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To the Graduate Council:

I am submitting herewith a thesis written by GonZalee Martin entitled "Structural changes in the dairy industry in Tennessee." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

James G. Snell, Major Professor

We have read this thesis and recommend its acceptance:

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a thesis written by GonZalee Martin entitled "Structural Changes in the Dairy Industry in Tennessee." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

James G. Snell, Major Professor

We have read this thesis
and recommend its acceptance:

S. Darrell Manley

Larry C. Morgan

Accepted for the Council:

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Vice Chancellor
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STRUCTURAL CHANGES IN THE DAIRY INDUSTRY IN TENNESSEE

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee

GonZalee Martin

August 1975

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ABSTRACT

The objective of this study was to describe the structure of the producer, processor, and to a lesser degree, the consumer sectors of the Tennessee dairy industry. Information concerning the structure of the sectors would be of benefit to the dairy industry as well as policymakers.

Various historical trends on selected variables were evaluated, described, and summarized for the different sectors. Secondary data were used for the most part, originating primarily from census and industry sources, milk marketing administrators, and previously published research.

The dairy production sector in Tennessee was characterized by the following: a reduction in total number of dairy farms in the last 15 to 20 years, relatively stable total milk production, a decline in total cow numbers during the same period with increased milk production per cow, a steady increase in total cash receipts from farm marketing of milk and cream, and an increased proportion of total milk sales originating from commercial dairy farms. Other characteristics included an increase in average herd size and a trend toward fewer but larger farms with greater average gross sales per farm and greater acreage per farm. The dairy farm tenure

patterns indicated a slight trend to increased ownership status by dairy farm operators where full or part ownership included 92 percent of all dairy farm operators in 1969.

The processing sector was characterized by a general decline in the number of fluid milk processing plants and in manufacturing milk plants. However, total plant capacity and output from 1954 to 1975 increased during this period with corresponding increases in labor productivity and value added per man-hour.

The demand sector was described by indicating the number and location of milk marketing orders in the state, the utilization of producer milk in the state and the regional milk markets in the United States. The estimated demands for fluid milk and frozen dessert for 1980 were presented. Demand was expected to grow, indicating the possibility of a need for expansion of the Tennessee dairy industry.

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CHAPTER I

INTRODUCTION

The Dairy Industry has been an industry which has undergone continual and substantial change. During the period 1950 to 1959, the number of dairy farms in Tennessee declined 43 percent with most of the decrease in the number of farms coming from farms with only 1-2 cows.[1] Further changes during the 1950-60 period included a decline in the number of milk cows (21 percent) and an increase in output per cow (29 percent).[2] The year-to-year changes in the number of cows and production per cow brought about a fluctuating total milk production in Tennessee ranging from approximately 95 percent to 105 percent of the 1949-1951 mean milk production. Changes have also occurred in the processing sector with the number of dairy plants declining and sales per plant increasing.[3]

On the national level some recent trends have been[4]:

---

[1]S. P. Parry and D. G. Greiner, Changes in the Structure of the Tennessee Dairy Industry, The University of Tennessee Agricultural Experiment Station, Bulletin 348, August 1962, p. 7.

[2]Ibid., pp. 8 and 9. [3]Ibid., p. 17.

[4]The following section has been taken from the United States Department of Agriculture, Dairy Situation, ERS, July, 1974, p. 13.

1. The number of plants manufacturing dairy products has continued to decline in the United States but average output per plant has gained sharply. In 1972 some 3,300 plants that were manufacturing dairy products were down almost half from the 6,100 plants operating in 1961.

2. Technological development and changes in the dairy manufacturing plants have increased the capital requirements and the optimum volume per plant. According to a report by Miller and Miller, significant economies of size in dairy processing is a major factor in the continuing trend to fewer but larger dairy plants. Larger manufacturing plants properly managed can achieve lower per unit operating costs than smaller plants.

3. Labor productivity increased more in dairy plants than in other food processing plants from 1960 to 1972. Also, output per man-hour rose 60 percent in dairy manufacturing plants according to Miller and Miller.

4. Cheese manufacturing has been characterized by small family operations. But with the development and adoption of new devices and techniques in the last few years, cheese making now requires more capital and a larger plant size to be economically efficient.

5. Innovations in transportation and storage of raw milk have helped to make larger plants feasible. These changes have facilitated gathering larger volumes

of milk in a given plant.

A. The development of larger regional dairy cooperatives has brought together volumes of milk sufficient to warrant large size processing operations.

B. Changing demand for dairy products has likely affected trends in plant numbers. Lower butter usage and production means fewer butter plants are needed to provide the United States output.

C. Rising labor costs and reduced flexibility in the use of labor have caused adjustments to be made in order to increase output per man-hour. Mechanization has been one of the most common adjustments. For several reasons this adjustment has been most advantageous to large-scale operations. Equipment costs per unit commonly are lower in larger operations.

Economic conditions have changed drastically since 1972. Feed costs have increased, petroleum products have increased in price, milk prices increased into 1973, then fell. The above factors accelerated some of the changes occurring in the dairy industry. The changes occurring in the dairy industry in Tennessee may have significant impact on the performance of the Tennessee Dairy Industry. Information concerning the changes would be of benefit to the industry as well as to policymakers.

Objective

The objective is to describe the structure of the producer, processor, and to a lesser degree, the consumer sectors of the Tennessee Dairy Industry.

CHAPTER II

PRODUCER SECTOR

Number of Farms

There was a substantial reduction in the number of farms with dairy cows (-72 percent) during the period 1959 to 1969 (Table 1). The largest reduction occurred in the number of farms reporting 1-4 milk cows (-78 percent) with the smallest reduction in numbers of farms on those farms with 20 or more cows (-14 percent).

The bulk of the decline in number of farms with dairy cows came from farms which apparently produced milk for home consumption or used dairy cows to produce calves. In 1969 only 40 percent of those farms with dairy cows sold milk and cream off the farm while 27 percent were classified as commercial dairy farms[1] (Table 2). The general conclusion is that while the number of farms with dairy cows declined substantially during the 1959-69 decade, dairying is increasing in economic importance on

---

[1]A farm is classified as a commercial dairy farm if (1) 50 percent or more of the total value of all farm products sold was dairy products or (2) if (a) dairy products sold accounted for more than 30 percent of the total value of product sold; (b) milk cows represented 50 percent or more of total cows; or (c) the value of dairy products sold plus the value of cattle and calves sold amounted to 50 percent or more of the total value of all farm products sold.

Table 1. Number of Farms Reporting Milk Cows and Percentage Change in Number of Farms Reporting Milk Cows, by Herd Size, Tennessee, 1959, 1964, and 1969

Number of Milk Cows	Number of Farms Year 1959	1964	1969	Percent Change from 1959-1964	1959-1969
1-4	62,869	33,820	13,742	-46	-78
5-9	13,686	9,544	4,018	-30	-71
10-19	7,129	5,281	3,558	-50	-26
20 and over	4,433	4,286	3,823	-3	-14
Totals	88,137	52,931	25,141	-40	-72

Source: United States Department of Commerce; Census of Agriculture, Vol. 31, pt. 1, 1959, 1964, 1969, Bureau of the Census, Washington, D. C.

Table 2. Total Number of Farms with Dairy Cows, Total Number of Farms Selling Milk and Cream and Total Number of Commercial Dairy Farms, Tennessee, 1959, 1964, and 1969

Totals	Year			Percent of Total		
	1959	1964	1969	1959	1964	1969
Farms with dairy cows	88,137	52,931	25,141	100	100	100
Farms selling milk and cream	38,211	22,769	9,988	43	43	40
Commercial dairy farms	9,642	10,133	6,806	11	19	27

Source: United States Department of Commerce, Census of Agriculture, Vol. 31, pt. 1, 1959, 1964, 1969, Bureau of the Census, Washington, D. C.

an increasing percentage of many farms in that many of the remaining farms are becoming larger in term of herd size.

The trend toward decreasing number of dairy farms has apparently continued. The Federal Milk Market Administrators report a total of 8,457 milk producers who sold milk in Tennessee as of January 1975.[2] Approximately 29 percent of the dairy farms were Grade A producers; the remaining 71 percent were manufactured milk producers (see Figures 1 and 2). It was reported in the 1969 Census of Agriculture that 9,988 milk producers sold milk. It would appear then that Tennessee has lost approximately 1,500 producers during the period 1969 to 1975.

