obtained from the Lake Shore and Fox Valley Farm Management Associations for approximately 900 dairy farms in the northeastern Wisconsin. This curve shows that the average costs for dairy farms fall, at a decreasing rate, as herd size rises. This is a key point because it means dairy farms can reduce average production costs and increase profit margins per unit of output if they increase herd size.

Another important point illustrated by Figure 1 is that average costs of production do not rise as herd size grows. This is an important point because it means dairy producers experience no penalties (cost increases) when they expand their herds. Given this it is not surprising that dairy producers have been enlarging their dairy operations because growth generally increases their ability to generate profits.

Dairy farm expansion is also being driven by technology. For example many producers are deciding to utilize milking parlors versus conventional stall-barns to milk cows. This move to parlors is occurring because producers have decided neither they nor their workers want to endure the physical discomforts of milking in a stall-barn when they can instead work more comfortably in a parlor. This improvement in working conditions is a strong incentive for moving to a parlor system.

Milking parlors are not only easier on milkers; they also greatly increase the productivity of labor. In most cases, a parlor system makes it possible for a person to milk two or three times more cows per hour than is typically possible in a stall-barn. This increase in productivity generally results in some significant labor savings for the dairy producers who incorporate parlors into their dairy operations.

Milking parlors, like combines, tractors, and other big ticket farm assets, are rather costly and they can be a drag on a dairy's profitability if they are not operated at full capacity. Thus it follows that dairy producers typically expand their herds as they move to parlor systems because they need to insure that they use their parlors at or close to peak capacity. This growth in herd size must take place or else dairy producers will not be able to capture the benefits of a parlor system.

Expanding a dairy herd and building housing for more cows in order to move to a parlor system can be a costly undertaking that forces dairy producers to borrow large sums of money. This is a problem for most dairymen because it puts them in such risky financial positions that lenders become reluctant to extend credit to the dairymen. This unwillingness of lenders to make loans stems from their belief that the dairies they are working with will not be able to generate the profits and cash flows needed to repay loans in a timely manner. This is a problem because dairymen cannot move to a parlor system if they do not get lenders to support their plans.

This paper will consider the financial challenges that dairymen face as they try to move to a parlor-based dairy system and expand their operations. We will examine the financing problems associated with moving to a parlor system and then look at some options for dairy producers to incorporate a parlor into their dairy system. Some of the options will be incremental growth plans that minimize the amount of money that dairy producers may commit expansion at any one time. Other options will be a little more ambitious and reflect what happens when dairy producers elect to make a major change in their operations and most quickly to a state of the art system. By performing these analyses we will hopefully help dairy producers gain a better understanding of what can happen to their financial positions if they elect to move to a parlor system in one or two major steps or a series of more modest steps.

The Problems of Financing Dairy Expansions

Investments in cows, free-stall housing, and parlors can be profitable undertakings and they can greatly improve the working conditions of dairy producers. Given this it is little wonder that dairy producers are interested in moving to parlor/free-stall dairy systems.

While there are profits to be gained from investing in parlors, free-stall, and cows these returns do not flow back to a producer in a short period of time. Instead the payback on parlors and free-stall-barns is 20 or more years. This slow payback on dairy facilities means these assets yield rather low annual returns.

The low annual returns experienced on dairy farm expansions make it difficult for dairy farms to meet the annual repayment requirements lenders set for loans. Because of this it is nearly impossible for dairy producers to borrow all of the money they may need to finance the construction of a parlor/free-stall system and the purchase of cows. One solution to this problem is to have dairy producers only finance, say, 60 to 70 percent of a project with credit and the balance with cash they have saved. An alternate solution to this problem is having the lender finance cash flow deficits in the short run with an operating loan that is eventually paid off with profits from the dairy. This latter option is not that desirable for lenders because it can result in a build-up of debt if a dairy's annual returns happen to stay low or, in the worst case, fall.

