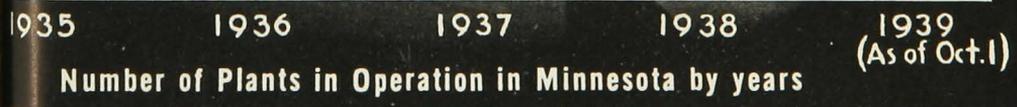


# MINNESOTA

## COLD STORAGE LOCKER PLANTS

INVESTMENT      OPERATING COSTS      INCOME      MEATS HANDLED



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# AGRICULTURAL EXPERIMENT STATION

# UNIVERSITY OF MINNESOTA

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# Minnesota Cold Storage Locker Plants<sup>1</sup>

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PLANTS equipped with individual lockers for storing foods in sub-freezing temperatures have been in operation for a number of years. It is reported that a locker plant was in operation at Crete, Nebraska as early as 1910 and that lockers were used extensively in the Pacific Northwest shortly after the World War. The modern locker plant equipped with chilling and cutting facilities and with separate sharp-freeze and locker rooms, however, is of more recent origin.

The first locker plant in Minnesota was opened at Waseca in 1935. By the close of 1935 there were four plants in this state. Eight additional plants opened in 1936, 48 in 1937, 91 in 1938, and 28 during the first two months of 1939. There were in operation in Minnesota on March 1, 1939, 179 plants with a total estimated capacity of 51,000 lockers.

A questionnaire requesting specific information as to date opened, locker capacity, and patronage was addressed to each of the 179 plants on March 1, 1939. The replies received from 118 plants are summarized in table 1.

The replies indicate that the older plants are operating more nearly at capacity, as measured by patronage, than those opened more recently. The table also shows the proportion of town and country patrons. Plants opened in 1937 had the highest proportion of town patrons, over one town to four rural patrons. On the other hand, only 10 per cent of the patrons of plants opened in 1935 lived in town. With an average for all plants of 17 per cent town patrons, it is clear that up to the present time this method of food storage has made its greatest appeal to rural families. The figures also reveal a gradual decline in the average size of plants. Those opened during the first two months in 1939 had only slightly more than one half the locker capacity of those opened in 1935, and were slightly smaller than those opened in 1938.

Of the 179 locker plants operating in Minnesota on March 1, 1939, 57 or approximately one third were cooperatively owned and 122 were owned by individuals or ordinary corporations. Of the 57 cooperatively owned plants, 44 were operated in connection with creameries, four with produce houses, five with other enterprises, and four as separate or independent plants. Of the 122 privately owned plants, 71

<sup>1</sup> Assistance in the preparation of these materials was furnished by the personnel of Works Progress Administration, Official Project No. 465-71-3-350.

<sup>2</sup> The authors acknowledge their indebtedness to the various locker plant managers whose generous cooperation made this study possible.

Table 1. Date Opened, Capacity, and Patronage of 118 Locker Plants in Operation in Minnesota on March 1, 1939

Year opened	1935	1936	1937	1938	1939	All plants
Number plants reporting .....	3	4	30	60	21	118
Average locker capacity .....	431	401	325	285	236	294
Average number of patrons per plant .....	323	285	212	144	77	159
Average number of patrons per 100 lockers* .....	75	71	65	50	32	54
Average per cent of town patrons .....	10	17	22	17	11	17

\* Based upon locker capacity.

were operated in connection with retail meat markets, 16 with creameries or ice cream plants, 19 with other enterprises, and 16 as separate or independent plants. Recently the trend has been toward private or ordinary corporate ownership, a result of the increase in number of plants installed in connection with retail butcher shops. This explains the decrease in the average size of plants as shown in table 1.

The location of the locker plants in operation on March 1, 1939 is shown in figure 1. Most of the plants are in the southern half of the state with the greatest concentration in the southwestern counties. The distribution of plants is influenced by the types of farming throughout the state.

The kind and amount of service rendered by the various plants differs among plants within a given region as well as between regions. The type of organization sponsoring the plant, the amount of capital available for investment, the size of the plant, and variations in the incomes and desires of the patrons in different communities cause these variations.

A few of the earlier plants installed locker rooms only and did not provide chilling, cutting, or sharp-freezing facilities. Such a system is unsatisfac-

tory since chilling and sharp freezing are considered essential to the proper preparation of products for storage in the locker.

In a number of plants equipped with chilling, cutting, and sharp-freezing facilities, butchers are not employed by the plant. The patrons must perform these services for themselves. This often leads to congestion and confusion in the chilling, cutting, and freezing rooms, and the packages frequently are improperly wrapped.

In Minnesota the plants usually furnish labor at the plant and insist on cutting, wrapping, and freezing all of the meat that goes into the locker. These plants will slaughter on the farm if the customer desires this service. They are also equipped with power grinders. A few Minnesota plants render lard, make sausage, and cure and smoke meats.

Some of the larger plants, especially those that have been constructed recently, have slaughtering facilities at or near the locker plant. These provide more sanitary slaughtering conditions, quicker chilling, and more efficient use of the butcher's time.

In some cases small locker rooms are served from other plants. At least three plants in Minnesota slaughter,



## SCOPE AND LIMITATIONS OF THE STUDY

The detailed part of this study consists of an economic analysis of the operations of 18 cold-storage locker plants during the 12-month period beginning July 1, 1937 and ending June 30, 1938. Data were obtained on the investment in real estate and equipment and operating expenses and income for each plant. Figures were also obtained from 13 of these plants on the amount of the different kinds of meat handled, sold, cut, and ground, and, from a more limited number of plants, on the amount of meat cured and the amount of lard rendered during this time. From these figures it was possible to ascertain the amount of the various kinds of meat handled by the plant per patron year.<sup>3</sup> For a limited number of patrons, these figures were supplemented by data covering the amount of the various kinds of meat obtained outside the locker plant together with the size and age distribution of each family and distance from the plant. Information was obtained from locker-plant patrons as to the advantages and criticisms or disadvantages of the services rendered by cold-storage locker plants compared with home slaughtering and curing or purchasing meat at retail shops.

Only a few plants were in operation in this state at the time the study was initiated. Furthermore, there were wide variations in the size and type of plants and in the services rendered. Consequently, it is necessary to present

much of the data separately for each plant rather than averages. Plants that were somewhat similar as to type or as to type and services rendered are grouped to facilitate comparisons. Many of the plants were of such recent origin that they were not well enough established to warrant drawing too definite conclusions from their operating costs.

**Group I.**—The three plants included in group I are housed in separate buildings and operated as separate or independent enterprises. They are equipped with chill, cutting, sharp-freeze, and locker rooms and employ butchers to process the meat.

**Group II.**—The plants in group II differ from those in group I chiefly in that they are housed in creamery buildings and are operated jointly with the creamery enterprise. The plants in this group are smaller, as measured by locker capacity, than those in group I.

**Group III.**—The plants included in group III differ from those in group II only in that butchers are not employed by the plants. Processing is performed by the patrons themselves or by butchers employed by them individually.

**Group IV.**—The two plants included in group IV are equipped with locker rooms only and rely upon a near-by plant to render such services as chilling, cutting, wrapping, sharp-freezing, and delivery of the frozen packages to their locker rooms.

<sup>3</sup> Twelve months of locker use.

The study does not include such factors as the comparative cost and efficiency of different types of insulation or refrigeration equipment, the proper temperatures for the chill, sharp-freeze, or locker rooms, or the effect of time in storage on the quality or flavor of the product.

### SOURCE OF DATA AND METHOD OF ANALYSIS

Figures on the investment in real estate and equipment were obtained from plant managers. The actual cost of the land and buildings was used where plants were erected especially for this purpose. In case a separate building was purchased, remodelled, and equipped for the locker plant, the value of the building site was estimated and this was deducted from the total purchase price to obtain separate figures on the investment in the land and building.

Plants that were installed in creameries were charged with their proportionate share of the total estimated value of the land and building. In single-story buildings this was determined by the relationship between the floor space of the locker plant and the entire floor space of the building. In two-story buildings, two thirds of the estimated value of the building and lot was charged against the ground floor and one third against the upper floor. In a two-story building with basement, one half of the total estimated value of the building and lot was charged to the ground floor, and

one fourth each to the basement and upper floor.

As all plants had been installed and equipped since 1935, it was possible to obtain actual cost figures on insulation, refrigeration, lockers, processing, and office equipment. The investment in lockers shown in table 2 and per locker in table 3 are based upon locker-room capacity. Locker capacity refers to the number of lockers that could be installed without adding to the insulated locker room space. This procedure was followed for three reasons. First, the potential volume of business that the plant can handle depends upon the number of lockers that can be installed in the locker room. Second, the cost of operating the locker room is about the same whether the locker room is full or empty. Third, the size of the chill and sharp-freeze rooms is based upon the size of the locker room; hence the investment and operating costs of the former depend in part upon the size of the latter.

In determining operating expenses, the following rates of depreciation were used: building, 3 per cent; insulation, 4 per cent; refrigeration, 8 per cent; and locker, processing, and office equipment, 10 per cent. A charge of 6 per cent interest was made on the investment in real estate and equipment. Figures on taxes, insurance, repairs, power, water, light, paper, and twine were obtained at the plant from records supplied by plant managers.

Items of expense that were incurred solely in connection with the locker plant were charged in full to that

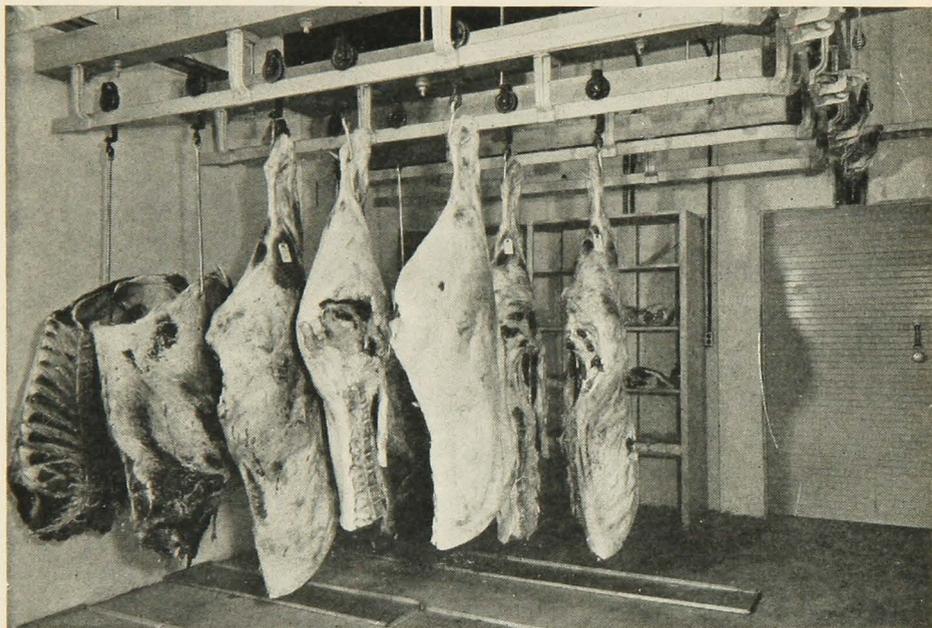


FIG. 2. CHILL ROOM

enterprise. In the case of most of the plants operated in connection with some other business, it was necessary to estimate the proportion of the total expense that was due to the locker plant. Such allocations were made in consultation with the plant managers. The total plant expense for taxes, insurance, and interest was charged against the real estate and equipment on the basis of the investment in each.