Milk Production and Number of Milk Cows

Total milk production was quite stable during the period 1960 to 1972 even in the face of constantly declining cow numbers (Figure 3 and Table 3). The stability in total milk production with decreasing cow numbers was possible by continual increases in production per cow. Genetic improvement undoubtedly contributed to increased production per cow; however, the general conclusion was

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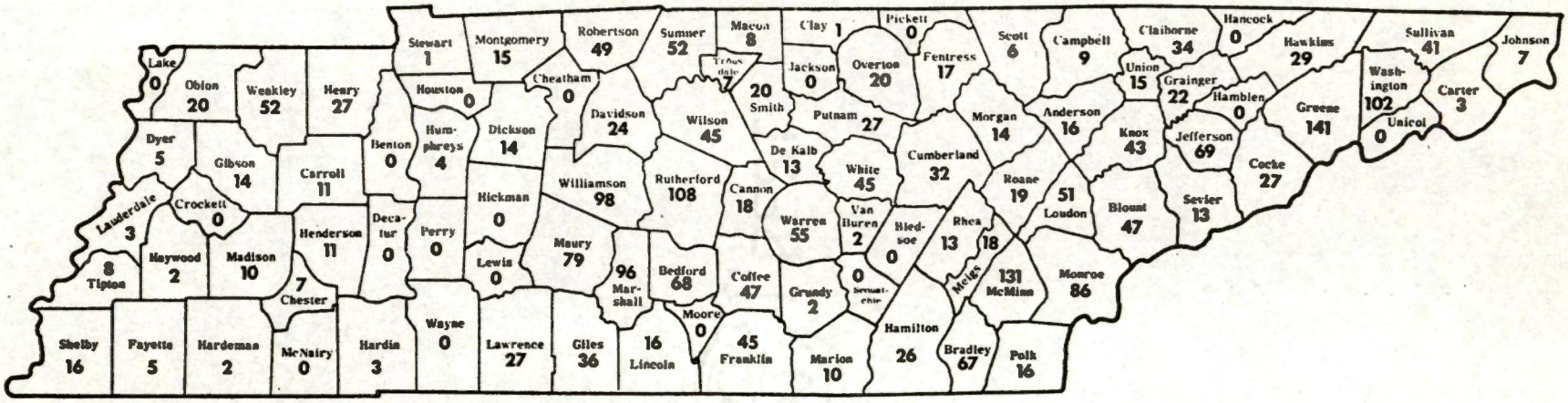
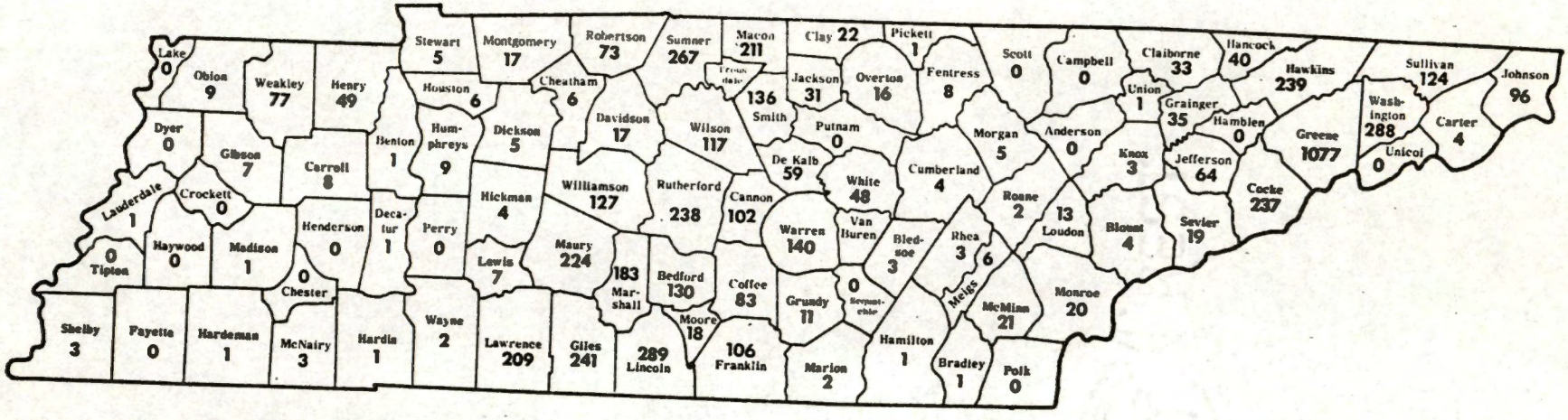
[2]Obtained through personal contact with Milk Market Administrators. The data are too limited to ascertain how many of the 8,457 dairy farms were commercial dairy farmers.



Total - 2423

Figure 1. Grade A Milk Producers, Tennessee, January, 1975

Source: Federal Milk Market Administration, Knoxville, Tennessee (personal communication).



Total = 6033

Figure 2. Manufactured Milk Producers, Tennessee, January, 1975

Source: Federal Milk Market Administration, Knoxville, Tennessee (personal communication).

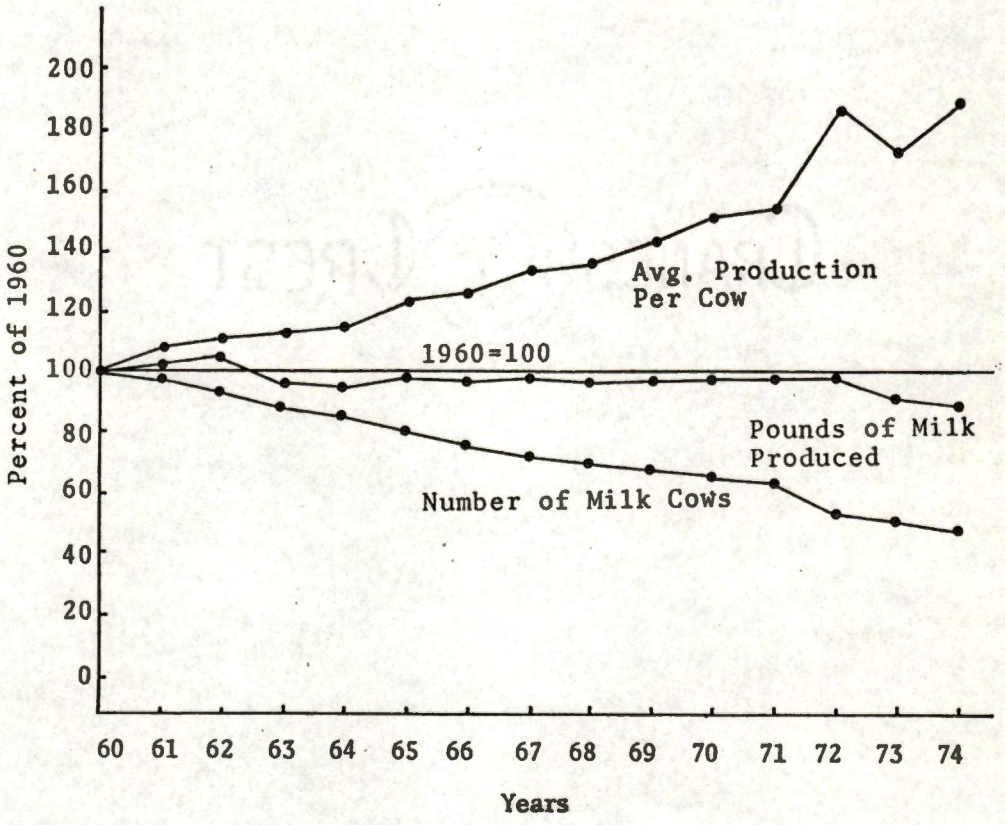


Figure 3. Number of Milk Cows, Pounds of Milk Produced, Average Production Per Cow as a Percent of 1960, 1960 to 1974.

Table 3. Number of Milk Cows on Farms, Percentage of 1960, Pounds of Milk Produced on Farms, Percentage of 1960, Mean Production Per Cow, and Percentage of 1960, Tennessee, 1960 to 1974

Year	Number of Milk Cows (000)	% of 1960	Pounds of Milk Produced on Farms (000,000)	% of 1960	Mean Production Per Cows in Pounds	% of 1960
1960	477	100	2,194	100	4,600	100
1961	461	97	2,277	101	4,939	107
1962	448	94	2,262	103	5,049	110
1963	426	89	2,173	99	5,101	111
1964	409	86	2,106	96	5,149	112
1965	387	81	2,171	99	5,610	122
1966	369	77	2,122	97	5,751	125
1967	348	73	2,144	98	6,161	134
1968	338	71	2,115	96	6,257	135
1969	318	67	2,104	96	6,616	142
1970	307	64	2,123	97	6,915	150
1971	302	63	2,122	97	7,026	153
1972	255	54	2,161	99	8,475	184
1973	244	51	1,982	90	8,123	175
1974	218[a]	46	1,982[a]	86	8,679	187

[a]Preliminary.

Source: United States Department of Agriculture and Tennessee Department of Agriculture, Tennessee Agricultural Statistics Annual Bulletin, Tennessee Crop Reporting Service, August, 1974.

that the cows being culled were relatively low producers from small, inefficient operations.

In 1973, milk production per cow dropped for the first time in approximately 20 years.[3] While cow numbers continued to drop between 1972 and 1973, the rate of decline was quite steady. This drop in total production and production per cow has been attributed to a reduction in the feeding rate brought about by relatively high feed costs. Production per cow regained its general upward trend in 1974 but total production continued to decline in 1974 as did cow numbers.

Simple regressions were run on cow numbers, pounds of milk produced and mean production per cow. The results were as follows:

Cow numbers = 498 - 18.039 (Time).

Pounds of milk produced = 2,264 - 16.7 (Time).

Mean production per cow = 4,002 + 286.8 (Time).

Where Time was defined as: 1960 = 1, 1961 = 2, etc.

The conclusion of this simple analysis is that cow numbers have been declining by approximately 18,000 head per year, total milk production has declined by

---

[3]S. P. Parry and D. G. Greiner, Changes in the Structure of the Tennessee Dairy Industry, Bulletin 348, August, 1962, pp. 3, 6, 9. Their Figure 2, p. 9, shows a continual increase in production per cow from 1954 to 1961.

16.7 million pounds per year and that mean production per cow increased by 286.8 pounds during the 15-year period.

Milk production by months for the years 1960 to 1974 is shown in Table 4. These data show evidence of decreased seasonality of production as well as a slightly declining total yearly milk production. The percentage deviation by years from the total period mean ranged from a +2 percent to a -2 percent with the exception of 1961, 1962 and 1973 (Table 5). The decrease in seasonality of production is supported by the standard deviation of the monthly production by years in that these standard deviations show a rather strong downward trend for the period. The conclusion is that the movement toward more efficient operations has apparently decreased the seasonality of production.

