November 1958 A.E. Res. 10

Pipeline Milking Systems for New York Dairy Farms

Investment, Operating Costs, and Farmer Experience

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SUMMARY

There are some farmers in nearly every county in New York today using pipeline milking equipment. Pipeline milking systems are most numerous in two areas - Southeastern and Western New York. A study of 94 farmers using pipeline equipment in these two areas was made in 1957.

The amount of capital invested in pipeline equipment depends primarily on the type (stall barn or parlor) and size of the system installed. Total investment and investment per cow for the stall barn systems were commonly double those for parlor systems of the same size. The average investment per stall for milking parlor arrangements decreased from $426 on farms with three stalls to $255 on farms with six stalls. On farms with around-the-barn systems, investment per stanchion decreased from $80 on farms with less than 40 stanchions to $65 on farms with over 60 stanchions.

Annual operating costs for pipeline equipment were also about twice as large for stall barn as for parlor systems handling an equivalent number of cows. Most farmers were operating their pipelines at costs between $5 and $15 per cow annually.

Installation of pipeline milking equipment enabled farmers to handle more cows. This was accomplished commonly by increasing the size of herd for the present labor force or by eliminating one hired man and milking the same number of cows.

On a farm with 50 to 60 cows it would be necessary to save 300 hours of labor per year with a milking parlor installation and 600 hours with an around-the-barn system at $1.25per hour to off-set higher costs associated with pipeline equipment. The value placed by a farmer on such items as improved working conditions, more leisure time, and decreased lifting might decrease the savings in time required to justify installing a pipeline milking system in some situations.

Budgets for a 36-cow and a 60-cow dairy were developed to compare original investment, operating costs, and equipment needed if a farmer with a stall barn were considering an around-the-barn system versus a milking parlor with his present barn. The budgets for the parlor systems included the costs for the additional building and milking stalls. The original investment in pipeline equipment was much less for parlor type installations than for an equivalent sized around-the-barn system. However, when the investment for a milking parlor and stalls were included, the total investment was about the same as for around-the-barn systems in the cases of both the 36 and 60-cow dairies. Likewise, operating costs per cow were roughly equivalent in both situations of comparable size. On the basis of both cost and convenience, the possibility of combining a milking parlor with an existing stall barn appears to have great merit.

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INTRODUCTION

During the past ten years large sums of money have been invested by northeastern dairy farmers in equipment for their dairy barns. Gutter cleaners, silo unloaders, and bulk tanks are only a few of these important investments. Now another potential saver of labor and effort is of interest to many dairymen. This is the pipeline milking system.

Since World War II new materials and equipment have become available for the construction of pipelines and equipment to carry milk directly from the cow to the milkhouse. New methods have been developed to clean these pipelines in place. Farmers have learned by experience that pipelines can do a satisfactory job of carrying milk.

Factors Increasing the Interest in Pipeline Milkers

There are probably not many more than 750 pipeline systems in New York State today. Yet, the number of pipeline milking systems has more than doubled in New York in the past three to five years. Bulk milk handling, increased labor costs, good farm incomes, a favorable general price level, and larger farm units are among the factors which have increased interest in pipeline milking.

Purpose of Study

Because of the availability of pipeline milking equipment, many questions have been raised about the place of pipeline milking on commercial dairy farms. Stimulated by these questions, a study was developed to:

(1) Determine the amount of initial investment required for pipeline equipment and its installation for different sizes of herds on commercial dairy farms;

(2) Determine annual operating costs connected with various types and lengths of pipelines;

(3) Evaluate changes in labor efficiency and farm organization which occurred when pipeline milking systems were installed; and

(4) Determine what kinds of problems were connected with the installation and operation of a pipeline system.

Procedure

In order to benefit from the experiences of farmers who were using pipeline milking equipment, a survey of 94 dairy farmers using pipeline

milking systems was conducted during the summer months of 1957. Only farmers who received a major portion of their income from the sale of fluid milk were included in the study. Farms with a major share of their capital coming from outside sources were excluded, as were producer-dealers where part of the income came from retail sales of milk. Records were taken only from farmers who had used their pipeline systems at least one year (since the summer of 1956). Both milking parlor and stall barn arrangements were included in the survey. The type of pipeline known as a transfer system was not appraised.

A list of farmers using pipeline systems was prepared with the help of equipment manufacturers and dealers, county agricultural agents, and farmers with pipelines. There were two areas in the state where pipeline milkers were most numerous - Southeastern and Western New York. Nearly every county of the state had at least one pipeline system on a commercial dairy farm in operation. The number of pipelines identified in 1957 in each county of the state is indicated in figure 1. Since all of the farms with pipelines in the two areas were studied, it was hoped that the variation found from farm to farm would be representative of the common experiences of most Northeastern farmers using pipelines. Milking parlor arrangements predominated in Western New York, while stall barn systems and combination stall barns with milking parlors were most common in the southeastern counties (table 1).

TABLE 1. NUMBER AND LOCATION OF PIPELINES STUDIED BY AREA
(94 New York Dairy Farms, 1957)

Area	Pipeline system for: Milking parlor	Stall barn	Stall barn and parlor	Total
Southeastern	10	22	8	40
Western	35	16	3	54
Total	45	38	11	94

Information was obtained to provide a general description of the type and size of farm business where pipelines were being used. A physical description of the pipeline system, original investment, and operating costs were enumerated. The number of men and time spent in milking before and after the installation of pipeline equipment were estimated. Individual reactions to the equipment and reasons for its installation were recorded.