In some plants water was purchased while in others it was pumped from a well owned by the plant. For this reason it was not possible to make a direct comparison of the cost of power for pumping and the purchase of the water at different plants. The power and water expenses were, therefore, combined into a single-cost item.

All data on plant income, with the exception of commission on meat sales, were taken from the patron-record sheets<sup>4</sup> that were filled out at the locker plants. A uniform commission of 1½ cents per pound on meat sold by the plant to the patrons was used in arriving at the income to the plant from this source. This figure was used instead of the actual income for two reasons. First, in some instances the kind and amount of meat sold was listed with no record of the income from such sales; second, the plant expense figures do not include the outlay for meat purchased for resale by

<sup>4</sup>Some of the plants used special patron-record forms prepared by the divisions of Agricultural Economics and Agricultural Extension while others used forms that had been developed by the individual plant managers.

the plant. Not all the plants offered the same services so there were variations in the sources of income as well as in the amount of income obtained from each type of service rendered.

Figures on wages paid were obtained from the plant records for plants which employed butchers. The cost of operating the truck used in picking up animals to be slaughtered at the plant or in hauling the carcasses of animals slaughtered on the farm by the plant butcher was obtained from plant records when available, otherwise it was estimated on the basis of the number of trips made during the year and the average mileage.<sup>5</sup>

Figures on the kind and amount of meat handled, sold, cut, wrapped, ground, and cured and the amount of lard rendered by the plant were obtained from plant records. Data were also obtained from a limited number of patrons on the amount of the various kinds of meat consumed during the year. Information on the kind and amount of meat removed from the lockers during the year was obtained by adding the opening inventory to the amount of meat handled by the plant during the year and deducting the closing inventory. Through the use of questionnaires, figures were obtained on the kind and amount of meat obtained for home use by farm slaughter and that purchased at retail shops

during the year. Information was also supplied as to the size of the family, the age of each member of the family, and the distance from the plant. The kind and amount of meat consumed per person and per adult equivalent, by distance zones, were calculated from these figures.

Over three thousand questionnaires were mailed to patrons of the 18 locker plants to ascertain their views as to the advantages and criticisms or disadvantages of the services of the locker plants compared to slaughtering, curing, and canning meat on the farm or the purchasing of meat from retail shops.

## INVESTMENT IN LOCKER PLANTS

The capital investment in each of the 18 plants included in the study is shown in table 2. The total capital outlay includes the investment in real estate and equipment. The former includes land, buildings, and insulation; the latter includes refrigeration, lockers, processing, and office equipment. To facilitate comparisons table 3 shows the investment per locker.

The investment per locker in the independent plants included in group I varied from \$21.46 in plant B to \$26.72 in plant A. The relatively high figure in the latter was due to a higher investment in building, insulation, and land. On the other hand, the investment in these items was less in plant C than in plant B, but the total investment per locker was greater owing to the high investment in refrigeration.

<sup>5</sup>In some instances the butcher supplied the truck and collected the charges for hauling. In such cases the expense of operating the truck was not included in the plant expenses, and the charge for hauling was not included in determining the gross plant income.

Table 2. Total Investment in 18 Cold-Storage Locker Plants

Plant	Real Estate			Equipment				Total	
	Land	Buildings	Insulation	Refrigeration	Lockers*	Processing	Office		
			Group I						
A .....	\$1,500	\$7,250	\$4,940	\$4,100	\$3,300	\$272	\$15	\$21,377	
B .....	400	2,650	2,710	2,600	2,877	695	42	11,974	
C .....	66	2,104	2,212	5,000	2,580	651	30	12,643	
			Group II						
D .....	700	2,539	2,228	2,149	2,393	733	60	10,802	
E .....	118	4,066	1,850	2,000	1,875	600	50	10,559	
F .....	285	5,010	2,052	2,872	1,955	799	50	13,023	
G .....	150	3,000	2,456	2,494	1,424	901	50	10,475	
H .....	185	1,998	1,575	1,868	1,200	181	15	7,022	
I .....	200	1,907	1,684	3,446	1,175	259	25	8,696	
J .....	25	1,150	1,875	2,900	880	140	15	6,985	
K .....	50	1,092	1,250	1,450	524	136	15	4,517	
			Group III						
L .....	300	5,060	4,704	4,032	3,500	116	50	17,762	
M .....	140	849	3,435	1,555	1,710	23	15	7,727	
N .....	96	1,182	2,091	1,751	1,114	26	15	6,275	
O .....	50	800	2,083	2,508	1,123	50	15	6,629	
P .....	55	970	1,329	1,722	679	37	25	4,817	
			Group IV						
Q .....	25	421	624	976	500		25	2,571	
R .....	11	391	551	792	541			2,286	

\* Based upon locker capacity.

The capital outlay per locker in group II varied from \$22.74 in plant D to \$35.85 in plant K. The smallest plant in this group had the highest investment per locker and the largest plant had the lowest investment. However, the investment per locker did not vary uniformly with variations in size. For example, the total investment per locker in plant F, the third largest in the group, was higher than in any other plant except plant K. The relatively high investment per locker in this plant was due primarily to the high building cost per locker. The investment in refrigeration was also higher in this plant than in plants D, E, G, or H. In general, however, the investment per locker in insulation and refrigeration decreased with increasing size of plant.

The investment per locker in group III varied from \$22.59 to \$38.23. The

second largest plant in this group had the lowest investment per locker while the smallest plant had the highest investment. With the exception of plant L, the investment per locker increased with decreasing size. As in group II, there was a relatively higher investment per locker in refrigeration in the smaller plants. With the exception of plant M, the same tendency is evident with respect to the investment in insulation. A high investment in the building was responsible for the total investment per locker in plant L exceeding that in plants M and N. The investment in processing equipment was considerably less in the plants in group III than those in group II.

The capital outlay per locker was much lower in the two small plants included in group IV than in the smallest plants in group II and group III. This was because the plants in

group IV were equipped with locker rooms only, not having chill, sharp-freeze, or processing rooms. This not only greatly reduced the investment in insulation and refrigeration but also the investment in land and buildings.

From these figures it appears that the capital outlay per locker in independent plants with 500 to 800 lockers does not vary greatly from the investment per locker in plants with 300 to 475 lockers that have the same facilities and offer the same services but are housed in creameries and operated jointly with the creamery. On the other hand, the investment per locker tends to be higher in plants with less than 300 lockers that are housed in creameries and offer the same services. The average investment per locker in plants with locker rooms only was less than the average investment per locker in any of the other groups and much

less than in plants with approximately the same locker capacity.

These figures indicate that there is considerable variation in the building, insulation, and refrigeration costs per locker. The variation in the capital outlay in buildings was due chiefly to variations in the age and type and hence value of the buildings in which the plants were housed. The variations in insulation cost per locker resulted to quite an extent from differences in size. The larger the plant, the lower the cost per locker, with, of course, some variation between plants of the same general size resulting from differences in the kind and amount of insulation used. The low insulation cost per locker in plants in group IV is due to the fact that they do not have chill or sharp-freeze rooms. Although related to the size of plant, refrigeration costs per locker vary be-

Table 3. Investment per Locker in Cold-Storage Plants\*

Plant	Locker capacity	Real Estate			Equipment			Total	
		Land	Building	Insulation	Refrigeration	Lockers	Processing Office		
Group I									
A	800	\$1.87	\$9.06	\$6.18	\$5.13	\$4.12	\$0.34	\$0.02	\$26.72
B	558	.71	4.75	4.86	4.66	5.16	1.24	.08	21.46
C	519	.13	4.05	4.26	9.63	4.97	1.26	.06	24.36
Group II									
D	475	1.47	5.35	4.69	4.52	5.04	1.54	.13	22.74
E	375	.32	10.84	4.93	5.33	5.00	1.60	.14	28.16
F	365	.78	13.73	5.62	7.87	5.36	2.19	.13	35.68
G	335	.45	8.95	7.33	7.44	4.25	2.69	.15	31.26
H	300	.62	6.66	5.25	6.23	4.00	.60	.05	23.41
I	270	.75	7.06	6.23	12.76	4.35	.97	.09	32.21
J	220	.11	5.23	8.52	13.18	4.00	.64	.07	31.75
K	126	.40	8.66	9.92	11.51	4.16	1.08	.12	35.85
Group III									
L	700	.43	7.23	6.72	5.76	5.00	.17	.07	25.38
M	342	.41	2.48	10.04	4.55	5.00	.07	.04	22.59
N	255	.38	4.63	8.20	6.87	4.37	.10	.06	24.61
O	255	.20	3.14	8.17	9.83	4.40	.20	.06	26.00
P	126	.43	7.70	10.55	13.67	5.39	.29	.20	38.23
Group IV									
Q	120	.21	3.51	5.20	8.13	4.16	.....	.21	21.42
R	115	.10	3.40	4.79	6.89	4.70	.....	.....	19.88

\* Based upon locker capacity.

tween plants of similar size. This may result either from the type of refrigeration machinery or from the joint use of the ice machine by both the locker plant and the creamery. Differences in locker investment were less than in the other items. The investment in lockers varied according to the type of locker used rather than to the size of plant. In most of the plants, the investment per locker in land was a minor item. Where the land investment is high due to a convenient location, increased patronage may result in greater earnings.

The investment in processing equipment varied considerably from plant to plant in groups I and II where butchers were employed by the plants. The kind and amount of power and hand equipment used caused these variations. The investment in office equipment was relatively unimportant.

### PLANT OPERATING EXPENSES

Total operating expenses, exclusive of management, for each plant are shown in table 4. In general, the most important expense item of the plants in groups I and II, which employed butchers to process the meat, was that of labor. This includes the wages paid to the butcher, or butcher and helper, but does not include a charge for management. In the case of plants which supplied trucks to haul the live animals or carcasses from the farms to the plants, the expense of operating the trucks was included. The labor expense varied greatly from plant to plant because of variations in the

amount of meat handled and services rendered by the different plants and because of differences in wage rates. The plants included in groups III and IV had no labor costs other than management. Much of the meat in some plants in groups I and II was processed by the patrons which reduced the labor required and the wages paid to the plant butcher.

Interest, depreciation, and power and water were the next most important items of expense in groups I and II and the most important items in groups III and IV. Variations in the interest and depreciation charges were due to variations in the investment in real estate and equipment. Part of the differences in the cost of power and water were due to variations in the size of the plants and volume of business handled, and part to variations in the cost of the current and water.

The next most important item was taxes, insurance, and repairs. Variation between plants was due to differences in the size of plants and the rates paid.