Cash receipts from farm marketing of milk and cream have climbed from 1965 to 1973 (Figure 4). However, the data in Table 6 indicate that dairy is losing in importance in terms of total crop and livestock receipts (columns 2 and 5) and livestock receipts (columns 3 and 6). In 1973 dairy fell to only 11.4 percent of total crop and livestock from a high of 17.3 percent in 1968. In the livestock sector dairy fell to 19.9 percent in 1973 and from 28.9 percent in 1968. The indication is that

Table 4. Milk Production: Total Milk Produced on Farms, by Months, Tennessee, 1960-1974

Year	Months												
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
	Million Pounds												
1960	147	136	155	183	220	215	223	223	203	180	160	149	2,194
1961	138	133	167	199	236	228	237	239	213	187	150	150	2,217
1962	148	143	168	197	226	219	232	226	198	193	161	151	2,262
1963	148	134	159	193	218	215	223	220	200	175	147	141	2,173
1964	140	136	156	176	206	201	207	212	198	173	153	148	2,106
1965	149	138	163	193	217	213	217	211	190	176	154	150	2,171
1966	148	136	160	185	210	204	201	201	191	177	155	154	2,122
1967	153	138	161	197	215	206	205	201	184	177	154	153	2,144
1968	154	148	162	188	207	201	197	194	183	175	156	150	2,115
1969	148	143	162	190	206	197	193	190	183	176	159	157	2,104
1970	152	146	166	190	207	198	194	191	185	175	159	160	2,123
1971	153	141	164	192	205	194	192	190	182	179	166	164	2,122
1972	150	144	168	199	214	198	196	192	184	184	167	165	2,161
1973	154	136	168	191	203	192	175	166	160	150	145	142	1,982
1974[a]	139	132	168	173	179	173							

[a]Preliminary.

Source: United States Department of Agriculture and Tennessee Department of Agriculture, Tennessee Agricultural Statistics Annual Bulletin, T-11, Tennessee Crop Reporting Service, August, 1973.

Table 5. Percentage Deviation from the 1960-1973 Mean Production and the Standard Deviation Based on Monthly Data, by Years, Tennessee, 1960-1973

Year	Percent Deviation from the Total Period Mean[a]	Standard Deviation in (000,000 Lbs.)
1960	+2	32
1961	+6	41
1962	+5	33
1963	+1	34
1964	0	28
1965	-1	30
1966	-1	25
1967	0	26
1968	-1	21
1969	-2	21
1970	-1	22
1971	-1	19
1972	+1	21
1973	-8	22

[a]Mean for 1960 to 1973 = 2,147 million pounds of milk.

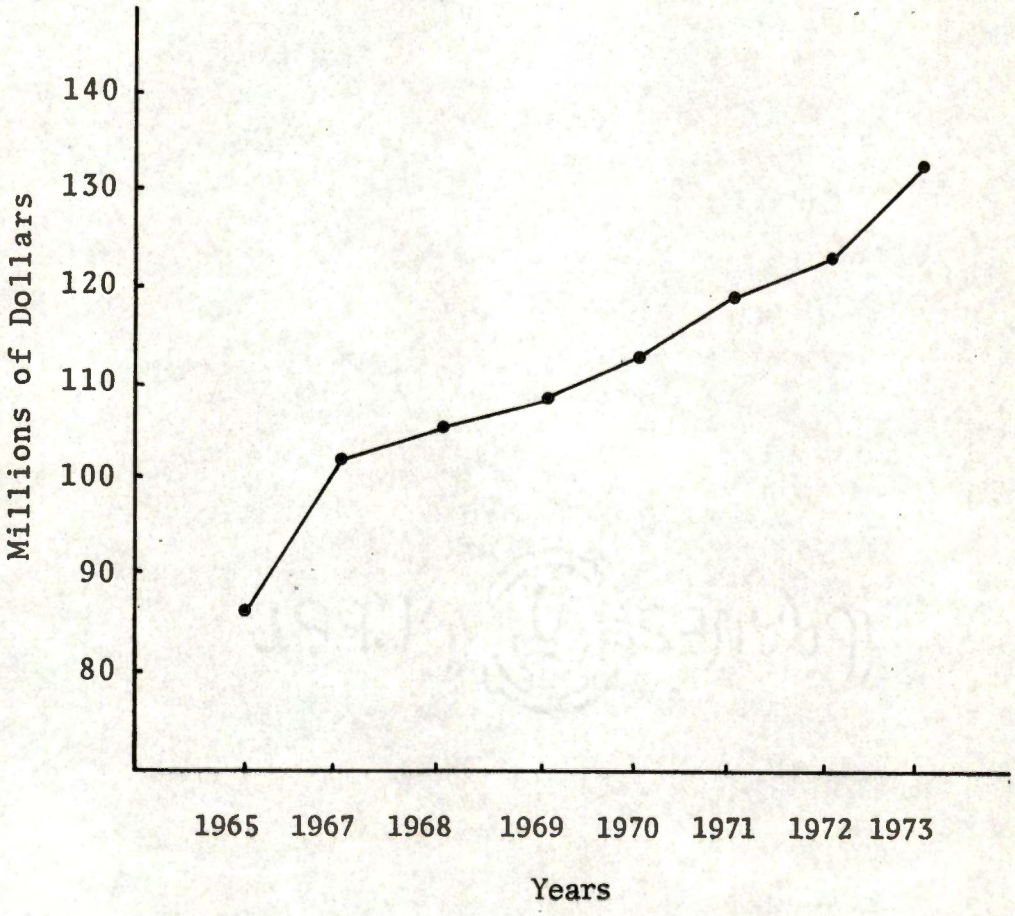


Figure 4. Cash Receipts from Farm Marketings of Milk and Cream (Tennessee), 1965-73.

Source: United States Department of Agriculture, Dairy Situation, ERS, May, 1974, p. 13.

Table 6. Cash Receipts from Farm Marketing of Crops and Livestock, Livestock, Dairy, and Dairy Products, 1965 to 1973

Year	Livestock (000 $)	Livestock (000 $)	Dairy (000 $)	Dairy as a % of Crops and Livestock %	Dairy as a % of Livestock %
1965	606,700	306,960	89,520	14.8	29.2
1966	601,351	345,804	97,282	16.2	28.1
1967	603,407	359,323	102,266	16.9	28.5
1968	615,875	371,924	106,329	17.3	28.9
1969	673,432	414,176	109,300	16.2	26.4
1970	702,541	434,518	113,320	16.1	26.1
1971	741,322	421,780	115,466	15.6	27.4
1972	832,561	516,774	123,014	14.8	23.8
1973	1,164,225	668,532	132,966	11.4	19.9

Source: United States Department of Agriculture and Tennessee Department of Agriculture, Tennessee Agricultural Statistics Annual Bulletin, T-1 through T-11, Tennessee Crop Reporting Service, August, 1973.

while the dairy sector is quite important to Tennessee agriculture it is losing relative to other agricultural sectors.

Commercial Dairy Production

The previous discussion has been on aggregate data. Detailed data are available from the Census of Agriculture for commercial dairy farms. The point that commercial dairy farms are of the primary economic importance is illustrated by the fact that 92 percent of all milk sales comes from 6,806 commercial dairy farms (Table 7). The remaining 3,182 farms whose operations sell dairy products received only 8 percent of the total revenue from selling dairy products. With this in mind, the remainder of the section will focus on commercial dairy farms.

Herd Size--Economic Class[4]

Average herd size has increased during the period

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[4]Classes: Class I - $40,000 or more of farm product sales; Class II - $20,000 to $39,999 of farm product sales; Class III - $10,000 to $19,999 of farm product sales; Class IV - $5,000 to $9,999 of farm product sales; Class V - $2,500 to $4,999 of farm product sales or having a value of products sold of less than $2,500 provided they had the acreage or livestock operation which normally would have had excess of $2,500. These would include new farm operations, farm having crop failure, and farms with large inventories and small 1969 sales.

Table 7. Commercial Reports

Items	Year 1959	1964	1969
Farm reporting dairy cows	88,137	52,931	25,141
Number of farms selling milk and cream	38,211	21,913	9,988
Commercial farms selling milk and cream	9,642	493	6,806
Pounds of milk sold (millions)	1,597	1,732	NA[a]
Revenue from selling milk (million dollars) all farms	62	75	96
Revenue from selling milk, commercial dairy farms (million dollars)	44	63	89
Percent milk sales from commercial dairy farms is of total milk sales	70	84	92

[a]NA = not available with comparable data.

Source: United States Department of Commerce, Census of Agriculture, Vol. 31, pt. 1, 1959, 1964, 1969, Bureau of the Census, Washington, D. C.

1959-1969. The number of farms with less than 50 cows per farm decreased ranging from a decrease of 79 percent in farms with 1-9 cows to a decrease of 12 percent in farms with 30-49 cows (Table 8). Farms with more than 50 cows increased in number. Farms with 50-99 cows increased by 58 percent, and farms with more than 100 cows increased 171 percent.

As might be expected with increasing herd size, the percentage of farms in Classes III, IV and V declined in number during the 1959-1969 period while farms in Classes I and II increased in number (Table 9).[5]

These data indicate that the general trend toward fewer but larger dairy operations in commercial dairy farms is similar to the trend in all dairy farms.

Tenure of Farm Operator

There was little change in the tenure status of dairy farm operators between 1959 and 1969. Sixty-two percent of the operators were full owners in 1959 as opposed to 64 percent for 1969. The percentage of dairy farm operators who were part owners increased from 26 percent in 1959 to 29 percent in 1969. Dairy farm

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[5]The large percentage increases are due to the fact that there were few large dairy operations in 1959. The change in absolute numbers of farms is still quite significant.