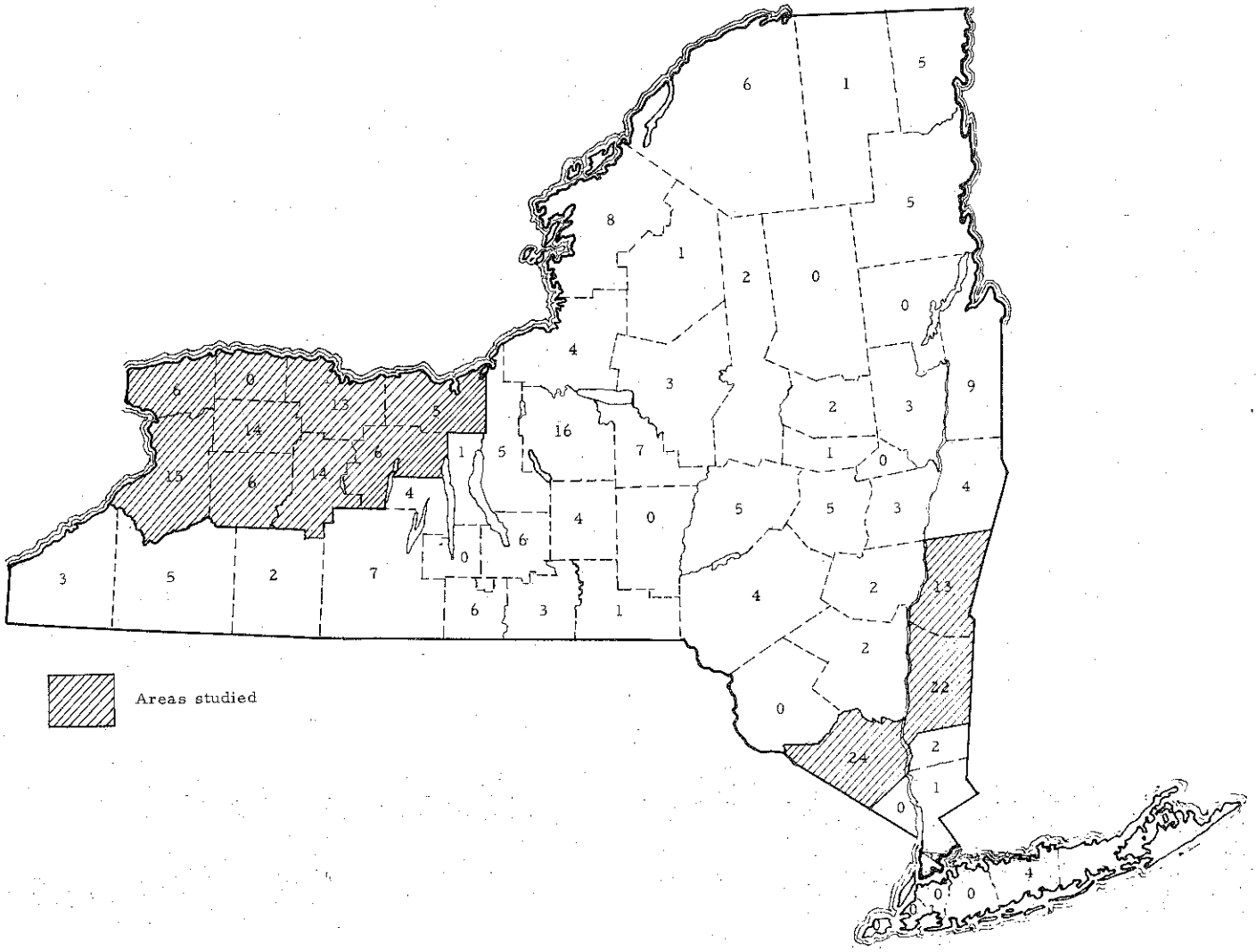


FIGURE 1. DISTRIBUTION OF PIPELINE MILKING SYSTEMS ON COMMERCIAL DAIRY FARMS IN NEW YORK, 1957

Types of Pipelines

The type of pipeline system used most frequently in New York State is installed in a milking parlor in connection with a loose housing arrangement (figure 2). In a milking parlor the cows come to the machine to be milked instead of the machine being taken to the cow. This greatly reduces the number of steps required in the milking operation. The cow stands on an elevated platform which eliminates bending when the machine is put on or taken off.

A milking parlor arrangement may also be used in connection with a stall barn. Cows are released from their individual stalls and move to the parlor for milking. The parlor type arrangement makes it possible for one man to milk more cows. Additional men are often freed from the milking operation to feed, control the movement of the animals, and do other chores.

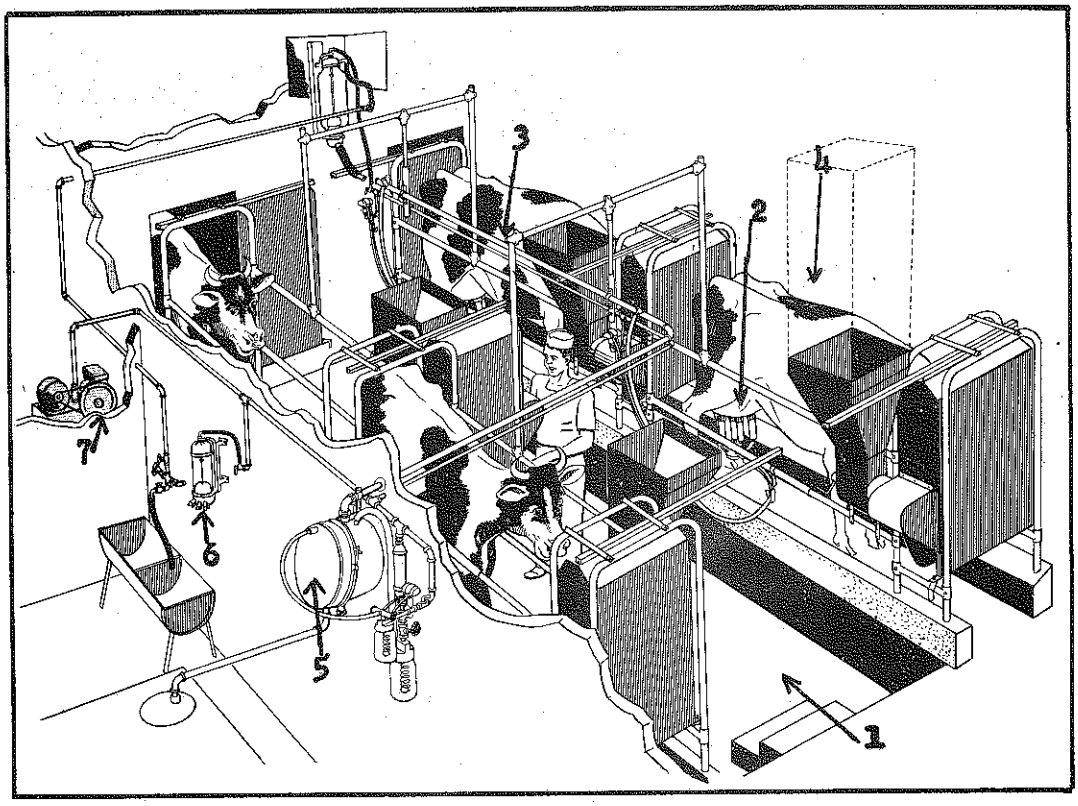
The most common types of stalls used to hold the cows while they are being milked in a parlor are individual side opening, or tandem and lane type stalls. Both types are satisfactory and do not influence the amount of pipeline needed to a great extent. The new herringbone system is creating a great deal of interest and works equally well with pipeline equipment.