The remaining expenses were light, heat, telephone, paper, twine, and miscellaneous items. No charge was made for heat in the plants included in groups II, III, or IV, and no charge was made for telephone in the plants in group IV and some of the smaller plants in groups II and III. Variations in the outlay for paper and twine were due to the volume of meat cut and wrapped and to differences in the amount of paper and twine used by different butchers in wrapping packages of the same size.

Table 4. Total Plant Operating Expenses Exclusive of Management

Plant	Real Estate			Equipment				Other					Labor*	Total
	Depreciation		Taxes, insurance, repairs	Depreciation			Taxes, insurance, repairs	Power and water	Light, heat, telephone	Paper and twine	Miscel- laneous	Interest on the invest- ment at 6 per cent		
	Build- ing	Insula- tion		Lockers	Re- frigeration	Processing, office equipment								
	Group I													
A .....	\$207	\$198	\$169	\$330	\$328	\$29	\$211	\$906	\$189	\$ 95	\$213	\$1,283	\$1,137	\$5,295
B .....	80	108	260	288	208	73	66	818	186	217	74	718	2,670	5,766
C .....	63	88	111	258	400	68	131	681	202	259	49	759	1,752	4,821
	Group II													
D .....	76	89	210	239	172	79	214	459	69	237	251	648	2,269	5,012
E .....	122	74	112	188	160	65	82	525	72	169	24	634	1,480	3,707
F .....	159	82	127	196	230	73	82	754	70	277	168	781	2,193	5,192
G .....	90	98	74	142	200	95	66	400	105	595	60	628	2,248	4,801
H .....	60	63	119	120	149	20	76	502	40	140	75	421	977	2,762
I .....	57	67	218	118	276	28	285	395	30	35	167	522	498	2,696
J .....	35	75	101	88	232	16	130	320	12	53	97	419	519	2,097
K .....	34	50	51	52	116	15	95	347	41	78	6	271	480†	1,636
	Group III													
L .....	152	188	330	350	323	17	405	602	71	130	139	1,066	.....	3,773
M .....	25	137	104	171	124	4	106	253	32	74	22	464	.....	1,516
N .....	35	44	110	111	140	4	96	517	9	118	29	377	.....	1,590
O .....	24	83	69	112	200	7	100	117	14	48	12	398	.....	1,184
P .....	30	53	52	68	138	6	56	300	12	24	127	289	.....	1,155
	Group IV													
Q .....	13	25	21	50	78	3	29	270	12	.....	12	144	.....	657
R .....	14	22	22	54	63	.....	31	197	12	.....	24	137	.....	576

\* Labor includes wages paid to butcher and helper and truck expenses in case of plants that provided trucking service.

† Estimated.

Table 5. Gross Plant Income, July 1, 1937 to June 30, 1938

Plant	Locker rental	Cutting, wrapping, freezing	Grinding meat and lard	Slaughtering	Commission on meat sales at 1½¢ a lb.	Curing and smoking	Lard rendering	Fruits and vegetables	Miscellaneous	Total
Group I										
A	\$2,311	\$1,100	\$ 47	\$ 66	\$ 76	\$ 24	.....	.....	\$ 32	\$3,656
B	4,934	1,380	435	701	322	.....	.....	.....	38	7,810
C	3,560	1,583	244	428	226	.....	.....	.....	53	6,094
Group II										
D	3,149	854	234	323	214	4	.....	.....	145	4,923
E	1,731	903	294	566	190	6	.....	.....	16	3,708
F	2,384	1,100	300	479	289	164	107	19	162	5,004
G	1,286	1,058	169	692	98	114	101	.....	18	3,536
H	1,284	419	120	232	83	34	.....	9	54	2,235
I	546	232	48	66	.....	.....	.....	.....	26	918
J	947	277	115	199	63	2	3	.....	1	1,607
K	1,011	337	114	.....	.....	.....	.....	.....	14	1,476
Group III										
L	1,979	.....	.....	.....	.....	.....	.....	.....	.....	1,979
M	1,225	.....	.....	.....	.....	.....	.....	.....	.....	1,225
N	998	.....	.....	.....	.....	.....	.....	.....	.....	998
O	427	.....	.....	.....	.....	.....	.....	.....	.....	427
P	458	.....	.....	.....	.....	.....	.....	.....	.....	458
Group IV										
Q	700	.....	.....	.....	.....	.....	.....	.....	.....	700
R	568	.....	.....	.....	.....	.....	.....	.....	.....	568

## GROSS PLANT INCOME

The gross plant income of a locker plant depends upon the number of lockers rented, kind of services rendered, and volume of business handled together with the locker rental rates and processing charges. As shown in table 5, the most important source of income for plants in groups I and II and the only source of income for plants in groups III and IV was locker rentals.

### Locker Rentals

The usual rental charge for lockers in plants in groups I, II, and IV was \$10.00 a year except in plant K where all lockers were rented at \$12.00 a year. In plant C the draw-type lockers were rented for \$12.00 and \$14.00, and in plants F and I the lower lockers were rented at \$12.00 a year. The yearly rental charge was \$6.00 a locker

in all plants in group III except plant P which charged \$8.00 and \$10.00.

Most of the plants in groups I and II rented lockers also by the month to patrons who did not wish to rent by the year and rented extra lockers by the month to patrons who required more than one locker immediately after slaughtering. The monthly rate to short-time patrons varied from \$1.00 to \$1.50 a month, the usual charge being \$1.00. Extra lockers were rented at \$.50 to \$1.00 a month with the majority of the plants charging \$1.00. A few of the plants in groups I and II, however, did not rent lockers by the month to short-time patrons, and one plant made no charge to regular patrons for extra lockers.

Three of the five plants in group III did not rent lockers by the month to short-time patrons while plants L and P charged \$.50 and \$1.00 a month, re-

spectively. Plant P charged \$1.00 a month for extra lockers; the other plants in this group charged from \$.50 to \$.75 a month.

Plant Q in group IV did not rent lockers by the month to short-time patrons while plant R charged \$1.00 a month. These plants made no charge to regular patrons for extra lockers.

The proportion of income derived from yearly, monthly, and extra-locker rentals varied greatly from plant to plant. For example, in plant M all of the income from locker rentals was obtained from yearly rentals; in plant B over 98 per cent was obtained from yearly rentals, 1 per cent from extra lockers, and less than one half of one per cent from monthly rentals; in

plant D, 67 per cent was obtained from yearly rentals, 24 per cent from monthly, and 9 per cent from extra-locker rentals. The average for all plants was 87 per cent from yearly rentals, 8 per cent from monthly, and 5 per cent from the rental of extra lockers.

While renting lockers by the month involves some additional record keeping, it may encourage greater use of the lockers by marginal patrons. The monthly rental rate to short-time patrons should be from one third to one half higher than the cost per month when rented by the year in order to cover the cost of additional bookkeeping and to take care of periods when such lockers stand vacant.



FIG. 3. PROCESSING ROOM

The rental rate of extra lockers for regular patrons should be somewhat higher than the cost per month on a yearly basis to discourage joint use of lockers and to encourage patrons to vacate the extra lockers as soon as the original lockers will hold the supply on hand. This increases the potential patron capacity of the locker room. However, the rate on extra lockers should not be as high as the monthly rate charged short-time patrons. It is suggested that the extra-locker rate should be from one tenth to one third more than the monthly cost when rented by the year.

### Cutting, Wrapping, and Freezing

The second most important source of income for plants in groups I and II was from cutting, wrapping, and freezing meat. Income from this source varied according to the volume of meat handled and to the charges made for this service. Most of the plants made a uniform charge per hundredweight for all kinds of meat that was cut, wrapped, and frozen. The charge for this service included the paper and twine used in wrapping the packages. In plants that followed this plan the charges varied from \$.65 to \$1.00 a hundredweight, the usual charge being \$1.00. A few plants made a specified charge per carcass or quarter. In such plants, charges varied from \$1.50 to \$2.50 a head for cattle, \$.75 to \$1.00 a head for calves, \$.75 to \$1.50 a head for hogs, and \$.75 to \$1.00 a head for sheep. Two plants made a flat charge per quarter of beef handled, one plant

charging \$.50 and the other \$.75.<sup>o</sup> The charge for dressing, drawing, wrapping, and freezing chickens varied from 6 cents to 13 cents, and for geese from 23 cents to 25 cents each.

### Slaughtering

The third important source of income in most of the plants in groups I and II was slaughtering. The charge varied from \$1.50 to \$2.50 a head for cattle, \$1.00 to \$1.50 for calves, and \$1.00 to \$2.00 for hogs, with a uniform charge of \$1.00 a head for sheep. The usual charge was \$1.50 a head for cattle and \$1.00 a head for calves and hogs. Some of the plants charged extra for cattle and hogs above a certain specified weight, and one plant slaughtered cattle for the hides. An additional charge for hauling the live animals or carcasses from the farms to the plants added to the income from slaughtering in the case of plants that supplied this service and operated their own trucks.

### Grinding Meat and Lard

The next most important source of income for most of the plants in groups I and II was from grinding meat and lard. The charge for grinding was 1 cent a pound in all plants except one that charged 1.5 cents a pound. With this exception the variations in the income from this source were, therefore, due to differences in the amount of meat and lard ground.

<sup>o</sup> During the period of the study most of the plants changed to a per hundredweight charge.

### Commission on Meat Sales

In most of the plants in groups I and II, the income from commissions on the sale of meat, figured on a uniform rate of 1.5 cents a pound, about equalled that from grinding meat and lard.

### Curing, and Smoking Meat and Rendering Lard

Seven plants derived some income from curing and smoking meat, three plants derived some income from rendering lard, and three from freezing fruits and vegetables. The income from these sources was negligible, however, except in the case of plants F and G

which obtained a substantial income from curing and smoking meat and from rendering lard. The charges for curing and smoking varied from 3 to 5 cents a pound, and the charges for rendering lard varied from 2 to 3 cents a pound.

### Miscellaneous Income

All of the plants received some income from various miscellaneous sources such as freezing fish and game, temporary storage of perishable products, and the sale of containers for fruits and vegetables. In only two plants was the income from these miscellaneous services more than \$54.00 during the year.



FIG. 4. MANY LOCKER PLANTS ARE EQUIPPED TO RENDER LARD

## NET INCOME

The net income exclusive of management for the period July 1, 1937 to June 30, 1938 for each of the 18 plants is shown in table 6. As the operating expenses (table 4) included depreciation, interest on the investment, and labor, the net income represents the return to management. Gross income exceeded operating expenses in two of the three plants in group I, one plant in group II, and one plant in group IV.

On the other hand, the gross income obtained by one plant in group I, two in group II, and one in group III failed to equal operating expenses by \$1,265.00 to \$1,794.00. The deficit in four plants in group II and four in group III varied from \$160.00 to \$490.00 while the deficit in one plant in group II and one in group IV was less than \$90.00 each.

