Managerial and Financial Implications of Major Dairy Farm Expansions in Michigan and Wisconsin¹

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ABSTRACT

This study examines the experiences and results of major dairy farm expansions in Michigan and Wisconsin. Twenty dairy farms that had one-time herd size increases of at least 20% between 1988 and 1998 were selected, surveyed, interviewed, and analyzed. A case study format reveals individual experiences and problem solutions. On average, studied dairy farms increased herd size from 296 to 569 cows. The most commonly cited reason for expansion was increased profits. On average, net farm income and return to operator management and capital improved following expansion. The most profitable expansions were highly correlated with modernizing facilities. In addition, a decline in return on assets was, in several cases, due to taking on too many new partners relative to the increase in herd size. Dairy farms were able to increase milk production and experienced a significant decrease in labor and management expense per hundredweight of milk produced through expansion. Outsourcing and the use of consultants increased with expansion. Public relations problems were not substantial impediments for producers who took a proactive approach. Reflecting on the expansion experience, managers indicated that human resource, financial, operations, herd management, and strategic management skills were the most important skills to achieve a successful expansion.

(Key words: expansion, financial management, profitability, labor efficiency)

Abbreviation key: D/A = debt-to-asset ratio, FTE = full-time equivalent, NFI = net farm income, RHA = rolling herd average, ROA = rate of return on assets, ROCM = return on operator capital and management.

INTRODUCTION

Herd size varies significantly across the United States. The Northeast and upper Midwest regions, traditional dairy producing regions, still have significant numbers of small dairy farms using older production technologies. Larger dairy herds are common in the West and Southwest. While the long-term trend everywhere has been larger farms, the growth rate of the average dairy farm has accelerated in recent years through a decline in the number of small farms by exit or expansion. This is particularly true in the upper Midwest and Northeast as older facilities exit or are replaced with large facilities.

Total US dairy farms with \$1,000 or more of sales declined from 213,961 in 1978 to 96,546 in 1997—a decline of 55% (US Department of Agriculture. *Census of Agriculture: 1978, 1987, and 1997*). Wisconsin, the state with the largest number of dairy farms, witnessed the largest decline in farm numbers. Wisconsin lost 22,296 farms between 1978 and 1997, a decline of 50%. Michigan had fewer farms than Wisconsin but still saw dairy farm numbers decline by 4586 (–56%) over the same period. Most of the decline in herd numbers came from the smaller herd size categories, as many small herds either expanded to a larger size category or exited (Table 1). The number of herds with fewer than 100 cows declined in number by as much as 60% in a 10-yr period in the upper Midwest states. Meanwhile, growth in number of dairy herds with 500 or more cows grew by 350% (1978 to 1987) followed by 500% (1987 to 1997) in Wisconsin and 125% followed by 333%, respectively, in Michigan. Those impressive growth rates are largely a function of the small initial number of farms in this size category. Note, however, that the 200- to 499-cow category also grew quickly, reflecting the trend to larger dairy herds.

As herd size expands, employees are added, facilities are built, and, perhaps most importantly, the job of the manager changes. At smaller herd sizes, the manager often spends time with individual cows directly handling breeding, health issues, and nutrition. At larger herd sizes, the manager necessarily delegates tasks and

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Table 1. Number of dairy farms* by herd size, 1978–1997.

	Herd size					Total
	< 50	50–99	100–199	200–499	500+	
Michigan						
1978	5362	2098	661	75	4	8200
1987	3091	1723	791	141	9	5755
1997	1605	1048	714	208	39	3614
Wisconsin						
1978	33,840	9337	1015	99	2	44,293
1987	22,718	11,645	1876	211	9	36,459
1997	10,707	8839	1916	481	54	21,997
United States						
1978	149,484	48,144	12,156	3334	843	213,961
1987	89,740	48,315	14,837	4253	1267	158,410
1997	43,348	33,472	12,602	4880	2244	96,546

¹The dairy farms are “operations with milk cows” as defined by NASS. Farms with less than \$1,000 in dairy product sales in each Census year were removed from those dairy farm numbers so that the figures more accurately represent commercial farms. All farms removed were in the “less than 50 cow” herd-size category. (Source: US Department of Agriculture. *Census of Agriculture*: 1978, 1987, and 1997.)

manages the labor who performs those tasks. Some dairy farmers entered the business specifically to manage cows. Those farms may perform poorly at larger herd sizes unless the managerial role changes.

Managers of smaller dairies, many of whom supply much of the day-to-day labor, tend to focus on herd and crop management activities. Increasing dairy farm size puts greater focus on new areas including: determining the financial requirements and implications of an expansion; hiring, training, evaluating, and retaining employees; sourcing an adequate supply of quality animals, land, and feed inputs; meeting environmental and zoning regulations; and managing public relations.

To evaluate the financial and managerial impacts of major expansions requires a detailed and critical analysis of the financial records and experiences. To accomplish a detailed analysis, the current study investigated the expansion managerial achievements and problems of 20 dairy farms in Michigan and Wisconsin before, during, and after a large herd expansion. The objectives of this study were to examine how expansion affected profitability, labor efficiency, milk production, and managerial responsibilities. In addition, the unique problem solving experiences of the managers were characterized to facilitate future expansion analysis.