Pipelines may also be installed around a stall barn in a manner similar to the vacuum line used for machine milking. This equipment eliminates the steps and lifting involved when milk is carried in pails (figure 3).

For nearly all pipeline milking systems a special claw with long hoses is used to take the milk from the cow to the pipeline. The milking machine pail is eliminated. Other items of equipment commonly used in the system are a milk pump or releaser, an electric motor, pipeline, vacuum pump, washer, and stalls in the milking parlor.

Characteristics of the Farms Studied

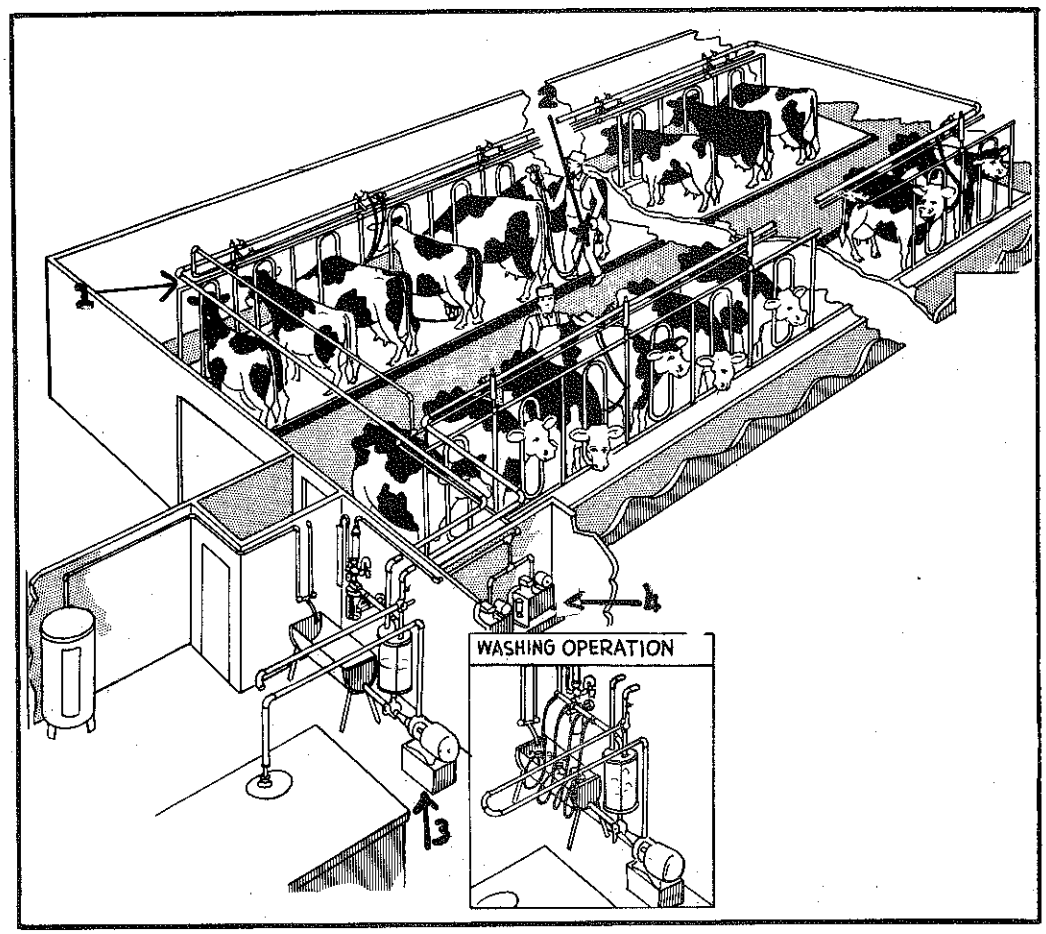
In general the 94 farms studied were larger than average. They ranged in size from a one-man business to one with a man equivalent of 9.5. Most were two or three man operations. Seven of the 94 farms had less than 30 cows in 1956, while 6 of the farms had 90 or more. It was more common for a man to use a pipeline milking system in a milking parlor for a herd of less than 40 cows than was true for those with stall barns.



1. Operator pit
2. Claw with long hose
3. Pipeline
4. Feeder
5. Releaser
6. Unit washer
7. Vacuum pump

FIGURE 2. A PIPELINE SYSTEM IN A MILKING PARLOR

Diagram: Courtesy of Universal Milking Machine Division, National Cooperatives, Inc., Albert Lea, Minnesota



1. Pipeline around the barn
2. Claw with long hose
3. Milk pump (also used for washing operation)
4. Vacuum pumps (2)

FIGURE 3. A PIPELINE SYSTEM IN A STALL BARN

Diagram: Courtesy of Universal Milking Machine Division, National Cooperatives, Inc., Albert Lea, Minnesota

TABLE 2. AVERAGE NUMBER OF COWS IN 1956
(94 New York Dairy Farms With Pipeline Milkers)

Number of cows	Pipeline system for Milking parlor	Stall barn	Stall barn and parlor
Under 30	6	0	1
30 - 39	10	2	2
40 - 49	16	10	3
50 - 59	5	8	1
60 - 69	2	10	1
70 - 79	2	0	2
80 - 89	2	5	0
90 and over	2	3	1
Total	45	38	11

These large farms also had above average rates of production. Nearly two-thirds of these dairymen had sold from nine to twelve thousand pounds of milk per cow in 1956 (table 3). These rates of production have greater significance when compared with what other farmers are doing. In a recent study of the North Country Region of New York State, 90 per cent of the 556 farmers sold less than 9000 pounds of milk per cow. 1/ A similar study in the Central Plain region of New York State showed that 71 per cent of the 371 farmers sold less than 9000 pounds of milk per cow. 2/

Because of their size and high rates of production, these farms had better than average labor efficiency. About 50 per cent of the farms had over 380 work units per man. Over 200,000 pounds of milk were sold per man on fifty per cent of the farms visited. No more than ten per cent of the dairymen in the state achieve this level of efficiency at present.