Table 6. Net Income Exclusive of Management, July 1, 1937 to June 30, 1938

Plant	Gross income	Operating expenses*	Net income
Group I			
A .....	\$3,656	\$5,295	-\$1,639
B .....	7,810	5,766	2,044
C .....	6,094	4,821	1,273
Group II			
D .....	4,923	5,012	-89
E .....	3,708	3,707	1
F .....	5,004	5,192	-188
G .....	3,536	4,801	-1,265
H .....	2,235	2,762	-527
I .....	918	2,696	-1,778
J .....	1,607	2,097	-490
K .....	1,476	1,636	-160
Group III			
L .....	1,979	3,773	-1,794
M .....	1,225	1,516	-291
N .....	998	1,590	-592
O .....	427	1,184	-757
P .....	458	1,155	-697
Group IV			
Q .....	700	657	43
R .....	568	576	-8

\* Including interest on the investment at 6 per cent and labor exclusive of management.

The failure of gross income to equal or exceed operating expenses in the majority of the plants was due chiefly to the fact that the plants were operating far below maximum locker capacity. In some instances, however, it was due, partly, to excessive capital investment; in others a sufficient charge had not been made for the services rendered. This is clearly indicated in the last column of table 7 which gives the percentage of all lockers that were rented for the equivalent of 12 months each. Plants A, G, I, and L, which suffered the greatest deficits, were operated at 28, 38, 20, and 42 per cent capacity, respectively. With the exception of plant E, all plants operating at less than 50 per cent capacity suffered substantial deficits.

On the other hand, with the exception of plant N, all plants operated at 50 per cent of capacity or over either had sufficient income to meet operating expenses or suffered only modest deficits. Plant B, which earned the highest net income of any of the plants studied, operated nearest to capacity, with 87 per cent of the lockers rented throughout the year.

The failure of many of the plants to be operated more nearly at capacity was because they had been in operation only a short time when this study was initiated. This is indicated by a comparison of the number of patrons on June 30, 1938 with the number of patrons at the beginning of the study on July 1, 1937 (table 7). In some of the plants the number of patrons more than doubled during the

Table 7. Proportion of Lockers Rented in 18 Locker Plants July 1, 1937 to June 30, 1938

Plant	Capacity	Total patrons* during year	Patrons July 1, 1937	Patrons June 30, 1938	Total locker months†	Total locker years‡	Total patron years§	Per cent of locker rented
Group I								
A .....	800	369	147	284	2,718	227	220	28
B .....	558	608	469	510	5,836	486	482	87
C .....	519	448	297	414	3,947	329	323	63
Group II								
D .....	475	521	211	368	3,936	328	279	69
E .....	375	246	68	229	1,986	166	154	44
F .....	365	322	77	291	2,576	215	191	59
G .....	335	197	129	174	1,531	128	128	38
H .....	300	160	89	.....¶	1,634	136	116	45
I .....	270	131	7	111	657	55	55	20
J .....	220	118	77	101	1,120	93	88	42
K .....	126	121	54	116	1,114	93	89	74
Group III								
L .....	700	234	199	.....¶	3,491	291	224	42
M .....	342	234	222	.....¶	2,450	204	204	60
N .....	255	184	120	.....¶	1,995	166	131	65
O .....	255	118	6	.....¶	847	71	70	28
P .....	126	66	.....¶	.....¶	604	50	45	40
Group IV								
Q .....	120	102	50	91	815	68	68	57
R .....	115	87	41	76	693	58	58	50

\* Includes all patrons on a yearly, monthly, or extra locker basis.

† Total months lockers were rented.

‡ Total months lockers were rented divided by 12.

§ Total months lockers were rented less total months extra lockers were rented divided by 12.

¶ Total locker years divided by locker capacity.

|| Data not available.

year. Since the figures on operating capacity and net income were based upon the year during which the study was in process, and since the number of patrons and business handled by most of the plants increased during the year, it follows that these figures do not reflect the situation that prevailed at the end of the year. By the end of the year a larger number of plants were meeting all operating expenses or more nearly meeting their expenses than is indicated in table 6. However, it is probable that some of the plants made the mistake of providing more facilities than warranted by the prospective patronage. In this event, operating expenses may be ex-

pected to continue to exceed the gross income unless charges can be raised without a loss of patronage.

While the number of patrons of most of the plants increased during the year, some patrons discontinued using the locker-plant service. The difference in number of patrons during the year and the number of patrons on June 30, 1938 (table 7) probably indicates a failure to hold all patrons although some who dropped out during the year may not have left the plant permanently. It appears that in addition to attracting new customers one of the problems confronting locker-plant managers is that of retaining old patrons.

Attention should be called to the fact that locker plants cannot be operated at 100 per cent capacity throughout the year because of the requirements of regular patrons for extra lockers immediately after slaughtering since the amount of meat that can be stored in a single locker is limited. Although no definite figure can be given because of the varied requirements of different patrons, it is doubtful that a plant can operate to the satisfaction of regular patrons at much above an average of 90 per cent of capacity.

### LOCKER AND PROCESSING COSTS

Cold-storage locker plants are so new that service charges have not been standardized. This is clearly indicated by the variations in service charges and locker rentals made by the 18 plants studied. The reason for these variations is mainly that the operators do not have adequate cost data for the determination of charges.

The processing and storage functions are fairly distinct in the operation of a typical locker plant. Consequently, charges can and should be related to the costs involved in rendering each type of service. If the charge for chilling, cutting, wrapping, and freezing is not sufficient to cover the costs, the deficit must be covered by profits from some other source. The loss is most likely to be absorbed by the income from locker rentals since the major income is derived from them.

The locker rental is based upon the fixed space rented, and this has no direct relationship to the volume of meat put through the locker during the year. Hence, if losses are incurred on processing and these are absorbed by profits from the rent obtained from the lockers, patrons who place a relatively small volume of meat in the lockers during the year are penalized as compared with those with a large volume. The reverse would be true if locker rentals were too low and processing charges too high. Charges that are not equitable may, therefore, discourage patronage.

Furthermore, it is important that the actual cost of processing be ascertained in order to arrive at equitable charges where a plant engages a nearby plant to perform this service. For these reasons, it is important that the charge for each service be based as accurately as possible upon the costs involved. An attempt, therefore, was made to separate the total plant operating expenses, exclusive of labor and management, into those chargeable to the locker room and those chargeable to the processing department. While the data are not entirely adequate, such an analysis may be of value to locker-plant operators and patrons alike.

The total investment in the plant was allocated as follows: Locker room, 65 per cent of the building and insulation,<sup>7</sup> 50 per cent of the refrigeration equipment, and 100 per cent of the

<sup>7</sup> This estimate was upon the floor space of 10 of the plants included in the study.

lockers; processing department, 35 per cent of the building and insulation, 50 per cent of the refrigeration equipment, and 100 per cent of the cutting room equipment. Depreciation, taxes, insurance, repairs, and interest were divided according to this allocation of investment.

Sixty per cent of the power and water cost was charged to the locker room and 40 per cent to the chill and sharp-freeze room.<sup>8</sup> In plants Q and R all power and water, as well as other costs, were charged to the locker room because the chilling, cutting, wrapping, and sharp-freezing for these plants were done elsewhere. In all cases, paper, twine, telephone, and miscellaneous expenses were charged to the processing department. In the three separate or independent plants in group I the expense of heating the plants was charged against the processing rooms. The cost of electric lights was divided equally between the two services. No charge was made for office supplies or record forms.

Attention should be called to the fact that since the above allocation of costs was applied uniformly it does not take into account variations between plants. For example, in the larger plants proportionately less space was devoted to the processing rooms than in the smaller plants, and the proportion of space devoted to each service varied in plants of the same size. Furthermore, the estimated proportion of the cost of power and water

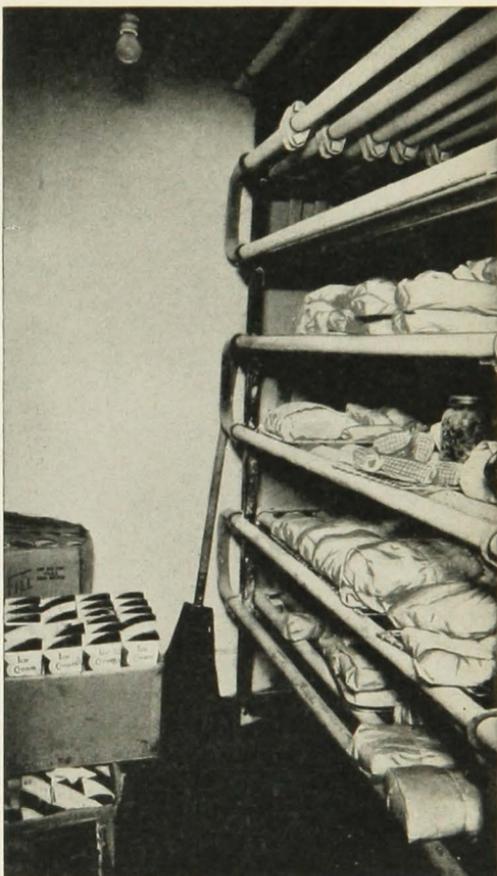


FIG. 5. SHARP-FREEZE ROOM

allocated to chilling and sharp freezing was based upon near-capacity operations, whereas this was not always the case. Hence, in plants that were operating at less than capacity a somewhat higher proportion of the total expense of power and water should have been charged against the locker room than appears in the tables. These arbitrary allocations should be kept in mind in connection with the following discussion.

<sup>8</sup>Based upon estimates submitted by refrigeration engineers.

Table 8. Locker-Room Expenses per Locker\* Exclusive of Labor and Management  
July 1, 1937 to June 30, 1938†

Plant	Locker capacity	Depreciation			Taxes, insurance, repairs	Interest on the investment at 6 per cent	Power and water	Light	Total	Per cent of lockers rented	Cost per locker used
		Buildings and insulation	Refrigeration	Lockers							
Group I											
A	800	\$0.33	\$0.21	\$0.41	\$0.32	\$1.07	\$0.68	\$0.05	\$3.07	28	\$10.81
B	558	.22	.19	.52	.38	.85	.88	.09	3.13	87	3.59
C	519	.19	.39	.50	.29	.92	.79	.05	3.13	63	4.92
Average		.26	.25	.47	.33	.96	.77	.06	3.10	.....	5.58
Group II											
D	475	.12	.18	.50	.60	.89	.58	.03	2.90	69	4.17
E	375	.34	.21	.50	.33	1.09	.84	.10	3.41	44	8.30
F	365	.43	.32	.54	.36	1.34	1.24	.07	4.30	59	7.29
G	335	.36	.30	.42	.25	1.21	.72	.07	3.33	38	8.82
H	300	.27	.25	.40	.42	.92	1.00	.05	3.31	45	7.35
I	270	.30	.51	.44	1.15	1.19	.80	.04	4.43	20	21.74
J	220	.32	.53	.40	.66	1.18	.87	.03	3.99	42	9.99
K	126	.44	.46	.41	.71	1.32	1.65	.17	5.16	74	7.07
Average		.30	.31	.46	.53	1.12	.89	.06	3.67	.....	7.46
Group III											
L	700	.32	.23	.50	.72	1.03	.52	.03	3.35	42	8.06
M	342	.31	.18	.50	.43	.94	.44	.04	2.84	60	4.77
N	255	.20	.27	.44	.54	.98	1.22	.02	3.67	65	7.13
O	255	.27	.39	.44	.43	1.01	.27	.03	2.84	28	10.21
P	126	.43	.55	.54	.55	1.46	1.43	.05	5.01	40	12.35
Average		.30	.28	.48	.58	1.04	.64	.03	3.34	.....	7.17
Group IV											
Q	120	.32	.65	.42	.54‡	1.20	2.25	.10	5.48	57	9.66
R	115	.31	.55	.47	.67§	1.19	1.71	.10	5.00	50	9.93
Average		.31	.60	.44	.60	1.20	1.99	.10	5.25	.....	9.78
Average all plants		.29	.29	.47	.48	1.05	.83	.06	3.47	.....	6.86

\* Based on locker capacity.