MATERIALS AND METHODS

To be eligible for this study, the dairy farm must have had a one-time herd size increase of more than 20% between 1988 and 1998 that required improvements in, or additional units of, labor, machinery, or facilities. Potential expansion managers from Michigan and Wisconsin were identified using Michigan State University Telfarm Record System, University Extension, and ag-

ribusiness contacts. By this process, 30 managers in Michigan and Wisconsin were contacted by telephone and twenty were ultimately chosen to participate. Twelve of the study farms were located in Wisconsin and eight in Michigan. The producers contributed financial and production records for at least 2 yr before and postexpansion. The survey and interview were conducted in two stages. In the first stage, producers completed a written questionnaire composed of closed ended questions concerning farm characteristics, production, and financial performance. The second stage was a face-to-face interview with open-ended questions used to discover issues each individual producer faced during expansion. Because each producer had the option to decline to answer any given question, the number of farms represented in a particular response, measure or issue vary and are indicated in the tables and discussion. Eighteen of the 20 producers provided enough detailed financial data to examine the economic aspects. The remaining two producers provided only experiences and opinions related to their expansion experience.

Because few farms qualified as major expansions with adequate records for this approach, a case-study analysis was used. The case-study format allows identification of patterns from which research propositions can be examined and useful conclusions drawn. This method facilitates an examination of the reasons why decisions were made rather than merely what decisions were made (Yin, 1994). Farm, manager, and financial characteristics are used along with specific examples of problem solving strategies to examine practical and theoretical propositions of dairy farm expansion implications.

Prior research indicated that expansion dairies typically faced a critical transition period of decreased productivity and financial performance lasting for 2 yr after expanding (Stoll, 1974). For the purposes of before and after expansion comparisons, "preexpansion" refers to the 2 yr before expanding a dairy. "Postexpansion" refers to the first 2 yr after expanding, including the expansion year.

Data Preparation

The calendar dates of the preexpansion and postexpansion periods varied from producer to producer, which necessitated adjustment to production and price data to facilitate farm comparison. With the exception of milk price, all other data were indexed to reflect 1998 levels by using indices and production data for the 1990 to 1998 period from Agricultural Statistics (USDA-NASS, 2000). Milk production was standardized using the rolling herd average (**RHA**) for each farm by an index where the 1998 DHIA national average RHA equals one. Expenses and assets were deflated by using the "Index for Production (all commodities)" of prices paid by farmers. Asset values were adjusted by using the simple average of the "Index for Farm Machinery" and the "Index for Building Materials" (USDA-NASS, 2000).

Rather than adjusting milk prices to 1998 levels, which were the highest milk price for the 1990 to 1998 period, the milk price was indexed to a \$13.50 per hundredweight (~29.7 cents/kg) gross price. This price was chosen as representative, long-run, upper Midwest region farm-level milk price. All other prices were adjusted to 1998 levels. Crop prices were deflated using the "Prices Received by Farmers Index for Feed Grains and Hay" (USDA-NASS, 2000). Calf, cull cows, and replacement dairy cattle were standardized according to the 1998 "Marketing Year Average Price Received by Farmers" of \$78.80 per calf, \$33.70 per hundredweight (~74.15 cents/kg) for cull cattle, and \$1,120 per replacement dairy cow.

Descriptive Statistics

Preexpansion, the average herd size of the studied herds was 296 milking cows with a range from 60 to 1071 cows. Six herds had fewer than 100 cows, while three herds had more than 500 cows. Five herds were housed in tie stall or stanchion facilities. With the exception of one farm without cropping activities, all preexpansion dairies had forage enterprises and five also had cash grain enterprises.

Preexpansion, average tillable acreage was 978 acres (396 ha), with an average acres per cow of 3.3 (1.34 ha/

cow; Table 2). Rolling herd average for the two years preceding expansion ranged from 15,248 to 28,794 lb (6931 to 13,088 kg) of milk per year with an average of 21,900 lb (9955 kg). The average total milk shipped per year was 5,317,295 lb (2,416,952 kg). The farms were staffed by an average of 2.5 managers and seven farm laborers employed. Of the employees, more than five were dedicated to dairy enterprises (milking herd and replacement heifers), with the residual labor usually allocated to crops.

Postexpansion average herd size almost doubled to 569 cows (Table 2). The smallest postexpansion herd size was 120 cows, and the largest was 1,350 cows. All stanchion or tie stall facilities in use before expansion were abandoned in favor of free-stall facilities. Despite the large increase in herd size, total tillable crop acreage increased by an average of only 9%, so that acres per cow decreased to 1.8 (0.7 ha/cow). Milk production per cow for the first 2 yr following expansion ranged from 18,500 to 27,841 lb (8409 to 12,655 kg) and on average increased by 5% to 23,064 pounds (10,484 kg). The increase in herd size and increased production per cow produced an increase in milk shipped per year of 107% to an average of 10,999,283 lb (4,999,674 kg). The expanded dairies required an average of 3.4 managers (an increase of 36% over the preexpansion average) and 10.7 employees (an increase of 53 percent) of which 8.5 were dedicated dairy employees.

Ten of the interviewed managers had no previous expansion experience (using the study definition). Six managers had expanded once before, and four others had expanded their dairy farms at least twice previously.

Financial Performance Measures

To examine the financial performance of the expansions, measures of solvency and profitability are utilized. To measure solvency, the debt to asset ratio (**D/A**) is used. The D/A indicates the level of creditor claims against the firm relative to total farm business asset value. The D/A is calculated by dividing total farm liabilities by the value of total farm assets measured at estimated fair market value.

Profitability refers to farm ability to generate a net return above expenses from the use of its resources. Profitability measurements examined in this research include net farm income (**NFI**), return to operator capital and management (**ROCM**), and rate of return on assets (**ROA**).

As the most familiar profitability measure among dairy farm managers, NFI is a measure of accrual income earned. Calculation of NFI is by taking the gross cash farm income, also called total revenues, less the

Table 2. Average farm characteristics (18 farms).