Besides triggering possible cash flow problems, major investments in dairy facilities can also put dairy producers into highly leveraged financial positions. For example it is not unusual for a dairy producers' debt to asset positions to rise to levels of .70 or higher when they undertake expansion projects. These high debt to asset positions are a concern to lenders because the potential for loan losses are relatively high when borrowers' debt to asset positions are at this level. Once lenders determine that a borrower's debt to asset position exceeds a value of .70, they generally refuse to extend additional credit to borrowers. This can be a problem for dairy producers because inaccessibility to credit can result in the failure of the dairy producers' operations.

In order to insure that credit resources are available when they may be needed, dairy producers can limit their borrowing to some extent and try to make sure that their debt to asset positions do not rise to the levels that are judged to be unacceptable by lenders. By doing this dairymen can make sure credit resources will be available when needed but they will have to forego profits they could earn if they go forward with some expansion activities. These foregone profits are the price dairymen must pay in order to be sure they can get credit when they may need it.

Deciding how low they should keep their debt to asset positions is a problem that all dairy producers have to deal with when they are managing their finances. Some producers elect to keep their debt to asset positions low and as a result they lose potential profits and grow at relatively modest rates. Other producers choose to be more aggressive in using debt and allow their debt to asset positions to bump up against the limits set by lenders. These dairymen many times reap higher profits but they also run the risk of bankruptcy if things do not work out as planned. There is no way to say whether a dairy

producer should or should not be somewhat aggressive in using debt because it is uncertain what economic conditions will be experienced after a dairy producer makes decisions about debts and expansion.

Low Investment Milking Systems

Dairy producers wanting to move from a stall-barn system to a parlor/free-stall dairy operation are sometimes unable or unwilling to make a sizable investment in a milking parlor at the same time they are building free-stall facilities and adding cows to their herds. In these cases dairy producers continue to use their old stall barns to do the milking. This is a workable arrangement that gives dairy producers a chance to build cow numbers and retire debts before they take the plunge and build a milking parlor.

Milking 100 to 200 cows in a conventional 50 to 60 stall-barn can be an exhausting and time consuming chore. Rather than putting up with this inconvenience and hardship, dairy producers can remodel their barns and retro-fit them with flat-barn or pit parlor systems. This remodeling can make milking chores much more manageable but it does require producers to invest money in a stall-barn that will eventually be abandoned or leveled.

A good number of dairy producers are of the opinion that it makes little sense to put any money into their stall-barns when they are going to move into a new parlor in a few years. At first glance this seems to be a logical conclusion; but when one considers the labor savings that could be gained from putting a parlor-system in an existing barn one generally finds that this can be a cost effective investment for dairy producers to make. This point is made by the data presented in the following table.

Table 1. Per hundredweight costs when milking in stalls or a retro-fitted parlor in a barn

Herd Size	Stall-barn	Double-6 Parlor in a Stall-barn
100	1.6512	1.3427
200	1.5208	1.0335
300	N/A	.9304
400	N/A	.8788

N/A: It is assumed that it is impossible for one person to milk more than 200 cows per day in stalls.

The values presented in Table 1 reflect the different costs that a dairy producer could incur depending on whether the producer elects to milk cows in a conventional stall-barn or one has been equipped with a double-six parlor system costing $30,000. This latter system allows a person to milk approximately 48 cows per hour while the stall-barn set-up has a 25 cow per hour capacity. Because the parlor system has a greater per hour milking capacity, it requires less labor resources to operate

than a stall-barn system. These labor savings are important because they are the return a dairyman receives from investing $30,000 in an existing barn.

The per hundredweight cost figures in the table were computed under the assumption that the average milk production per cow is 21,000 lbs per year and the cost of labor is $10.00 per hour. The cost estimates reported for the stall-barn are solely labor costs while the retro-fit parlor costs are a combination of labor costs and the ownership costs (depreciation, repairs, etc.) associated with a $30,000 investment that has a five year useful life.