Table 8. Percentage Change in the Number of Commercial Dairy Farms, by Herd Size, Tennessee, 1959 to 1964 and 1959 to 1969

Number of Milk Cows	Percent Change from 1959 Year	
	1964	1969
1-9	0	-79
10-19	+8	-24
20-29	-12	-30
30-49	0	-12
50-99	+38	+58
100 or more	+90	+171

Source: Data from which this table was constructed can be found in the Appendix, Table 26, page 58.

Table 9. Percentage Change in the Number of Dairy Commercial Farms, by Economic Class, Tennessee, 1959 to 1964 and 1959 to 1969

Year	Total	Economic Class I	II	III	IV	V
1964	+2	+213	+66	+32	+9	0
1969	-32	+968	+200	-10	-30	-50

Source: Data from which this table was constructed can be found in the Appendix, Table 26, page 58.

operators who were tenants decreased from 11 percent in 1959 to 8 percent in 1969. These changes do, however, indicate a slight trend to ownership status by dairy farm operators (Table 10).

Farm Size in Acres

There has been little change in the distribution of commercial dairy farms by size of farms in acres (Table 11). It appears, however, that there is a slight trend toward larger farms as shown by the slight decrease in the percentage distribution in farms of less than 140 acres and a slight increase in the percentage distribution in farms over 260 acres.

Table 10. Tenure of Farm Operator by Number of Farms and Percentage Distribution of Tenure, Tennessee, 1959, 1964, and 1969

Tenure	1959		1964		1969	
	Number of Farms	Percent of Total Farms	Number of Farms	Percent of Total Farms	Number of Farms	Percent of Total Farms
Full owner	5,984	62	6,161	61	4,347	64
Part owner	2,484	26	2,934	29	1,983	29
Tenant	1,088	11	988	10	476	8
Totals	9,556	100	10,083	100	6,806	100

Table 11. Percentage Distribution of Farm Size by Number of Acres, 1959, 1964, and 1969

Number of Acres	Percents Year 1959	1964	1969
1-9	1.1	.9	1.7
10-49	8.9	10.2	6.4
50-99	24.1	24.6	22.4
100-139	19.4	17.4	17.3
140-179	13.2	12.2	13.4
180-219	9.4	8.8	10.4
220-259	6.6	9.1	6.4
260-499	13.6	12.7	15.8
500-999	3.2	3.5	5.3
1000-1999	.5	.5	.8
2,000 or more	.1	.1	.1
Totals[a]	100.1	100.0	100.0

[a]Totals may not equal 100 due to rounding error.

Source: Data from which this table was constructed can be found in the Appendix., Table 27, page 59.

CHAPTER III

DEMAND SECTOR

Milk Marketing Orders

Federal milk orders are operating in most of the fluid milk marketing areas of the United States. According to the report by the Dairy Division Consumer and Marketing Service about 80 percent of the milk eligible for fluid use is marketed under the terms of these orders.[1]

Fluid milk, chiefly milk used for bottling, flows from dairy farmers to consumers through a vast channel work of modern production, processing and distribution. The supply of milk cannot easily be turned on and off to fit the supply of milk to the demand; the marketing system often runs into trouble with milk prices. At times, marketing conditions result in wildly fluctuating prices which work unnecessary hardships, both on those who depend on milk for a living and on those who depend on it for food.

There was a decrease in the number of federal order markets during the period 1960 to 1973 (Table 12).

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[1]Questions and Answers on Federal Milk Marketing Orders by the Dairy Division, Consumer and Marketing Service, United States Department of Agriculture, October, 1971.

Table 12. Measures of Growth in Federal Milk Order Markets, Selected Years 1960-1973, United States

Year	Number of Markets	Population of Federal Milk Marketing Areas in Thousands	Number of Handlers	Number of Producers	Receipts as Percentage of Milk Sold to Plants and Dealers		Daily Deliveries Per Producer in Lbs.
					Fluid Grade	All Milk	
1960	80	88,818	2,259	189,816	64	43	648
1961	81	93,727	2,314	192,947	67	45	704
1962	83	97,353	2,258	186,468	70	47	761
1963	82	100,083	2,144	176,477	70	48	821
1964	77	99,333	2,010	167,503	70	48	888
1965	73	102,351	1,891	158,077	70	48	944
1966	71	98,307	1,724	145,964	70	48	994
1967	74	103,566	1,650	140,657	70	49	1,056
1968	67	117,013	1,637	141,620	74	52	1,089
1969	67	122,319	1,628	144,275	77	56	1,164
1970	52	125,358	1,566	143,400	81	59	1,244
1971	62	NA[a]	1,529	141,347	NA	60	1,316
1972	61	NA	1,487	136,881	NA	60	1,372
1973	61	NA	1,355	131,566	NA	60	1,386

[a]NA = not applicable.

Source: Questions and Answers on Federal Milk Marketing Orders by the Dairy Division, Consumer and Marketing Service, United States Department of Agriculture, October, 1971.

This does not represent a decrease in the quantity of milk being marketed under federal regulation but a consolidation of marketing orders. Also the number of handlers and producers have declined in the federal order markets. The percentage of milk sold going into fluid uses has increased as has the mean daily deliveries by producers.

Tennessee has five federal orders. They are Appalachian, Chattanooga, Knoxville, Memphis and Nashville (Figure 5). Its Appalachian order contains only three Tennessee counties while the Nashville order (the largest) has 35 counties. There appears to be no significant difference between the federal order counties of the state and those counties not in a federal order. The possible exception is the area of Lincoln, Franklin, and Moore counties which have a slightly heavier concentration of manufacturing grade milk producers. In this area 85 percent of the producers produce manufacturing milk compared to approximately 70 percent for the state. Lincoln County also has four processing plants which helps account for the heavier concentration of manufacturing milk producers.

Utilization of Producer Milk

The utilization of milk in the United States is shown in Figure 6. Approximately 45 percent of the total

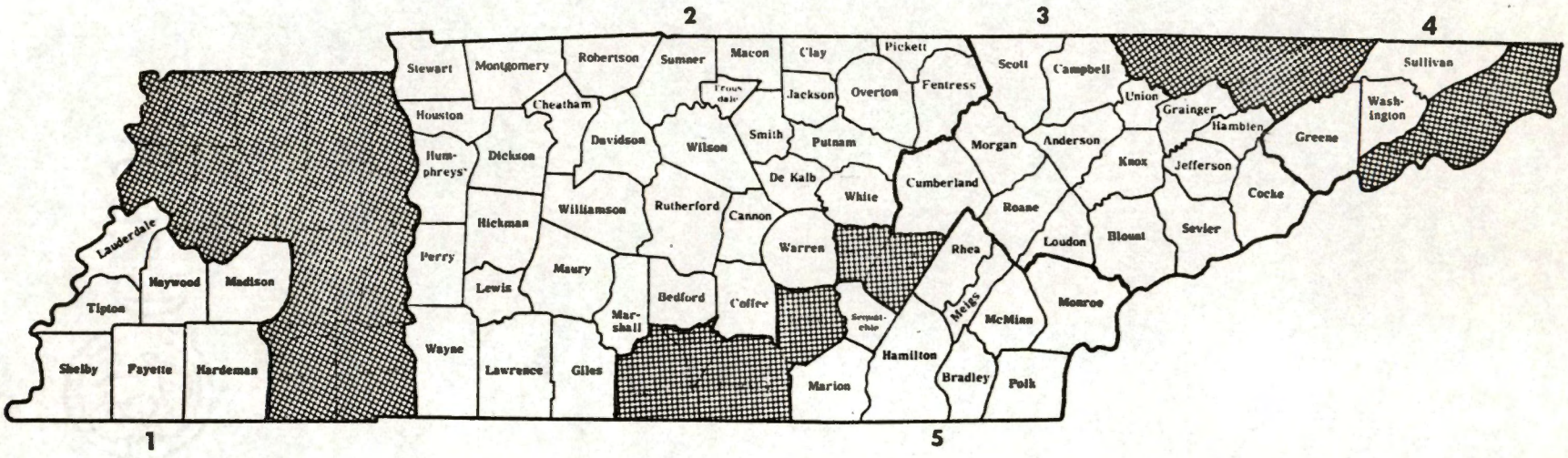

Figure 5. Tennessee Federal Orders

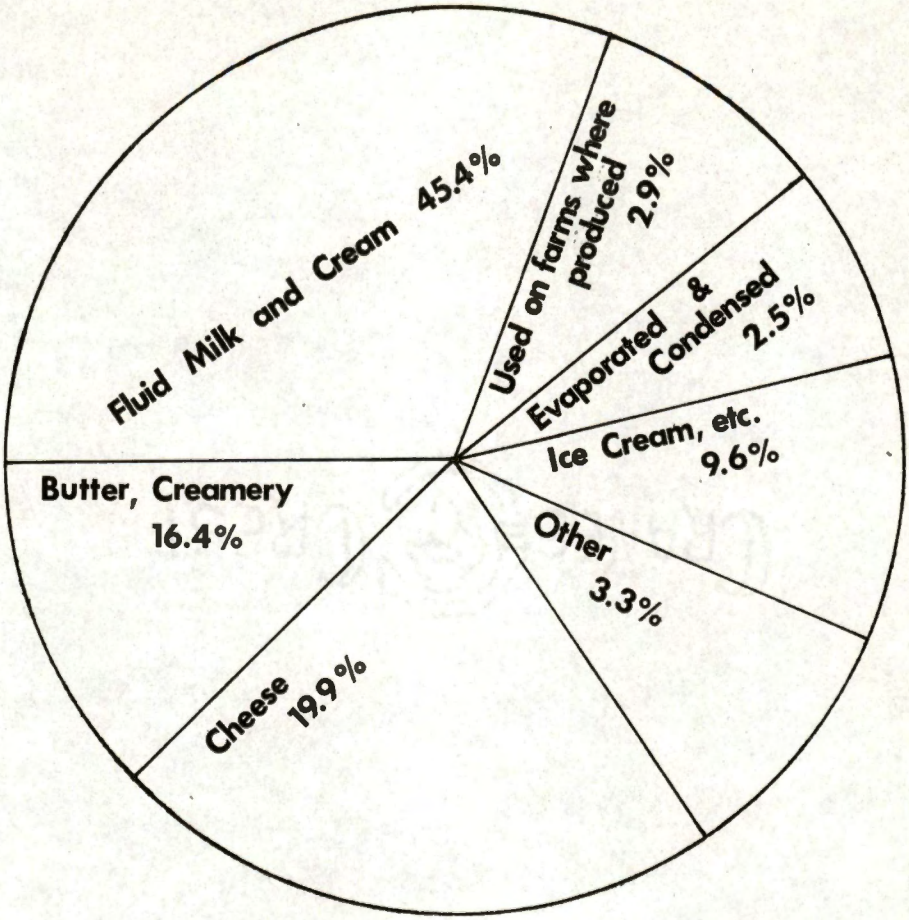

Figure 6. How 1973 United States Milk Supply Was Used By Product.