	Preexpansion	Postexpansion	Percent change
Herd size (cows)	296	569	92
Crop acreage ¹	978	1069	9
Acres/cow ¹	3.3	1.8	-45
Milk production (lb/cow/year) ²	21,900	23,064	5
Milk sold/year (lb) ²	5,317,295	10,999,283	107
Number of managers	2.5	3.4	36
Total dairy employees	5.1	8.5	7
Total employees	7.0	10.7	53

¹Acres/2.47 = hectares (ha).

²Pounds or lbs/2.2 = kilograms (kg).

operating expenses and depreciation and adding or subtracting the change in inventory, market animals, and accounts receivable or payable. The NFI measure does not take into account a charge for the labor provided by the manager and family, nor does it charge, or provide a return, for operator investment in the farm business.

The ROCM accounts for unpaid manager and family labor. This profitability measure is calculated by subtracting a charge for the unpaid labor from NFI. For this study, the charge assigned for the preexpansion unpaid family labor was equal to the wage earned by the postexpansion hired employee conducting similar activities. To estimate the opportunity cost of managing partner labor, a salary was estimated by adding \$5,000 to the herd manager salary (a lower level management position on large dairies).

Rate of ROA measures the amount of profit generated per dollar of asset. ROA is calculated by taking ROCM plus interest charges, divided by the average total asset value measured at market value.

RESULTS AND DISCUSSION

Reasons for Expansion

There are many reasons to expand a dairy farm. Nott (1968) noted that a common expansion reason was to utilize surplus springing heifers. In 1974, Stoll concluded that primary reasons for expansion were to accommodate additional labor or family members, to reduce excess facility capacity, and to adopt new technologies. Erven (1992) listed the advantages of expansion as potential economies of size, larger net income with increased volume, bargaining power, accommodating new partners, and intangibles such as prestige while disadvantages included potential inconsistencies in farm lifestyle goals, diseconomies of size, increased risk, and stress.

The managers were asked to rank their top three reasons for expanding. The most common overall reason for expansion, totaling first, second, and third ranked

responses, was "improved profitability." Managers indicated improved profitability as an expansion reason 16 times (80% of respondents). "Improved quality of life" was mentioned eight times. "To replace a worn facility" and "human resource issues" tied for the third most common expansion reason with each earning five responses.

The most common reason ranked first was "improved quality of life" with six first-place responses. The producers defined quality of life improvements as the ability to spend more time with their families, take vacations, and perform less physical labor. It is worth noting that the ability to enjoy those improvements occurs only if an expansion is financially successful. Quality of life was followed by "improved profitability" with five first-place responses. Two managers indicated that they expanded when their milk production facilities needed replacing. Two other managers expanded at least in part as a managerial challenge. Other expansion reasons that ranked first included "to accommodate new partners" and "to increase cash flow."

The reasons for expanding, combined with previous literature on the subject, identified factors examined in assessing expansion results. Improved profitability was the most common reason cited for expanding and is addressed first. Measuring "quality of life improvements" is subjective and largely beyond the scope of this research, with the exception of operator responsibilities, which are examined. However, also examined are changes in labor efficiency, milk production, and the managerial job responsibilities, which are also reasons to expand and may influence perceived quality of life. The factors related to success and failure in those areas are addressed in each section.

Financial Implications

Desire to increase income and profitability was the most common reasons these dairy farms expanded. Profitability is the net return above expenses from the use of farm resources and can be measured in several

Table 3. Economic and productivity measures from dairy farm expansion.

Measure		Mean	Standard deviation	High	Low	Farms ¹
Debt/Asset ² (%)	Preexpansion	31.3	23.2	64.1	3.6	14
	Postexpansion	43.4	22.8	67.3	0.7	14
Net farm income ³ (\$)	Preexpansion	104,580	106,900	391,440	-42,010	14
	Postexpansion	141,310	132,170	446,790	-50,720	14
ROCM ⁴ (\$)	Preexpansion	8860	117,510	347,910	-142,920	14
	Postexpansion	33,390	145,320	355,640	-168,510	14
ROA ⁵ (%)	Preexpansion	3.25	6.29	11.25	-13.67	14
	Postexpansion	3.21	5.93	13.94	-7.86	14
Labor productivity ⁶ (milk/FTE)	Preexpansion	686,656 ⁸	316,341	1,523,957	210,511	18
	Postexpansion	917,980 ⁸	365,001	1,871,364	406,843	18
Labor expense ⁷ (\$/cwt)	Preexpansion	5.14 ⁸	2.30	10.93	2.05	18
	Postexpansion	3.50 ⁸	1.37	6.16	1.67	18
Rolling herd average (lbs/cow/year)	Preexpansion	22,075	3746	28,794	15,247	17
	Postexpansion	23,228	3140	28,056	18,388	17

¹Managers could decline to answer any given question, so that the number of farms responding varies across measures.

²Debt-to-asset ratio is calculated as the value of farm liabilities divided by the fair market value of farm assets expressed in percentage terms.

³Net farm income (NFI) is calculated as gross cash farm income less operating expenses and adjustments for inventory and capital changes.

⁴Return to operator capital and management (ROCM) is calculated as NFI less a charge for unpaid family labor.

⁵Rate of return on assets (ROA) is calculated as NFI plus interest charges and subtracting a charge for managing partner labor, divided by the average total asset value measured at market value and expressed in percentage terms.

⁶Labor productivity is pounds of milk sold per full-time employee (pounds/2.2 = kg).

⁷Labor expense is calculated as dairy worker cost per hundredweight (45.45 kg) of milk.

⁸Indicates that the mean values from pre- to postexpansion were significantly different at a 95% confidence level using a one-tailed, pooled variance *t*-test.

ways. In the current study, profitability was measured by net farm income, return to operator capital and management, and rate of ROA. Another measure of financial well-being is solvency, the degree to which assets exceed the debt level. One common measure of solvency is the debt-to-asset ratio.