At the scale of 100 cows the cost of milking in a stall-barn is roughly $1.65 per hundredweight. In contrast the cost of milking in a retro-fitted barn with a parlor is approximately $1.35 per hundred pounds of milk. This 30 cent savings that comes from moving to a retro-fitted parlor system is evidence that it pays to invest in a modest parlor system. The savings are even greater if a dairy producer has a 200 cow herd. The average cost of milking 200 cows in a stall-barn is $1.52 while it is only $1.03 in a remodeled barn with parlor. These savings of almost 50 cents per hundredweight can add up to some substantial profits for dairy farmers who elect to spend money that is needed to set-up a parlor system in their existing barns.

Using a retro-fitted parlor system may not be the preferred option for dairy producers who want to grow to a scale of 400 or more cows but it is something they can use in the short run while they are building free-stall housing and adding cows with limited financial resources. This is something producers should keep in mind when they are developing their plans for putting together the dairy operations they ultimately want to have.

Financial Performance Of Dairy Operations Under Various Expansion Plans

Dairy producers have the option of expanding their dairy option gradually or they can make some major changes in a relatively short period of time. In this section we will consider how different growth strategies can affect the financial performance of dairy farms.

For our analysis we will assume that we are working with a 50 cow dairy operation that is considering six options for growth. These plans for growth vary in terms of how quickly cows will be added to the operation and the types of parlor systems that are used. In some situations the milking herd will be increased in 100 or 200 cow increments and in others the miking herd will be expanded at greater rates. The milking systems used in these various plans include a stall-barn, a retro-fitted double-six parlor in an existing barn and a conventional double-ten parlor. The specifics of each of the six growth strategies considered here are detailed in Table 2.

In all the cases considered here it is assumed that cows will be purchased at a price of $1250 per head. It is also assumed that free-stall housing for cows will be added at a cost of $1200 per stall. Loans used to finance the purchase of cows are at a 9 percent interest rate with a five year repayment requirement and the loans on the free-stall housing are also at 9 percent interest but the repayment period is 20

years. Loans on parlor facilities are assumed to have the same terms as those used for the free-stall housing loans.

For the sake of simplicity it is assumed the dairy producer will purchase replacement stock rather than raise it. This is done because it is assumed the dairy producer cannot afford to simultaneously construct the facilities needed to raise replacements and carry-out other expansion activities such as purchasing cows, building free-stall housing and constructing parlor facilities. This decision to purchase versus raise replacements is assumed to be representative of what dairy producers do in the short-run when they are engaged in expansion activities.

Table 2: Potential Growth Strategies For a Hypothetical Dairy Farm

YEAR	CHANGE	STRATEGY 1	STRATEGY 2	STRATEGY 3	STRATEGY 4	STRATEGY 5	STRATEGY 6
1	Cows	50	50	150	350	350	750
1	$ cows	62500	62500	187500	437500	437500	937500
1	$ free-stalls	120000	120000	240000	480000	480000	960000
1	$ parlor		30000	30000	30000	300000	300000
6	Cows	100	100	200			
6	$ cows	125000	125000	250000			
6	$ free-stalls	120000	120000	240000			
6	$ parlor	30000					
11	Cows	100	100	200	400	400	
11	$ cows	125000	125000	250000	500000	500000	
11	$ free-stalls	120000	120000	240000	480000	480000	
11	$ parlor		300000	300000	300000		
16	Cows	100	100	200			
16	$ cows	125000	125000	250000			
16	$ free-stalls	120000	120000	240000			
16	$ parlor						

In Strategy 1 it is assumed the producer initially uses an existing stall-barn to milk 100 cows in years 1 through 5 and then spends $30,000 in year 6 to construct a retro-fitted parlor in the barn. Under this plan the producer will be able to milk 25 cows per hour in the first five years and then 48 cows per hour once the retro-fitted parlor system is in placed.

In Strategy 2 the dairy producer immediately constructs the retro-fitted parlor and uses it for ten years. After this the producer then constructs a double-10 parlor at a cost of $30,000. With this arrangement the producer's milking capacity is 48 cows per hour in years 1 through 11 and then 80 cows per hour in year 12 and beyond.