Fluid milk and cream sales 28.2 bil. qts. -	60,680 mil. lbs.
Frozen dairy product[a] ----------	11,183 mil. lbs.
Creamery butter ----------	19,039 mil. lbs.
Cheese ----------	23,160 mil. lbs.
Evaporated and condensed milk ----------	2,857 mil. lbs.
Used on farms where produced ----------	3,410 mil. lbs.
Other uses ----------	3,882 mil. lbs.

[a]Only that milk used directly in making frozen dairy products. Does not include approximately 2,036,000,000 pounds of milk derived from other manufactured dairy products which, when added, give a total of 13,219,000,000 pounds of milk used in the production of frozen dairy products in 1973.

Source: Milk Facts, 1974, Milk Industry Foundation, Washington, D. C., p. 16.

milk supply for the United States was used as fluid products. The percentage of producer milk utilized as fluid milk in Tennessee was much higher ranging from a low 74 percent for the Nashville order to a high of 86 percent for the Chattanooga and the Knoxville orders (Table 13).

Regional Milk Markets

The locations of the regional milk markets in the United States are shown in Figures 7, and the locations of the Southern primary milk markets are shown in Figure 8.

Tennessee Demand

The estimated demand for fluid milk is shown in Table 14. By 1980 per capita demand in the Knoxville market is projected to be 7 percent larger than in 1970. In absolute terms this means an aggregate increase of approximately 16 million more pounds of milk consumed in the Knoxville market. The per capita demand in the other three markets is expected to be up 4 percent in Nashville and up 5 percent in Chattanooga and Memphis. Aggregate demand was 1,802 in 1970 and projected to 1,978 in 1980 for an overall increase of 9.7 percent. Per capita demand increases will account for the bulk of 9.7 percent aggregate increase and increases in population accounting for the remaining increase.

Table 13. Percent of Producer Milk Utilized as Fluid Milk by Federal Order, Tennessee, 1961 to 1974

Year	Appalachian	Chattanooga	Knoxville	Memphis	Nashville
1961	84	73	67	NA	74
1962	88	73	78	NA	77
1963	89	79	81	NA	81
1964	90	87	81	NA	82
1965	92	80	79	NA	79
1966	92	81	78	NA	77
1967	89	76	70	NA	74
1968	91	78	75	NA	79
1969	91	73	70	NA	78
1970	90	73	76	NA	74
1971	94	63	80	NA	--
1972	NA	66	77	NA	68
1973	86	NA	86	NA	74
1974	89	NA	NA	NA	61

[a]NA = not available for comparable data.

Source: United States Department of Agriculture, ERS, Compilation of Statistical Material, Federal Orders, 1961-1974, May, 1974.

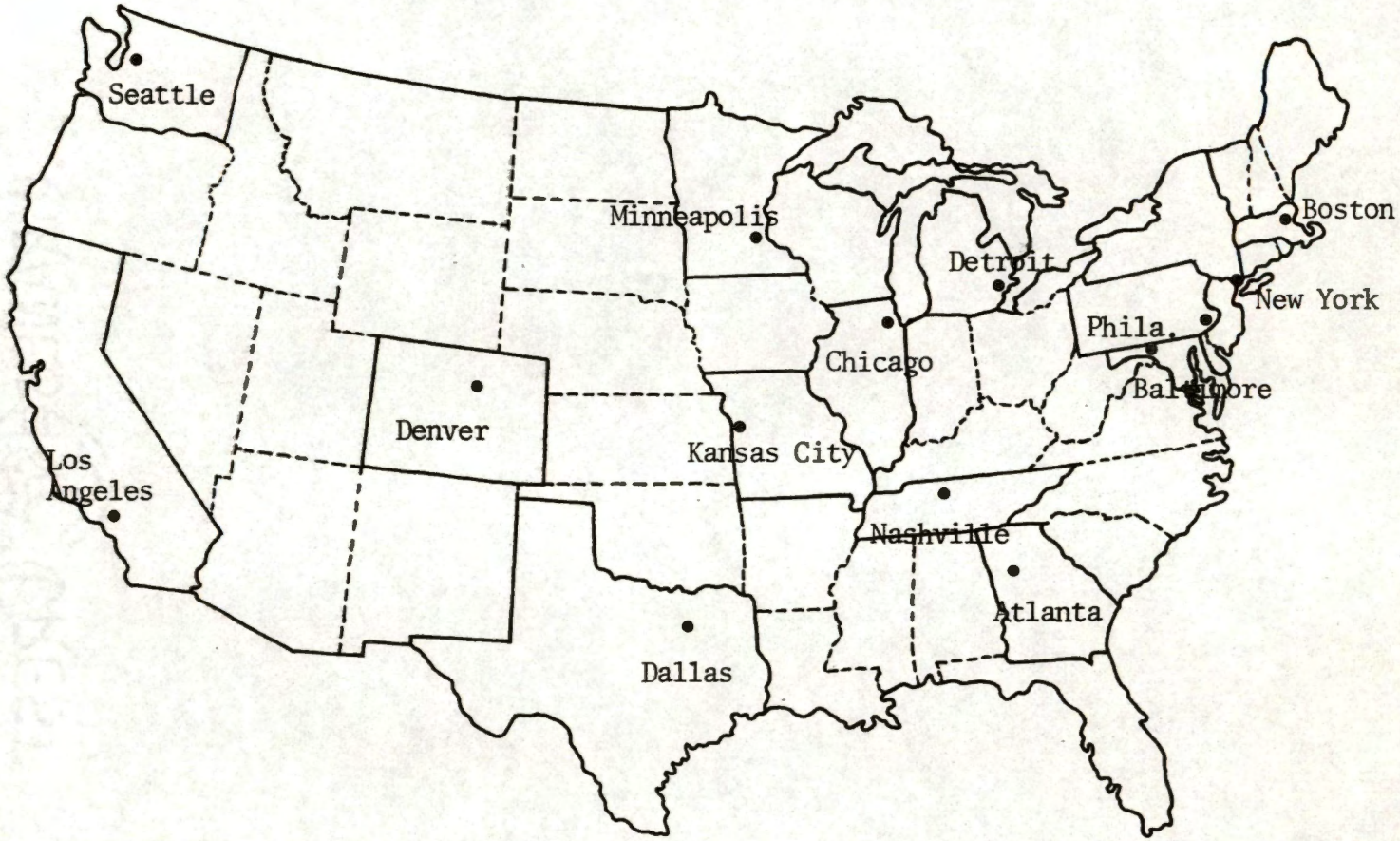

Figure 7. Regional Markets, United States

Source: Robert Raunikar and Joseph C. Purcell, Trends in the Milk Market, University of Georgia, College of Agriculture Experiment Stations, July, 1972, Research Report 139, pp. 16, 19, 21, 24.

Figure 8. Southern Primary Markets, United States

Source: Robert Raunikar and Joseph C. Purcell, Trends in the Milk Market, University of Georgia, College of Agriculture Experiment Stations, July, 1972, Research Report 139, pp. 16, 19, 21, 24.

Table 14. Estimated Demand for Fluid Milk (Product Weight) by Primary Market, Tennessee 1970 and Projected to 1980

Primary Market	Per Capita		Aggregate		
	1970 Relative to U.S. Average Index (U.S.=100)	1980 Relative to 1970 Index (1970=100)	1970 in Mil. Lbs.	1980 Relative to 1970 Index (1970=100)	Projected Total Consumption in Mil. Lbs.
Chattanooga (Ga.)	81	105	187	113	212
Knoxville (Va., Ky.)	87	107	516	103	532
Memphis (Ky., Ark., Miss.)	75	105	746	112	843
Nashville (Ky.)	87	104	353	111	391
Totals	NA[a]	NA	1801	NA	1978

[a]NA = not applicable.

Source: Robert Raunikar and Joseph C. Purcell, Trends in the Milk Market, University of Georgia, College of Agriculture Experiment Stations, July, 1972, Research Report 139, pp. 16, 19, 21, 24.

The demand for frozen dessert is also projected to increase as with fluid milk. Knoxville per capita demand is expected to increase by 22 percent over 1970 (Table 15). The other three markets are projected to increase 14 to 15 percent. An aggregate consumption of frozen desserts is expected to increase by 21 percent.

The estimated demand for cheese is much the same as with fluid milk and frozen desserts. Knoxville leads with a projected per capita demand of 16 percent followed by Chattanooga with 10 percent, Nashville with 11 percent and Memphis with 9 percent. Aggregate demand is projected to be 68 million pounds for a 17 percent increase over the 58 million pounds in 1970 (Table 16).