† See text for allocation of investment and operating costs between locker and processing rooms.

‡ Includes \$15.00 miscellaneous items in addition to taxes, insurance, and repairs.

§ Includes \$24.00 miscellaneous items in addition to taxes, insurance, and repairs.

## Locker-Room Operating Costs

The various costs involved in operating the locker room are shown in table 8 on the basis of the cost per locker. In making these calculations it was assumed that all lockers were installed, thus eliminating variations that would result from the fact that some of the plants had not purchased or installed all of the lockers that the insulated locker room would hold. The investment and fixed costs were thus placed on a comparable basis. Furthermore, power costs chargeable to the locker room are about the same

whether the lockers are filled or empty except for slight differences due to the human load<sup>9</sup> and door losses.

Depreciation costs per locker on building and insulation vary from plant to plant. However, the figures do not reveal a significant relationship between size of plant and depreciation cost. This is due to variations in the types and costs of housing locker plants of similar size. On the other hand, depreciation of refrigeration equipment tends to increase with de-

<sup>9</sup> Human load refers to the amount of heat given off by persons while in the locker room.

creasing size of plants. Locker costs are approximately the same in all plants, the slight variations being due to differences in the type or quality of lockers used. On the average depreciation charges on building, insulation, refrigeration, equipment, and lockers accounted for about 30 per cent of total cost of operating locker room exclusive of labor and management.

Taxes, insurance, and repairs varied from \$.25 to \$1.15 a locker with a weighted average of \$.48. This amounts to approximately 13 per cent of the total cost. The charge for interest on the investment at 6 per cent varied from \$.85 to \$1.46 a locker, the average being about 30 per cent of the total.

Power and water costs varied more than any of the other cost items shown in table 8, the range being from \$.27 per locker in plant O to \$2.25 in plant Q. In plants included in groups II, III, and IV, this was due, in part, to differences in electricity rates, and, in part, to the fact that the amount of electricity used by the locker plants was determined by comparing monthly consumption before and after the locker plants were installed in the creamery buildings. Two errors are possible in calculating electric power consumption by the latter method: first, in some instances changes were made in the refrigeration machinery when the locker plants were installed; second, the refrigeration load in the creameries may have changed.

On the other hand, power and water costs in the plants included in group I were separate and distinct from any

Table 9. Relationship between Electricity Rate and Power and Water Cost

Plants in group I	A	B	C
Cost of electricity per kilowatt hour (cents) .....	4.9	4.3	2.7
Kilowatt hours per locker per year* .....	13.8	20.4	29.2
Cost of power and water per locker per year (cents)*.....	68	88	79

\* Sixty per cent of the total power cost was charged to the locker room. Total consumption in these plants would be approximately 22, 34, and 45 kilowatt hours per locker per year when operating at or near capacity.

other operation. Hence, variations in power and water costs in these three plants were due largely to differences in electricity rates. Table 9 shows differences in rates. The rate charged for electricity and the amount consumed determine the cost per locker. For example, if the rate charged plant C were applied to plant A, the cost per locker would have been \$.37 instead of \$.68, while if the rate charged plant A were applied to plant C, the cost would have been \$1.43 instead of \$.79 a locker per year. Kilowatt hours per locker provide the prospective operator with a more accurate basis for estimating probable cost. The figures presented in table 9 are indicative of actual costs when operating at capacity.

The total of all costs, exclusive of labor and management, ranged from \$2.84 a locker in plants M and O to \$5.48 in plant Q. The low cost in the former plants was due to a low depreciation on the refrigeration equipment and low power and water cost while the high cost in plant Q was due to the high cost of these items. Each of the four plants with total costs of \$5.00 or over per locker were plants

with less than 130 locker capacity. Plants with total costs below \$3.25 per locker were plants with more than 250 locker capacity. Thus, operating costs per locker were lower in the larger plants.

Table 8 indicates that variations in the cost of operating the locker room are due chiefly to variations in the cost of power and water; depreciation on refrigeration equipment; and taxes, insurance, and repairs.

The effect of less-than-capacity operations on the cost per locker is shown in the last column in table 8. These figures are based upon the average number of lockers rented throughout the 12 months covered by the study. The cost per locker actually used varied from \$3.59 in plant B which was operated at 87 per cent capacity to \$21.74 in plant I which had only 20 per cent of its lockers rented.

### Processing Costs

The processing costs (table 10) were computed on the basis of the allocation of plant expenses to the processing rooms and on the number of pounds of meat handled by the plants. Since accurate figures on the amount of meat handled could not be obtained for the plants in groups III and IV, this analysis is limited to those in groups I and II. Some processing costs such as paper, twine, and power and water vary with the volume of meat handled, while others are like fixed costs. The latter include depreciation, taxes, insurance, interest, light, heat, telephone, and certain miscellaneous items.

The fixed costs per hundred pounds of meat handled tend to decline with increased volume while the variable costs per unit tend to remain more nearly constant. Because many of the plants included in the study were operating far below capacity, the cost

Table 10. Processing Expenses Exclusive of Labor and Management per Hundredweight of Meat Handled July 1, 1937 to June 30, 1938

Plant	Total pounds meat handled	Fixed Costs				Variable Costs			Total	
		Depreciation, taxes, insurance, repairs	Interest	Light	Heat, telephone, miscellaneous	Total	Power and water	Paper and twine		
Group I										
A	124,035	\$0.37	\$0.35	\$0.03	\$0.26	\$1.00	\$0.29	\$0.08	\$0.37	\$1.37
B	232,393	.15	.10	.02	.07	.35	.14	.09	.23	.58
C	172,956	.24	.16	.02	.11	.53	.16	.15	.31	.84
Average	176,461	.23	.18	.02	.13	.56	.18	.11	.29	.85
Group II										
D	132,965	.30	.17	.01	.21	.69	.13	.17	.31	1.00
E	131,802	.21	.17	.03	.02	.43	.16	.13	.28	.71
F	137,412	.25	.21	.02	.13	.61	.22	.20	.42	1.03
G	169,830	.19	.14	.02	.07	.41	.09	.35	.44	.85
H	57,110	.36	.26	.03	.15	.79	.35	.24	.60	1.39
I	37,492	1.06	.53	.03	.47	1.76	.47	.09	.56	2.33
J	53,442	.48	.30	.....	.18	.96	.25	.10	.35	1.31
K	61,699	.25	.16	.....	.05	.45	.22	.12	.34	.79
Average	97,719	.30	.20	.02	.12	.64	.19	.20	.39	1.03
Average all plants	119,194	.27	.19	.02	.13	.61	.19	.16	.35	.96

per hundredweight of meat handled was much higher than if they had been operating at or near capacity. This was due to the relative importance of the fixed costs. Thus the variable costs should provide some indication of costs for other plants, while the fixed costs must be related to the volume of meat handled. On the other hand, the total cost figures may serve as an indication of costs in plants operating at varying capacities.

Four plants—B, C, D, and K—were operated at 63 to 87 per cent of locker capacity during the year. In those plants, depreciation, taxes, insurance, and repairs varied from 15 to 30 cents per hundred pounds of meat handled and interest from 10 to 16 cents. The average cost of these two items for all plants in groups I and II was 27 and 19 cents, respectively, per hundred pounds of meat handled.

The total of all fixed costs per hundred pounds of meat handled ranged from \$.35 in plant B which operated at 87 per cent of capacity, to \$1.76 in plant I which had only 20 per cent of the lockers rented.

In a given plant the amount and cost of power, water, paper, and twine used per hundred pounds of meat remains fairly constant regardless of the volume of meat handled. However, the cost and amount used varies from plant to plant. For example, power and water costs per hundred pounds of meat handled by all plants included in groups I and II ranged from 9 cents in plant G<sup>10</sup> to 47 cents in plant I. In

plants B, C, D, and K which were operated nearest to capacity the power and water costs were 14, 15, 13, and 22 cents, respectively. Paper and twine costs varied from a minimum of 7 cents per hundred pounds of meat handled in plant A and a maximum of 35 cents in plant G. The average of about 16 cents for all plants would appear to be a reasonable figure for this item of expense.

The total of all processing costs, exclusive of labor and management, varied from \$.58 per hundred pounds of meat handled in plant B to \$2.33 in plant I. The weighted average cost of \$.96 for all plants in groups I and II is useful to the extent that it represents the cost in plants operating at approximately 50 per cent of capacity. Similarly, total costs of \$.58 and \$.84 in plants B and C represent costs in plants operating at 87 and 63 per cent of capacity, respectively.

If the plants in groups I and II had been operating at an average of 85 per cent instead of at approximately 50 per cent of capacity, the average fixed costs chargeable to the processing department would have totaled about \$.41 per hundred pounds of meat handled. On the assumption that the average power and water costs in the plants in group I or \$.19 per hundred pounds of meat handled, and the average paper and twine cost of all plants in groups I and II or \$.16, are reasonably dependable, the total processing costs exclusive of labor and management would be \$.76 per hundred pounds of meat handled. To this

<sup>10</sup> This plant was operated in connection with the two other enterprises and the power rate charged to the locker plant was very low.

should be added the cost of labor which is estimated to be about \$.50 per hundred pounds of meat. The total processing cost exclusive of management would, therefore, be about \$1.26 per hundred pounds of meat handled. The usual processing charge made by the plants included in this study was \$1.00 per hundredweight, whereas actual costs when operating at about 85 per cent capacity would, according to these estimates, amount to \$1.26 per hundredweight exclusive of management.

### MEAT HANDLED, SOLD, CUT, AND GROUND BY LOCKER PLANTS

Thirteen plants supplied data on the kind and amount of meat handled, sold, cut, and ground during the year. These data were obtained from individual patron record sheets filled out at the locker plants. As these records included the length of time each patron utilized the locker, it was possible to calculate the number of patron years<sup>11</sup> for each plant. Figures on the kind and amount of meat handled, sold, and cut by the plants are presented in table 11 on a per-patron-year basis.