1/ L. C. Cunningham, North Country Dairy Farming, Part I, Physical and Financial Operation of Commercial Dairy Farms, Department of Agricultural Economics, Cornell University, Ithaca, New York, A. E. 1084, December 1957, p. 14.

2/ L. C. Cunningham, Guides to Farming in the Central Plain Region of New York, Department of Agricultural Economics, Cornell University, Ithaca, New York, A. E. 1035, May 1956, p. 11.

TABLE 3. DISTRIBUTION OF POUNDS OF MILK SOLD PER COW, 1956
(94 New York Dairy Farms With Pipeline Milkers)

Pounds of milk sold per cow	Pipeline system for Milking parlor	Stall barn	Stall barn and parlor
Under 8,000	6	2	2
8,000 - 8,999	4	3	2
9,000 - 9,999	14	8	1
10,000 -10,999	6	11	1
11,000 -11,999	7	8	4
12,000 and over	8	6	1
Total	45	38	11

On all of the farms except two, dairying was the primary enterprise. Forage and grain crops to support the dairy herd were second in importance.

INVESTMENT AND OPERATING COSTS

The installation of a pipeline milking system commonly is a part of or results in a major change in the organization or size of most dairy farms. The initial investment requires considerable capital. In making the decision of whether or not to invest, the important question is, "Will the returns from capital invested in pipeline milking equipment be greater than or equal to the returns from some alternative use of this capital, such as new harvesting equipment, a new silo, or additional cows?"

The initial investment in a pipeline system depends primarily on two factors, the (1) type and (2) size of the system. The amount of glass or stainless steel pipeline is important, and depends primarily on the number of milking stalls in a parlor, or the number of stanchions and their arrangement in a stall barn. Each milking stall requires about eight feet of pipe in a parlor, while each stanchion in a stall barn requires from three and one-half to five feet depending on stall width. Milking parlors nearly always require less pipeline than stall barn arrangements to handle the same number of cows. The distance to the milkroom is important in both cases.

Because less pipeline is used, a smaller vacuum pump is required to operate the same number of milking units in a milking parlor than in a stall barn. Automatic washing equipment, udder washers, and special devices to weigh each cow's milk are optional and may cause a great deal of variation between quoted prices of individual systems.

In this study original investment in pipeline equipment includes the values placed on such items as pipeline, vacuum and milk pumps, milking units, releasers, and special washing equipment, whether old or new. Major changes in wiring, new or additional buildings, and similar investments were not included in the total.

Total investment, investment per cow, and investment per stall or stanchion provide alternative ways of describing the amount of capital needed for a pipeline milking system. Total investment, while easy to understand for a single installation, is not a good measure to use in comparing systems because total investment varies greatly depending on the size of the system, equipment included, and type of pipeline. Investment per cow is a better measure for purposes of comparison. It shows how much capital is required for each producing unit. It is especially useful in picturing capital needs for pipeline systems installed in a conventional stanchion barn. However, because the number of cows milked in parlor systems with the same amount of equipment varies widely from farm to farm, it is less useful in estimating capital requirements for this type of situation. Investment per stall is probably the best measure to describe milking parlor systems.

Total Investment

On the 94 farms studied original investment in stall barn systems averaged nearly $2000 more than for milking parlor arrangements handling about the same number of cows (table 4). However, a milking parlor must be built to house the pipeline equipment, especially if combined with a stall barn, while in a conventional barn with an around- the barn system, only minor building changes are required. The kind of pipe used (glass or stainless steel) did not influence total investment greatly.

The original investment in pipeline equipment varied more for the around-the-barn systems than for the parlor systems. It ranged from $1800 to $6500 for the stall barn installations and from $500 to $2675 for the parlor arrangements. The total investment for milking equipment ranged between $1000 and $2000 for two-thirds of the milking parlor systems. The investment for equivalent equipment in stall barns ranged between $3000 and $4000 in half of the cases.

TABLE 4. DESCRIPTION OF PIPELINE EQUIPMENT
(94 New York Dairy Farms, 1957)

Description	Pipeline system for Milking parlor	Stall barn	Stall barn and parlor
Number of cows	52	65	66
Number of farms	45	38	11
Average number of stalls	5		5
Average number of stanchions		54	
Feet of pipeline	45	274	50
Number of milking units	3.6	4.4	3.6
Proportion of farms with bulk tanks	80%	97%	91%
Original investment, present system	$1488	$3729	$1882
Present value	1216	3055	1485
Original investment in pipeline:			
Per cow	$ 29	$ 58	$ 29
Per stall	286		383
Per stanchion		69	
Pipe per stanchion or stall (ft.)*	9	5	10
Cows per stall	10	1.2	13
Cows per milking unit	15	15	16

* Includes pipeline to milkhouse.

Many of these farmers had some equipment on hand that was used in connection with their pipeline systems. This tended to reduce their initial investment. Such items as the vacuum pump, vacuum line, and stall cocks from the old system were commonly used. Some were also able to obtain sizeable discounts from list price on their new equipment because they were the first farmers in the area to install their systems.

Investment Per Cow

Investment in pipeline equipment was less than $40 per cow on four-fifths of the farms studied with milking parlor arrangements. Only three of the farms with stall barn systems had investments per cow of less than $40. The costs of constructing the milking parlor are not included in these figures. Many of the milking parlors handled from 40 to 60 cows. In these cases the investment per cow usually ranged from $20 to $40 (table 5). In stall barns of similar size most farmers had between $50 and $80 invested per cow. As herd size increased, investment per cow

TABLE 5. ORIGINAL INVESTMENT IN PIPELINE EQUIPMENT PER COW
(94 New York Dairy Farms, 1957)

Investment per cow	Pipeline system for Milking parlor	Stall barn	Stall barn and parlor
$ 0 - 19	7	1	3
20 - 39	29	2	5
40 - 59	5	12	1
60 - 79	4	19	1
80 - 99	0	4	1
Total	45	38	11

decreased (table 6). With little more equipment required to milk an additional 20 to 30 cows in most milking parlors, the decrease in investment per cow was greater for parlor arrangements than for stall barn systems. A larger vacuum pump, additional pipeline, and milking units are required as the size of the herd increases in a stall barn.