Fourteen of the 20 farms provided sufficient data to conduct a thorough financial analysis. The mean herd size for the 14 farms increased from 271 cows to 472 cows, an increase of 74%. The market value of assets increased by 48% from a preexpansion market value mean of \$2,243,000 to postexpansion mean of \$3,309,000. Postexpansion asset values ranged from \$618,000 to \$10,851,000. The expansions were financed through a mean increase in liabilities of \$617,000 and a mean increase in equity of \$449,000. Postexpansion liabilities averaged \$1,323,000, ranging from \$34,000 to \$5,091,000. Mean postexpansion equity was \$1,986,000 and ranged from \$263,000 to \$5,838,000.

The D/A ratio expressed as a percentage increased from a preexpansion mean of 31.3% to a postexpansion mean of 43.4% across farms (Table 3). Postexpansion

D/A ranged from 0.7 to 67.3%. Debt proportion did not increase a great amount on average because seven of the 14 managers used proportionately more equity than debt capital to finance the expansion. Three of those seven managers increased equity capital through owner contributions by the expansion manager. Four expansion managers added either family or nonfamily partners and their capital. Financing the expansion with equity and including new partners has important implications for profitability.

Preexpansion net farm income averaged \$104,560 and ranged from -\$42,010 to \$391,440 (Table 3). Postexpansion, the net farm income per farm increased to an average of \$141,320. Eight farms increased net farm income after expanding. Only one farm experienced a negative postexpansion net farm income of -\$50,720. The largest postexpansion net farm income was \$446,790. While average net farm income per farm increased, the postexpansion mean was not significantly greater than the preexpansion mean at the 95% significance level (Table 3). Across farms of this size, age and investment level, net farm income is not an ideal

measure of profitability because it fails to account for unpaid management, labor, and capital. For example, these farms had substantially more interest, because of increased use of debt capital, and depreciation expense after expanding. Depreciation, a noncash expense and, therefore, easily overlooked and interest expense increased by \$1.08 per hundredweight of milk. Also, while many of the expansion managers provided much of the preexpansion labor needs, after the expansion, hired employees provided the majority of labor.

Return to operator capital and management accounts for unpaid manager and family labor. The preexpansion ROCM per farm averaged \$8,860 and ranged from -\$142,200 to \$347,910. After expanding, the farms mean ROCM was \$31,580 and ranged from -\$168,500 to \$355,640 (Table 3).

Return to operator capital and management includes a charge assigned for unpaid labor but does not account for varying levels of capital investments, which, in all cases, increased with expansion. Before expanding, nine farms failed to earn sufficient funds to fully compensate for unpaid labor and management resulting in an implied negative return to manager equity capital and management. While average ROCM improves with expansion, seven farms still failed to generate a positive ROCM. Farms had a negative ROCM for several reasons. Four of the seven farms raised expansion funds by taking on additional partners. While taking on partners allowed those farms to expand with little impact on solvency, the farms did not expand enough to fully compensate the larger number of managing partners. The other three farms maintained the same number of managing partners, but still had a large number of post-expansion managing partners relative to herd size. Among the seven farms with negative ROCM, the managing partner labor cost was \$1.78 per hundredweight (3.92 cents/kg). For the seven farms with positive ROCM, the managing partner salary expense per hundredweight was \$0.74 (1.63 cents/kg). When planning an expansion dairy, managers should be cognizant of farm ability to generate sufficient funds to adequately compensate the managing partners for their labor and management.

While ROCM accounts for unpaid labor, it is still necessary to compare farms across varying levels of capital investment. There are measures that calculate profit as a return to assets and equity that standardize across investment size. Return on assets is the rate that farm assets generated profitable returns to the managers regardless of size.

Seven farms experienced an increase in ROA and seven farms experienced decreases. The mean pre-expansion ROA was 3.25% and ranged from -13.67 to

11.25% (Table 3). Postexpansion, the mean ROA decreased to 3.21% and ranged from -7.86 to 13.94%.

The farms that used equity, often through adding partners, rather than debt to finance the expansion committed large payments to the managers that brought the equity capital. To examine the effect of debt per cow on postexpansion ROA, 14 expansion dairies were divided into two groups. The "low-debt" group was made up of eight dairies that had preexpansion debt loads of less than \$2,000 per cow and postexpansion debt loads of less than \$3,000 per cow. The "high-debt" group consisted of herds that had preexpansion debt loads in excess of \$2,000 per cow and/or postexpansion debt loads of more than \$3,000 per cow. The high-debt group, rather than the low-debt group, earned a numerically higher mean postexpansion ROA. The low-debt group earned a mean postexpansion ROA of 1.94%, ranging from -6.71 to 7.55%. The high-debt group earned a mean postexpansion ROA of 4.91%, ranging from -7.86 to 13.94%. One possible reason for this occurrence is that highly skilled farm managers may be better able to use debt to finance activities than lower skilled managers. A second reason is that financing with equity often meant bringing in additional partners that must be paid. A third reason concerns the costs associated with building a new facility with the latest technology and equipment. These managers paid as much as \$5500 per cow to build, equip, and fill the postexpansion facility. Managers who keep postexpansion debt load below \$3000 may be forced to expand in much smaller increments or forego updating the production technology. This does not mean that managers should rely exclusively on debt capital to finance dairy expansions. When determining an optimal debt load, over-capitalization or under-capitalization could negatively affect farm financial performance. The dairy farms studied were, on average, either undercapitalized or had committed too much to high-cost managers rather than low-cost labor. In fact, the three dairy farms that added two partners, realized the largest declines in net farm income and return on assets.