#### Meat Handled

Meat handled by the plant includes all the meat that came into the plant from patrons as well as the meat sold

to patrons by the plant. The figures indicate rather wide variations between plants in the kind and amount of meat handled. The total amount of meat handled ranged from 482 pounds a patron year in plant B to 864 pounds in plant E. The wide variation between plants was due, in part, to the fact that the number of patrons in some of the plants increased greatly during the year. Where large amounts of meat were placed in the lockers late in the year, the poundage figures on a per-patron-year basis were greater than in plants where a higher proportion of the patrons made use of the lockers throughout the period covered by the study. The average of all plants for all kinds of meat combined was 586 pounds handled per patron year. This figure should serve as a basis for estimating the probable total volume of meat handled by a typical locker plant and should be useful both to present and prospective plant operators.

As an average of all plants, 48.0 per cent of the meat handled consisted of pork, 47.1 per cent of beef, 2.3 per cent of veal, 0.6 per cent of poultry, 0.4 per cent of mutton and lamb, and 1.6 per cent of other meats. However, there was considerable variation among the different plants. For example, nine plants handled more pork than beef while four plants handled more beef than pork. The figures indicate that cold-storage locker plants in Minnesota are used primarily for the storage of pork and beef. These two items are, on the average, of about

<sup>11</sup> The total patron years for each plant was obtained by subtracting the extra locker months from the total locker months and dividing by 12.

Table 11. Kind and Amount of Meat Handled, Sold, and Cut by Cold-Storage Locker Plants July 1, 1937 to June 30, 1938\*

	Beef	Veal	Pork†	Mutton, Lamb	Poultry	Other‡	Total
	Pounds per patron year§						
Meat Handled							
Range .....	176.8-402.6	4.4-46.7	204.1-417.4	0.5-6.7	0.0-10.2	0.0-30.7	481.9-863.8
Average .....	275.9	13.4	281.4	2.6	3.2	9.5	586.0
Meat Sold							
Range .....	0.0- 72.7	0.0- 0.8	0.0- 30.0	0.0-0.7	0.0- 0.4	0.0- 9.5	0.0- 99.6
Average .....	35.8	0.3	9.2	0.1	0.1	0.7	46.6
Meat Cut							
Range .....	170.0-352.3	3.8-46.9	194.6-416.1	0.5-5.3	.....	0.0- 9.6	413.9-777.1
Average .....	260.8	12.8	270.2	2.4	.....	2.5	548.7

\* Includes all plants in groups I, II, and IV.

† Includes lard.

‡ Includes fish, game, and unclassified meat.

§ Patron years obtained by subtracting extra locker months from total locker months and dividing by 12.

|| Includes meat sold by plants to locker patrons.

equal importance and together account for about 95 per cent of the total meat handled. Relatively small amounts of veal and "other meats" and even less of mutton and lamb and of poultry are handled by the locker plants.

### Meat Sold

The total amount of all kinds of meat sold per patron year varied from none in plant I to one hundred pounds in plant F. The demands of the patrons varied in the different areas as well as the emphasis placed on this service by the different plant operators. An average for all plants, of about 46 pounds of all kinds of meat combined were sold per patron year. Of this amount, 76.8 per cent was beef, 19.7 per cent pork, 1.1 per cent poultry, 0.6 per cent veal, 0.2 per cent mutton and lamb, and 1.5 per cent other meats.

Patrons of plants in group IV purchased much less meat from the plants than patrons of any other plants except I and K. This was probably due

to the inconvenience of purchasing meat from the plant that performed the processing services for plants Q and R.

### Meat Cut

Most of the meat handled by plants that provide processing services is cut by the plant butcher. For this reason the figures on the kind and amount of meat cut per patron year by the various plants do not differ greatly from the figures on meat handled. However, the amount of meat cut by the plant is slightly less than the amount handled for two reasons: first, some of the patrons performed this service for themselves; second, poultry, which is included in the amount handled, is drawn, wrapped, and frozen without being cut.

The total amount of meat cut per patron year ranged from 414 to 777 pounds with an average for all plants of 549 pounds. Of the latter amount pork was 270 pounds; beef, 261 pounds;

Table 12. Kind and Amount of Meat Ground by Plants for Locker Patrons July 1, 1937 to June 30, 1938, in Pounds per Patron Year\*

	Beef	Veal	Pork	Lard	Total
Group I					
A .....	9.3	.04	7.1	6.0	22.8
B .....	23.0	.1	21.9	45.2	90.2
C .....	27.3	.4	47.8	.2	75.7
Group II					
D .....	16.6	2.4	22.3	43.3	84.6
E .....	31.0	.3	30.9	95.9	158.1
F .....	37.8	.8	35.0	75.1	148.7
G .....	23.6	.3	15.7	27.8	67.4
H .....	23.8	.3	27.6	52.6	104.3
I .....	29.8	3.0	14.6	9.4	56.8
J .....	23.5	.9	21.1	84.7	130.2
K .....	30.9	3.3	35.6	58.0	127.8
Group IV					
Q .....	17.2	.....	9.1	19.4	45.7
R .....	10.2	.05	16.9	36.8	64.4
All Plants					
Average .....	23.4	.8	25.7	40.3	90.2
Percentage distribution .....	25.94	.88	28.50	44.68	100.0

\* See footnote §, table 11.

veal, 13 pounds; and mutton and lamb and other meat, about 2½ pounds each. Pork thus accounted for 49.2 per cent of the total meat cut; beef, 47.5 per cent; veal, 2.3 per cent; mutton and lamb, 0.4 per cent; and other meat, 0.5 per cent.

### Meat Ground

The amount of meat ground per patron year is of interest to locker operators since grinding is a source of additional revenue. As shown in table 12 there were wide variations in the amount of meat ground per patron year. The range was from 23 pounds to 158 pounds with an average of slightly over 90 pounds. In addition to the explanation given for the differences in the amount of meat handled per patron year by the different plants,

the variations in the amount of meat ground were apparently due to the fact that some plants emphasized this service more than others.

Beef, pork, and lard were the chief products ground. The average for all plants was 23 pounds of beef per patron year, 26 pounds of pork, and 40 pounds of lard. The percentage distribution was approximately 26, 28, and 45 per cent, respectively. The amount of veal ground was negligible.

Four major conclusions may be drawn from the figures presented in tables 11 and 12. First, the greater part of the meat handled by cold-storage locker plants in Minnesota is supplied by the patrons. As an average for all plants in groups I, II, and IV, 586 pounds of all kinds of meat combined were handled per patron year, and of this amount the plants sold 46 pounds and the patrons supplied 540 pounds.

Second, beef is the most important kind of meat sold by the plants to their patrons. Whereas about equal amounts of beef and pork were handled by the plants, the amount of beef sold to patrons was nearly four times that of pork.

Third, the greater part of the meat handled was cut by the plant butcher in those plants providing this service. The average for all plants included in these tables was 549 pounds meat cut compared with 586 pounds handled or approximately 94 per cent of the total.

Fourth, on the average about 15 per cent of the meat handled was ground by the plant butcher. These figures

appear to be fairly representative of the Minnesota situation at the present time.

### MEAT CONSUMED BY LOCKER PATRONS

Data were also obtained on the kind and amount of meat consumed by 145 locker patrons during the 12 months covered by the study. These patrons were selected at random from several of the locker plants. Each was asked to fill out a schedule which supplied data on the number and age distribution of children and the number of adults in the family, distance from plant, and kind and amount of meat used from sources other than the locker plant. The kind and amount of meat handled by the locker plant, including meat purchased from the plant, were obtained for each of these patrons from the plant records.

To determine the amount of meat consumed by each patron and his family an inventory was taken of the contents of the locker at the beginning of the year. The kind and amount of meat in the locker at that time were added to the kind and amount handled by the plant for the patron during the year. From this was deducted the amount of meat remaining in the locker at the end of the year as shown by the closing locker inventory. Thus accurate figures were obtained on the meat consumed from the locker by the patron and his family for the year. To this was added the amount used from other sources as reported on the individual schedules.

One of the objectives of the meat-consumption study was to determine whether distance from the plant influenced the amounts consumed from the lockers and from other sources. Other sources include meat purchased at retail, meat slaughtered and used at home without going through the locker plant, and miscellaneous sources such as purchases from neighbors.

The number of patrons, persons, and adult equivalents included in this section of the study classified by distance zones is shown in table 13. Of the total of 145 patrons, 10 lived less than one mile from the plants and hence were classified as town patrons and 23 lived 10 miles or more from the plants. The size of families of rural patrons was larger than that of town patrons, the average for the former being 5.7 compared with 5.0 for the latter.

### Meat Consumed per Person

Table 14 shows the kind and amount of meat consumed per person by the 827 people included in the families of these 145 patrons, classified according

Table 13. Locker Patrons Included in Meat-Consumption Study Classified by Distance from the Plant

Distance from Plant in Miles	Number of Patrons	Number of Persons	Adult Equivalent*
Less than 1	10	50	42.6
1-3.9	32	187	176.7
4-6.9	45	260	232.1
7-9.9	35	207	185.5
10 and over	23	123	110.9
Total	145	827	747.8

\* Adult Equivalent: adult male, 1.00; adult female, .90; child 11 to 14 years, .90; child 7 to 10 years, .75; child 4 to 6 years, .40; child 3 years or under, .15. "Cost of Living in the United States." Bulletin of the United States Bureau of Labor Statistics, No. 357, May 1924, page 70.

Table 14. Kind and Amount of Meat Consumed per Person by 145 Patrons Classified According to Distance from Locker Plants July 1, 1937 to June 30, 1938

Distance from plant in miles	Source of Meat	Amount Consumed per Person in Pounds							Total
		Beef	Veal	Pork‡	Mutton and lamb	Poultry	Fish	Other meat§	
Less than 1	Plant*	46.7	0.0	43.2	.5	2.5	0.4	0.0	93.3
	Other†	8.6	2.9	4.9	...	4.3	3.1	1.2	25.0
	Total	55.3	2.9	48.1	.5	6.8	3.5	1.2	118.3
1-3.9	Plant	44.8	3.2	50.8	.5	3.8	1.2	0.1	104.4
	Other	17.8	1.8	12.5	.3	6.1	1.7	0.9	41.1
	Total	62.6	5.0	63.3	.8	9.9	2.9	1.0	145.5
4-6.9	Plant	46.9	6.3	51.9	.5	3.4	0.9	0.2	110.1
	Other	11.7	3.3	14.3	.0	8.7	2.6	1.6	42.2
	Total	58.6	9.6	66.2	.5	12.1	3.5	1.8	152.3
7-9.9	Plant†	47.5	3.3	56.3	.0	3.2	0.9	0.0	111.2
	Other	10.4	0.2	9.5	.1	4.0	2.6	1.5	28.3
	Total	57.9	3.5	65.8	.1	7.2	3.5	1.5	139.5
10 and over	Plant	51.9	5.2	55.5	.....	4.2	0.8	0.1	117.7
	Other	5.3	0.4	17.1	.....	9.2	2.4	2.2	36.6
	Total	57.2	5.6	72.6	.....	13.4	3.2	2.3	154.3
Average	Plant	47.3	4.3	52.8	.3	3.5	0.9	0.1	109.2
	Other	11.6	1.7	12.5	.1	6.8	2.4	1.5	36.6
	Total	58.9	6.0	65.3	.4	10.3	3.3	1.6	145.8

\* Includes all meat consumed from the locker during the year.