Investment Per Stall

Investment is most accurately measured in relation to its capacity. The most useful measure of size for a milking parlor is the number of milking stalls used. Average investment per stall for the 45 farms with milking parlors was $286. The range of investment per stall was from $120 to $770. Much of this variation is due to differences in number of stalls. The investment in equipment such as the vacuum pump, releaser,

TABLE 6. INVESTMENT PER COW AND SIZE OF HERD
(94 New York Dairy Farms, 1957)

Number of cows	Investment per cow for pipeline equipment in: Milking parlor	Stall barn	Stall barn and parlor
39 and under	$ 52	$ 78*	$ 78*
40 - 49	34	70	35*
50 - 59	27	67	**
60 and over	18	55	21*

* Less than five observations.
** No observations.

and washing device is similar whether two or six stalls are used. As the number of stalls increased, the average investment per stall decreased (table 7).

TABLE 7. AVERAGE INVESTMENT PER MILKING STALL
(45 Milking Parlors, 1957)

Number of stalls	Number of farms	Average investment per stall
3	9	$ 426
4	8	356
5	3	292
6	22	252
over 6	3	242

Annual Operating Costs

A dairyman's original investment in new equipment is only the first item of expense. Any investment, no matter how small, may be uneconomical if annual costs are prohibitive. Annual operating costs provide an additional way to appraise the advisability of such an investment.

Fixed costs (depreciation, interest, and insurance) made up about one-half of the annual operating costs for the pipelines studied. Cleaning compound and electricity to heat additional water for cleaning the system made up another 30 percent. Other variable costs include repairs, strainers, other cleaning supplies, and electricity for the vacuum and milk pumps. Total operating costs as discussed here consist of costs connected with the equipment itself, but do not include the labor used in milking or in cleaning the pipeline equipment.

Total annual operating costs for the stall barn systems were double those for the parlor type (table 8). This is due primarily to the higher depreciation and interest charges associated with the greater initial investment. Cleaning compound and additional hot water are other important items which contribute to the higher operating costs of stall barn systems.

TABLE 8. ANNUAL OPERATING COSTS FOR PIPELINE EQUIPMENT
(94 New York Dairy Farms, 1957)

Description	Pipeline system for Milking parlor	Stall barn	Stall barn and parlor
Average number of cows	52	65	66
Number of farms	45	38	11
Number of stalls or stanchions	5	54	5
Feet of pipeline	45	274	50
Original cost of system	$1549	$3729	$1882
Annual costs:			
Depreciation	$ 77	$187	$ 94
Interest	74	183	89
Insurance	4	11	5
Repairs	15	37	19
Cleaning compound	69	104	59
Strainers	29	44	40
Other supplies	12	17	8
Additional electricity:			
Hot water	52	100	44
Motor	13	30	18
Total annual costs	$345	$713	$376
Annual cost per cow	$ 7	$ 11	$ 6
Annual cost per milking unit	97	163	104
Annual cost per stall	66	13	77

Depreciation - Depreciation provides a means for spreading original investment as an annual expense over the lifetime of equipment. It was the largest single cost in operating the pipeline systems of all three types (table 8).

Depreciation was figured using the straight line method over a twenty year period. Twenty years was chosen somewhat arbitrarily since the farmers visited had very little idea as to how long a pipeline system would last. None of the systems had been installed long enough to gain much experience in terms of their expected life. Many farmers felt their systems would become obsolete before they wore out.

Interest - The second largest component of operating costs was interest on the initial investment. Six percent was used to calculate the charge for interest since this was the rate commonly charged farmers for short term loans. Over the life of the equipment this cost would decrease. After ten years, for example, interest would amount to only about half of the amount shown in table 8.

Insurance - Since the investment in pipeline equipment is a major one, most farmers felt they should be fully protected against loss. The insurance coverage on milking equipment was obtained from each farmer and the annual cost calculated using a rate of $4 per thousand.

Repairs - Repairs were estimated at a rate of one percent annually on the original investment. This seemed to be the best way of making this estimate since many farmers had had no repair charges, except for the teat cup liners and other rubber parts for the milking unit. As the equipment becomes older, repairs should be expected to increase just as the charge for interest decreases.

Cleaning compound - A special cleaning compound, usually a strong detergent, is required to insure proper cleaning of pipeline equipment. Since more cleaning compound is required for hard than soft water to do an acceptable job, the mineral content of the water is an important factor in determining costs. Likewise, the more water required, the more compound it takes to make the correct concentration of cleaning solution. This is very important in stall barn systems where a great deal of water is required. The type of cleaning system is also an important factor affecting the amount of water used. The costs reported in table 8 summarize the farmers' actual cash expenditures.

Strainers - Two types of strainers are most commonly used. One type fits into the pipeline before the milk reaches the releaser. The other type is designed to filter the milk from each individual milking

unit before it goes into the pipeline. Both types of strainers must be strong enough to filter milk under pressure. Many farmers used their strainers for more than one milking in order to reduce costs. Farmers' actual expenditures are reported in the table.

Other supplies - These included special cleaning brushes, milkstone remover, and chlorine to sanitize the line. These costs varied with the management practices of the individual farmers. Since no two operators care for their equipment in the same way, these costs vary greatly.

Additional electricity - Farmers were asked how much more hot water was required to clean the pipeline than they had used to simply wash their milking machines and the dairy equipment. Some used over 100 gallons of additional hot water per day. To figure the cost of heating this water, it was estimated that most farmers heat their water to 145° F., or about 90° rise in temperature. One B. T. U. is required to raise one pound of water 1° F. or 90 B. T. U.'s to raise one pound of water 90° F. Using eight and one-third pounds per gallon, it would require 750 B. T. U.'s (90 x 8-1/3) to raise one gallon of water 90° F. One kilowatt hour of electricity equals 2750 B. T. U.'s. Hence, 750/2750 kilowatt hours would be required to raise one gallon of water 90° F. If each kilowatt hour is charged at 2.1 cents, it would cost approximately 0.6 cents (750/2750 x .021) to heat one gallon of water. This factor was used in calculating costs of additional electricity for hot water.

Additional electricity for motors running vacuum pumps or milk pumps was charged at one kilowatt hour per horse power hour used. For example, a 1.5 horsepower motor running for two hours uses three kilowatt hours of electricity under average conditions. Increasing the size of the motor required to operate these pumps was the major item causing variation in this item of operating costs.