Strategy 3 is the same as Strategy 2 in terms of the milking systems that are employed by the producer but it differs from the latter strategy in that it adds more cows to the operation. For Strategy 3 cows are added at a rate of 200 head every five years rather than at the rate of 100 cows as is done in Strategy 2. This more aggressive strategy for adding cows in Strategy 3 increases the profit opportunities for the dairy producer but also forces the producer to make greater use of credit resources.
Strategy 4 is the same as Strategy 2 and 3 in terms of parlor investments but it is an even much more ambitious growth plan. In this case 350 cows are added to the operation in year 1 and then in year 11 the herd is expanded to a total of 800 cows. The potential pay-off from this growth plan is higher profits but it requires the use of considerable credit resources. Thus that possibility for bankruptcy is greater for this particular plan.

Strategies 5 and 6 call for the dairy producer to go straight to the double-10 parlor costing $300,000. In Strategy 5 the herd size is initially set at 400 cows and then it is increased to 800 head in year 11. For Strategy 6 the herd size is immediately set at 800 head of cows. These two strategies are the most risky growth plans because they require greatest use of credit resources. Despite these greater risks, these strategies may be attractive to the hypothetical dairy producer because they also have the greatest potential for generating profits.

All of the growth strategies mentioned above were analyzed over a twenty year period using the assumptions presented in Table 3. These assumptions about milk production per cow, milk price, the market value of calves, and the cost of input such as feed, breeding, supplies, etc. were judged to be representational of the returns and costs a typical dairy producer could experience when operating a dairy operation. It was also assumed for this analysis that all labor, hired or operator, would be compensated at a rate of $10.00 per hour. For the sake of simplicity, no attempts were made to account for the federal and state income taxes this dairy producer would have to pay on earnings. This should be kept in mind when considering the financial outcomes of the various growth strategies because the incomes and cash flows of the dairy operation would not be as favorable as reported if the dairy had to pay taxes on income.

The information presented in Table 4 summarizes the results that were obtained when the operations of the hypothetical dairy farm were simulated over a twenty year period for the six growth strategies being considered. These data show how the example dairy farm's profits, cash flows, working capital, debt to asset positions, and equity were affected by how quickly or slowly the dairy producer elected to expand the dairy farm.

Base Strategy

The first column of values in Table 4 are the results that were obtained when no changes were made in the hypothetical 50 cow dairy farm. The income data for this case show that the profits of this farm would be positive in all years ranging from a low of almost $2100 to a high of nearly $9900. The cash flows of this dairy would not be quite as favorable. The cash flows would

range from -$18,373 to a high of nearly $9900. These low cash flows are a problem because they mean the dairy has to borrow money in the short run to stay in business.

This cash flow problem is evidenced by the fact that the dairy's working capital position falls to -$103,501. This negative working capital balance would be a concern for lenders.

The debt to asset position of the 50 cow dairy never gets seriously high. In fact the dairy's debt to asset position never exceeds .25. This relatively low debt to asset position is noteworthy because it means the dairy never has a debt position that would be a problem for lenders. Given this it is quite probable that lenders would be willing to let this dairy run-up an operating loan balance to cover the cash flow problems that are evidenced by the negative working capital position previously discussed.

The ending net worth reported for the 50 cow dairy is $603,085. This equity position is not quite $100,000 greater than the beginning net worth of $505,000. This increase in net worth is a positive outcome but it is not much of a return over two decades on a half a million dollar investment.