† Includes all retail purchases at shops and meat slaughtered and used at home or obtained from sources other than locker plant or retail shops during the year.

‡ Includes lard from hogs slaughtered and used at home and lard from hogs handled by the plant.

§ Includes fish, game, and unclassified meat.

to distance from the plants. The total amount of meat consumed per person was greater among rural than among town patrons. The average per capita consumption by persons living less than one mile from the plants was 118 pounds compared with 146, 152, 140, and 154 pounds, respectively, in the successive zones moving outward from the plants. The average consumption of all meats was 146 pounds per person. As indicated, these totals include lard from hogs slaughtered and used at home and lard from hogs handled by the plants.

The amount of meat used from the lockers increased gradually with distance from the plants. Town patrons consumed an average of 93 pounds per capita from the lockers while those from the most distant zone consumed approximately 118 pounds per capita. Rural patrons also used more

meat per capita from other sources than town patrons with those from the 1.0-3.9 mile and 4.0-6.9 mile zones using more per capita from other sources than either of the more distant groups.

Pork consumption per capita increased with distance from the plant. However, in the most distant zone there was a slight reduction in the amount of pork used from the lockers and a marked increase in amount used from other sources. This suggests that the more distant patrons butchered and processed more pork on the farm than those located nearer the plants. On the other hand, town patrons consumed about as much beef per capita as country patrons although there was a tendency for the latter to use relatively more beef from other sources.

Rural patrons used more pork per capita than beef and there was a tendency for the proportion of pork to

increase with distance. Town patrons on the other hand used more beef per capita than pork. The average for all groups was 65 pounds pork and 59 pounds beef per capita. As previously noted, the figures on pork consumption include the lard from pork processed at the plants and the lard from hogs slaughtered and used outside the plants. Consequently the figures on pork consumption and on total meat consumption include lard from this source but exclude lard purchased at retail shops. The average consumption per person of other kinds of meat was as follows: poultry, 10 pounds; veal, 6 pounds; fish, slightly over 3 pounds; other meats, less than 2 pounds; and mutton and lamb less than one-half pound.

The average consumption of pork and lard per capita in the United States during 1937 was 65.6 pounds; beef, 54.3 pounds; veal, 8.4 pounds; and mutton and lamb, 6.6 pounds.<sup>12</sup> Figures presented in table 14 indicate that patrons of cold-storage locker plants in Minnesota consumed much less mutton and lamb per capita than the national average from July 1, 1937 to June 30, 1938, slightly less veal, somewhat more beef, and about the same amount of pork and lard. However, no figures were obtained on the amount of lard, if any, used by locker patrons other than that obtained from the pork used from locker plants and from hogs butchered, processed, and used outside the plants.

Much of the poultry and fish consumed by locker patrons came from sources other than the locker plants. The average for all patrons indicates that 6.8 pounds of poultry per person came from other sources and only 3.5 pounds from the lockers while 2.4 pounds of fish per person came from other sources and less than 1.0 pound from the lockers. A negligible amount of mutton and lamb was consumed by the patrons included in this study.

### Meat Consumed per Adult Equivalent

The data presented in table 14 are shown in table 15 on the basis of the amount of meat consumed per adult equivalent instead of the amount consumed per person. The number of persons in each family was converted to adult equivalents according to the formula shown in table 13. This was done to place all families on a comparable basis by eliminating variations caused by the number and ages of children and possible differences in the number of adult males and females.

The amount consumed per adult equivalent is naturally higher than the amount consumed per person. As there were more children in the families of rural than of town patrons, there is less difference in the average consumption per adult equivalent between town and rural patrons than when the figures are shown on a per capita basis.

A number of significant conclusions may be drawn from the data presented in tables 14 and 15. First, rural patrons consumed more meat per person

<sup>12</sup> "Livestock, Meats and Wool Market Statistics and Related Data, 1937," Bureau of Agricultural Economics, May 1938, page 81.

Table 15. Kind and Amount of Meat Consumed per Adult Equivalent by 145 Patrons Classified According to Distance from Locker Plants July 1, 1937 to June 30, 1938

Distance from plant in miles	Source of Meat	Amount Consumed per Adult equivalent in Pounds							Total
		Beef	Veal	Pork‡	Mutton and lamb	Poultry	Fish	Other meat§	
Less than 1	Plant*	54.9	.....	50.7	.5	3.0	0.4	0.0	109.5
	Other†	10.1	3.4	5.7	.....	5.0	3.7	1.4	29.3
	Total	65.0	3.4	56.4	.5	8.0	4.1	1.4	138.8
1-3.9	Plant	47.4	3.3	53.8	.5	4.0	1.3	0.1	110.4
	Other	18.9	2.0	13.2	.3	6.5	1.7	1.0	43.6
	Total	66.3	5.3	67.0	.8	10.5	3.0	1.1	154.0
4-6.9	Plant	52.4	7.0	58.2	.6	3.8	1.0	0.3	123.3
	Other	13.2	3.7	15.9	.0	9.8	2.9	1.8	47.3
	Total	65.6	10.7	74.1	.6	13.6	3.9	2.1	170.6
7-9.9	Plant	53.1	3.7	62.9	.....	3.5	1.0	.....	124.2
	Other	11.6	0.3	10.6	.1	4.5	2.8	1.7	31.6
	Total	64.7	4.0	73.5	.1	8.0	3.8	1.7	155.8
10 and over	Plant	57.6	5.8	61.5	.....	4.6	1.0	0.1	130.6
	Other	5.9	0.4	19.0	.....	10.2	2.6	2.4	40.5
	Total	63.5	6.2	80.5	.....	14.8	3.6	2.5	171.1
Average	Plant	52.3	4.7	58.4	.3	3.9	1.0	0.2	120.8
	Other	12.9	2.0	13.8	.1	7.5	2.6	1.6	40.5
	Total	65.2	6.7	72.2	.4	11.4	3.6	1.8	161.3

\* Includes all meat consumed from the locker during the year.

† Includes all retail purchases at shops and meat slaughtered and used at home or obtained from sources other than locker plant or retail shops during the year.

‡ Includes lard from hogs slaughtered and used at home and lard from hogs handled by the plant.

§ Includes fish, game, and unclassified meat.

and per adult equivalent than town patrons. Second, rural patrons consumed more pork and poultry per capita and per adult equivalent than town patrons while the amount of beef consumed was about the same in each group. Third, rural patrons consumed more pork than beef while town patrons consumed more beef than pork. Fourth, relatively little mutton and lamb is consumed by patrons of cold-storage plants in Minnesota.

### ADVANTAGES AND CRITICISMS OR DISADVANTAGES OF LOCKER SERVICE

Patron reaction to the services offered by cold-storage locker plants should throw some light on probable future developments. For example, if present users are satisfied with this type of storage, further expansion may

be expected. On the other hand, if, in the opinion of experienced users, the disadvantages outweigh the advantages, the opposite result might be expected. Furthermore, it is highly desirable that plant operators know the nature and relative importance of the advantages and criticisms or disadvantages as reported by their patrons. By centering their attention on the reported criticisms or disadvantages, the operators should be able to bring about desired changes either in the kind or amount of service rendered and thereby encourage not only continued but increased patronage.

In order to discover the users' opinions, over 3,000 questionnaires were mailed to patrons of 17 Minnesota locker plants during June, 1938. Among other questions, the patrons were asked to list, in the order of importance, the advantages and criti-

Table 16. Advantages of the Cold-Storage Locker System as Reported by Patrons

	Number of times given
<b>Advantages Compared to Home Butchering and Processing</b>	
1. Fresh meats available throughout the year.....	265
2. Eliminates work of home butchering, processing, and canning.....	214
3. Freezing reduces the danger of waste or spoilage of meats.....	90
4. Butchering can be done at any time of the year.....	72
5. A greater variety of meats can be kept on hand.....	49
6. Locker system provides a proper storage place for meats.....	47
7. Frozen meats are more palatable than salted, canned, or cured meats.....	44
8. Meat is cut and wrapped in proper size packages for family use.....	37
9. Provides expert butchering and cutting service.....	25
<b>Advantages Compared to Purchase of Meat at Retail Shops</b>	
1. Locker system effects a saving over buying meat at retail.....	236
2. A higher quality of meat is available.....	139
3. Satisfaction of using home produced meat.....	59
4. Meat available when butcher shop is closed.....	52
5. Supply as convenient as butcher shop.....	27
<b>Miscellaneous Advantages</b>	
1. Provides good storage facilities for fruits, vegetables, game, and fish.....	21
2. Increases consumption of meat.....	7
3. Other.....	4

cisms or disadvantages of the locker service. Returns were obtained from 520 patrons or approximately 17 per cent of those to whom the schedules were mailed.

All of the schedules that were returned contained one advantage or more, the average being 2.7 per patron. On the other hand, 119 patrons stated specifically that there were no disadvantages while an additional 151 patrons did not report on this section. The average number of criticisms or disadvantages reported was 0.7 per schedule returned.

The advantages of the cold-storage locker service as reported by 520 patrons are shown in table 16. The replies are grouped under three main headings; advantages compared to home butchering and processing, advantages compared to purchase of meat at retail shops, and miscellaneous advantages.

According to these reports the most important advantages compared to home butchering and processing in-

clude the availability of the equivalent of fresh meat throughout the year and the elimination of the work of home butchering, processing, and canning. The two most important advantages over the purchase of meat at retail included cash savings and the fact that a higher quality of meat can be obtained through the use of the locker.

The criticisms or disadvantages of the locker service as reported by the same group of patrons are presented in table 17. Distance from farm to plant and the fact that the locker service was more expensive than home slaughtering and processing were two disadvantages mentioned most frequently. The inconvenience of distance may in time be overcome either through the adoption of a delivery service or improvements in refrigeration facilities on the farm whereby meat may be kept in the home for longer periods of time after the packages are removed from the locker room. At the present time Minnesota locker-plant operators are

Table 17. Criticisms or Disadvantages of the Cold-Storage Locker System as Reported by Patrons

	Number of times given
1. Distance from farm to plant.....	85
2. More expensive than home slaughtering and processing.....	52
3. Slowness of thawing out before meat can be used.....	28
4. Locker boxes too small.....	23
5. Difficulty of finding kind and size of cut wanted.....	21
6. Less convenient than purchase at the butcher shop and less variety.....	21
7. Frozen meat less palatable than fresh meat.....	20
8. Difficulty of keeping frozen meat at home after removal from the locker.....	17
9. Irregular temperature in the locker room.....	15
10. Tendency for pork to become rancid.....	14
11. Meat dries out.....	12
12. Careless butchering, cutting, etc. by the plant butcher.....	9
13. Coldness of the locker room when securing meat.....	8
14. No saving for a small family.....	6
15. Locker key difficulties; loss, duplication, etc.....	5
16. Problem of utilizing cheaper cuts.....	4
17. Loss of juices upon thawing out.....	3
18. Meat not properly aged before freezing.....	2
19. No record of kind and amount of meat in the locker.....	2
Number specifically indicating no disadvantages.....	119
Number giving no report on disadvantages.....	151

of the opinion that delivery service is not practical. However, with the extension of rural electrification it is probable that home refrigeration will reduce the frequency of trips to and from the locker plant for many farmers. It is obvious that the cash outlays for the locker service are greater than those involved in slaughtering and processing on the farm by the farm family. Since each plant should make a sufficient charge for each type of service rendered to cover the costs involved, the patron must weigh the advantages against the extra costs.