Examining the change in financial variables only 2 yr postexpansion does not necessarily provide final conclusions regarding expansion success. However, some patterns were evident. On average, the dairy farms were providing more income, although it was not statistically significant by the measures considered. Correlations with many potential explanatory factors were considered to account for the change in net farm income and ROA. One factor that was perfectly correlated with an increase in net farm income and a positive change in rate of return on assets was facilities modernization. Those dairy farms that changed from stanchion barn or tie stall, or in a couple of cases very old (poorly

ventilated) free-stall barns realized an increase in profitability.

Labor Productivity

Labor productivity is expected to increase as management and labor specialization increase providing an incentive for farm expansion. St-Pierre (1998) noted that milk shipped per employee increased as herd size increased. Similarly, Karszes et al. (1998) found that New York herds that expanded by 35% or more during the 1993 to 1997 period increased milk per full time worker (milk/FTE) from 794,855 lb in 1993 to 1,029,524 lb in 1997, (361,298 to 467,965 kg) an increase of 30% as average herd size increased from 270 cows to 428 cows (59% increase).

In the current study, all farms averaged 686,656 lb (312,116 kg) milk/FTE before expansion, ranging from a low of 210,511 to a high of 1,523,957 lb (95,687 to 692,708 kg) milk/FTE (preexpansion herd size averaged 296 cows—Table 2). Postexpansion, average milk/FTE increased by 34% to 917,980 lb milk/FTE (417,264 kg/FTE), ranging from a low of 406,843 to a high of 1,871,364 lb of milk/FTE (184,929 to 850,620 kg/FTE) as herd size increased to an average of 569 cows (93% increase). Average postexpansion milk/FTE was significantly greater than preexpansion milk/FTE at a 95% confidence level (Table 3).

While milk/FTE is a measure of productivity, more important to the farm profitability aspect are the labor costs associated with that productivity. Dairy labor expense/hundredweight of milk decreased with increased labor productivity. Mean preexpansion labor expense per hundredweight of milk was \$5.14 (11.3 cents/kg), ranging from a low of \$2.05/cwt to a high of \$10.93/cwt (4.51 to 24 cents/kg). The maximum figure came from a dairy with a large number of managing partners, which resulted in higher costs. Postexpansion labor expense/cwt milk decreased to an average of \$3.50/cwt (6.47 cents/kg). Postexpansion labor expense/cwt ranged from a low of \$1.67/cwt to a high of \$6.16/cwt (3.67 to 14.52 cents/kg). As with the labor efficiency measure, average postexpansion labor expense per hundredweight of milk produced was statistically significantly less than average preexpansion labor expense (Table 3).

As herd size increased, labor efficiency improved because of labor saving technology adoption, specialization, and economies of size. Most expansions experienced a significant improvement in labor and management expense per hundredweight. Those who did not improve labor expense either failed to adopt technology to improve labor efficiency or faced an extremely competitive labor environment.

Expansion Effects on Milk Production

Earlier studies indicated that managers were challenged by poor cattle adjustment, inability to feed according to production, and increased workload that often led to decreased milk production. Stoll found an 8.3% (914 lb) decline in milk per cow per year during the postexpansion transition period. Milk production levels did not rise above preexpansion levels until the fourth year after expansion. Recent research has found that milk production can be enhanced through the facilities and management changes that accompany expansion (Stahl et al., 1999; Bewley et al., 2001). That research suggests that improved cow comfort and management in a free-stall facility offset some of the disadvantages associated with expansion. In these cases, production may not decrease, or even increase, in the period following expansion.

To determine expansion effects on production, RHA data were examined for 2 yr preceding the expansion and 2 yr after expansion. Seventeen farms provided sufficient production data to compare preexpansion and postexpansion RHA (Table 3). Preexpansion RHA ranged from 15,247 to 28,794 lb (6931 to 13,088 kg) of milk with a mean of 22,075 lb (10,034 kg; standardized to 1998 levels). Average postexpansion RHA was 23,228 lb (10,558 kg) and ranged from 18,388 to 28,056 lb (8358 to 12,753 kg). As milk increased postexpansion, butterfat and milk protein yields also increased. Mean butterfat production per cow increased from 769 to 810 lb (350 to 368 kg). Mean milk protein production increased from 675 to 716 lb (307 to 325 kg).

Four farms increased RHA by more than 2000 pounds (909 kg). On three of those farms, the managers attributed the increase to moving into modern facilities and having more specialized management and labor. The fourth manager of this group credited the increase to moving out of an overcrowded facility and to increased management and labor specialization.

Three herds experienced RHA decreases in the 2-yr postexpansion period analyzed. Declines in RHA ranged from 50 to 500 lb per cow (23 to 227 kg). One manager attributed the RHA decrease to the inability of his cattle to adjust to the new free-stall facility. That individual previously managed cows in a tie-stall facility. The cattle were mature and accustomed to tie stalls rather than free stalls. All of the mature cattle from that preexpansion facility were culled within a year. Another manager credited the RHA decline to overcrowding and acidosis. The third dairy farm had calving problems that led to a decline in production. The final expansion dairy's RHA declined due to housing the additional cows in old heifer facilities and by overcrowding the preexpansion free-stall facility.

Having increased postexpansion milk production per cow does not necessarily mean that the expansion had no negative effects on milk production. A farm can expand its herd without an initial decrease in production but may fall behind the current farm or industry trend growth rate. To investigate production changes relative to industry trend, postexpansion RHA for each farm was compared to projected production for that farm if production grew at the average rate of US dairy farms participating in DHIA. By taking the preexpansion RHA for each farm and projecting growth at the average US DHIA rate of milk production increase, it was found that on average, milk production per cow on these farms grew at a faster rate than the average US DHIA herd. Therefore, not only did the expanding farms remain at the industry trend in increasing milk production per cow, they actually exceeded that growth rate.