Analysis of Costs

Annual operating costs per cow is a good measure to use when comparing different types and sizes of pipeline systems. It indicates how much present costs such as labor will have to be reduced to justify pipeline milking, or how much additional income will be needed to meet the costs of operation if a pipeline milking system is installed. On the other hand, average operating costs per cow should not be used to estimate total operating expenses for pipeline equipment because the number of cows milked may have an important effect on this average.

There was a wide range in operating costs per cow for the three types of systems (table 9). Most of the men with milking parlors had annual

costs of less than $10 per cow. Over half of the men with around-the-barn systems had annual costs between $10 and $15 per cow.

TABLE 9. DISTRIBUTION OF ANNUAL OPERATING COSTS PER COW FOR PIPELINE MILKERS
(94 New York Dairy Farms, 1957)

Annual cost per cow	Pipeline system for		
	Milking parlor	Stall barn	Stall barn and parlor
$ 0 - 4	10	1	3
5 - 9	24	11	5
10 - 14	8	20	2
15 - 19	2	3	1
20 - 24	1	2	0
25 - 29	0	1	0
Total	45	38	11

Annual operating costs per cow decreased as herd size increased (table 10). As the stall barn system became larger, fixed and variable costs both increased, but not proportionately to increases in herd size. On farms with parlor systems as the herd size increased, fixed costs did not change much. Likewise, there was only a slight increase in total variable costs when the number of cows milked was increased. As a result, operating costs per cow decreased quite rapidly to about $5 per cow on the largest farms.

Although the number of farms with stall barns and milking parlor arrangements is limited, the observations available follow the pattern of costs for the loose housing and parlor set-ups (table 10). Operating costs for stall barn systems in each size group average nearly $5 more than the same size group for the parlor set-ups.

TABLE 10. ANNUAL OPERATING COSTS PER COW AND SIZE OF HERD
(94 New York Dairy Farms With Pipeline Milkers, 1957)

Size of herd	Operating costs per cow		
	Milking parlor	Stall barn	Stall barn and parlor
39 and under	$ 11	$ 13*	$ 17*
40 - 49	8	12	8*
50 - 59	6	12	**
60 and over	6	11	5*

* Less than five observations. ** No observations.

USE OF LABOR

Because of steadily increasing wage rates, new methods of improving efficiency are much in demand. In an effort to increase their labor efficiency many farmers are substituting capital in the form of machinery for labor at various spots on their dairy farms. The desire to reduce physical effort in doing most jobs is also important. Mechanization on a modern dairy farm is complex. Consideration of pipeline milking must be related to other needs within a business.

Farmers gave many reasons for installing pipeline equipment. Those mentioned most frequently were directly related to the farm labor situation. In order of importance they were:

(1) improvement in working conditions,
(2) saving time, and
(3) making possible an efficient one-man operation.

Bulk milk handling, improved sanitation and lower labor costs were other important reasons given by farmers for installing pipelines.

A pipeline milking system may improve working conditions by reducing the amount of bending, by eliminating the lifting and carrying of milk, and by making it easier to care for the milking equipment. These conditions usually involve both the farmer and his family, and, often make it easier to keep a good hired man.

To measure the effects of pipeline milking on labor requirements, farmers were asked how many cows they milked, how long it took to do their chores, how long the vacuum pump was running at chore time, and how many men were working in the barn during the sumer and winter months. Insofar as possible, each dairyman indicated this same information for his situation before a pipeline was installed.

In general, current estimates of the time used in milking and feeding, as well as handling and caring for dairy equipment appeared to be quite accurate. Recalling earlier experience was naturally more difficult. Direct comparisions of savings in labor resulting from the change-over to pipelines cannot be made because changes in barn arrangement, milkhouse, and size of herd very often occurred simultaneously. All could have a separate effect on labor efficiency. However, it is of interest that about 15 percent of the men using milking parlors reported no saving of time after installation of their pipelines and 20 percent of those installing systems around stall barns had the same experience. All the rest, 80 to 85 percent of the group, reported definite increases in labor efficiency. The

majority indicated rather modest improvements, from one to three minutes saved per cow per day. However, the total effect of some of the changes, where herd size was doubled and barn layout changed, was very striking. A great deal depended on the kind of job of milking, and organizing that had been done before the change.

Perhaps one of the best ways to see how pipelines were used as an important part of a move toward increasing labor efficiency is to compare the average number of cows milked per man before and after pipeline equipment was installed. All of the change shown in Table 11 is not the result of pipelines, but they helped make it possible.

TABLE 11. AVERAGE NUMBER OF COWS MILKED PER MAN BEFORE AND AFTER INSTALLING PIPELINES
(94 New York Dairy Farms, 1957)

Cows milked per man	Pipeline system in	
	Milking parlor	Stall barn
Summer:		
Before pipeline	18	19
After pipeline	33	23
Winter:		
Before pipeline	20	23
After pipeline	34	27

The above table cannot be used to compare the relative efficiency of milking in conventional stall barns and milking parlors. Herd size was not the same. The nature of the changes made was different in the two sets of situations. It does demonstrate that one man can milk more cows in either type of barn with this equipment. The changes made when milking parlors were installed were usually most striking. Loose housing is more flexible in terms of the number of cows that can be handled. Size of dairy was more commonly increased on farms where milking parlors were used.

Averages don't tell the whole story. Most commonly from 20 to 30 cows were milked per man regardless of the type of pipeline system used (table 12). However, there was again more variation among those using milking parlors. Over half of this group were milking 30 or more cows per man, a few as many as 50. On the other hand, two-thirds of the dairymen with around-the-barn systems were concentrated in the group milking 20 to 29 cows per man.

TABLE 12. COWS MILKED PER MAN, WINTER MONTHS WITH PIPELINE SYSTEMS
(92 New York Dairy Farms, 1957)

Cows milked per man	Type of system	
	Milking parlor	Stall barn
0 - 9	1	0
10 - 19	6	4
20 - 29	17	24
30 - 39	13	6
40 - 49	10	2
50 and over	7	2

Many dairymen dislike washing milking equipment. In-place cleaning of pipelines partially eliminates this chore. Mechanical devices to control the cleaning operation are available for some makes of equipment. All that the operator has to do is put in the cleaning compound and turn on the switch. Other systems are manually controlled, but the washing is done mechanically.

Mechanical cleaning is one way that chore time may be saved with a pipeline system. Other work may be done while the system is being cleaned. Nearly one-half of the farmers visited indicated that they saved time in cleaning their pipeline equipment (table 13).