Table 15. Estimated Demand for Frozen Desserts by Primary Market, Tennessee, 1970 and Projected to 1980

Primary Market	Per Capita		Aggregate		
	1970 Relative to U.S. Average Index (U.S.=100)	1980 Relative to 1970 Index (1970=100)	1970 in Mil. Lbs.	1980 Relative to 1970 Index (1970=100)	Projected Total Consumption in Mil. Lbs.
Chattanooga (Ga.)	98	115	41	123	50
Knoxville (Va., Ky.)	89	122	95	116	110
Memphis (Ky., Ark., Miss.)	89	114	161	121	195
Nashville (Ky.)	96	114	70	123	86
Totals	NA[a]	NA	365	NA	441

[a]NA = not applicable.

Source: Robert Raunikar and Joseph C. Purcell, Trends in the Milk Market, University of Georgia, College of Agriculture Experiment Stations, July, 1972, Research Report 139, pp. 16, 19, 21, 24.

Table 16. Estimated Demand for Cheese by Primary Market, Tennessee, 1970 and Projected to 1980

Primary Market	Per Capita		Aggregate		
	1970 Relative to U.S. Average Index (U.S.=100)	1980 Relative to 1970 Index (1970=100)	1970 in Mil. Lbs.	1980 Relative to 1970 Index (1970=100)	Projected Total Consumption in Mil. Lbs.
Chattanooga (Ga.)	71	112	6	125	8
Knoxville (Va., Ky.)	66	116	15	112	17
Memphis (Ky., Ark., Miss.)	67	109	26	115	30
Nashville (Ky.)	70	111	11	116	13
Totals	NA[a]	NA	58	NA	68

[a]NA = not applicable.

Source: Robert Raunikar and Joseph C. Purcell, Trends in the Milk Market, University of Georgia, College of Agriculture Experiment Stations, July, 1972, Research Report 139, pp. 16, 19, 21, 24.

CHAPTER IV

PROCESSING SECTOR

The general trend in fluid milk processing plant numbers in the United States has been one of a steady decline (Table 17). The downward trend has also been present in manufacturing milk plants (Table 18); however, plant capacity has increased by a greater percentage than the percentage decrease in plant numbers, so that total productive capacity has increased during this general period. Tennessee has been no exception to this trend. Tennessee manufacturing plants and fluid milk plant numbers have decreased by 57 percent and 77 percent, respectively, from 1954 to 1975 (Table 19). The general location of these plants is shown in Figure 9.

Data from the Census of Manufacturing for 1963, 1967, and 1972 indicate the decline in plant numbers as well as decreases in production workers and man-hours worked and value added by manufacturer (Tables 20, 21, and 22).

Total plant numbers decreased by 49 percent during the period 1963 to 1972 (Table 23). Value added by manufacturers decreased by 13 percent. This implies that

Table 17. Number of Fluid Milk Bottling Plants by Commercial Processors in the United States, December 1961-1971

December	Regulated by Federal Order (Number)	Other (Number)	Total (Number)	Decrease from Preceding Year (Percent)
1961	2,217	2,742	4,959	7.0
1962	2,136	2,742	4,683	5.6
1963	2,060	2,382	4,442	5.1
1964	1,940	2,163	4,103	7.6
1965	1,785	1,958	3,743	8.8
1966	1,532	1,847	3,379	9.7
1967	1,456	1,522	2,978	11.9
1968	1,485	1,171	2,656	10.8
1969	1,478	995	2,473	6.9
1970	1,343	873	2,216	10.4
1971	1,248	832	2,080	6.1

Source: United States Department of Agriculture, ERS, Compilation of Statistical Material, Federal Orders, 1961-1974, May, 1974.

Table 18. Number of Plants Making Dairy Products and Average Output Per Plant, Selected Years 1957-1972, United States

Product	Number of Manufacturing Plants			Percent Change		Average Output Per Plant in Thousand Pounds			Percent Change	
	1957	1963	1972	57-72	63-72	1957	1963	1972	57-72	63-72
Butter	2060	1321	475	-77	-64	685	1075	2320	+239	+116
American cheese	1194	924	613	-49	-34	853	1200	2682	+214	+124
Swiss cheese	184	133	76	-59	-43	544	902	2339	+330	+159
Italian cheese	167	184	199	+19	+ 8	668	1045	2574	+285	+146
All cheese	1603	1282	901	-44	-30	880	1273	2892	+229	+127
Cream cottage cheese	1654	1086	482	-71	-56	419	732	2103	+402	+187
Nonfat dry milk	456	405	180	-61	-56	3561	5200	6797	+ 91	+ 31
Dry whole milk	66	48	32	-52	-33	1666	1896	2351	+ 41	+ 24
Canned whole milk	93	68	36	-61	-47	26962	29062	32869	+ 22	+ 13
Totals	5932	4210	2106							
Ice cream	3397	2476	1451	-57	-41	179	475	513	+187	+ 87
All frozen dairy products	3447	2512	1480	-57	-41	214	375	652	+205	+ 85
Total manufacturing plants	--	6134[a]	3312	--	-46[a]	--	10.4[a]	188	--	+ 81[b]

[a]1961 data.

[b]1961-72 data.

Source: United States Department of Agriculture, Dairy Situation, ERS, July, 1974, p. 13.

Table 19. Dairy Plant Changes in Tennessee, 1954 through 1975

Dairy Plants	Number of Plants			Percent of Change
	1954	1958	1975	1954 to 1975
Creamery butter	3	3	4	+33
Natural cheese	20	19	9	-55
Condensed and evaporated milk	13	8	3	-77
Ice cream and frozen desserts	39	39	16	-59
Special dairy plants[a]	5	3	2	-60
Total manufacturing	80	72	34	-57
Fluid milk plants	91	82	21	-77
Totals	171	154	55	-68

[a]Special plants: Kraft Food-Gallatin-cream cheese; Kraft Food-Fayetteville-Swiss cheese.

Source: Federal Milk Market Administration, Knoxville, Tennessee (personal communication).

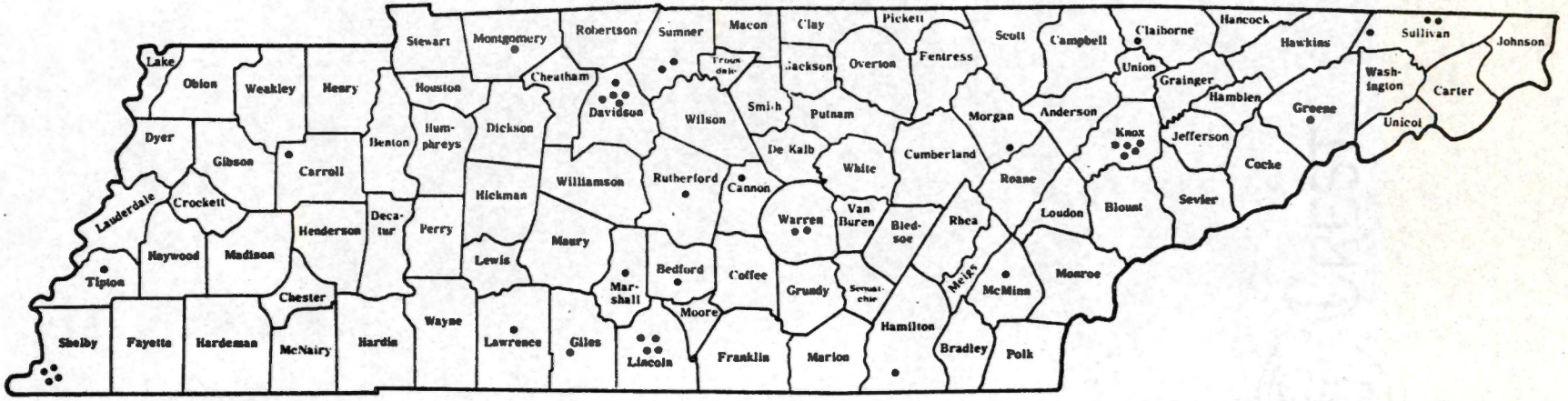

Figure 9. Location of Dairy Processing Plants, 1975[a]

[a]Map excludes location of ice cream plants.

Table 20. General Statistics for Milk Processing Plants, Tennessee, 1963

Processing Plants	Total	1963 Establishment with 20 Employees or More	All Employees Number (1000)	All Employees Payroll (Mil. Dol.)	Production Workers Number (1000)	Production Workers Man-Hours (Mil.)	Production Workers Wages (Mil. Dol.)	Value Added by Manufacture (Mil. Dol.)	Cost of Material Fuel, Etc. (Mil. Dol.)	Value of Industry Shipment (Mil. Dol.)	Capital Expenditure (Mil. Dol.)
Fluid milk	59	37	2.9	14.3	1.0	2.3	4.5	31.9	69.3	101.1	2.0
Condensed and evaporated milk	7	5	.5	2.4	.4	.9	1.9	9.3	24.0	33.5	.3
Ice cream and frozen desserts	33	19	1.1	4.7	.6	1.3	2.2	12.0	18.2	0.1	1.5
	—	—	—	—	—	—	—	—	—	—	—
Totals	99	61	4.5	21.4	2.0	4.5	8.6	53.2	111.5	164.0	5.5

Source: United States Department of Commerce, Census of Agriculture, Vol. 31, pt. 1, 1959, 1964, and 1969, Bureau of the Census, Washington, D. C.