The fact that the expansions did not experience a decrease in production in the first year after expanding or for the average of the first 2 yr postexpansion suggests that managers and advisors may conservatively anticipate a postexpansion production comparable to preexpansion levels and trends. This is especially true when the expansion involves a change from stanchion or tie-stall facility to a free stall facility.

Managerial Responsibilities

In this study, labor activities were defined to involve those physical activities that could be performed by hired laborers and typically considered chores. Management activities do not usually include the actual physical tasks. Instead management activities involve planning, organizing, staffing, directing, and controlling (Hutt et al., 1994). Before expanding, on average 40% of managerial time was dedicated to management activities. Postexpansion, the average percentage of time dedicated to management activities increased to 64%. Included in the preexpansion average were three managers who each dedicated 100% of their time to management. Without those three managers, the average time dedicated to management activities increased from 27 to 57%. Some managers stated that the amount of time spent on dairy enterprise related management did not change from pre- to postexpansion. Even so, the changes that accompanied expansion allowed those managers to delegate labor and activities to employees, which enabled them to increase dedicated management time.

Another change that occurred among these managers from pre- to postexpansion was the nature of their job responsibilities. During the preexpansion phase, a typical manager was a "jack-of-all-trades" or "laborer and manager." Only six out of 20 managers had job descrip-

tions with specific management activities (such as human resource manager, financial manager, public relations). Postexpansion, 15 of the managers had job descriptions with specific management activities. The management job responsibilities, both dedicated management time and perspective, changed from pre- to postexpansion. The delegation of labor and lesser management activities that accompanied large dairy farm expansion enabled managers to alter their job without increasing the amount of work time. While not decreasing the total hours that managers worked, this delegation also afforded increased flexibility in times worked and tasks performed. This flexibility, and the task delegation that accompanied expansion, were viewed as positive changes and were considered by the managers to be consistent with improved quality of life.

Expansion Experiences, Issues, and Solutions

Dairy farm expansions require that the manager deal with many issues that are not easily measured by financial or production records. Human resource management, outsourcing, use of consultants, and public relations management issues related to environmental concerns that accompanied expansion are examined in this section. Those issues and solutions complement the success measures in providing a complete picture of the expansion experiences.

Human resource management. For the farms in this study, especially those expanding for the first time, managing human resources before expanding meant managing a small number of employees. On some farms, the manager and laborers worked side by side completing daily chores preexpansion. On those farms, training and task organizing often consisted of "do-as-I-do" techniques.

Only three managers specifically mentioned human resource management as part of preexpansion job responsibilities, but 13 managers included it in postexpansion job responsibilities. Further, when the managers were asked to select and rank the most important specific skills needed for expansion dairy management, human resource management earned the most "first-rank" ratings and the most responses regardless of rank.

When asked to indicate the pre- and postexpansion human resource management problems, the most common preexpansion human resource management problem encountered by study managers was "full-time employee availability." Seven managers stated that they had problems finding a suitable number of candidates. Most attributed the labor availability problem to a low unemployment rate. Finding part-time employees of

suitable quality was difficult for six managers. Many managers credited this problem to competing with other businesses, both farm and nonfarm, for high quality part-time employees. Six managers indicated that "communicating" with employees was problematic. Some managers also indicated a difficulty in finding time to discuss issues with employees.

The human resource management problems changed postexpansion. Ten managers found "evaluating" employees to be the greatest postexpansion human resource management difficulty. Several managers found it difficult to establish a fair evaluation criterion that was flexible enough to accommodate individual strengths and weaknesses. "Full-time employee availability" and "communicating" with employees tied as the second most common postexpansion human resource management problem, with nine managers indicating each. Most producers still indicated that full-time employee availability was difficult due to low unemployment rate. Unlike preexpansion, several managers stated that time was not a constraint to communicating with employees. Instead, it was inexperience in communicating with employees that caused difficulties.

Outsourcing. Outsourcing is the practice of hiring an outside person or firm to perform a production or management activity that could be performed by the business. To facilitate successful outsourcing programs, managers should analyze operations to determine whether an enterprise or activity can efficiently and economically be performed by another firm. This analysis entails identifying the desired quality of the product or activity to be potentially outsourced, determining the production costs for that activity, and ascertaining whether there are firms offering such services at competitive rates and whether the outsourcing can be efficiently coordinated.

Preexpansion, only nine managers engaged in outsourcing with 1.4 activities on average. "Forage and/or grain production" and "heifer raising" were each cited three times by the managers and were the most common activities outsourced. Two managers outsourced "forage and/or grain harvesting," making it the third most commonly outsourced activity. Artificial insemination, cattle procurement, manure hauling and application, parlor maintenance, and payroll were each mentioned once by the managers.

Postexpansion, 19 managers engaged in outsourcing, with an average that more than doubled to 2.9 outsourced activities per farm. Many of the 19 managers who outsourced activities did so to take advantage of reduced costs. Other managers used outsourcing to reduce farm capital investment requirements.

The most common postexpansion outsourced activity was "forage and/or grain harvesting," which was out-

sourced by 12 managers (compared with two preexpansion). "Heifer raising" was outsourced by nine farms (compared with three preexpansion), making it the second most commonly outsourced activity. "Calf raising" and "manure hauling and application" were each mentioned by six managers (zero and one preexpansion, respectively). "Forage and/or grain production" was mentioned by five managers (three preexpansion).

Although few in number, isolated outsourcing problems did occur. Three managers experienced diseased or poorly grown heifers when using custom heifer raisers. One manager experienced poorer postexpansion alfalfa quality. In those instances, the contractual arrangements concerning quality were not well specified. Another problem was the inability to outsource certain activities. Crop production, human resource management, and manure application were each mentioned twice as activities managers wished to outsource but could not.