TABLE 13. CLEANING TIME FOR PIPELINE SYSTEMS
(94 New York Dairy Farms, 1957)

Time per day	Pipeline systems for		
	Milking parlor	Stall barn	Stall barn and parlor
Saves time	21	17	5
No change	14	11	4
More time	10	10	2
Total	45	38	11

Comparing Time Saved and Costs

The number of cows milked per man on farms using pipelines reflect two important ways in which the additional costs which result from installing and using pipelines are met. Merely saving time is not enough to justify owning new equipment, if that time cannot be used to good advantage somewhere else. Either one man must be able to do more productive work or hired labor other than the operator must be eliminated if a pipeline is to pay for itself by reducing labor costs.

The average cost of operating an around-the-barn system in a stall barn for 60 cows was about $700 per year in 1957. If labor were valued at $1.25 per hour, one could say that 560 hours of labor had to be saved by the pipeline system to make it pay. How does one eliminate 560 hours of hired labor? Most dairymen either milk themselves or have a regular, full-time man to do this important job. About the only way to save 560 hours at milking time is to have one less man on the job or have the regular milking crew handle more cows in about the same amount of time as formerly.

The following cases are representative of the most commonly reported experiences of those who had put in pipelines. A young man who wanted to expand his business from 18 to 30 cows or more, but did not want to hire a full-time man, used a pipeline to make the job of milking more cows by himself feasible. A father and son operating a 70-cow dairy with two regular hired men besides themselves, cut down to one regular hired man and now hire day help during the summer whenever needed after installing their around-the-barn system. Three men do the milking and chores during the winter instead of four. In both cases the pipeline system helped to make the changes possible. It was not the only factor involved, but a very important one.

Not everyone had saved labor or was milking more cows after installing a pipeline. In some cases it probably cost more to produce a hundredweight of milk after installing this new equipment. Here, saving one's back or the pleasure of having a new piece of equipment and working less rapidly while milking was balanced against the additional costs of the pipeline.

ESTIMATED INVESTMENT AND OPERATING COSTS FOR 1958

Prices of equipment used in pipeline systems have changed since many of the farmers in this study installed their systems. In order to have some basis for more accurately estimating the size of investments and operating costs for pipeline equipment in 1958, budgets were prepared on four farm situations using current prices.

Nearly all of the farmers who are building loose housing barns today for their dairy herds are installing pipeline milking equipment in their milking parlors. The question of whether or not to consider pipeline equipment in this situation has been pretty well answered already. But the man with a good serviceable stall barn, which he wants to continue to use, has quite a different kind of problem. The possibility of pipeline milking can be viewed by him in two ways. There is the alternative of installing an around-the-barn system which will involve very little change in buildings from his present arrangement. There is also the possibility of building a milking parlor in connection with his stall barn and installing pipeline equipment here. While such an action creates problems of moving cows to the parlor in the winter and involves a new building, it also allows greater flexibility in the number of cows milked and eliminates much of the bending associated with conventional milking. Because these two alternatives for dairymen will stall barns most nearly approximate the position of the majority of New York dairy farmers, the following farm situations were established for study:

Farm #1 - An around-the-barn pipeline system for a 36-cow dairy in a stall barn with two rows of cows facing out. The milkhouse is at the center of the barn with bulk tank installed.

Farm #2 - A milking parlor system for a 36-cow dairy housed in a conventional stall barn with two rows of cows facing out. New buildings for a milking parlor, milking stalls, feeders, and a paved area to hold the cows before they are milked are necessary.

Farm #3 - An around-the-barn pipeline system for a 60-cow dairy in a stall barn with two rows of cows facing out. The milkhouse is at the center of the barn with bulk tank installed.

Farm #4 - A milking parlor system for a 60-cow dairy housed in a conventional stall barn with two rows of cows facing out. New buildings for a milking parlor, milking stalls, feeders, and a paved area to hold the cows before they are milked are necessary.

A letter was sent to pipeline equipment manufacturers selling systems in New York State asking for estimates of the cost of the equipment they would recommend in each of the farm situations. Since the replies to these letters did not contain sufficient data to make an itemized list of the equipment included in the estimates, the sales divisions of these companies were visited to obtain additional information. Investment costs for the building and paved area for the parlor situations were obtained from the Department of Agricultural Engineering at Cornell University. Estimates of operating costs were prepared using procedures and data obtained in the analysis of the 94 farms with pipeline equipment.

Estimates were not prepared for pipeline systems in loose housing and milking parlor arrangements. However, the pipeline equipment should be essentially the same as that required on the two farms adding a milking parlor to their conventional barns.

Milking units, pipeline, vacuum pump and line, a milk pump or releaser, and the accessories to install these items were basic to most systems. A hot water heater of the recommended size was included with all systems, as well as a wash tank and installation charges. Remodeling of the milkhouse and the cost of a bulk tank are not included in total investment for any of these farms. However, the cost of a new milking parlor where required was added into the final total.

Investment

The range in equipment suggested and their respective prices for the four situations was more variable than might have been expected. No one manufacturer provided the lowest or highest estimates for all four situations. In the following tables the actual range in costs of new equipment recommended is listed for each item and a "typical" or average value for total investment is suggested in each case.

TABLE 14. ESTIMATED INVESTMENT IN PIPELINE MILKING EQUIPMENT
(Two Farms With 36 Cows, 1958)

Item	Pipeline system for Stall barn (range)	Pipeline system for Milking parlor (range)
Pipeline (milk)	$ 1150 - 1150	$ 250 - 500
Vacuum line	135 - 300	35 - 60
Vacuum pump and motor	320 - 450	200 - 450
Milking units (3)	280 - 500	300 - 320
Milk pump	--- - 600	--- - ---
Releaser	300 - ---	175 - 260
Cleaning equipment including wash vat	190 - 560	375 - 580
Accessories	175 - 270	50 - 120
Installation	150 - 300	--- - 200
Hot water heater (82 gallons)	150 - 170	150 - 170
Total	$ 2850 - 4300	$ 1535 - 2660
Milking stalls		$ 550 - 570
Building for parlor		1000 - 1700
Paved area (18' x 30')		180 - 240
		$ 3265 - 5170
Average Total Investment	$3500	$4000