Table 3: Key Assumptions of Analysis

Per cow returns and costs:	**Quantity**	**Unit**	**Unit Value**	**Total**
Gross returns:				
Milk	210	cwt	$13.00	$2,730.00
Calf	0.84	hd.	$85.00	$71.40
Total gross returns:				**$2,801.40**
Variable costs:				
Forage	6.35	ton	$100.00	$635.00
Corn	109.00	bu.	$2.50	$272.50
Soybean meal	1550.00	lbs	$0.13	$201.50
Dical	165.00	lbs	$0.13	$21.45
T.M. salt	87.50	lbs	$1.00	$87.50
Milk hauling	210.00	cwt.	$0.50	$105.00
Bedding	1.25	ton	$50.00	$62.50
Vet & medicine	$45.00	$	1.00	$45.00
Power & fuel	$50.00	$	1.00	$50.00
Supplies	$30.00	$	1.00	$30.00
Overhead	$20.00	$	1.00	$20.00
Interest on var. costs	$765.23	$	0.09	$68.87
Total variable costs:				**$1599.32**
Breeding stock costs:				
Purch. replacement cow	0.40	hd.	$1,250.00	$500.00
Less: Sale of cull cow	0.39	hd.	$500.00	<$196.00>
Total breeding stock costs				**$304.00**
Labor costs (Excluding milking)	25.00	hrs	10.00	$250.00
Other assumptions:				
Pounds of milk per cow/year				21000
Calves per cow/year				0.84
Death loss rate				2%

Percent cows culled annually	40%

Strategy 1

The financial information for Strategy 1 shows that profits will increase from adding cows and going to a parlor system; but it also shows that there will be some problems with profits and cash flows. For this case losses are experienced in five of the 20 years being analyzed and cash flows are negative 11 of 20 years. Due to these low profits and cash flows the working capital position of the dairy dips to a low of -277,830. This erosion of the dairy's liquidity would be a serious concern for lenders.

The debt to asset position in this case peaks at .6025. Since this peak debt to asset value is well below the lenders' critical value of .70 we can conclude that this growth strategy would allow the dairy to meet the debt to asset standard of lenders.

Table 4: Financial Outcomes of Various Dairy Farm Growth Strategies

Financial Measure	Base	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6
Income							
Minimum	2094	-4988	1366	20650	59219	30897	128312
Maximum	9876	130001	102862	347901	434531	415655	631690
Yrs. Neg.	0	5	0	0	0	0	0
Cash Flow							
Minimum	-18373	-36607	-27416	-25152	-20623	-47538	-12220
Maximum	9876	101317	75896	291920	421628	388042	578515
Yrs. Neg.	10	11	10	6	6	6	6
Working Capital							
Minimum	-103501	-277830	-114080	-97942	-76004	-199249	-34016
Maximum	4301	281892	283117	1872952	2971734	2429403	5409481
Yrs. Neg.	19	16	14	7	5	7	5
Debt to Asset							
Minimum	.0897	.2114	.3102	.2081	.1291	.1044	.0201
Maximum	.2351	.6025	.5655	.5847	.6853	.7305	.8228
Yrs. > .70	0	0	0	0	0	2	3
Yrs. > .50	0	8	4	3	5	9	5
Change in Net	98085	750783	697712	1367952	3863500	3366179	4904481

Strategy 2

The information for Strategy 2 indicates that the hypothetical dairy's financial performance would improve if the dairy producer elects to immediately invest $30,000 in a retro-fitted parlor . By taking

this action the producer can ensure that profits are positive in all years and improve the dairy's cash flows. In this case cash flows are still negative 10 of 20 years but the cash flow deficits are not as great as they are in Strategy 1. As a result of this the dairy's working capital only goes down to -114,080. This working capital deficit is still a concern but it is not as big a problem of the -277,830 working capital balance experienced in Strategy 1.

The debt to asset position in Strategy 2 reaches a maximum value of .5655. This debt position easily meets the standard set by lenders so we can assume that lenders would not be terribly troubled with financing this growth plan.

Strategy 3

The financial results for Strategy 3 are much more favorable than the ones obtained for Strategies 1 and 2. Profits are positive in all 20 years and they are generally higher for all years of the analysis. Thanks to these higher profits cash flows are also much better for the growth strategy that calls for the dairy producer to immediately invest in a retro-fitted double-6 parlor and increases the herd size in 200 cow increments. This plan results in negative cash flows six years but the working capital position only falls to a minimum of -97942. This low for the working capital position is a concern but it is not critical a critical problem.