Less frequently mentioned criticisms or disadvantages included the following: locker boxes too small, difficulty in finding kind and size of cut wanted, less convenient than purchasing at the butcher shop, frozen meat less palatable than fresh meat, difficulty in keeping frozen meat at home after removal from the locker, irregular temperatures

in the locker room, and the tendency for pork to become rancid.

Plant operators can do much to eliminate many of these criticisms. For example, the criticism that the locker boxes are too small may be overcome by providing lockers of various sizes to meet the requirements of different patrons. Greater care in slaughtering, chilling, aging, cutting, and wrapping, the maintenance of proper temperatures in the sharp-freeze and locker rooms, together with proper labelling and storing of packages in the locker will do much toward eliminating criticism of the locker service. Plant operators can also assist in bringing to the attention of patrons the latest information on the use of frozen meats.

Two important conclusions may be drawn from the reaction of patrons to the locker service. First, the advantages of the locker service were

mentioned much more frequently than were the criticisms or disadvantages. Second, many of the criticisms can be eliminated or at least modified by improved management and plant operation, by locker-patron education and experience, and by the extension of rural refrigeration.

### PROSPECTS FOR THE FUTURE

Up to the present time, cold-storage locker plants in Minnesota have been patronized largely by farmers. This new development has brought about the first significant change in the system of farm processing and storing of meat during modern times. Processing and storing and, in some cases, slaughtering have been moved from the farm to the local cold-storage locker plant.

The use of cold-storage lockers may result in a change in the relative proportion of the different kinds of meat consumed on the farm. Since the locker plant enables the farmer to slaughter or to purchase beef at wholesale from others at any time during the year and preserve it in a fresh-frozen state, it may increase the absolute as well as relative amount of beef consumed by farm families. Many patrons and operators of locker plants believe that this service will lead to greater consumption of all meats by farmers. If this takes place, it will be because of the greater palatability of frozen than of home-cured and canned meat and to some extent from lower costs or to the procurement of

a more suitable grade of meat than was formerly purchased at retail.

Sufficient time has not elapsed to justify conclusions as to whether this movement will extend rather generally to urban consumers. If the movement spreads to urban centers it will be chiefly due to possible cash savings and to a lesser extent to the possibility of procuring a grade of meat more suitable to the pocketbook and taste of the consumer. Hence, the locker service may be expected to make a greater appeal to large rather than to small families, and in the larger urban centers where all grades of meat are available it will make a greater appeal to families in the lower- rather than in the higher-income groups.

The effect of the cold-storage locker development on slaughterers, wholesalers, transportation, and market agencies will depend upon whether it leads to an increase in local slaughter in production areas. In the long run, this will depend upon whether savings in transportation and labor costs will more than offset the advantages that accrue to large-scale slaughterers through specialization in labor and equipment and in the utilization of by-products.

Attention should be called to the danger of overexpansion of the locker industry. The size and number of plants should be based upon probable patronage. Furthermore, rapid changes are to be expected in a new industry.

New developments may lead to more rapid depreciation of plant and equipment than contemplated at the time the plant was erected and equipped.

## SUGGESTIONS AS TO TYPE AND SIZE OF PLANT

Prospective operators should carefully consider the type and size of plant to be erected. This will depend upon prospective patronage and the kind and amount of services to be rendered. In general, the larger plants have a lower investment per locker and lower power rates. If operating at or near capacity, they are also in a more favorable position to employ competent butchers. On the other hand, if the large plants are operated far below capacity, the fixed costs result in high unit costs. Every effort should be made to determine the patronage that may be expected before the plant is erected.

Data obtained in connection with this study do not reveal the point at which plants may experience increasing costs due to increased size of plants. On the other hand, decreasing size of plants is associated with increasing overhead costs per locker and higher labor and management costs. Based upon the data obtained in this study, it appears that in plants that employ competent full-time butchers to perform the cutting, grinding, freezing, and locker-management services there should be at least 200 regular patrons. This limit may be lowered somewhat by increasing the service charges or by expanding the kind and amount of services rendered or both.

A locker room only may be economically constructed and operated in conjunction with some other enterprise with as few as one hundred patrons

providing a near-by plant can be engaged to perform the work of chilling, cutting, freezing, and delivering the frozen packages to the local locker room. In such cases arrangements should be made for the processing services before the local locker room is installed.

In determining the size of plant in a community, prospective operators should weigh carefully the possibility of competition both within and on the fringe of the territory they expect to serve. Many farmers market their products at one point and do most of their trading at another. The choice of a locker plant will depend upon the relative frequency of trips to each point. The relative incomes of the patrons to be served must also be taken into account. In low-income areas a smaller proportion of farmers are likely to utilize the locker service than in high-income areas.

## SUGGESTIONS TO PLANT OPERATORS

Efficient management is essential to the successful operation of a locker plant. The operator should possess the technical knowledge required to run the physical plant and to perform the various services, and be able to supervise additional labor and develop an intelligent understanding between the plant and its patrons. The following suggestions involve some of the more difficult problems with which the operator is likely to be confronted:

1. Every effort should be made to secure favorable power rates.

2. Labor payments should be on a basis which will offer an incentive to the employees to handle as much of the peak load as possible without employing additional help. This will avoid the necessity of layoffs during slack periods.

3. Employees should be encouraged to know and promote an understanding of the limitations as well as the possibilities of the locker service. Overselling will cause dissatisfaction eventually.

4. Rental rates and processing charges should be in line with the costs involved. Shifting costs from one department to another or to other joint enterprises inevitably leads to dissatisfaction on the part of patrons and to unsound developments in the industry.

5. Inadequate chilling facilities for handling peak loads exist in many plants. This situation may cause "slimy" carcasses, slow chilling, and spoilage. Where this condition exists, operators should make the changes that are necessary to correct it. The load in the chill room can be reduced by cutting and freezing pork as soon as it is thoroughly chilled.

6. Good floors, equipment, and cleansing facilities are essential for proper sanitation. Patrons, who do their own slaughtering, should be encouraged to deliver the carcasses in as satisfactory condition as possible.

7. Careful consideration should be given to the demands for miscellaneous services. The possibilities of at-

tracting additional patrons and securing added income from rendering more complete food-processing services should be thoroughly explored.

8. Locker-plant operators should encourage the intelligent and economic use of lockers by patrons.

## SUMMARY

The first modern cold-storage locker plant in Minnesota was opened in 1935. By March 1, 1939 a total of 179 plants with an estimated capacity of 51,000 lockers were in operation. A detailed study of 18 plants was made during the period July 1, 1937 to June 30, 1938.

The investment per locker in different plants varied according to the size and type of plant and to the kind and amount of equipment installed. The capital outlay per locker was much less in plants with locker rooms only than in plants of approximately the same locker capacity that were also equipped with processing rooms.

In plants that are equipped with processing rooms and employ butchers to render the processing service, the most important operating expense is that of labor. Interest, depreciation, and power and water are the next most important items of expense. Other operating expenses include taxes, insurance, repairs, light, heat, telephone, paper, twine, and miscellaneous items.

The most important source of income in the 18 plants studied was locker rentals. As an average, 87 per cent of the total income from locker

rentals was obtained from yearly rentals, 8 per cent from monthly, and 5 per cent from the rental of extra lockers. Other sources of income for plants in Groups I and II were cutting, wrapping, and freezing meat, slaughtering, grinding meat and lard, commission on meat sales, curing and smoking meat, and rendering lard and miscellaneous items. During the period covered by this study, Minnesota locker plants were used largely for the processing and storing of meats.

Where depreciation, interest or investment at 6 per cent, and all cash operating expenses including labor other than management were charged against the locker plants, the net income for the year July 1, 1937 to June 30, 1939 varied from a maximum of \$2,044 to a loss of \$1,794. Based upon this method of calculating operating expenses the gross income failed to equal operating expenses in 14 out of the 18 plants. This was due chiefly to the fact that many of the plants were operating far below capacity. With one exception, plants that had an average of 50 per cent or more of the lockers rented throughout the year either had sufficient income to meet operating expenses or suffered only modest deficits. As patronage in most of the plants increased during the year in which the study was in progress, these figures do not reflect the situation that prevailed at the close of the year. However, it is probable that some of the plants were equipped to handle a larger volume of business than the local situation warrants. Excessive capital investment or failure to

make a sufficient charge for the services rendered naturally are reflected in the net income.

On the assumption that all lockers were installed, the cost of operating the locker room exclusive of labor and management varied from \$2.84 to \$5.48 a locker. However, the actual cost during the year of the study varied from \$3.59 in one plant which was operated at 87 per cent of capacity to \$21.74 in a plant which had only 20 per cent of the lockers rented. There was a distinct tendency for operating costs to increase with decreasing size of plants.

Processing costs exclusive of labor and management varied from \$.58 to \$2.33 per one hundred pounds of meat handled, an average of \$.96 being representative of plants operating at approximately 50 per cent of capacity. At 85 per cent of capacity the cost of processing, exclusive of labor and management, would have averaged approximately \$.76 per one hundred pounds of meat handled. With an estimated cost of \$.50 per hundred pounds for labor, the cost, exclusive of management, would have been \$1.26 per hundredweight of meat handled.

As an average for the 13 plants included in groups I, II, and IV, 586 pounds of all kinds of meat combined were handled per patron year. Of this amount the patrons supplied 540 pounds and the plants sold 46 pounds. The plants cut 94 per cent and ground 15 per cent of the meat handled.

Rural patrons consumed more meat per person and per adult equivalent than town patrons. This was because

the rural patrons consumed more pork and poultry than did the town patrons. The consumption of beef was about the same in each group. Relatively little mutton and lamb were consumed by either rural or town patrons.

Based upon the reports of patrons of locker plants it appears that farmers are attracted to the locker plants, not because of cash savings over farm butchering and processing, but primarily because the locker plant makes available the equivalent of fresh meat throughout the year and eliminates the work of home butchering, processing, and canning. Patrons also

emphasized the importance of cash savings and the possibility of obtaining a higher quality of meat through the locker than if purchases are made over the retail counter.

Many of the criticisms or disadvantages reported by locker patrons can be reduced or eliminated through more efficient operation of the plant and by supplying patrons with more complete information on the use of frozen meats. Criticisms such as greater inconvenience, limited savings in the case of small families, or greater cost than if slaughtered and processed on the farm may be less subject to modification.