Table 21. General Statistics for Milk Processing Plants, Tennessee, 1967

Processing Plants	Total	Establishment with 20 Employees or More	1967 All Employees Number (1000)	All Employees Payroll (Mil. Dol.)	Production Workers Number (1000)	Production Workers Man-Hours (Mil.)	Production Workers Wages (Mil. Dol.)	Value Added by Manufacture (Mil. Dol.)	Cost of Material Fuel, Etc. (Mil. Dol.)	Value of Industry Shipment (Mil. Dol.)	Capital Expenditure (Mil. Dol.)
Fluid milk	36	26	2.2	13.6	.8	1.8	4.1	26.7	73.9	100.5	2.0
Condensed and evaporated milk	10	6	.5	2.7	.4	.7	2.0	11.1	24.2	35.9	.3
Ice cream and frozen desserts	25	18	1.1	6.2	.5	1.2	2.5	14.4	24.1	38.3	1.2
	—	—	—	—	—	—	—	—	—	—	—
Totals	71	50	3.8	22.5	1.7	3.7	8.6	52.2	122.2	174.7	3.5

Source: United States Department of Commerce, Census of Agriculture, Vol. 31, pt. 1, 1959, 1964, and 1969, Bureau of the Census, Washington, D. C.

Table 22. General Statistics for Milk Processing Plants, Tennessee, 1972

Processing Plants	Total	Establishment with 20 Employees or More	1972 All Employees Number (1000)	All Employees Payroll (Mil. Dol.)	Production Workers Number (1000)	Production Workers Man-Hours (Mil.)	Production Workers Wages (Mil. Dol.)	Value Added by Manufacture (Mil. Dol.)	Cost of Material Fuel, Etc. (Mil. Dol.)	Value of Industry Shipment (Mil. Dol.)	Capital Expenditure (Mil. Dol.)
Fluid milk	26	21	2.2	18.6	.7	1.5	5.4	42.0	99.7	141.7	3.7
Condensed and evaporated milk	11	6	.3	2.6	.3	.6	2.0	6.1	30.1	37.3	.4
Ice cream and frozen desserts	16	11	.6	4.7	.3	.3	2.1	12.1	20.8	33.0	.5
	—	—	—	—	—	—	—	—	—	—	—
Totals	53	48	3.1	25.9	1.3	2.8	9.5	60.2	150.6	212.0	4.6

Source: United States Department of Commerce, Census of Agriculture, Vol. 31, pt. 1, 1959, 1964, and 1969, Bureau of the Census, Washington, D. C.

Table 23. Percentage Change for 1963 to 1972 in Number of Plants and Value Added by Manufacturer Man-Hours Worked in Dairy Processing

Item	Percentage Change from 1963 to 1972	
	Number of Plants	Value Added by Manufacture[a]
Fluid milk	-56	+1
Condensed and evaporated milk	+57	-50
Ice cream and frozen desserts	-52	-33
Totals	-49	-13

[a]Dollar values are in constant dollars 1967=100.

the capacity of those remaining plants has increased which again follows the general trend in the United States. Man-hours worked decreased by 38 percent for all dairy processing plants. Labor productivity in fluid milk plants has increased as evidenced by increases in value added per man-hour from $14.40/man-hour in 1963 to $22.40/man-hour in 1972. This is approximately a 55 percent increase (Table 24).

Labor productivity in condensed and evaporated milk has remained at $8/man-hour. Labor productivity in ice cream and frozen dessert increased from 1963 to 1967 ($9.60/man-hour to $14.10/man-hour) but fell slightly from 1967 to 1972 ($14.10/man-hour to $13.80/man-hour).

Production of manufactured dairy products for 1960 to 1973 is shown in Table 25. Butter production has trended upward with 1973 being an exception.

Cheese appears to have been somewhat unstable with times. Again 1973 is obviously a sharp drop. Frozen products have been relatively stable. Processed milk in general is trending downward with a sharp drop in 1973.

It is relatively obvious that 1973 was an unusual year both in the production and manufacturing and processing sectors. It is very difficult to predict what change will occur in the near future.

Table 24. Increase in Value Added Per Man-Hours Worked in Tennessee for 1963, 1967, and 1972

Productivity	Value Added Per Man-Hour 1963	1967	1972
Fluid milk	14.4	14.8	22.4
Condensed and evaporated milk	10.8	15.9	8.0
Ice cream and frozen dessert	9.6	14.1	13.8

Source: Computed from data contained in Tables 20, 21, and 22, pages 45, 46, and 47, respectively.

Table 25. Production of Butter, Cheese, Processed Milk and Frozen Products and Milk, Tennessee, 1960 to 1973[a]

Year	Butter	Cheese (000 Lbs.)	Processed Milk[b]	Frozen Products and Milk (000 Gal.)
1960	9,628	47,929	223,891	35,739
1961	11,773	55,309	238,587	37,190
1962	10,568	50,825	257,893	40,492
1963	8,597	45,834	231,515	41,227
1964	7,949	43,988	207,359	43,378
1965	8,359	45,755	200,401	46,400
1966	8,721	45,345	191,422	43,812
1967	13,593	48,468	162,633	45,758
1968	11,441	49,896	124,144	43,015
1969	12,207	49,255	132,206	41,897
1970	12,762	48,918	141,748	44,699
1971	15,659	48,913	173,268	44,933
1972	16,119	45,447	134,035	44,101
1973	12,948	37,585	106,554	45,425

[a]These are minimum production data as data for some years were not released to protect identity of individual plants.

[b]Full skin American type cheese, cottage cheese, condensed milk, evaporated milk, condensed or evaporated buttermilk, condensed whey, dry milk.

CHAPTER V

SUMMARY

The dairy industry has undergone continual and substantial change. In general, cow numbers are down, those herds remaining are increasing in size and total milk production is relatively stable due to increased output per cow. Plant numbers are down and consumption patterns are changing. The purpose of this study was to describe these changes in the Tennessee dairy industry.

In Tennessee there was a decrease of 72 percent in the number of farms reporting dairy cows. Most of the decrease in the number of farms came in farms with 1-9 cows (over a 70 percent decrease in number).

The number of cows on farms has decreased by approximately 18,000 head per year since 1960. Total milk produced has dropped by 16.7 million for 1960 to 1974. On the positive side, the average production per cow has increased by approximately 290 pounds per year from 1960 to 1974. Also, the seasonality of production has decreased which has resulted in a more stable flow of milk to the market.

The demand sector has remained relatively stable. The utilization of total milk for fluid uses has remained

much the same with a slight upward trend. The demand for milk is expected to increase by 11 percent for the United States with the South having a greater increase. Of the four primary markets, Knoxville is expected to have the greatest increase in per capita demand (+74 percent) with Chattanooga, Memphis and Nashville per capita demand increasing 5 percent, 5 percent and 4 percent, respectively. Given the present trend in total milk production and the projected increase in demand, Tennessee will become a net importer of milk in the near future.

There has been a substantial decrease in the number of plants processing milk in Tennessee. The overall decrease has been 68 percent from 1954 to 1975. The largest reduction in numbers of plants occurred in fluid milk plants and condensed and evaporated milk plants. Creamery butter plants increased from three to four. The Census of Manufacture data indicate that from 1963 to 1972 total dairy processing plant numbers decreased by 49 percent. Value added by manufacture (deflated) decreased by 13 percent. This gives evidence that the average output per plant has increased. In terms of labor productivity, the fluid milk segment has increased in efficiency by approximately 33 percent. Productivity increased from 1963 to 1967 for condensed and evaporated milk and for

ice cream and frozen desserts but fell during the period 1967 to 1972.

In conclusion the number of cows, plants, and people engaged in the dairy industry is declining. Total production of milk and milk products is relatively stable. Demand is growing indicating that there may be room for expansion of the dairy industry in Tennessee.

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APPENDIXES

APPENDIX A

Table 26. Number of Dairy Farms, by Herd Size, by Economic Class, Tennessee, 1959, 1964, and 1969

Number of Milk Cows	Total Number[a]	Class I	II	III	IV	V
		1959				
1-9	2,521	--	10	25	100	795
10-19	3,246	--	--	36	905	1,950
20-29	1,692	5	11	311	955	405
30-49	1,394	--	95	787	457	55
50-99	592	31	271	249	41	--
100 or more	82	25	56	1	--	--
Totals	9,767[b]	61	443	1,409	2,451	3,205
		1964				
1-9	2,578	--	2	37	246	1,105
10-19	3,531	--	17	191	1,233	1,863
20-29	1,503	3	30	398	845	222
30-49	1,397	9	208	827	333	20
50-99	817	71	432	287	27	--
100 or more	156	108	43	5	--	--
Totals	9,982[b]	191	732	1,745	2,684	3,210
		1969				
1-9	582	1	7	13	77	484
10-19	2,485	--	5	235	1,144	1,101
20-29	1,197	1	97	519	494	86
30-49	1,240	36	706	484	14	--
50-99	936	399	509	28	--	--
100 or more	223	215	8	--	--	--
Totals	6,663	652	1,332	1,279	1,729	1,671

[a]Includes Class VI.

[b]Totals differ due to apparent error in original source.

Source: United States Department of Commerce, Census of Agriculture, Vol. 31, pt. 1, 1959, 1964, 1969, Bureau of the Census, Washington, D. C.

Table 27. Tenure of Farm Operator by Economic Class, Tennessee, 1959, 1964, and 1969

Status	Total[a]	Class I	II	III	IV	V
1959						
Full owners	5,984	19	199	697	1,433	2,210
Part owners	2,484	18	192	519	765	695
Tenants	1,088	5	40	178	255	320
Totals	9,556[b]	42	431	1,394	2,453	3,225
1964						
Full owners	6,161	65	313	857	1,574	2,253
Part owners	2,934	107	350	738	851	668
Tenants	988	15	66	153	291	322
Totals	10,083[b]	187	729	1,748	2,716	3,243
1969						
Full owners	4,347	279	736	772	1,224	1,336
Part owners	1,983	348	514	424	426	271
Tenants	476	34	97	92	121	132
Totals	6,806	661	1,347	1,288	1,771	1,739

[a]For 1959 Class IV is included in the total.