TABLE 15. ESTIMATED INVESTMENT IN PIPELINE MILKING EQUIPMENT
(Two Farms With 60 Cows, 1958)

Item	Pipeline system for Stall barn (range)	Pipeline system for Milking parlor (range)
Pipeline (milk)	$ 2050 - 2500	$ 390 - 490
Vacuum line	240 - 350	25 - 60
Vacuum pump and motor	410 - 450	410 - 425
Milking units (4-6)	540 - 600	360 - 600
Milk pump, Releaser, Cleaning equipment including wash vat	1170 - 1750	380 - 1750
Accessories	80 - 100	35 - 100
Installation	200 - 200	75 - 90
Hot water heater (82 gallons)	150 - 150	150 - 150
Total	$ 4840 - 6100	$ 1825 - 3665
Milking stalls		$ 1095 - 1190
Building for parlor		1200 - 2000
Paved area (20' x 50')		400 - 500
		$ 4520 - 7335
Average Total Investment	$5200	$5500

These estimates of the investment required for new equipment and buildings should be reduced where existing equipment such as vacuum lines and pumps can be used in the new system. Because less pipeline and equipment are required in a parlor installation, the total investment including stalls and parlor as well as the pipeline equipment is only $300 to $500 greater than for a pipeline installed around the barn. Considering the long term saving of physical effort this amount of additional initial investment may well be justified. However, personal preference and procedures for moving cows into and out of the parlor are also important considerations.

TABLE 16. COMPARISON OF FOUR PIPELINE MILKING INSTALLATIONS - TOTAL INVESTMENT AND INVESTMENT PER COW, 1958

Number of cows	System for	Typical total investment	Typical investment per cow
36	Stall barn	$ 3500	$ 97
36	Milking parlor	4000	111
60	Stall barn	5200	87
60	Milking parlor	5500	92

Operating Costs

Annual operating costs were estimated for the four budgeted pipeline systems. Operating costs during the first four or five years of use were calculated and annual averaged presented in table 17 and 18. Procedures followed in making these estimates were similar to those used in determining costs on the 94 farms studied in the survey. One should expect interest charges to decrease as the equipment gets older or is paid for. Likewise, repairs might increase over time. The cost of cleaning compound would obviously vary depending on the hardness of water on the farm. All of these "typical" costs are subject to individual interpretation and are at best only guides to what one might expect to happen.

On an annual basis the difference in operating costs between a stall barn system and the milking parlor alternative are surprisingly small. This analysis indicates that under average conditions in New York there is a small cost advantage for a pipeline installed around a stall barn for 36 cows. However, when 60 cows were considered, the cost advantage lies with the milking parlor system. No estimates of labor saved or extra labor required are included in these figures. This is because there is no reliable evidence to show significant differences in the labor requirements for these two alternatives. One can argue that there would be no actual out-of-pocket cost differences since the same labor force would probably milk in either situation.

TABLE 17. TYPICAL ANNUAL OPERATING COSTS FOR PIPELINE MILKING EQUIPMENT ON TWO FARMS WITH 36 COWS, 1958

Item	Stall barn system	Milking parlor system
Fixed costs:		
Depreciation	$ 175	$ 100
Interest	105	65
Insurance	15	10
Repairs	35	20
Variable costs:		
Cleaning compound	70	50
Strainers	25	25
Other supplies	20	15
Electricity:		
Additional for hot water	60	40
Milk pump	10	0
Vacuum pump	20	20
Total	$ 535	$ 345
Operating costs on parlor:		
Depreciation		$ 100
Interest		65
Insurance		10
Repairs		20
Total Operating Costs	$ 535	$ 540

TABLE 18. TYPICAL ANNUAL OPERATING COSTS FOR PIPELINE MILKING EQUIPMENT ON TWO FARMS WITH 60 COWS, 1958

Item	Stall barn system	Milking parlor system
Fixed costs:		
Depreciation	$ 260	$ 135
Interest	165	80
Insurance	25	15
Repairs	50	25
Variable costs:		
Cleaning compound	100	70
Strainers	40	30
Other supplies	25	25
Electricity:		
Additional for hot water	100	50
Milk pump	20	0
Vacuum pump	40	30
Total	$ 825	$ 460
Operating costs on parlor:		
Depreciation		$ 150
Interest		95
Insurance		15
Repairs		30
Total Operating Costs	$ 825	$ 750

TABLE 19. TYPICAL ANNUAL OPERATING COSTS PER COW (Four Farm Situations, 1958)

Number of cows	System for	Total annual costs	Average costs per cow
36	Stall barn	$ 535	$ 14.85
36	Milking parlor	540	15.00
60	Stall barn	825	13.75
60	Milking parlor	750	12.50

CONCLUSIONS

The number of pipeline milking systems in New York State has been increasing rapidly in the last five years. Indications are that they will continue to increase in the future as large size farm units and bulk tanks become more common. Farm incomes will also influence the number of pipeline systems installed.

Large farms have a comparative advantage over smaller ones with pipeline milking systems. Investment and operating costs per cow decrease as size of herd increases, especially with a parlor system. As the amount of milk sold increases, the cost of owning pipeline equipment per hundredweight decreases.

Farmers with conventional stall barns should not overlook the possibility of a milking parlor system to go with their present barn, if a feasible method of moving the cows at milking time can be worked out. The budgeted farm situations indicate that a milking parlor system including the parlor investment may be installed for approximately the same initial investment as a pipeline system around a stall barn. The milking parlor system had some advantages that must not be overlooked. One man can milk more cows with less bending and fewer steps. A milking parlor has greater flexibility since a few more cows can readily be milked without any change in the system. The stall barn need not be used during the pasture season, thus summer chores are reduced.

Operating costs for a stall barn or parlor system will range from $350 to $750 per year for a 36-cow dairy and from $500 to $1200 per year for a 60-cow farm. Data from the survey indicate that a pipeline system may save sufficient time to justify these costs by making it possible to increase the size of the herd or reduce the labor force. Improved working conditions are also an important consideration.

A pipeline milking system may make a larger sized one-man business possible. One man can milk at least 30 cows with a pipeline system. On farms with more than one full time man more cows can be kept or part time help may replace a regular man if a pipeline system is installed.

It appears that as improvements in pipeline equipment take place, pipeline milking will become more common on New York dairy farms. Farmers who have the capital for the initial investment will use pipeline milking systems to improve working conditons, and, in many cases, their labor efficiency.