Consultant use. The complexities associated with dairy farm management make it difficult for a single manager to manage all aspects of a dairy farm. One method to alleviate this problem is outsourcing some management expertise by hiring consultants. Managers were also asked to identify the source of the consulting services contracted to assist in farm management as a business (firms offering consulting services in conjunction with purchased agribusiness products), independent agency (a firm specializing in only consulting services), lender, extension service, or industry network panel (an advisory panel made up of individuals from the consulting sources).

The most common consulting service utilized was a nutritionist. Nineteen farms used nutrition consultants. Eleven managers used nutrition consultants from the agribusiness firms of which they purchased their feed products. Seven managers used nutrition consultants who operated independent agencies.

Eighteen farms hired outside farm management expertise. Agribusinesses supplied most (eight) of the farm consulting services. Five managers utilized the farm management expertise offered by extension programs. Three managers used the services of independent consultants, and two used an industry network. The third most common consulting service type was an agronomist. Thirteen managers used agronomy consultants. Seven of those consultants were employed by agribusiness firms, five were independent agronomists, and one was an extension specialist.

Six managers hired financial management consultants. Five of the financial management consulting services were independent consulting agencies and one was a lending institution. Four managers used an accounting consulting service for income tax purposes.

Three used parlor management consulting services. Genetics, human resource management, and marketing consulting services were each identified once.

Public relations management. Dairy farm expansions in Michigan and Wisconsin, as is the case in most of the United States, operate in a landscape that is increasingly urbanized. The result is that a dairy expansion may face opposition from neighbors and concerned citizens regarding manure management and odor issues (Brake et al., 1994). While past research has demonstrated that intensive dairy farms can be both environmentally and technically efficient (Reinhard et al., 1999), many believe that farm expansion is correlated with increased environmental damage. This changing rural landscape has led many states to enact strict environmental quality laws (Fulhage, 1997) and zoning restrictions on livestock production units (Bartok, 1993). Many managers were aware of potential public relations problems before expansion. Some experienced managers and advisors recommend adopting strategies and technologies that exceed minimum animal waste handling requirements and to proactively address public relations issues (Sattler, 2000). While environmental concerns potentially involve legal and cost issues, those concerns were not prohibitive for the farms examined. This study concentrated on public relations issues including anticipated and encountered problems, managerial approach, and residential backgrounds of complainants.

Preexpansion, 10 managers anticipated public relations problems. Eight producers were concerned with environmental compliance issues. Five were concerned that acquiring zoning approval would be difficult. Five managers did not anticipate any public relations problems.

Postexpansion, 11 managers indicated that some form of public relation issues arose. Those issues included odor complaints, losing land rental agreements postexpansion, concerns about harvest-time road traffic, and "rumor mill" issues (unsubstantiated stories circulating about postexpansion animal death loss, financial crises, and/or unethical treatment of animals). Five managers experienced environmental compliance difficulties. These included such issues as the amount of environmental compliance paperwork, manure spills, and waterway contamination. One producer faced a zoning-related issue that involved getting an access road upgraded to accommodate semi-truck traffic.

Of the five managers who did not anticipate public relations problems, four encountered problems. Three of the problems were odor complaints, while the neighbor of a fourth lodged a complaint with local police concerning spilling manure on a road.

Seven managers did not receive complaints. A common theme among those managers was the use of pre- and postexpansion strategies to proactively deal with public relations problems. Five of the seven managers launched public relations campaigns to educate neighbors and local officials on dairy farming in general as well as their specific dairy farm. Two managers held open houses. Three offered guided tours of their dairy farm. One manager participated in town and school board governance and sponsored local community events. Another manager regularly communicated with his neighbors about public relations issues including, for example, informing his neighbors of manure spreading dates, not spreading manure on holidays, birthdays and anniversaries, and spreading free manure on neighborhood gardens.

Four of the seven managers without public relations problems adopted manure handling technologies that exceeded permit requirements. For example, one built extra concrete runways and filter strips. Only two of the managers who took preventive countermeasures, in the form of public relations campaigns or utilizing manure management technology that exceeded requirements, encountered public relations problems. In both instances, the manure management technology failed and odor became an issue. Overall, those producers who took preventive countermeasures reduced public relations problems.

To develop appropriate, proactive public relations campaigns, an understanding of the potential complainants is required. For instance, handling the complaints of someone with a nonrural background often requires additional information concerning dairy farming and animal waste management. To examine this issue, the complaints were allocated to one of four residential backgrounds: agricultural, rural nonagricultural, nonrural, or unknown. Forty-six percent of complaints were submitted by people with agricultural backgrounds. Complainants with urban backgrounds accounted for 29% of the public relations complaints, 17% of the complaints were from people with rural nonagriculture backgrounds, and 8% by people of unknown residential background.

The fact that the majority of the complainants had rural backgrounds may be a function of the proportion of agricultural, rural nonagricultural, and urban background residents and in proportion to the relevant population. This result indicates that rural neighbors and people with agricultural backgrounds must also be considered in public relations management for expanding dairy farms.

Expansion Management Skills and Training

Taking into account the expansion experiences, the managers asked to choose the top three management

Table 4. Essential management skills for dairy farm expansion (14 farms responding).

Management skill	First-rank responses	Second-rank responses	Third-rank responses	Total responses	Weighted score ¹
Human resource	6	1	3	10	23
Operations	3	2	2	7	15
Financial	2	4	1	7	15
Herd	2	3	2	7	14
Strategic	0	4	3	7	11
Environmental	1	0	0	1	3
Risk management ²	0	0	2	2	2
Marketing	0	0	1	1	1

¹Point weighting system: first rank = 3, second rank = 2, third rank = 1.