The debt to asset position for Strategy 3 is not significantly different what is experienced for Strategies 1 and 2. Thus Strategy 3 is no more risky than the other two growth plans we have considered to this point. Given that this strategy has roughly the same risk and yields greater returns, it would seem to be preferred to either Strategies 1 and 2.

Strategy 4

The financial information for Strategy 4 is quite similar to the information that is reported for Strategy 3. Profits are positive in all twenty years while cash flows are negative in six. These cash flow deficits are not all that much of a problem because they only cause the dairy's working capital position to fall to -76004. This working capital deficit would not seem to be a major problem in light of the fact that this deficit will only be experienced for five years.

The debt to asset position for Strategy 4 peaks at .6853. This higher debt to asset for this case is explained by the fact that the dairy will make fewer, but larger, investments as it grows in 400 cow increments in years 1 and 11. This investment pattern causes debt to rise dramatically in the years investments are made and then they decline as debts are retired.

The change in net worth experienced for Strategy is double the equity change reported for the other three strategies considered to this point. This greater growth in equity is evidence that greater returns can be gained from expanding at more aggressive rates.

Strategy 5

The financial information reported for Strategy 4 shows what happens when a dairy producer elects to use a retro-fitted double-6 parlor for 10 years and then move to a double-10 parlor. In contrast to

these results, the information for Strategy 5 shows what will happen if a dairy producer decides immediately construct a double-10 parlor.

The Strategy 5 data clearly shows that the financial performance of the hypothetical dairy farm slips somewhat if a double-10 parlor is constructed in favor of a retro-fitted double-6 parlor. The profits in this case are still positive but they are not as high as they are in Strategy 4. These lower profits are in essence the cost of moving directly to a state of the art parlor system.

The debt to asset information for Strategy 5 shows that this growth strategy causes the dairy's debt to asset position to rise above the value of .70 for two years. This relatively high debt to asset position is a potential problem because the dairy could have trouble getting additional credit from lenders in the years debt to asset ratio exceeds the lenders' standards. At the extreme this could results in bankruptcy for the dairy.

Strategy 6

The financial information reported for Strategy 6 shows what happens when the hypothetical dairy producer decides to immediately expand to 800 cows and construct a double 10 parlor. This option is highly profitable and for the most part it has the most favorable cash flows working capital positions. Despite these positives it is questionable whether it would be financially feasible for the example dairy farmer to undertake this project because the debt to asset position exceeds the standard set by lenders.

Under this strategy the debt to asset ratio peaks at a value of .8228 and exceeds the lenders' critical value of .70 for three years. This unacceptably high debt to asset position will most likely scare most lenders away from this deal even though it appears to be the most profitable over time. This reluctance of lenders to finance this plan will make it nearly impossible for the hypothetical dairy producer to pursue this particular expansion plan even though it offers the best potential for financial rewards.

Conclusions

In this paper we have considered some of the option dairy producers have for moving to parlor based dairy systems that have the potential for improving the working conditions on dairy farms and increasing profits. The results of the analyses considered in this paper show dairy producers can gain profits through growth but they also show that it may not always be possible for producers to grow to relatively large scales in a short period of time.

Ambitious growth plans are not always feasible because lenders will not be finance these activities. The results presented here clearly show that decisions to grow quickly and dramatically can result in debt to asset positions for dairy operations that exceed the lenders' standards. Given this it follows that dairy producers may have to adopt some more modest growth plans as they try to expend their operations. One such option may be putting a retro-fitted parlor system in an existing barn so that debt levels can be held down to acceptable levels while limited credit sources are committed to the purchase of cows and free-stall facilities. This option affords producers an opportunity to increase profits in the short-run and puts them in a position where they can eventually add conventional parlors to their operations. This action may not be the preferred option of producers but it may be the action they have to take given the

fact that lenders are not going to be willing to enter into arrangements where producers' debt to asset positions are likely to be .70 or greater for a few years.