[b]Totals differ due to apparent error in original source.

Source: United States Department of Commerce, Census of Agriculture, Vol. 31, pt. 1, 1959, 1964, 1969, Bureau of the Census, Washington, D. C.

Table 28. Dairy Farms by Size in Acres, Tennessee, 1959, 1964, and 1969

Number of Acres	Total[a]	Class I	II	III	IV	V
1959						
1-9	110	--	--	--	10	15
10-49	850	--	--	15	50	250
50-99	2,325	--	--	35	460	1,020
100-139	1,870	--	10	170	565	820
140-179	1,271	--	11	210	435	410
180-219	905	--	25	225	350	270
220-259	635	--	20	200	240	150
260-499	1,316	31	200	475	330	270
500-999	308	17	156	75	40	20
1,000-1,999	47	11	21	12	2	--
2,000 or more	5	2	--	2	1	--
Totals	9,642[b]	61	474	1,219	2,473	3,210
1964						
1-9	96	--	2	4	9	26
10-49	1,074	--	1	17	106	460
50-99	2,578	--	11	132	668	1,206
100-139	1,830	2	36	261	635	689
140-179	1,276	2	63	285	461	386
180-219	924	5	82	289	296	218
220-259	592	6	71	215	181	108
260-499	1,330	65	323	465	326	132
500-999	365	78	131	91	42	18
1,000-1,999	57	29	21	6	1	--
2,000 or more	11	9	1	1	--	--
Totals	10,133	196	742	1,766	2,725	3,243
1969						
1-9	114	3	12	17	31	51
10-49	437	--	2	39	102	294
50-99	1,523	--	66	198	512	745
100-139	1,179	13	127	267	464	308
140-179	912	25	208	228	294	157
180-219	710	35	223	196	168	88
220-259	433	60	162	101	77	33
260-499	1,077	269	430	208	119	51
500-999	359	200	111	33	4	11
1,000-1,999	53	45	6	1	--	1
2,000 or more	9	9	--	--	--	--
Totals	6,806	661	1,347	1,867	1,771	1,739

Table 28 (continued)

[a]Includes Class VI.

[b]Totals differ due to apparent error in original source.

Source: United States Department of Commerce, Census of Agriculture, Vol. 31, pt. 1, 1959, 1964, 1969, Bureau of the Census, Washington, D. C.

Plant Survey

In 1975 the Tennessee Milk Inspection Division tested 42 plants as having licenses to operate in Tennessee.[1] A simple questionnaire was sent to all plants; 23 plants responded.

The number of plants by products produced are as follows:

13 fluid[2]

8 cheese[2]

1 powder

1 butter

2 pool (no processing)

1 non-dairy

Most of the fluid milk processing plants produce a range of products (only one plant produced only fluid milk).

Five fluid milk plants and five cheese plants produced fluid milk under contract for other labels.

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[1]Excludes ice cream and frozen desserts plants.

[2]Some plants produce both fluid milk and cheese.

Table 29. Number of Fluid Milk and Cheese Plants by Size

Number of Plants	Small	Medium	Large
Fluid milk[a]	6	4[b]	3
Cheese[c]	2	5[b]	1
Totals[d]	8	9	4

[a]Small - less than 1 million lbs. processed per year; medium - 1 to 5 million lbs. processed per year; large - over 5 million lbs. processed per year.

[b]One plant produces both fluid milk and cheese.

[c]Small - less than 15 million #/milk equivalent per year; medium - 15 to 30 million #/milk equivalent per year; large - 30 million #/milk equivalent per year.

[d]The total number of plants is less than the total respondents due to two respondents operating as pool plants and one operating with no dairy processing.

APPENDIX B

SIZE DISTRIBUTION OF TENNESSEE BOTTLING AND CHEESE PLANTS

Plant 1

Fluid Milk Products	Monthly Averages
Whole milk	500,000 lbs.
Flavored whole milk	80,000 lbs.
Lowfat (2 percent milk: plain	40,000 lbs.
Skim milk: solids added	9,000 lbs.
Buttermilk	60,000 lbs.
Light cream	1,000 lbs.
Total	69,000 lbs.

Operates 5 days

Plant 2

Fluid Milk Products		Cheese Products	Per Year
Whole milk	15,480	Type--Barrel Cheddar	3,050,000 lbs.
Lowfat (2 percent milk: solids added	6,880		
Buttermilk	2,150		
Flavored milk drink	2,500		
Total	27,010		

Operates 5 days
Package under contract

Plant 3

Cheese Products	Per Year
Type--Cheddar and Stirred Curd	2.6 million pounds

Package under contract

Plant 4

Cheese Product	Per Year
Type--Cheddar	2,600,000

Package under contract

Plant 5

Fluid Milk Products	Monthly Average
Whole milk	802,707 lbs.

Lowfat (2 percent) milk:
plain---------- 84,267 lbs.
Skim milk:
solid added---------- 51,703 lbs.
Buttermilk---------- 99,633 lbs.
Flavored milk drink----------605,629 lbs.
Total---------- 1,643,939 lbs.
Operates 5 days
Package under contract
Under 2 labels
Percent of total volume under contract 5 percent

Plant 6

Cheese Products	Per Year
Type-----Cheddar----------	100,000 lbs.

Plant 7

Fluid Milk Products	Monthly Averages
Whole milk----------	100,000 lbs.

Operates 6 days

Plant 8

Fluid Milk Products	Monthly Averages
Whole milk----------	3,268,000 lbs.
Flavored whole milk----------	43,000 lbs.
Lowfat (2 percent) milk:	
plain----------	448,000 lbs.
Buttermilk----------	258,000 lbs.
Flavored milk drink----------	390,000 lbs.
Total----------	4,407,000

Operates 5 days

Plant 9

Fluid Milk Product	Monthly Averages
Whole milk----------	900,000 lbs.
Flavored whole milk----------	135,000 lbs.
Lowfat (2 percent) milk:	
solids added----------	140,000 lbs.
Skin milk:	
solids added----------	40,000 lbs.
Buttermilk----------	30,000 lbs.
Flavored milk drink----------	180,000 lbs.
Total----------	1,475,000

Operates 5 days
Package under contract
Total volume under contract 50 percent

Plant 10

Fluid Milk Products	Monthly Averages
Whole milk	2,700,000 lbs.
Lowfat (2 percent) milk:	
plain	2,800,000 lbs.
Skim milk:	
solids added	35,000 lbs.
plain	20,000 lbs.
Buttermilk	600,000 lbs.
Flavored milk drink	400,000 lbs.
Total	6,555,000

Operates 5 days
Package under contract
Under 4 labels

Plant 11

Fluid Milk Products	Monthly Averages
Milk and cream mixture	16,000 lbs.

Operates 2 days

Plant 12

Cheese Products	Per Year
Type--Cheddar	5,000,000 lbs.

Plant 13

Cheese Products	Per Year
Type--Cheddar	3,000,000 lbs.

Package under contract

Plant 14

Fluid Milk Product	Monthly Averages
Whole milk	1,800,000 lbs.
Lowfat (2 percent) milk:	
plain	803,000 lbs.
Skim milk:	
plain	104,000 lbs.
Buttermilk	186,000 lbs.
Flavored milk drink	167,000 lbs.
Heavy cream	24,000 lbs.
Sour cream	8,000 lbs.

Operates 4 days

Plant 15

Fluid Milk Product	Monthly Averages
Whole milk	596,735 lbs.
Flavored whole milk	75,600 lbs.
Lowfat (2 percent) milk:	
solid added	65,781 lbs.

Skim milk:	
solid added	4,300 lbs.
Buttermilk	47,921 lbs.
Operates 5 days	

Plant 16

Cheese Product	Per Year
Type--Cheddar	35,000 lbs.
Type--Washed curd	1,333,000 lbs.

Plant 17

Fluid Milk Product	Daily Averages
Whole milk	0 lbs.
Buttermilk	17 lbs.
Milk and cream mixture	25 lbs.
Total	42 lbs.

Plant 18

Fluid Milk Product	Monthly Averages
Whole milk	9,200,000 lbs.
Lowfat (2 percent) milk:	
plain	5,200,000 lbs.
Skim milk:	
plain	530,000 lbs.
Buttermilk	1,300,000 lbs.
Flavored milk drink	660,000 lbs.
Yogurt	5,000 lbs.
Light cream	27,000 lbs.
Heavy cream	15,000 lbs.
Sour cream	30,000 lbs.
Cottage cheese	200,000 lbs.
Total	17,167,000
Operates 5 days	

Plant 19

Cheese Product	Per Year
Type--Cottage cheese	2,400,000 lbs.

Plant 20

Fluid Milk Product	Daily Averages	Monthly Averages
Whole milk	73,000 lbs.	2,190,000 lbs.
Lowfat (2 percent) milk:		
plain	40,000 lbs.	1,200,000 lbs.
Skim milk:		
plain	2,000 lbs.	60,000 lbs.
solids added	600 lbs.	18,000 lbs.

Buttermilk	12,000 lbs.	360,000 lbs.
Flavored lowfat milk	11,000 lbs.	345,000 lbs.
Milk and cream mixture	300 lbs.	9,000 lbs.
Sour cream	320 lbs.	9,000 lbs.
Cottage cheese	3,000 lbs.	90,000 lbs.
Total		4,281,000

Operates 5 days
Package under contract
Under 1 label

VITA

GonZalee Martin was born in Edgefield, South Carolina on November 13, 1950.

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In July 1973, he accepted a research assistantship at The University of Tennessee in Knoxville and began study toward a Master's degree in Agricultural Economics.