²Includes all forms of risk management other than commodity marketing.

skills needed to profitably undertake a large dairy expansion (Table 4). The results were weighted by number of first rank, second rank, third rank, total responses, and total weighted score (where a first response earned 3 points, a second 2 points, and a third 1 point).

Five specific management skills scored consistently higher regardless of the ranking method: human resource, financial, operations, herd, and strategic management (Table 4). Human resource management skills was the most important managerial skill, as it received the most overall votes (10 votes) and was the highest scoring category with 23 total points and six first rank votes. Financial, herd, operations, and strategic management skills each earned seven overall votes to tie for second essential management skill. Strategic management concerns establishing and evaluating firm vision, mission, long-term goals, and operating parameters. Operations management is the management of the productive processes to achieve goals. Financial and operations management tied for the second highest weighted score with 15 points each. Herd management was the fourth highest scoring category, with 14 points, and strategic management was fifth with 11 points. Despite the publicity that public relations issues garner, this area received only one first-rank response. Many managers stated that before expansion they thought environmental management would have been more important. Following expansion, however, the majority of managers felt that it was relatively simple to meet or exceed regulations and recommendations concerning environmental issues and use public relations tactics to manage neighbor relations.

CONCLUSIONS

With large expansions becoming common in the upper Midwest, the role of and returns to the manager are critical for the continued success of the dairy farm industry. This research studied 20 major dairy farm

expansions to determine managerial and financial results. The managers generally expanded their dairy farms to increase profit. Other common reasons included improving quality of life and human resource issues. On average, net farm income and return to operator capital and management increased postexpansion. Return on asset declined slightly following expansion. Adding partners was negatively related to profitability, perhaps indicating that some expansions were too small to provide adequate return to the increased number of managers. Change in net farm income and return on assets was positively correlated with modernization of facilities. Compared to preexpansion, milk production level increased in the period following expansion. Labor efficiency, as measured by milk/FTE and labor expense per unit of milk production, improved significantly through expansion on those farms. Profitability, measured by NFI and ROCM, also improved following expansion. Rate of return on assets did not improve; however, the lower end of the distribution did increase.

Human resource management issues changed pre- to postexpansion expansion. The problems that showed the highest increase in occurrence were those associated with evaluating employees, achieving manager performance goals for the employees, finding qualified full-time employees, and training. To assist in alleviating those problems, managers were interested in educational programs designed to improve their human resource management skills in such areas as communication, motivation, and evaluation. Producers who took preventive countermeasures (public relations campaigns and more advanced manure management technology than required for permitting purposes) had success at reducing public relations complaints. The majority of the complainants had a rural background rather than an urban background. Managers indicated that human resource, financial, operations, herd, and strategic management skills were most important to assure a successful expansion.

REFERENCES

- Bartok, J. W. 1993. Will Your Expansion Plans Meet the Zoning Regulations? National Dairy Database.
- Bewley, J., R. W. Palmer, and D. B. Jackson-Smith. 2001. An overview of experiences of Wisconsin dairy farmers who modernized their operations. *J. Dairy Sci.* 84:717–729.
- Brake, J. R., K. E. Jack, W. Menzi, R. A. Milligan, A. M. Novakavic, B. P. Tillapaugh, and G. O. Yarnell. 1994. Your Dairy in Transition. Cornell Cooperative Extension Bulletin. 94–18.
- Erven, B. 1992. Economies of Size Questions for Ohio Dairy Farmers. National Dairy Database.
- Fulhage, C. D. 1997. Manure management considerations for expanding dairy herds. *J. Dairy Sci.* 80:1872–1879.
- Hutt, G. K., R. A. Milligan, T. B. Kauffman, and E. A. Claypoole. 1989. PRO DAIRY Management Resource Workbook. A.E. Ex. 89-22. Cornell University.
- Karszes, J., W. Knoblauch, and L. Putnam. 1998. Five Year Comparison of Same 129 DFBS Farms By Expansion Rate 1993 to 1997. Cornell Farm Business Management and Finance Program.
- Nott, S. B. 1968. Economic restrictions to the Expansion of New York Dairy Farms. Ph.D. Diss. Cornell University, Ithaca, NY.
- Reinhard, S., C. A. Knox Lovell, and G. Thijssen. 1999. Econometric estimation of technical and environmental efficiency: An application to Dutch dairy farms. *Am. J. Agric. Econ.* 81:44–60.
- Sattler, J. 2000. Like a good neighbor, Emerald and Baldwin dairy control odor. *Midwest DairyBusiness*. (April):6–8.
- Stahl, T. J., B. J. Conlin, A. J. Seykora, and G. R. Steuernagel. 1999. Characteristics of Minnesota dairy farms that significantly increased milk production from 1989–1993. *J. Dairy Sci.* 82:45–51.
- Stoll, T. L. 1974. An analysis of the effect of expansion on cash flow, management income, and various management factors. M.S. Thesis. Michigan State University, East Lansing.
- St-Pierre, N. 1998. Herd size and efficiency . . . what the records show. *Hoard's Dairyman*. (August 25):575.
- U.S. Department of Agriculture—National Agricultural Statistics Service. 2000. Agricultural Statistics. U.S. Government Printing Office.
- U.S. Department of Agriculture—National Agricultural Statistics Service. 1978. Census of Agriculture.
- U.S. Department of Agriculture—National Agricultural Statistics Service. 1987. Census of Agriculture.
- U.S. Department of Agriculture—National Agricultural Statistics Service. 1997. Census of Agriculture.
- Yin, R. K. 1994. Case Study Research. Sage Publications, Thousand Oaks, CA.